

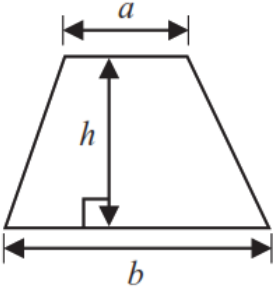
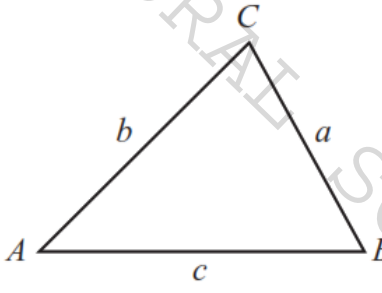
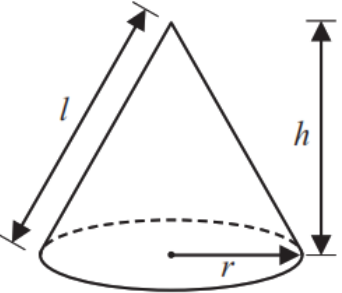
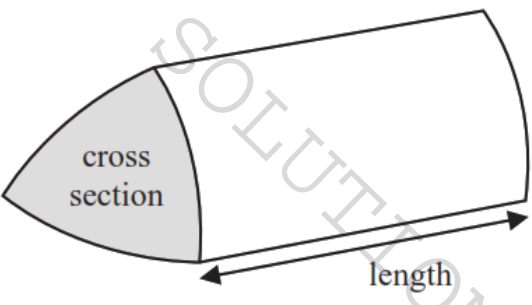
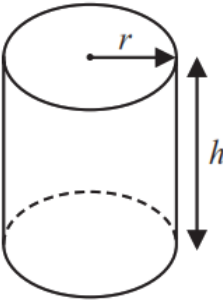
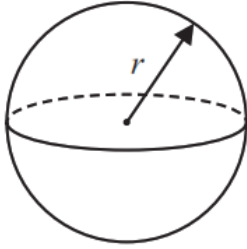
"Knowing the path is good but not enough, walking the path with determination leads to destiny"

IGCSE EDEXCEL Paper-2(4MA1)

2H and 2HR

CLASSIFIED QUESTIONS

International GCSE Mathematics
Formulae sheet – Higher Tier

<p>Arithmetic series</p> <p>Sum to n terms, $S_n = \frac{n}{2} [2a + (n - 1)d]$</p>	<p>Area of trapezium = $\frac{1}{2}(a + b)h$</p> 
<p>The quadratic equation</p> <p>The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	<p>In any triangle ABC</p> <p>Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$</p> <p>Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$</p> <p>Area of triangle = $\frac{1}{2}ab \sin C$</p> 
<p>Volume of cone = $\frac{1}{3}\pi r^2 h$</p> <p>Curved surface area of cone = $\pi r l$</p> 	<p>Volume of prism = area of cross section \times length</p> 
<p>Volume of cylinder = $\pi r^2 h$</p> <p>Curved surface area of cylinder = $2\pi r h$</p> 	<p>Volume of sphere = $\frac{4}{3}\pi r^3$</p> <p>Surface area of sphere = $4\pi r^2$</p> 

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Number

Topic-1: HCF-LCM-Prime Factors-1

Q1.

(a) Find the highest common factor (HCF) of 96 and 120

(2)

$$A = 2^3 \times 5 \times 7^2 \times 11$$

$$B = 2^4 \times 7 \times 11$$

$$C = 3 \times 5^2$$

(b) Find the lowest common multiple (LCM) of A , B and C .

(2)

(Total for question = 4 marks)
(Q06 4MA1/2H, Jan 2019)

Q2.

(a) Find the highest common factor (HCF) of 200 and 420

.....
(2)

$$A = 2^3 \times 3 \times 5 \times 7^2$$

$$B = 2 \times 3^2 \times 7$$

$$C = 3 \times 5^2 \times 11$$

(b) Find the lowest common multiple (LCM) of A , B and C

Write your answer as a product of powers of prime factors.

NATURAL SCIENCE SOLUTION

.....
(2)

(Total for question = 4 marks)

(Q07 4MA1/2HR, Jan 2023)

Q3.

Find the lowest common multiple (LCM) of 28, 42 and 63
Show your working clearly.

.....
(Total for question = 3 marks)

(Q07 4MA1/2H, Jan 2022)

Q4.

Write 600 as a product of powers of its prime factors.
Show your working clearly.

.....
(Total for question = 3 marks)
(Q01 4MA1/2H, June 2021)

Q5.

Write 1200 as a product of powers of its prime factors.
Show your working clearly.

.....
(Total for question = 3 marks)
(QU02 4MA1/2HR, June 2022)

Q6.

$$A = 2^3 \times 3^2 \times 5^2 \times 11$$

$$B = 2^4 \times 3 \times 5^4 \times 13$$

Find the lowest common multiple (LCM) of A and B .

Give your answer as a product of powers of prime numbers.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 2 marks)

(Q09 4MA1/2H, Jan 2021)

Topic-2: HCF-LCM-Prime Factors-2

Q1.

- (a) Write 224 as a product of powers of its prime factors.
Show your working clearly.

.....
(3)

- (b) Write down 3 **different** factors of 224 with a sum between 99 and 110

.....
(2)
(Total for question = 5 marks)
(Q08 4MA0/4HR, Jan 2015)

Q2.

- (a) Find the Highest Common factor (HCF) of 75 and 90

.....
(2)

- (b) Find the Lowest Common Multiple (LCM) of 75 and 90

.....
(2)
(Total for question is 4 marks)
(Q11 4MA0/4H, Jan 2012)

Q3.

$$A = 2^3 \times 3^2 \times 5^4$$

$$B = 3^5 \times 5 \times 7^3$$

Find the Highest Common Factor (HCF) of A and B .

.....
(Total for question = 2 marks)
(Q11 4MA0/4HR, June 2013)

Q4.

Express 825 as a product of its prime factors.

.....
(Total for Question is 3 marks)
(Q08 4MA0/4H, Jan 2014)

Q5.

$$m = 3^4 \times 5^3$$

$$n = 3^3 \times 5^2 \times 11$$

(a) Find the Lowest Common Multiple (LCM) of m and n .

.....
(2)

(b) Find the Highest Common Factor (HCF) of $5m$ and $3n$.

.....
(2)
(Total for question = 4 marks)

(Q10 4MA0/4HR, Jan 2017)

Q6.

Express 200 as a product of powers of its prime factors.

.....
(Total for question is 3 marks)
(Q07 4MA0/4H, Jan 2012)

Q7.

Express 300 as a product of its prime factors.

.....
(Total for question = 3 marks)
(Q08 4MA0/4H, June 2012)

Q8.

Express 204 as a product of its prime factors.

.....
(Total for question = 3 marks)
(Q08 4MA0/4H, June 2013)

Q9.

Express 126 as a product of its prime factors.

.....
(Total for question = 3 marks)
(Q10 4MA0/4H, June 2011)

Q10.

(a) Write 252 as a product of its prime factors.

.....
(2)

Given that $240 = 2^4 \times 3 \times 5$

and that $y = 240 \times 252$

(b) write y as a product of powers of its prime factors.

.....
(2)
(Total for Question is 4 marks)
(Q08 4MA0/4HR, June 2014)

Q11.

x is an integer.

The Lowest Common Multiple (LCM) of x and 12 is 120

The Highest Common Factor (HCF) of x and 12 is 4

Work out the value of x .

$x =$

(Total for question = 2 marks)
(Q11 4MA0/4H, June 2015)

Q12.

The highest common factor (HCF) of 140 and x is 20

The lowest common multiple (LCM) of 140 and x is 420

Find the value of x .

$x = \dots\dots\dots$

(Total for question = 2 marks)

(Q10 4MA0/4H, June 2016)

NATURAL SCIENCE SOLUTION

Topic-3: Mixed number-1

Q1.

Show that $5\frac{1}{3} - 2\frac{6}{7} = 2\frac{10}{21}$

(Total for question = 3 marks)

(QU04 4MA1/2H, June 2022)

Q2.

Show that $2\frac{4}{7} \times 3\frac{1}{9} = 8$

(Total for question = 3 marks)

(QU04 4MA1/2H, June 2024)

Q3.

Show that $3\frac{4}{7} - 1\frac{5}{8} = 1\frac{53}{56}$

(Total for question = 3 marks)

(QU04 4MA1/2H, June 2018)

Q4.

Show that $4\frac{2}{3} + 3\frac{4}{5} = 8\frac{7}{15}$

(Total for question = 3 marks)

(Q03 4MA1/2H, Jan 2020)

Q5.

Show that $6\frac{3}{4} \div 2\frac{4}{7} = 2\frac{5}{8}$

(Total for question = 3 marks)
(Q02 4MA1/2H, Jan 2022)

Q6.

Show that $2\frac{4}{7} \div 1\frac{1}{8} = 2\frac{2}{7}$

(Total for question = 3 marks)

(Q02 4MA1/2H, June 2021)

Q7.

Show that $4\frac{2}{3} \div 1\frac{5}{6} = 2\frac{6}{11}$

(Total for question = 3 marks)

(Q01 4MA1/2HR, Jan 2023)

Q8.

Show that $3\frac{3}{7} \div 2\frac{2}{3} = 1\frac{2}{7}$

(Total for question = 3 marks)

(Q06 4MA1/2H, Nov 2023)

Q9.

Show that $3\frac{5}{7} \div 1\frac{5}{8} = 2\frac{2}{7}$

(Total for question = 3 marks)

(Q01 4MA1/2H, Jan 2023)

Q10.

Show that $4\frac{2}{3} \div 1\frac{1}{5} = 3\frac{8}{9}$

(Total for question = 3 marks)

(QU01 4MA1/2H, June 2023)

Topic-4: Mixed number-2

Q1.

(a) Show that $\frac{4}{5} + \frac{2}{3} = 1\frac{7}{15}$

(2)

(b) Show that $2\frac{1}{4} \div 3\frac{1}{2} = \frac{9}{14}$

(3)

(Total for Question is 5 marks)
(Q04 4MA0/4HR, Jan 2014)

Q2.

(a) Show that $\frac{7}{12} + \frac{3}{8} = \frac{23}{24}$

(2)

(b) Show that $1\frac{2}{3} \times 2\frac{1}{15} = 3\frac{4}{9}$

(3)

(Total for question = 5 marks)
(Q07 4MA0/4H, June 2017)

Q3.

Show that $\frac{3}{4} + \frac{4}{5} = 1\frac{11}{20}$

(Total for question = 2 marks)
(Q03 4MA0/4HR, Jan 2016)

Q4.

(a) Show that $4\frac{1}{5} \div \frac{7}{15} = 1\frac{5}{7}$

(2)

(b) Show that $5\frac{1}{4} - 1\frac{2}{3} = 3\frac{7}{12}$

(3)

(Total for question = 5 marks)
(Q05 4MA0/4H, June 2012)

Q5.

$\frac{5}{9}$ of the students in a group are male.

$\frac{5}{6}$ of the **female** students in the group are right-handed.

(a) Work out the fraction of students in the group who are right-handed females.

.....
(3)

(b) Find the smallest possible number of students in the group.

.....
(2)
(Total for question = 5 marks)
(Q06 4MA0/4H, Jan 2013)

Q6.

(a) Show that $\frac{7}{8} - \frac{5}{6} = \frac{1}{24}$

(b) Show that $\frac{5}{8} \div \frac{7}{12} = 1\frac{1}{14}$

(2)

(2)

(Total for question = 4 marks)
(Q05 4MA0/4H, June 2013)

Topic-5: percentage-Money-problem-1

Q1.

Himari's annual salary is 3 130 000 Japanese Yen (JPY).
She gets a salary increase of 4%

(a) Work out Himari's salary after this increase.

..... JPY
(3)

Kaito bought a car.
The value of the car when Kaito bought it was 750 000 JPY.
At the end of each year, the value of his car had depreciated by 15%

(b) Work out the value of Kaito's car at the end of 3 years.

Give your answer correct to the nearest JPY.

..... JPY
(3)

(Total for question = 6 marks)

(Q05 4MA1/2H, Nov 2020)

Q2.

Gladys buys a table for \$465 to sell in her shop.

She sells the table for \$520

- (a) Work out the percentage profit that Gladys makes from the sale of the table.
Give your answer correct to 3 significant figures.

..... %
(3)

Gladys has a sale in her shop.

She decreases all the normal prices by 12%

The normal price of an armchair was \$550

- (b) Work out the sale price of the armchair.

\$
(3)

(Total for question = 6 marks)

(Q03 4MA1/2H, Jan 2021)

Q3.

Chengbo sold a house for 180 000 yuan.

The amount for which he sold the house is 24% more than the amount he paid for the house.

- (a) Work out how much Chengbo paid for the house.
Give your answer correct to 3 significant figures.

..... yuan
(3)

Zhi bought a house on 1st January 2017

When she bought the house, its value was 120 000 yuan.

The value of the house increased by 1.8% per year.

- (b) Work out the value of Zhi's house on 1st January 2020
Give your answer correct to 3 significant figures.

..... yuan
(3)

(Total for question = 6 marks)

(Q11 4MA1/2H, June 2021)

Q4.

The table gives information about the average house price in England in 2018 and in 2019

Year	2017	2018	2019
Average house price (£)		228 314	231 776

(a) Work out the percentage increase in the average house price from 2018 to 2019 Give your answer correct to one decimal place.

..... %
(2)

The average house price in 2019 was 7.7% greater than the average house price in 2017

(b) Work out the average house price in 2017
Give your answer correct to 3 significant figures.

£
(3)

(Total for question = 5 marks)

(Q08 4MA1/2H, Jan 2022)

Q5.

Hermione buys a boat for \$26 800

The value of the boat depreciates by 8% each year.

Work out the value of the boat at the end of 3 years.

Give your answer correct to the nearest dollar.

\$

(Total for question = 3 marks)

(Q07 4MA1/2H, Nov 2023)

Q6.

Sandeep wants to buy some packets of pens and some boxes of pencils for his stationery shop.

Each packet of pens contains 9 pens.

Each box of pencils contains 12 pencils.

Each packet of pens costs £7.60

Each box of pencils costs £4.80

Sandeep can only buy full packets of pens and full boxes of pencils.

He wants to buy exactly the same number of pens as pencils.

Work out the minimum amount Sandeep needs to pay.

£

(Total for question = 4 marks)

(QU02 4MA1/2HR, June 2023)

Q7.

Pasha invests 50 000 dollars in a savings account for 4 years.
 He gets 1.3% per year compound interest.
 Work out how much money Pasha will have in his savings account at the end of 4 years.
 Give your answer correct to the nearest dollar.

..... dollars

(Total for question = 3 marks)
(QU09 4MA1/2H, June 2022)

Q8.

The table shows the cost, in euros, of Brigitte's car insurance in each of the years 2016, 2017 and 2018

Year	2016	2017	2018
Cost of insurance (euros)	500	545	592

Brigitte says,

"The percentage increase in the cost of my car insurance from 2017 to 2018 is more than the percentage increase in the cost of my car insurance from 2016 to 2017"

(a) Is Brigitte correct?

You must show how you get your answer.

(4)

Henri wants to insure his car.

He gets a discount of 15% off the normal price.
 Henri pays 952 euros for his car insurance after the discount.

(b) Work out the discount that Henri gets.

..... euros

(3)
(Total for question = 7 marks)
(Q08 4MA1/2H, Jan 2020)

Q9.

Gopal is paid 20 000 rupees each month.
Jamuna is paid 19 200 rupees each month.

Gopal and Jamuna are both given an increase in their monthly pay.
After the increase, they are both paid the same amount each month.

Gopal was given an increase of 8%

Work out the percentage increase that Jamuna was given.

NATURAL SCIENCE SOLUTION

..... %

(Total for question = 4 marks)
(QU03 4MA1/2H, June 2018)

Q10.

Victor buys 12 bottles of apple juice for a total cost of \$21
Victor sells all 12 bottles at \$2.45 each bottle.

Work out Victor's percentage profit.

..... %

(Total for question = 3 marks)
(Q06 4MA1/2H, Nov 2021)

Q11.

Josh buys and sells books for a living.

He buys 120 books for £4 each.

He sells $\frac{1}{2}$ of the books for £5 each.

He sells 40% of the books for £7 each.

He sells the rest of the books for £8 each.

(a) Calculate Josh's percentage profit.

..... %
(5)

One book that Josh owns had a value of £15 on the 1st May 2019
The value of this book had increased by 20% in the last year.

(b) Find the value of the book on the 1st May 2018

£
(3)

(Total for question = 8 marks)

(Q05 4MA1/2H, June 2019)

Q12.

In his previous job, Pierre was paid 400 euros in total for working a 5-day week.

In his new job, Pierre is paid 14 euros per hour.

In his new job, Pierre works for 7 hours each day for a 5-day week.

(a) Work out the percentage increase in the amount that Pierre is paid for a 5-day week.

..... %
(4)

Marie changes her job.

Her salary decreases by 6%

Her new salary is 23 030 euros.

(b) Work out Marie's salary before she changes her job.

..... euros
(3)

(Total for question = 7 marks)
(QU06 4MA1/2HR, June 2023)

Q13.

A field is in the shape of a trapezium.

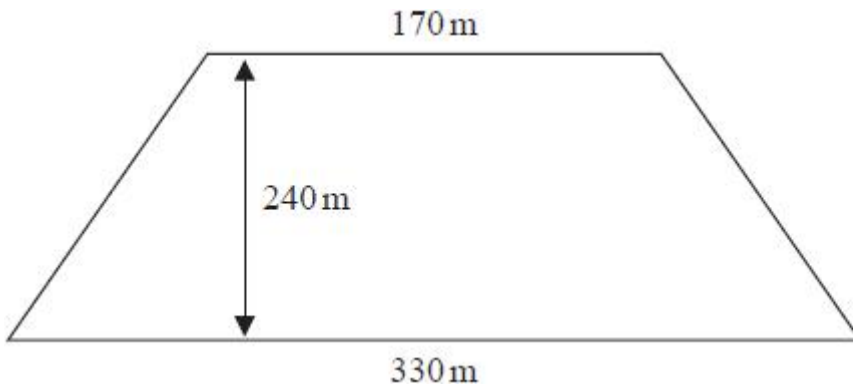


Diagram NOT
accurately drawn

The field is sold for a price of \$49 650

Given that 1 hectare = 10 000 m²

work out the average price of the field per hectare.

\$

(Total for question = 4 marks)
(QU05 4MA1/2HR, June 2023)

Q14.

The people working for a company work in Team A or in Team B.

number of people in Team A : number of people in Team B = 3 : 4

$\frac{4}{5}$ of Team A work full time.

24% of Team B work full time.

Work out what fraction of the people working for the company work full time.

Give your fraction in its simplest form.

.....
(Total for question = 3 marks)
(Q10 4MA1/2H, Jan 2021)

Q15.

A rectangle has length L and width W

L is increased by 20%

W is decreased by 35%

Calculate the percentage reduction in the area of the rectangle.

..... %

(Total for question = 3 marks)

(Q13 4MA1/2HR, Jan 2023)

Q16.

A cinema increased the cost of an adult ticket by 12%

After the increase, the cost of an adult ticket was £18.20

Work out the cost of an adult ticket before the increase.

£

(Total for question = 3 marks)

(QU08 4MA1/2HR, June 2022)

Q17.

Mario is going to save \$50 in the year 2021

He is going to continue to save, up to and including the year 2070, by increasing the amount he saves each year by \$ k

Mario will save a total of \$33 125 from 2021 to 2070

Work out the value of k .

$k =$

(Total for question = 3 marks)
(Q25 4MA1/2H, Jan 2020)

Q18.

Ahmed, Behnaz and Carmen each have some money.

Ahmed has 20% more money than Behnaz.

Carmen has $\frac{7}{8}$ of the amount of money that Behnaz has.

Carmen has 31.50 euros.

Work out how much money Ahmed has.

..... euros

(Total for question = 3 marks)
(Q08 4MA1/2H/EAM, Specimen papers)

Q19.

The table gives the average crowd attendance per match for each of five football clubs for one season.

Football club	Average crowd attendance
Monaco	9.5×10^3
Chelsea	4.2×10^4
Juventus	3.9×10^4
Oxford United	8.3×10^3
Barcelona	7.7×10^4

(a) Find the difference between the average crowd attendance for Barcelona and the average crowd attendance for Monaco.

Give your answer in standard form.

.....
(2)

Antonio says,

"The average crowd attendance for Chelsea is approximately 50 times that for Oxford United."

(b) Is Antonio correct?

You must give a reason for your answer.

.....
.....
.....

(2)

During last season the cost of a ticket to watch Seapron United increased by 15% and then decreased by 8%

(c) Work out the overall percentage change in the cost of a ticket to watch Seapron United during last season.

..... %
(2)

(Total for question = 6 marks)

(Q11 4MA1/2H, June 2019)

Topic-6: percentage-Money-problem-2

Q1.

In a sale, normal prices are reduced by 35%
 The normal price of a bed is \$1200

Work out the sale price of the bed.

\$

(Total for question = 3 marks)
(Q03 4MA0/4HR, Jan 2017)

Q2.

Amit invests 15000 rupees.

At the end of one year, his investment has increased by $7\frac{1}{2}\%$

(a) Work out the value of Amit's investment at the end of one year.

..... rupees

(2)

Priya invests a sum of money at an interest rate of 8% per year.
 At the end of one year, the interest she receives is 1800 rupees.

(b) Work out the value of Priya's investment at the end of one year.

..... rupees

(3)

(Total for question = 5 marks)
(Q03 4MA0/4HR, June 2015)

Q3.

Jomo invested an amount of money at 4% per annum **compound interest**.
At the end of 2 years, the value of his investment was £3380

How much of the £3380 was interest?

£.....

(Total for question = 4 marks)

(Q14 4MA0/4HR, June 2013)

Q4.

In a sale, all normal prices are reduced by 15%.

(a) The normal price of a washing machine is 270 dollars.
Work out the sale price of the washing machine.

..... dollars
(3)

(b) The normal price of a food processor is reduced by 13.50 dollars.
Work out the normal price of the food processor.

..... dollars
(3)

(Total for Question is 6 marks)

(Q04 4MA0/4H, June 2014)

Q5.

On Monday, Nalim made a journey.
On Tuesday, she made the same journey.
Her average speed on Tuesday was 25% greater than her average speed on Monday.

Calculate the percentage reduction in the time her journey took on Tuesday compared with Monday.

.....%

(Total for question = 3 marks)

(Q24 4MA0/4H, Jan 2013)

Q6.

In a sale, normal prices are reduced by 15%.
The normal price of a television was \$640
Work out the sale price of the television.

\$.....

(Total for question = 3 marks)

(Q01 4MA0/4H, June 2011)

Q7.

Eric travels from the UK to India every year.

In 2010, the exchange rate was £1 = 67.1 rupees.

In 2012, the exchange rate was £1 = 82.5 rupees.

In 2010 Eric changed £600 into rupees.

How many pounds (£) did Eric have to change to rupees in 2012 to get the same number of rupees as he did in 2010?

£

(Total for question = 3 marks)
(Q01 4MA0/4HR, Jan 2015)

Q8.

The weekly rent for a holiday apartment is £530, which is the same as 715.5 euros.

The weekly rent for a holiday cottage is £750

Using the same rate of currency exchange, work out the weekly rent for the cottage in euros.

..... euros

(Total for question = 3 marks)
(Q03 4MA0/4H, Jan 2017)

Q9.

Lyn went on holiday to India.

She changed £250 into rupees.

The exchange rate was £1 = 97 rupees.

(a) How many rupees did Lyn get?

..... rupees

(2)

When she returns from holiday, Lyn has **four** 500 rupee notes.
She changes this money into pounds.

The exchange rate is now £1 = 93.5 rupees.

- (b) Work out how many pounds Lyn gets.
Give your answer to the nearest pound.

£

(3)

(Total for question = 5 marks)
(Q03 4MA0/4H, June 2017)

10.

Jalin lives in England.
He does a search on the internet and sees the same type of camera on sale in France and in America.
In France, the camera costs 126 euros.
In America, the camera costs \$165.24
Jalin finds out these exchange rates.

Exchange rates
1 euro = £0.89
£1 = \$1.62

How much cheaper is the camera in America than in France?
Give your answer in pounds (£).

£

(Total for Question is 4 marks)

(Q06 4MA0/4H, June 2014)

Q11.

Kim bought 12 boxes of drinks.
He paid \$15 for each box.
There were 12 drinks in each box.
Kim sold $\frac{3}{4}$ of the drinks for \$1.50 each.
He sold all of the other drinks at a reduced price.
He made an overall profit of 15%.
Work out how much Kim sold each reduced price drink for.

\$

(Total for Question is 5 marks)

(Q06 4MA0/4HR, June 2014)

Q12.

A clothes shop has a sale.
In the sale, normal prices are reduced by 12%
The normal price of a shirt is £30
(a) Work out the sale price of the shirt.

£

(3)

The price of a coat is reduced by £9 in the sale.
(b) Work out the normal price of the coat.

£

(3)

(Total for question = 6 marks)
(Q07 4MA0/4H, Jan 2016)

Q13.

Manu, Liam and Ned share £420 in the ratios 4 : 5 : 3
Liam then gives Ned £75

Express the amount of money that Ned now has as a percentage of the £420
Give your answer correct to the nearest whole number.

..... %
(Total for question = 4 marks)
(Q09 4MA0/4H, June 2017)

Q14.

Kwo invests HK\$ 40000 for 3 years at 2.5% per year compound interest.
Work out the value of the investment at the end of 3 years.

HK\$.....
(Total for question = 3 marks)
(Q14 4MA0/4H, Jan 2015)

Q15.

Mabintou invested \$7500 for 3 years at 4% per year compound interest.
Calculate the value of her investment at the end of 3 years.

\$.....
(Total for question = 3 marks)
(Q11 4MA0/4HR, June 2017)

Q16.

The value of a boat depreciates by 16% each year.
At the end of 2012, the value of the boat is £65000
Work out the value of the boat at the end of 2015

£

(Total for question = 3 marks)

(Q12 4MA0/4H, June 2015)

Q17.

In a sale, all normal prices are reduced by 20%

(a) The normal price of a television set is 485 euros.

Work out the sale price of the television set.

..... euros
(3)

(b) In the sale, the normal price of a tablet computer is reduced by 79 euros.

Work out the normal price of the tablet computer.

..... euros
(3)

(Total for question = 6 marks)

(Q03 4MA0/4H, June 2016)

Q18.

A shop, *Furniture 4U*, had a sale.

(a) In the sale, normal prices were reduced by 15%.

(i) The normal price of a table was \$280
Work out the sale price of the table.

\$.....

(ii) The normal price of a chair was reduced in the sale by \$24
Work out the normal price of the chair.

\$.....

(6)

(b) Ruth, Suha and Yasmin went to the sale.

The amounts of money spent by Ruth, Suha and Yasmin were in the ratios 2 : 3 : 7

Ruth and Suha spent a total of \$320 in the sale.

Work out the amount of money Yasmin spent in the sale.

\$.....

(3)

(Total for question = 9 marks)
(Q05 4MA0/4HR, June 2013)

Q19.



Ying eats some yoghurt.

The yoghurt contains 192 mg of calcium.

This is 16% of the total amount of calcium that Ying should have each day.

Work out the total amount of calcium that Ying should have each day.

..... mg

(Total for question = 3 marks)
(Q08 4MA0/4HR, Jan 2016)

Q20.

There were 2.1 million people living in Dubai in 2013

1.75 million of these people were not born in Dubai.

(a) Work out 1.75 as a percentage of 2.1

Give your answer correct to 1 decimal place.

..... %

(2)

The unit of currency in Dubai is the dirham.

The exchange rate is £1 = 5.52 dirham.

The cost of a pair of running shoes in Dubai is 343 dirham.

The cost of an identical pair of running shoes in the UK is £54.99

The pair of running shoes is more expensive in Dubai than in the UK.

(b) How much more expensive?

Give your answer to the nearest dirham.

..... dirham

(3)

A plane flies a distance of 5522 km from London to Abu Dhabi in 7 hours 24 minutes.

(c) Work out the average speed of the plane.

Give your answer in kilometres per hour, correct to 3 significant figures.

..... kilometres per hour

(3)

(Total for question = 8 marks)
(Q03 4MA0/4HR, June 2016)

NATURAL SCIENCE SOLUTION

Topic-7: Compound Interest

Q1.

Jenny invests \$8500 for 3 years in a savings account.
She gets 2.3% per year compound interest.

- (a) How much money will Jenny have in her savings account at the end of 3 years?
Give your answer correct to the nearest dollar.

\$ (3)

Rami bought a house on 1st January 2015
In 2015, the house increased in value by 15%
In 2016, the house decreased in value by 8%
On 1st January 2017, the value of the house was \$687 700
(b) What was the value of the house on 1st January 2015?

\$ (3)

(Total for question = 6 marks)
(Q07 4MA1/2H, Jan 2019)

Q2.

Shane invests 7200 dollars for 3 years in a savings account.
He gets 2.5% per year compound interest.

How much money will Shane have in his savings account at the end of 3 years?
Give your answer to the nearest dollar.

..... dollars

(Total for question = 3 marks)
(Q05 4MA1/2HR, Jan 2022)

Q3.

Feruzi invests 80 000 Kenyan shillings (KES)
He invests the money for 3 years at $x\%$ compound interest each year.
At the end of 3 years, the total interest he receives is 6151.25 KES
Work out the value of x

$x = \dots\dots\dots$

(Total for question = 3 marks)

(QU13 4MA1/2HR, June 2023)

Q4.

Charlotte buys a painting for \$680
The value of the painting increases by 4% each year.
Work out the value of the painting at the end of 3 years.
Give your answer correct to the nearest \$

\$ $\dots\dots\dots$

(Total for question = 3 marks)

(QU08 4MA1/2H, June 2023)

Q5.

Giovanni invests 4500 koruna in a savings account for 4 years.

He gets 2.4% per year compound interest.

Work out how much money Giovanni will have in the savings account at the end of 4 years.

Give your answer correct to the nearest koruna.

..... koruna

(Total for question = 3 marks)
(QU09 4MA1/2H, June 2024)

Q6.

Teresa invests \$2000 for 3 years in a savings account.

She gets 4% each year compound interest.

(a) How much money will Teresa have in her savings account at the end of 3 years?

Give your answer correct to the nearest dollar.

\$.....
(3)

Sam invested \$ T

The value of his investment decreased by 9% each year.

At the end of the first year, the value of Sam's investment was \$1365

(b) Work out the value of T

.....
(3)
(Total for question = 6 marks)
(Q09 4MA1/2HR, Jan 2023)

Q7.

Ali and Badia each have 25 000 dollars to invest.

Cyclone Bank	Tornado Bank
Invest 25 000 dollars 4.5% compound interest per year for 3 years	Invest 25 000 dollars Receive 1150 dollars interest each year for 3 years

Ali invests in the Cyclone Bank for 3 years.

Badia invests in the Tornado Bank for 3 years.

By the end of the 3 years, Ali will have received more interest than Badia.

How much more?

Show your working clearly.

Give your answer correct to the nearest dollar.

..... dollars

(Total for question = 4 marks)
(Q07 4MA1/2H, Nov 2021)

Q8.

Hermione buys a boat for \$26 800

The value of the boat depreciates by 8% each year.

Work out the value of the boat at the end of 3 years.

Give your answer correct to the nearest dollar.

\$

(Total for question = 3 marks)
(Q07 4MA1/2H, Nov 2023)

Q9.

Matteo is going to invest 5000 Swiss francs for two years.
He can invest his money in Bank **G** or in Bank **H**.

<p style="text-align: center;">Bank G</p> <p style="text-align: center;">1.6% per year compound interest</p>

<p style="text-align: center;">Bank H</p> <p style="text-align: center;">2.9% interest added after two years</p>

The total amount of interest Matteo would receive at the end of two years from Bank **G** is more than the amount of interest Matteo would receive at the end of two years from Bank **H**.
How much more?

..... Swiss francs

(Total for question = 4 marks)
(Q08 4MA1/2H, Jan 2023)

Q10.

Pasha invests 50 000 dollars in a savings account for 4 years.
He gets 1.3% per year compound interest.
Work out how much money Pasha will have in his savings account at the end of 4 years.
Give your answer correct to the nearest dollar.

..... dollars

(Total for question = 3 marks)
(QU09 4MA1/2H, June 2022)

Q11.

Mario is going to save \$50 in the year 2021

He is going to continue to save, up to and including the year 2070, by increasing the amount he saves each year by \$ k

Mario will save a total of \$33 125 from 2021 to 2070

Work out the value of k .

NATURAL SCIENCE SOLUTION

$k = \dots\dots\dots$

(Total for question = 3 marks)

(Q25 4MA1/2H, Jan 2020)

Q12.

Aayush invests 18 000 rupees for 3 years at a rate of 4% per year compound interest.

Work out the total amount of interest Aayush has received by the end of 3 years.

Give your answer correct to the nearest rupee.

$\dots\dots\dots$ rupees

(Total for question = 3 marks)

(Q05 4MA1/2H/EAM, Specimen papers)

Topic-8: Ratio problem-1

Q1.

There are 90 counters in a bag.

Each counter in the bag is either red or blue so that

$$\text{the number of red counters : the number of blue counters} = 2 : 13$$

Li is going to put some more red counters in the bag so that

the probability of taking at random a red counter from the bag is $\frac{1}{3}$

Work out the number of red counters that Li is going to put in the bag.

NATURAL SCIENCESOLUTION

(Total for question = 4 marks)
(Q03 4MA1/2H, Jan 2019)

Q2.

Andreas, Isla and Paulo share some money in the ratios 3 : 2 : 5

The **total** amount of money that Isla and Paulo receive is £76 more than the amount of money that Andreas receives.

Andreas buys a video game for £48.50 with some of his share of the money.

Work out how much money Andreas has left from his share of the money when he has bought the video game.

£

(Total for question = 4 marks)
(Q04 4MA1/2H, Nov 2020)

Q3.

Nancy has some coins with a total value of 85 pence.
She has only 2 pence coins and 5 pence coins.
The ratio

$$\text{number of 2 pence coins} : \text{number of 5 pence coins} = 1 : 3$$

Nancy has more 5 pence coins than 2 pence coins.

How many more?

.....
(Total for question = 4 marks)
(QU05 4MA1/2H, June 2023)

Q4.

Ishir plants 600 bulbs in a garden.

He plants tulip bulbs, crocus bulbs and daffodil bulbs so that

$$\text{number of tulip bulbs} : \text{number of crocus bulbs} : \text{number of daffodil bulbs} = 9 : 4 : 2$$

45% of the tulip bulbs are for yellow flowers.

$\frac{5}{8}$

of the crocus bulbs are for yellow flowers.

All of the daffodil bulbs are for yellow flowers.

Work out the number of bulbs that are for yellow flowers.

.....
(Total for question = 5 marks)
(QU08 4MA1/2H, June 2024)

Q5.

Avril bakes a cake.

She uses flour, butter and sugar such that

$$\text{weight of flour} : \text{weight of butter} = 6 : 5$$

$$\text{weight of butter} : \text{weight of sugar} = 3 : 2$$

Avril uses 120 grams of sugar.

Work out the weight of flour Avril uses.

..... grams

(Total for question = 3 marks)
(Q05 4MA1/2H, Nov 2023)

Q6.

The people working for a company work in Team A or in Team B.

$$\text{number of people in Team A} : \text{number of people in Team B} = 3 : 4$$

$\frac{4}{5}$ of Team A work full time.

24% of Team B work full time.

Work out what fraction of the people working for the company work full time.
Give your fraction in its simplest form.

.....
(Total for question = 3 marks)
(Q10 4MA1/2H, Jan 2021)

Q7.

The diagram shows cuboid $ABCDEFGH$.

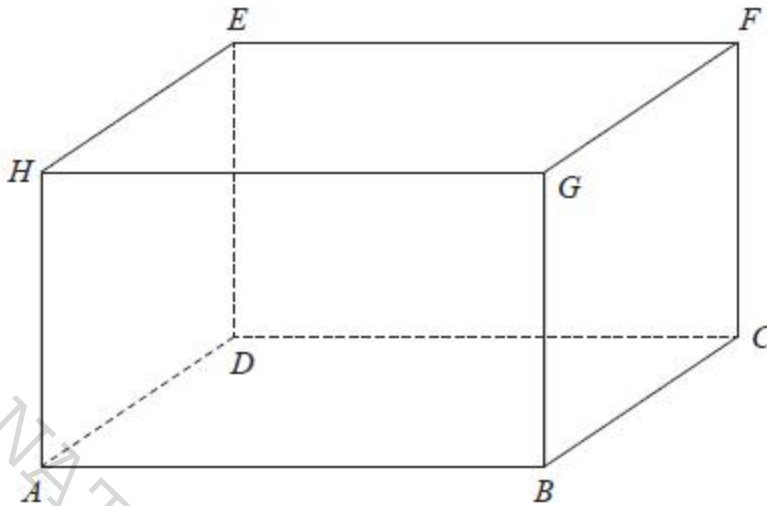


Diagram NOT
accurately drawn

For this cuboid

the length of AB : the length of BC : the length of $CF = 4 : 2 : 3$

Calculate the size of the angle between AF and the plane $ABCD$.

Give your answer correct to one decimal place.

.....°

(Total for question = 3 marks)

(Q21 4MA1/2H, June 2019)

Q8.

Mariana sells bags of bird food.

The bags that Mariana sold last week each contained 12 kg of seeds.

The bags that she is going to sell next week will each contain a mixture of nuts and seeds where for each bag

$$\text{weight of nuts} : \text{weight of seeds} = 4 : 5$$

The total weight of the nuts and the seeds in each bag will be 19.35 kg

The weight of seeds in each bag that Mariana sells next week will be less than the weight of seeds in each bag that Mariana sold last week.

Work out this decrease as a percentage of the weight of seeds in each bag that Mariana sold last week. Give your answer correct to one decimal place.

NATURAL SCIENCE SOLUTION

..... %
(Total for question = 4 marks)
(Q06 4MA1/2H, June 2021)

Q9.

Work out the difference between the largest share and the smallest share when 3450 yen is divided in the ratios 2 : 6 : 7

..... yen
(Total for question = 3 marks)
(QU02 4MA1/2H, June 2018)

Q10.

Behnaz makes 300 celebration cards so that

number of birthday cards : number of anniversary cards : number of congratulations cards = 7 : 5 : 3

$\frac{2}{5}$ of the birthday cards have numbers on them.

36% of the anniversary cards have numbers on them.

None of the congratulations cards have numbers on them.

Work out what fraction of the 300 cards have numbers on them.

Give your answer in its simplest form.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

(QU08 4MA1/2H, June 2022)

Topic-9: Ratio problem-2

Q1.

Jack, Kate and Lila share some money in the ratios 5 : 9 : 6
In total, Jack and Kate receive £56

Work out the amount of money Lila receives.

£.....

(Total for question = 3 marks)

(Q11 4MA0/4H, Jan 2013)

Q2.

Lisa, Max and Punita share £240 in the ratio 3 : 4 : 8
How much more money than Lisa does Punita get?

£.....

(Total for question = 3 marks)

(Q07 4MA0/4H, Jan 2015)

Q3.

A school has 840 pupils and 40 teachers.

(a) Find the ratio of the number of pupils to the number of teachers.
Give your ratio in the form $n : 1$

..... : 1

(2)

In Year 11 at the school, the ratio of the number of pupils who study Chemistry to the number of pupils who study Physics is 3 : 2

- (b) 105 pupils in Year 11 study Chemistry.
Work out the number of pupils in Year 11 who study Physics.

.....
(2)

For the 105 pupils who study Chemistry, the ratio of the number of boys to the number of girls is 4 : 3

- (c) Work out the number of girls in Year 11 who study Chemistry.

.....
(2)

(Total for Question is 6 marks)
(Q01 4MA0/4H, Jan 2014)

Q4.

Louis makes a model of a plane.
The wingspan of the model is 50 centimetres.
The wingspan of the real plane is 80 metres.

- (a) Work out the scale of the model.
Give your answer in the form 1: *n*

1:
(2)

The length of the real plane is 72 metres.

- (b) Work out the length of the model.
Give your answer in centimetres.

..... centimetres
(2)

(Total for question = 4 marks)
(Q08 4MA0/4HR, June 2016)

Q5.

(a) There are 32 students in a class.
All the students are either left-handed or right-handed.
The ratio of the number of left-handed students to the number of right-handed students is 1 : 7

Work out the number of right-handed students.

.....
(2)

(b) Sajid makes a scale model of a lorry.
He uses a scale of 1 : 32
The length of Sajid's model lorry is 45 cm.
Chitra makes a scale model of the same lorry.
She uses a scale of 1 : 72

Work out the length of Chitra's model lorry.

..... cm
(3)

(Total for question is 5 marks)

(Q06 4MA0/4H, Jan 2012)

Q6.

Green paint can be made by mixing yellow paint and blue paint in the ratio 2 : 3
Wendy makes 15 litres of green paint.

Work out how many litres of blue paint Wendy uses.

.....litres

(Total for question = 2 marks)

(Q02 4MA0/4H, June 2013)

Q7.

Jalin lives in England.
He does a search on the internet and sees the same type of camera on sale in France and in America.
In France, the camera costs 126 euros.
In America, the camera costs \$165.24
Jalin finds out these exchange rates.

Exchange rates
1 euro = £0.89
£1 = \$1.62

How much cheaper is the camera in America than in France?
Give your answer in pounds (£).

£

(Total for Question is 4 marks)
(Q06 4MA0/4H, June 2014)

Q8.

Pritam, Sarah and Emily share some money in the ratios 3 : 6 : 4
Sarah gets \$15 more than Emily.
Work out the amount of money that Pritam gets.

\$

(Total for question = 3 marks)
(Q02 4MA0/4H, June 2015)

Q9.

Manu, Liam and Ned share £420 in the ratios 4 : 5 : 3
 Liam then gives Ned £75

Express the amount of money that Ned now has as a percentage of the £420
 Give your answer correct to the nearest whole number.

..... %

(Total for question = 4 marks)
(Q09 4MA0/4H, June 2017)

Q10.

Mortar mix is made by mixing cement, sand and quicklime in the ratio 1 : 2 : 3

(a) Work out the volume of sand needed to make 2.1 m³ of mortar mix.

..... m³

(2)

Julie has 0.75 m³ of quicklime.

She has plenty of sand and cement.

(b) Work out the greatest volume of mortar mix she could make.

..... m³

(2)

(Total for Question is 4 marks)
(Q10 4MA0/4HR, June 2014)

Q11.

The lengths of the sides of a triangle are in the ratios 2 : 6 : 7
The length of the longest side of the triangle is 24.5 cm.

Work out the perimeter of the triangle.

..... cm

(Total for question = 3 marks)
(Q10 4MA0/4H, Jan 2016)

Q12.

In the 2012 Paralympic Games, the total number of gold and silver medals won by Brazil was 35
The ratio of the number of gold medals that Brazil won to the number of silver medals that Brazil won was 3 : 2

How many silver medals were won by Brazil?

.....
(Total for Question is 2 marks)
(Q01 4MA0/4H, June 2014)

Q13.

Flaky pastry is made using flour and fat in the ratio 9:7 by weight.
Cassie makes some flaky pastry.
She uses 175 grams of fat.

(a) Work out the weight of flour Cassie uses.

..... grams
(2)

Sweet pastry is made using flour, fat and sugar in the ratio 27:14:9 by weight.
Luke makes some sweet pastry.
The total weight of flour, fat and sugar he uses is 400 grams.

(b) Work out the weight of flour Luke uses.

..... grams
(2)

Elisha makes some flaky pastry and some sweet pastry.
 She uses the same weight of flour for the flaky pastry as she does for the sweet pastry.

(c) Work out the ratio of the weight of fat she uses in the flaky pastry to the weight of fat she uses in the sweet pastry.

..... grams

(2)

(Total for question = 6 marks)
(Q08 4MA0/4HR, June 2015)

Q14.

Here is a list of ingredients needed to make 16 cookies.

Ingredients for 16 cookies
120 g butter
150 g sugar
240 g flour
170 g chocolate
1 egg

Max wants to make 40 cookies.

(a) How much flour does Max need?

..... g

(2)

Abby made cookies to sell at a school fair.
 She used 600 g of butter.

(b) How many cookies did she make?

.....

(2)

(c) Find the ratio of the weight of sugar to the weight of flour in the list of ingredients.

Give your answer in the form 1: n

1 :

(2)

(Total for question = 6 marks)
(Q01 4MA0/4HR, Jan 2016)

Q15.

Here is a list of ingredients for making 24 Rocky Road Crunchy Bars.

Rocky Road Crunchy Bars	
Ingredients for 24 bars	
125 grams	butter
300 grams	chocolate
3 tablespoons	syrup
200 grams	biscuits
100 grams	marshmallows
2 teaspoons	icing sugar

Silvester wants to make 30 Rocky Road Crunchy Bars.

(a) Work out the amount of marshmallows he needs.

..... grams
(2)

Nigella makes some Rocky Road Crunchy Bars.
She uses 850 grams of chocolate.

(b) Work out the number of Rocky Road Crunchy Bars she makes.

.....
(2)
(Total for question = 4 marks)
(Q01 4MA0/4HR, Jan 2017)

Q16.

A shop, *Furniture 4U*, had a sale.

(a) In the sale, normal prices were reduced by 15%.

(i) The normal price of a table was \$280
Work out the sale price of the table.

\$.....

(ii) The normal price of a chair was reduced in the sale by \$24
Work out the normal price of the chair.

\$.....
(6)

(b) Ruth, Suha and Yasmin went to the sale.
The amounts of money spent by Ruth, Suha and Yasmin were in the ratios 2 : 3 : 7
Ruth and Suha spent a total of \$320 in the sale.
Work out the amount of money Yasmin spent in the sale.

\$.....
(3)

(Total for question = 9 marks)
(Q05 4MA0/4HR, June 2013)

Q17.

There are 20 students in a class.
12 of the students are girls.
Find the ratio of the number of girls to the number of boys.
Give your ratio in the form $n : 1$

.....: 1

(Total for question = 2 marks)
(Q01 4MA0/4HR, June 2013)

Q18.

On a map, 4 centimetres represents a real distance of 1 kilometre.

(a) On the map, the distance between two points is 14 cm.
Work out the real distance between these two points.
Give your answer in kilometres.

..... km
(2)

(b) Work out the scale of the map in the form 1: n

1 :

(2)

(Total for Question is 4 marks)

(Q09 4MA0/4HR, Jan 2014)

NATURAL SCIENCE SOLUTION

Topic-10: Standard form and rounding

Q1.

(a) Write down the value of y^0

.....
(1)

$$\frac{9.6 \times 10^{141} + 6.4 \times 10^{140}}{3.2 \times 10^{16}}$$

(b) Work out

Give your answer in standard form.

.....
(3)
(Total for question = 4 marks)
(Q06 4MA1/2H, Jan 2021)

Q2.

The table gives information about the population, correct to 2 significant figures, of each of five cities in 2018

City	Population (2018)
Ahmedabad	7.7×10^6
Barcelona	5.5×10^6
Chicago	8.8×10^6
Lagos	1.3×10^7
Tokyo	3.7×10^7

(a) Write 8.8×10^6 as an ordinary number.

.....
(1)

(b) Which of these cities had the least population in 2018?

.....
(1)

- (c) Work out the difference between the population of Tokyo and the population of Ahmedabad in 2018
Give your answer in standard form correct to 2 significant figures.

.....
(2)
(Total for question = 4 marks)
(QU09 4MA1/2HR, June 2022)

Q3.

$$a = 6 \times 10^{40}$$

Work out the value of a^3
Give your answer in standard form.

.....
(Total for question = 3 marks)
(Q12 4MA1/2H, Jan 2022)

Q4.

A rainwater tank contains 2.4×10^7 raindrops.
The rainwater tank also contains 1.75×10^6 bacteria.

- (a) Work out the number of bacteria per raindrop in the tank.
Give your answer in standard form correct to 2 significant figures.

.....
(3)

A drop of rainwater contains 5.01×10^{21} atoms.

In a drop of rainwater the number of atoms is 3 times the number of molecules.

(b) Work out the number of molecules in the rainwater tank.

Give your answer in standard form correct to one significant figure.

..... molecules
(2)

(Total for question = 5 marks)

(Q09 4MA1/2H, Nov 2021)

Q5.

(a) Write 76 000 000 in standard form.

.....
(1)

(b) Write 5.4×10^{-4} as an ordinary number.

.....
(1)

(Total for question = 2 marks)

(QU06 4MA1/2H, June 2023)

Q6.

The table gives the average crowd attendance per match for each of five football clubs for one season.

Football club	Average crowd attendance
Monaco	9.5×10^3
Chelsea	4.2×10^4
Juventus	3.9×10^4
Oxford United	8.3×10^3
Barcelona	7.7×10^4

(a) Find the difference between the average crowd attendance for Barcelona and the average crowd attendance for Monaco.

Give your answer in standard form.

.....
(2)

Antonio says,

"The average crowd attendance for Chelsea is approximately 50 times that for Oxford United."

(b) Is Antonio correct?

You must give a reason for your answer.

.....
.....
.....

(2)

During last season the cost of a ticket to watch Seapron United increased by 15% and then decreased by 8%

(c) Work out the overall percentage change in the cost of a ticket to watch Seapron United during last season.

..... %
(2)

(Total for question = 6 marks)

(Q11 4MA1/2H, June 2019)

Q7.

Astrid wants to buy some oil.
She can buy the oil from either Dane Oil or Arctic Oil.

Here is information about the price that each company will charge Astrid.

Dane Oil	Arctic Oil
(4.2×10^5) litres for 2 500 000 Krone	(8.6×10^5) litres for 770 000 Dollars

Astrid wants to get the better value for money for the oil.

$$1 \text{ Dollar} = 6.57 \text{ Krone}$$

From which company should she buy her oil, Dane Oil or Arctic Oil?
You must show your working.

(Total for question = 4 marks)
(Q12 4MA1/2H, Jan 2020)

Q8.

The table gives information about the population and the total amount of money, in dollars, spent on healthcare for two countries in 2016

Country	Total population	Total spent on healthcare (\$)
Austria	8.7×10^6	4.2×10^{10}
Luxembourg	6.3×10^5	3.7×10^9

Work out how much more was spent **per person** on healthcare in Luxembourg than in Austria.
Give your answer correct to the nearest whole number.

..... dollars

(Total for question = 3 marks)
(Q10 4MA1/2HR, Jan 2022)

Q9.

The weight of a cake is 2.75 kg, correct to 2 decimal places.

(a) Write down the lower bound of the weight of the cake.

..... kg
(1)

(b) Write down the upper bound of the weight of the cake.

..... kg
(1)

$$\frac{81.3 \times 59.2}{1.9^2}$$

Penny has worked out $\frac{81.3 \times 59.2}{1.9^2}$ on her calculator.

Her answer is 13 332.299 17

Penny's answer is not sensible.

(c) By rounding each number to one significant figure, work out a suitable estimate to show that her answer is not sensible.

Show your working clearly.

(2)

(Total for question = 4 marks)

(Q05 4MA1/2H, Jan 2023)

Topic-11: Calculator and rounding

Q1.

$$\frac{6.7 - 2.5}{2.8 \times 0.4}$$

Work out the value of $\frac{6.7 - 2.5}{2.8 \times 0.4}$
Give your answer as a decimal.

.....
(Total for question is 2 marks)

(Q01 4MA0/4H, Jan 2012)

Q2.

$$\frac{6.6 \times 1.2}{4.4 - 2.75}$$

Work out the value of $\frac{6.6 \times 1.2}{4.4 - 2.75}$

.....
(Total for question = 2 marks)

(Q01 4MA0/4H, June 2012)

Q3.

(a) (i) Use your calculator to work out the value of

$$\frac{16^2}{3 \times 12 - \pi}$$

Write down all the figures on your calculator display.

(ii) Write your answer to (a) (i) correct to 3 significant figures.

.....
.....
(3)

$$\frac{4.2 \times 10^4}{700\,000}$$

(b) Work out

Give your answer in standard form.

.....
 (2)
(Total for question = 5 marks)
(Q04 4MA0/4H, Jan 2017)

Q4.

(a) Work out the value of $\frac{\sqrt{4.6}}{8.1 - 3.7}$

Give your answer as a decimal.
 Write down all the figures on your calculator display.

.....
 (2)

(b) Write your answer to part (a) correct to 3 significant figures.

.....
 (1)
(Total for question = 3 marks)
(Q01 4MA0/4H, Jan 2016)

Q5.

(a) Use your calculator to work out the value of

$$\frac{8.7 + 2.8}{1.4^2}$$

Give your answer as a decimal.
 Write down all the figures on your calculator display.

.....
 (2)

(b) Give your answer to part (a) correct to 2 significant figures.

.....
 (1)
(Total for question = 3 marks)
(Q01 4MA0/4H, Jan 2013)

Q6.

$$\frac{17.7 \times 5.8}{\sqrt{3.4 + 5.3}}$$

(a) Work out the value of $\frac{17.7 \times 5.8}{\sqrt{3.4 + 5.3}}$

Write down all the figures on your calculator display.

.....
(2)

(b) Give your answer to part (a) correct to 3 significant figures.

.....
(1)

(Total for question = 3 marks)

(Q03 4MA0/4HR, June 2017)

NATURAL SCIENCE SOLUTION

Topic-12: Upper and Lower Bounds-1

Q1.

$e = 8.31$ correct to 2 decimal places

$f = 0.65$ correct to 2 decimal places

Work out the lower bound for the value of $e - f$
Show your working clearly.

.....
(Total for question = 2 marks)

(QU15 4MA1/2H, June 2018)

Q2.

$$P = a(c + y)$$

$a = 8.3$ correct to 2 significant figures

$c = 2$ correct to 1 significant figure

$y = 15$ correct to the nearest 5

Work out the upper bound for the value of P

Show your working clearly.

.....
(Total for question = 3 marks)

(Q17 4MA1/2H, Nov 2023)

Q3.

$$P = \frac{a}{m - x}$$

- $x = 8$ correct to 1 significant figure
- $a = 4.6$ correct to 2 significant figures
- $m = 20$ correct to the nearest 10

Calculate the lower bound of P .
Show your working clearly.

(Total for question = 4 marks)
(Q18 4MA1/2H, Jan 2019)

Q4.

The weight of a cake is 2.75 kg, correct to 2 decimal places.

(a) Write down the lower bound of the weight of the cake.

..... kg
(1)

(b) Write down the upper bound of the weight of the cake.

..... kg
(1)

$$\frac{81.3 \times 59.2}{1.9^2}$$

Penny has worked out $\frac{81.3 \times 59.2}{1.9^2}$ on her calculator.

Her answer is 13 332.299 17

Penny's answer is not sensible.

(c) By rounding each number to one significant figure, work out a suitable estimate to show that her answer is not sensible.

Show your working clearly.

(2)
(Total for question = 4 marks)
(Q05 4MA1/2H, Jan 2023)

Q5.

$$G = \frac{c}{2f - 3h}$$

$c = 8$ correct to the nearest whole number

$f = 6.62$ correct to 2 decimal places

$h = 1.2$ correct to 1 decimal place

Work out the lower bound for the value of G

Give your answer correct to 3 decimal places.

Show your working clearly.

.....
(Total for question = 3 marks)
(QU19 4MA1/2H, June 2024)

Q6.

$$X = \frac{2a - b}{f}$$

$a = 7.5$ correct to 1 decimal place.

$b = 3.42$ correct to 2 decimal places.

$f = 2$ correct to the nearest whole number.

Work out the upper bound of the value of X

Show your working clearly.

.....
(Total for question = 3 marks)
(QU18 4MA1/2H, June 2022)

Q7.

A solid sphere has a radius of 2.8 centimetres, correct to 1 decimal place.
The sphere has a mass of $M\pi$ grams, where $M = 260$ correct to 2 significant figures.

Work out the upper bound for the density of the sphere.
Give your answer in g / cm^3 correct to 2 decimal places.
Show your working clearly.

NATURAL SCIENCE SOLUTION

..... g / cm^3

(Total for question = 4 marks)

(QU25 4MA1/2H, June 2023)

Q8.

Kaidan and Sonja went on two different car journeys.

For Kaidan's journey

distance = 80 km correct to the nearest 5 km
time = 2.7 hours correct to 1 decimal place

For Sonja's journey

distance = 33 km correct to 2 significant figures
time = 1 hour correct to the nearest 0.1 hour

Kaidan says,

"My average speed could have been greater than Sonja's average speed."

By considering bounds, show that Kaidan is correct.
Show your working clearly.

NATURAL SCIENCE SOLUTION

(Total for question = 4 marks)

(QU18 4MA1/2HR, June 2022)

Q9.

A solid metal cube has sides of length 125 mm, correct to 3 significant figures.

The cube is melted down and the metal used to make solid spheres.

The volume of each sphere is to be 140 cm^3 , correct to the nearest 10 cm^3

Work out the greatest number of spheres that could be made from the metal.

Show your working clearly.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)

(Q17 4MA1/2H/EAM, Specimen papers)

Q10.

Each side of a regular octagon has a length of 18 mm, correct to the nearest 0.5 mm

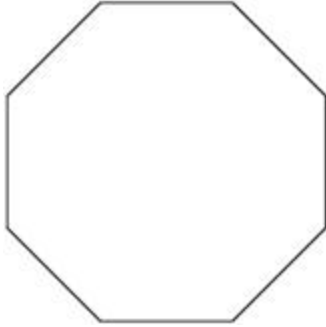


Diagram **NOT**
accurately drawn

(a) Write down the lower bound of the length of each side of the octagon.

..... mm
(1)

(b) Write down the upper bound of the length of each side of the octagon.

..... mm
(1)

(Total for question = 2 marks)

(Q04 4MA1/2H, Jan 2022)

Topic-13: Upper and Lower Bounds-2

Q1.

$$t = \frac{v - u}{a}$$

$v = 27.3$ correct to 3 significant figures.

$u = 18$ correct to 2 significant figures.

$a = 9.81$ correct to 3 significant figures.

Work out the lower bound for the value of t .

Show your working clearly.

Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 3 marks)
(Q23 4MA0/4HR, June 2017)

Q2.

The length of a fence is 137 metres, correct to the nearest metre.

Write down

(i) the lower bound for the length of the fence,

..... metres

(ii) the upper bound for the length of the fence.

..... metres

(Total for question = 2 marks)

(Q09 4MA0/4H, June 2011)

Q3.

There are 1300 sheets of paper, correct to the nearest 100 sheets, in a pile.
 Each sheet is of equal thickness.
 The height of the pile is 160 mm, correct to the nearest 10 mm.

Calculate the upper bound, in millimetres, for the thickness of one sheet of paper.

..... mm

(Total for Question is 3 marks)
(Q21 4MA0/4H, Jan 2014)

Q4.

An athlete runs 400 metres, correct to the nearest metre.
 The athlete takes 50.2 seconds, correct to the nearest 0.1 of a second.
 Work out the upper bound of the athlete's average speed.
 Give your answer correct to 3 significant figures.

..... m/s

(Total for question = 3 marks)
(Q18 4MA0/4H, Jan 2015)

Q5.

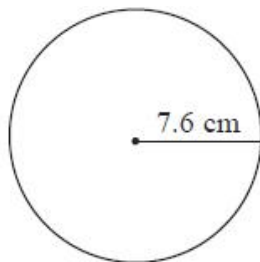


Diagram NOT
 accurately drawn

(a) A circle has a radius of 7.6 cm.
 Work out the area of the circle.
 Give your answer correct to 3 significant figures.

..... cm²

(2)

The radius, 7.6 cm, is correct to 1 decimal place.

(b) (i) Write down the upper bound of the radius.

..... cm

(ii) Write down the lower bound of the radius.

..... cm

(2)

(Total for Question is 4 marks)

(Q03 4MA0/4H, June 2014)

Q6.

A car travels a distance of 63.5 km, correct to the nearest 0.5 km.
The car takes 45.8 minutes correct to 1 decimal place.

Work out the lower bound for the average speed of the car.
Show your working clearly.
Give your answer in km/h correct to 1 decimal place.

..... km/h

(Total for question = 4 marks)

(Q20 4MA0/4H, June 2017)

Q7.

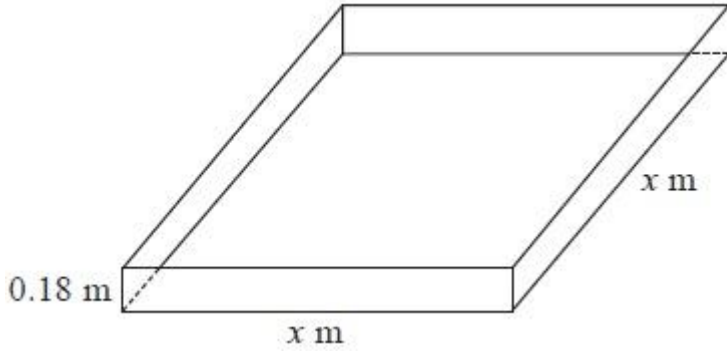


Diagram NOT accurately drawn

Trena wants to build a sandpit in the shape of a cuboid.
 The volume of sand in the sandpit will be 1.0 m^3 , correct to 1 decimal place.
 The depth of sand in the sandpit will be 0.18 metres, correct to 2 decimal places.
 The sandpit will have a square base with sides of length x metres.

Find the upper bound for x
 Give your answer correct to 3 significant figures.

upper bound =

(Total for Question is 4 marks)

(Q19 4MA0/4HR, Jan 2014)

Q8.

The diagram shows a ladder, EF , leaning against a vertical wall. The foot, E , of the ladder is on horizontal ground.

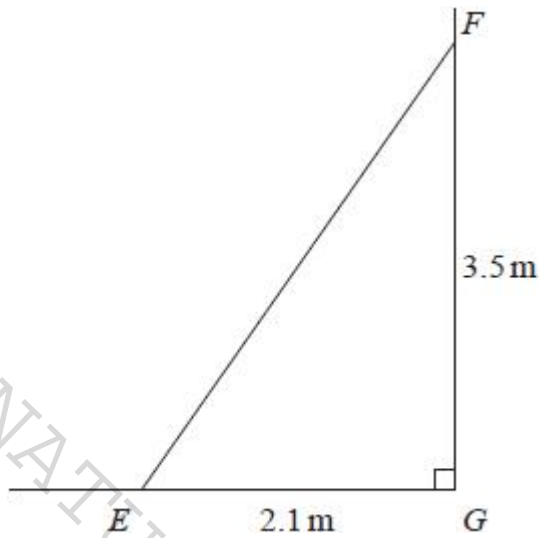


Diagram NOT accurately drawn

$EG = 2.1\text{ m}$ $FG = 3.5\text{ m}$ angle $EGF = 90^\circ$

(a) Work out the length of the ladder.

Give your answer correct to 1 decimal place.

..... m
(3)

(b) Work out the size of angle EFG .

Give your answer correct to the nearest degree.

.....^o
(3)

(Total for question = 6 marks)

(Q09 4MA0/4H, Jan 2017)

Q9.

(a) Work out the value of $\frac{\sqrt{4.6}}{8.1 - 3.7}$

Give your answer as a decimal.
Write down all the figures on your calculator display.

.....
(2)

(b) Write your answer to part (a) correct to 3 significant figures.

.....
(1)

(Total for question = 3 marks)
(Q01 4MA0/4H, Jan 2016)

Q10.

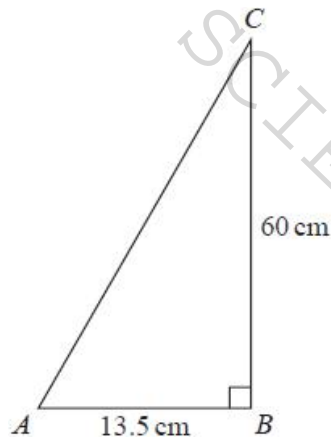


Diagram NOT accurately drawn

Work out the perimeter of the triangle.

..... cm

(Total for question = 4 marks)
(Q09 4MA0/4H, June 2016)

Q11.

The diagram shows the positions of two towns, *A* and *B*.

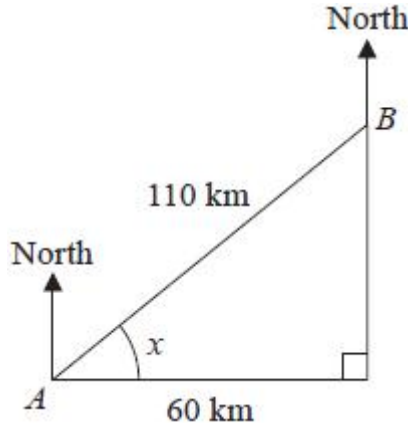


Diagram NOT accurately drawn

The distance from *A* to *B* is 110 km.
B is 60 km east of *A*.

- (a) Work out the size of angle *x*.
 Give your answer correct to 1 decimal place.

..... °
 (3)

- (b) Work out the bearing of *B* from *A*.
 Give your answer correct to the nearest degree.

..... °
 (2)

The distance from *A* to *B* is 110 km correct to 2 significant figures.

- (c) (i) Write down the lower bound for the distance from *A* to *B*.

..... km

- (ii) Write down the upper bound for the distance from *A* to *B*.

..... km
 (2)

(Total for question = 7 marks)
(Q09 4MA0/4HR, Jan 2017)

Topic-14: Surds-1

Q1.

(a) Show that $\sqrt{45} + \sqrt{20} = 5\sqrt{5}$

Show your working clearly.

(2)

(b) Express $\frac{2}{\sqrt{3}-1}$ in the form $p + \sqrt{q}$

where p and q are integers.
Show your working clearly.

(2)

(c) Express $x^2 + 6\sqrt{2}x - 1$ in the form $(x + a)^2 + b$

Show your working clearly.

(2)

(Total for question = 6 marks)
(QU21 4MA1/2H, June 2018)

Q2.

The area of a rectangle is 18 cm^2

The length of the rectangle is $(\sqrt{7} + 1)$ cm.

Without using a calculator and showing each stage of your working, find the width of the rectangle.

Give your answer in the form $a\sqrt{b} + c$ where a , b and c are integers.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 3 marks)
(Q20 4MA1/2H, Jan 2020)

Q3.

(a) Use algebra to show that $0.\dot{3}\dot{7}\dot{2} = \frac{41}{110}$

(2)

(b) Express $\frac{\sqrt{125} + \sqrt{80}}{\sqrt{3}}$ in the form \sqrt{n} where n is an integer.
Show your working clearly.

.....

(3)
(Total for question = 5 marks)

Q4.

Show that $\frac{4 + \sqrt{8}}{\sqrt{2} - 1}$ can be written in the form $a + b\sqrt{2}$, where a and b are integers.
Show each stage of your working clearly and give the value of a and the value of b .

(Total for question = 3 marks)
(Q16 4MA1/2H, June 2019)

Q5.

Express $\frac{8}{\sqrt{5} - 1}$ in the form $\sqrt{a} + b$ where a and b are integers.
Show each stage of your working clearly.

.....
(Total for question = 3 marks)
(Q17 4MA1/2H, Nov 2021)

NATURAL SCIENCE SOLUTION

Q6.

$$a = \sqrt{8} + 4$$

$$b = \sqrt{8} - 4$$

$(a - b)(a + b)$ can be written in the form $y\sqrt{4y}$

Find the value of y
Show your working clearly.

$$y = \dots\dots\dots$$

(Total for question = 3 marks)

(Q13 4MA1/2HR, Jan 2022)

Q7.

Show that $\frac{2\sqrt{3}}{\sqrt{3}-1}$ can be written in the form $a + \sqrt{a}$ where a is an integer.

Show your working clearly.

(Total for question = 3 marks)

(QU16 4MA1/2HR, June 2023)

Q8.

The diagram shows a cuboid with a square cross section.

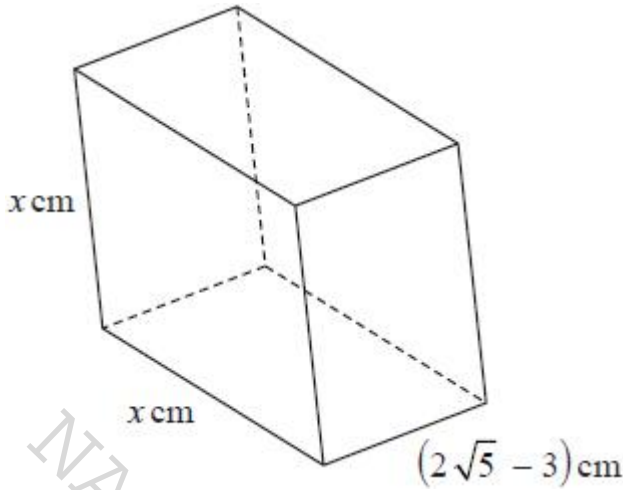


Diagram NOT
accurately drawn

The volume of the cuboid is $(13 + 6\sqrt{5}) \text{ cm}^3$

Without using a calculator, find the value of x
Give your answer in the form $a + \sqrt{b}$ where a and b are integers.
Show your working clearly.

NATURAL SCIENCE SOLUTION

$x = \dots\dots\dots$

(Total for question = 4 marks)

(QU23 4MA1/2H, June 2023)

Q9.

$$\frac{\sqrt{12}}{\sqrt{3} + 2}$$

Show that

can be written in the form $a + \sqrt{b}$ where a and b are integers.

(Total for question = 3 marks)
(Q17 4MA1/2H, Jan 2022)

Q10.

Given that $8\sqrt{m} + \sqrt{49m} - \sqrt{9m} = k\sqrt{m}$

where k is an integer and m is a prime number,

(a) work out the value of k

$k = \dots\dots\dots$ (1)

$$\frac{5 - \sqrt{18}}{1 - \sqrt{2}}$$

(b) Show that can be written in the form $a + b\sqrt{2}$

where a and b are integers.
Show each stage of your working clearly.

(3)
(Total for question = 4 marks)
(Q17 4MA1/2H, Jan 2023)

Topic-15: Surds-2

Q1.

$(a + \sqrt{b})^2 = 49 + 12\sqrt{b}$ where a and b are integers, and b is prime.
Find the value of a and the value of b

$a = \dots\dots\dots$

$b = \dots\dots\dots$

(Total for question = 3 marks)
(Q22 4MA0/4HR, Jan 2016)

Q2.

Express $\sqrt{48} + \sqrt{108}$ in the form $k\sqrt{6}$ is a surd

$\dots\dots\dots$
(Total for question = 3 marks)
(Q23 4MA0/4H, June 2011)

Q3.

(a) Show that $(3 + 2\sqrt{2})(4 - \sqrt{2}) = 8 + 5\sqrt{2}$
Show your working clearly.

$$\frac{10 + 3\sqrt{2}}{\sqrt{2}}$$

(b) Rationalise the denominator and simplify fully
Show your working clearly.

.....
(2)

(Total for question = 4 marks)

(Q17 4MA0/4HR, Jan 2015)

Q4.

Simplify $(7 + 2\sqrt{50})(5 - 2\sqrt{2})$

Give your answer in the form $a + b\sqrt{18}$ where a and b are integers.

Show your working clearly.

.....
(Total for question = 3 marks)

(Q19 4MA0/4H, June 2016)

Q5.

Show that $(6 - \sqrt{8})^2 = 44 - 24\sqrt{2}$

Show each stage of your working clearly.

(Total for question = 3 marks)
(Q20 4MA0/4H, June 2012)

Q6.

$(3 + \sqrt{a})(4 + \sqrt{a}) = 17 + k\sqrt{a}$ where a and k are positive integers.
Find the value of a and the value of k .

$a = \dots\dots\dots$
 $k = \dots\dots\dots$

(Total for question = 3 marks)
(Q19 4MA0/4H, Jan 2013)

Q7.

(a) Show that $(5 - \sqrt{8})(7 + \sqrt{2}) = 31 - 9\sqrt{2}$

Show each stage of your working.

Given that c is a prime number,

$$\frac{3c - \sqrt{c}}{\sqrt{c}}$$

- (b) rationalise the denominator of
Simplify your answer.

.....
(2)
(Total for question = 5 marks)
(Q19 4MA0/4H, June 2015)

Q8.

$$(3 + \sqrt{c})(2\sqrt{c} - 3) = 1 + k\sqrt{c}$$

where c and k are prime numbers.

- (a) Find the value of c and the value of k .

$c =$ $k =$
(3)

$$p^m = \frac{1}{p \times \sqrt[3]{p^2}}$$

- (b) Find the value of m .

$m =$
(3)

(Total for question = 6 marks)
(Q20 4MA0/4HR, Jan 2017)

Q9.

$$\frac{1}{5^3} = 5^p \quad 1 = 5^q \quad \sqrt{5^3} = 5^r$$

(a) Write down the value of

(i) p

$p = \dots\dots\dots$

(ii) q

$q = \dots\dots\dots$

(iii) r

$r = \dots\dots\dots$

(3)

NATURAL

(b) Show that $\frac{14}{\sqrt{245}} = \frac{2\sqrt{5}}{5}$

You must write down each stage of your working.

SCIENCE

SOLUTION

(2)

$(e - 2\sqrt{3})^2 = f - 20\sqrt{3}$ where e and f are integers.

(c) Find the value of e and the value of f

$e = \dots\dots\dots$

$f = \dots\dots\dots$

(3)

(Total for question = 8 marks)
(Q19 4MA0/4HR, June 2015)

Q10.

(a) Write $\frac{1}{32}$ as a power of 2

.....
(2)

(b) Show that $(4 + \sqrt{12})(5 - \sqrt{3}) = 14 + 6\sqrt{3}$
Show each stage of your working clearly.

(3)

(Total for question = 5 marks)

(Q22 4MA0/4H, Jan 2015)

NATURAL SCIENCE SOLUTION

Topic-16: Recurring decimals

Q1.

Use algebra to show that $0.\dot{4}\dot{3}\dot{8} = \frac{217}{495}$

(Total for question = 2 marks)
(Q16 4MA1/2H, Jan 2023)

Q2.

(a) Use algebra to show that $0.\dot{3}\dot{2}\dot{4} = \frac{107}{330}$

(b) Rationalise the denominator of $\frac{4}{7 - \sqrt{5}}$
Show each stage of your working.

Give your answer in the form $a + b\sqrt{5}$ where a and b are fractions in their simplest forms.

(2)

(3)

(Total for question = 5 marks)
(Q14 4MA1/2H/EAM, Specimen papers)

Q3.

Use algebra to show that $0.\dot{6}\dot{8}\dot{1} = \frac{15}{22}$

(Total for question = 2 marks)
(Q13 4MA1/2H, Nov 2020)

Q4.

Use algebra to show that $0.\dot{3}\dot{4}\dot{5} = \frac{19}{55}$

(Total for question = 2 marks)
(QU17 4MA1/2HR, June 2022)

Q5.

(a) Use algebra to show that $0.\dot{3}\dot{7}\dot{2} = \frac{41}{110}$

(2)

- (b) Express $\frac{\sqrt{125} + \sqrt{80}}{\sqrt{3}}$ in the form \sqrt{n} where n is an integer.
Show your working clearly.

.....
(3)

(Total for question = 5 marks)

(Q15 4MA1/2H, Nov 2023)

NATURAL SCIENCE SOLUTION

Topic-17: Sets and Venn diagram-1

Q1.

$$\mathcal{E} = \{\text{integers } x \text{ such that } 10 \leq x \leq 25\}$$

$$A = \{x : x < 18\}$$

$$B = \{x : 13 \leq x < 22\}$$

(a) Write down $n(A)$

.....
(1)

(b) List the members of the set $(A \cup B)'$

.....
(2)

(c) List the members of the set $A' \cap B$

.....
(2)

$$C \subset A, C \subset B \text{ and } n(C) = 5$$

(d) List the members of the set C

.....
(1)
(Total for question = 6 marks)
(Q14 4MA1/2H, Nov 2020)

Q2.

$$\mathcal{E} = \text{letters of the alphabet}$$

$$B = \{b, r, a, z, i, l\}$$

$$I = \{i, r, e, l, a, n, d\}$$

(a) List the members of the set

(i) $B \cup I$

.....

(ii) $B \cap I'$

(2)

$K = \text{k, e, n, y, a}$

Cody writes down the statement $B \cap K = \emptyset$

Cody's statement is wrong.

(b) Explain why.

(1)

(Total for question = 3 marks)
(Q04 4MA1/2H, June 2021)

Q3.

Some students were asked the following question.

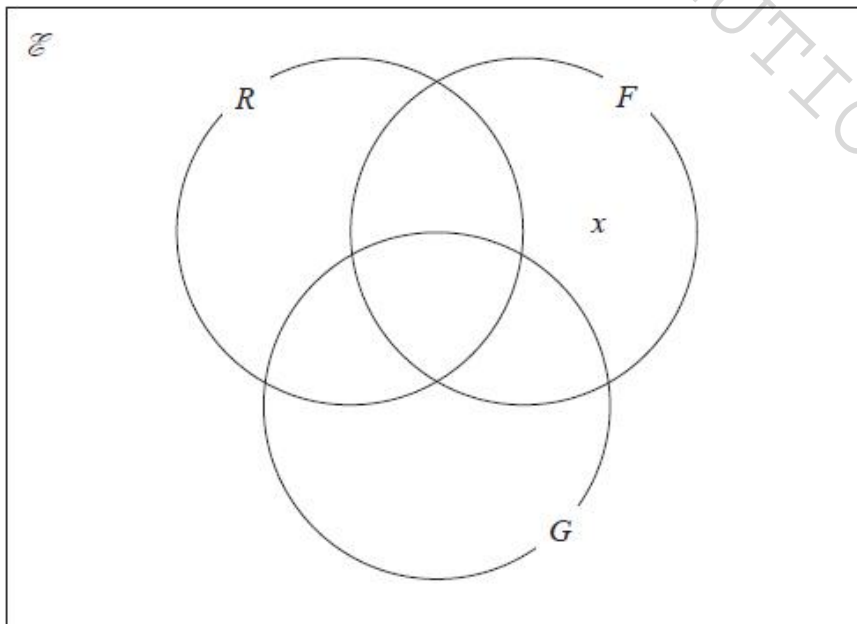
"Which of the subjects Russian (R), French (F) and German (G) do you study?"

Of these students

- 4 study all three of Russian, French and German
- 10 study Russian and French
- 13 study French and German
- 6 study Russian and German
- 24 study German
- 11 study none of the three subjects
- the number who study Russian only is twice the number who study French only.

Let x be the number of students who study French only.

(a) Show all this information on the Venn diagram, giving the number of students in each appropriate subset, in terms of x where necessary.



(3)

Given that the number of students who were asked the question was 80

(b) work out the number of these students that study Russian.

.....
(3)
(Total for question = 6 marks)
(Q16 4MA1/2H, Jan 2021)

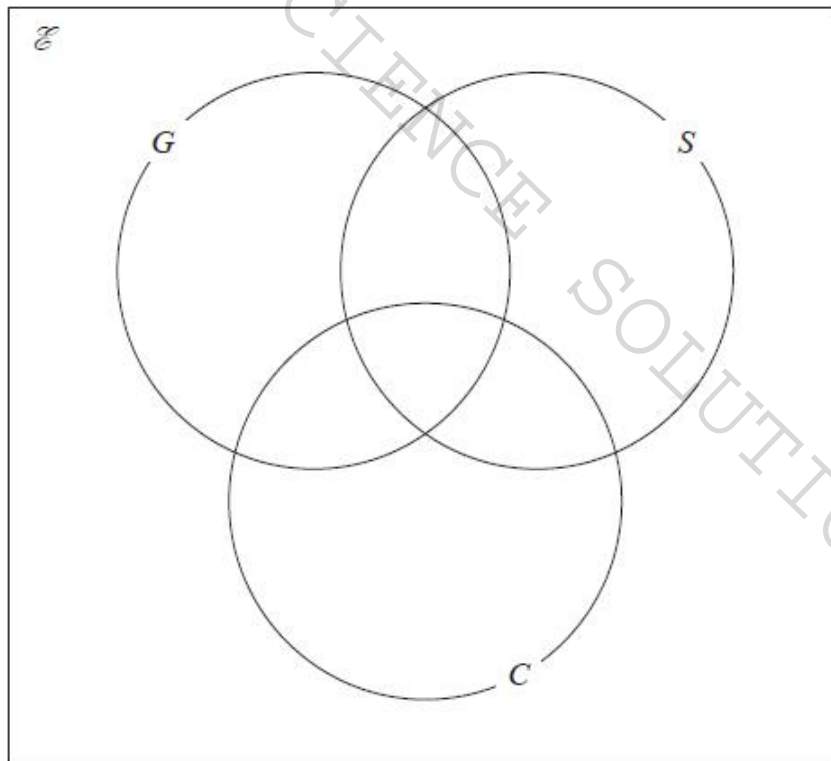
Q4.

100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers

- 31 have sheep
- 53 have chickens
- 6 have goats, sheep and chickens
- 11 have sheep and goats
- 17 have sheep and chickens
- 18 have goats and chickens
- 20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

- (b) Find
- (i) $n(G)$

.....
(1)

(ii) $n([G \cup S]')$

.....
(1)

(iii) $n(G' \cap C)$

.....
(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

.....
(2)

(Total for question = 8 marks)
(QU16 4MA1/2H, June 2022)

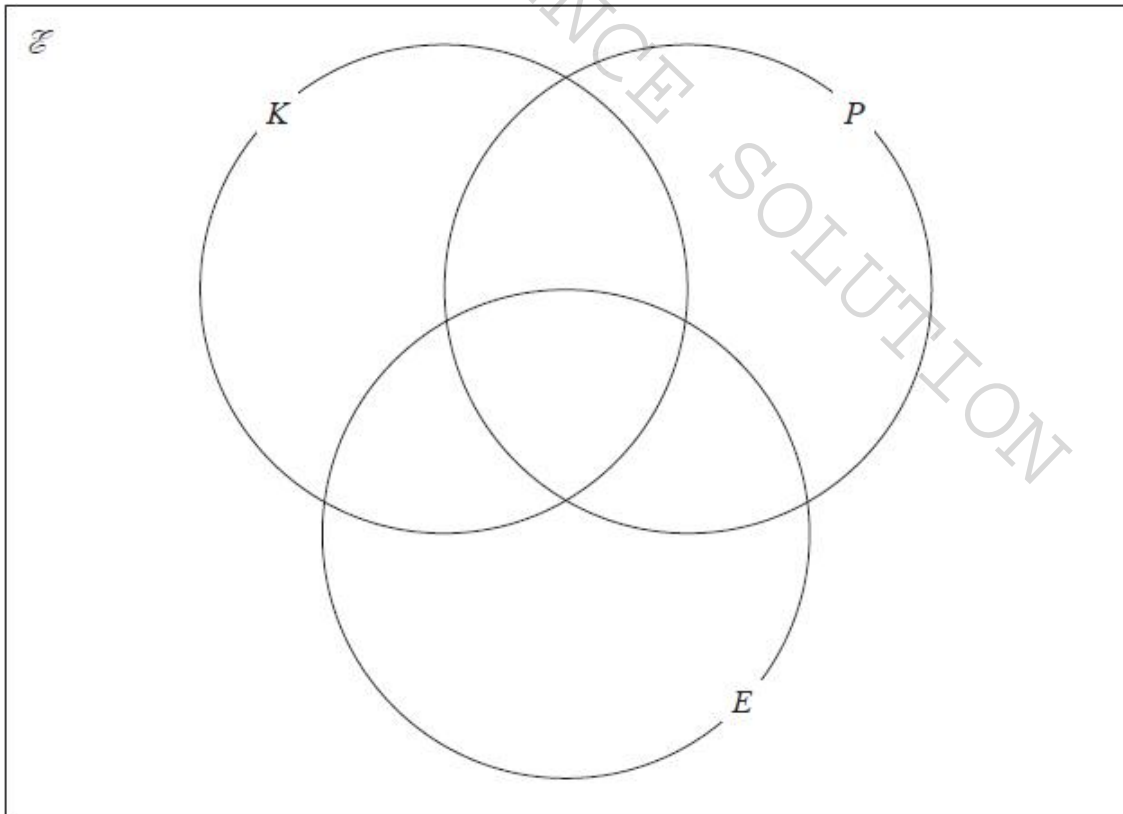
Q5.

60 art students were asked if they would like to attend workshops for knitting (K), for photography (P) or for embroidery (E)

Of these students

- 9 chose knitting, photography and embroidery
- 17 chose knitting and photography
- 16 chose photography and embroidery
- 20 chose knitting and embroidery
- 28 chose photography
- 39 chose embroidery
- 2 chose none of the workshops

(a) Using this information, complete the Venn diagram to show the numbers of students in each subset.



(3)

One of the students is chosen at random.

Given that this student chose photography,

(b) find the probability that this student also chose knitting.

.....
(2)

(c) Find $n(P \cap K)$

.....
(1)

(d) Find $n((P \cup E) \cap K)$

.....
(1)

(Total for question = 7 marks)

(QU16 4MA1/2H, June 2024)

NATURAL SCIENCE SOLUTION

Topic-18: Sets and Venn diagram-2

Q1.

\mathcal{E} = whole numbers

A = factors of 100

B = multiples of 5

List the members of the set $A \cap B$

NATURAL SCIENCE SOLUTION

.....

(Total for question = 2 marks)

(Q04 4MA0/4HR, Jan 2016)

Q2.

$\mathcal{E} = \{ \text{even numbers} \}$

$A = \{ 2, 4, 6, 8, 10 \}$

(a) B is a set such that $A \cap B = \{ 4, 8 \}$

The set B has 3 members.

List the members of one possible set B .

.....

(2)

(b) C is a set such that $A \cap C = \emptyset$

The set C has 3 members.

List the members of one possible set C .

.....

(1)

(Total for question = 3 marks)

(Q05 4MA0/4H, Jan 2013)

Q3.

$$\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A = \{2, 3, 5, 7\}$$

$$B = \{1, 3, 5, 7, 9\}$$

(a) List the members of the set

(i) $A \cap B$

.....

(ii) $A \cup B$

.....

(2)

(b) Find $n(A')$

.....

(1)

(Total for question = 3 marks)

(Q05 4MA0/4HR, Jan 2017)

Q4.

A and B are two sets.

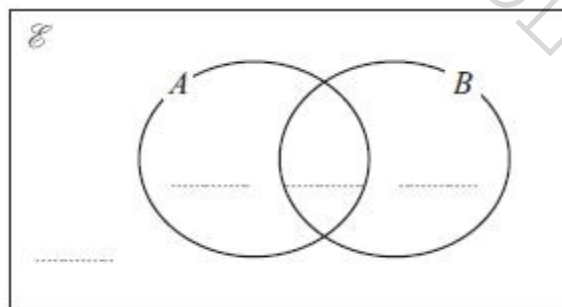
$$n(\mathcal{E}) = 37$$

$$n(A) = 22$$

$$n(A \cap B) = 12$$

$$n(A \cup B) = 30$$

(a) Complete the Venn Diagram to show the **numbers** of elements.



(2)

(b) Find (i) $n(A \cup B)$

.....

(i) $n(A' \cup B)$

.....

(2)

(Total for question is 4 marks)

(Q19 4MA0/4H, Jan 2012)

Q5.

- $\mathcal{E} = \{\text{positive whole numbers less than 13}\}$
- $A = \{\text{even numbers}\}$
- $B = \{\text{multiples of 3}\}$
- $C = \{\text{prime numbers}\}$

(a) List the members of the set

(i) $A \cap B$

.....

(ii) $B \cup C$

.....

(2)

(b) Is it true that $14 \in A$?

Tick (✓) the appropriate box.

Yes

No

Explain your answer.

.....

(1)

(Total for Question is 3 marks)
(Q09 4MA0/4H, Jan 2014)

Q6.

$S = \{\text{c, h, i, n, a}\}$

$V = \{\text{i, t, a, l, y}\}$

List the elements of the set

(i) $S \cap V$

.....

(ii) $S \cup V$

.....

(Total for question = 2 marks)
(Q01 4MA0/4HR, June 2015)

Q7.

$$E = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A = \{\text{even numbers}\}$$

$$B = \{\text{multiples of 3}\}$$

(a) List the members of set B .

.....
(1)

(b) Find $A \cup B$

.....
(1)

(c) Find $A \cap B$

.....
(1)

x is a member of E

$$x \in B$$

$$x \notin A$$

(d) What are the possible values of x ?

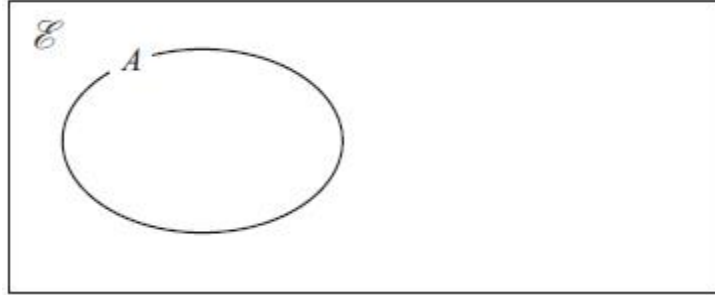
.....
(2)

(Total for question = 5 marks)

(Q09 4MA0/4HR, Jan 2015)

Q8.

A , B and C are three sets.
 $A \cap B = \emptyset$ and $C \subset A$



- (a) Complete the Venn diagram to show the sets B and C (2)
- (b) On the Venn diagram, shade the region that represents $A \cap C'$ (1)

(Total for question = 3 marks)

(Q12 4MA0/4H, June 2012)

Q9.

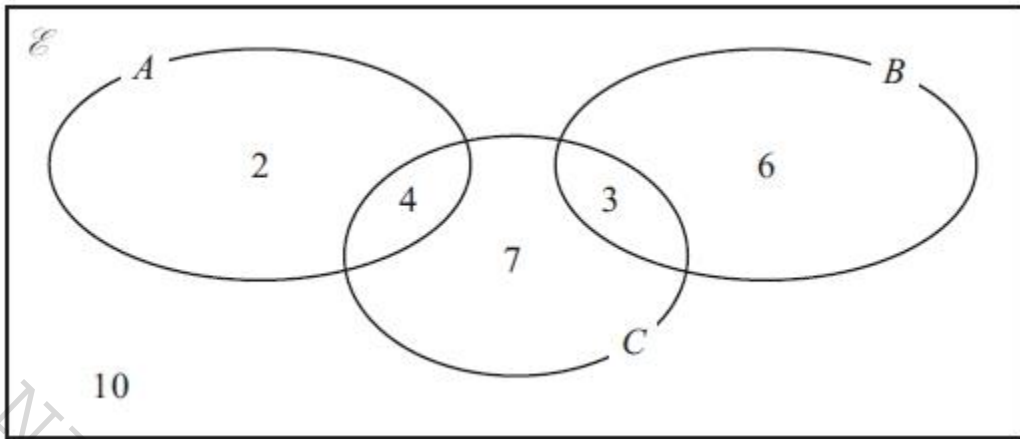
There are 31 students in a class.
 The only languages available for the class to study are French and Spanish.
 17 students study French.
 15 students study Spanish.
 6 students study neither French nor Spanish.
 Using a Venn diagram, or otherwise, work out how many students study only one language.

(Total for question = 4 marks)

(Q14 4MA0/4H, June 2012)

Q10.

The Venn diagram shows a universal set \mathcal{E} and 3 sets A , B and C .



2, 4, 7, 3, 6 and 10 represent **numbers** of elements.

Find

(i) $n(A \cup B)$

(ii) $n(B')$

(iii) $n(A \cap C)$

(iv) $n(B' \cap C)$

.....

.....

.....

.....

(Total for question = 4 marks)

(Q20 4MA0/4H, June 2013)

Q11.

A garage tests cars for faults.

There are three types of fault - braking, steering and lighting.

A car fails the test if it has one or more of these three types of fault.

Last week, 11 cars had braking faults

9 cars had steering faults

7 cars had lighting faults

no car had both steering faults and lighting faults

2 cars had both braking faults and steering faults

3 cars had both braking faults and lighting faults.

By drawing a Venn Diagram, or otherwise, find the number of cars which failed the test last week.

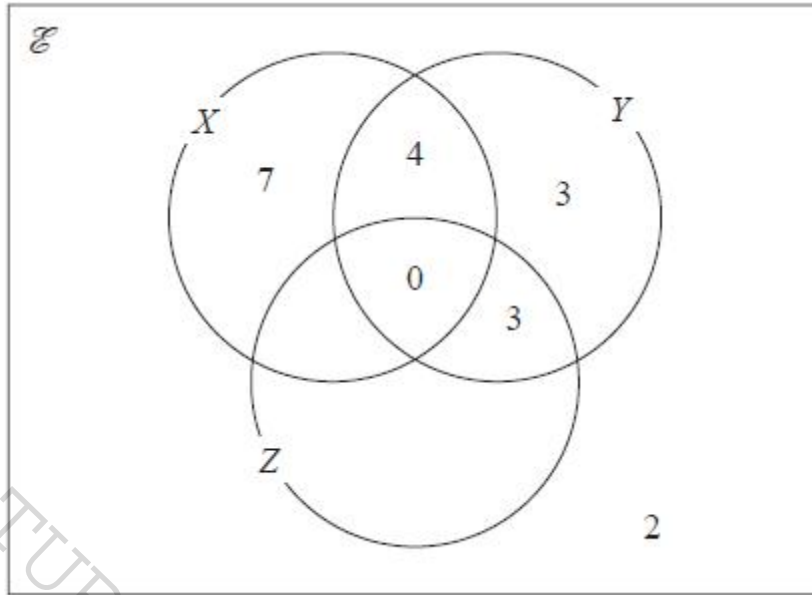
NATURAL SCIENCE SOLUTION

(Total for question = 3 marks)

(Q21 4MA0/4HR, June 2013)

Q12.

The Venn diagram shows a universal set \mathcal{E} and three sets X, Y and Z.



The numbers shown represent **numbers** of elements.

$$n(X') = 14$$

$$n(Z) = 14$$

(a) Complete the Venn diagram.

(2)

(b) Find the value of

(i) $n(X \cup Z)$

(ii) $n(X \cap Y')$

.....

(2)

(Total for question = 4 marks)

(Q18 4MA0/4HR, June 2016)

Q13.

A and B are two sets.

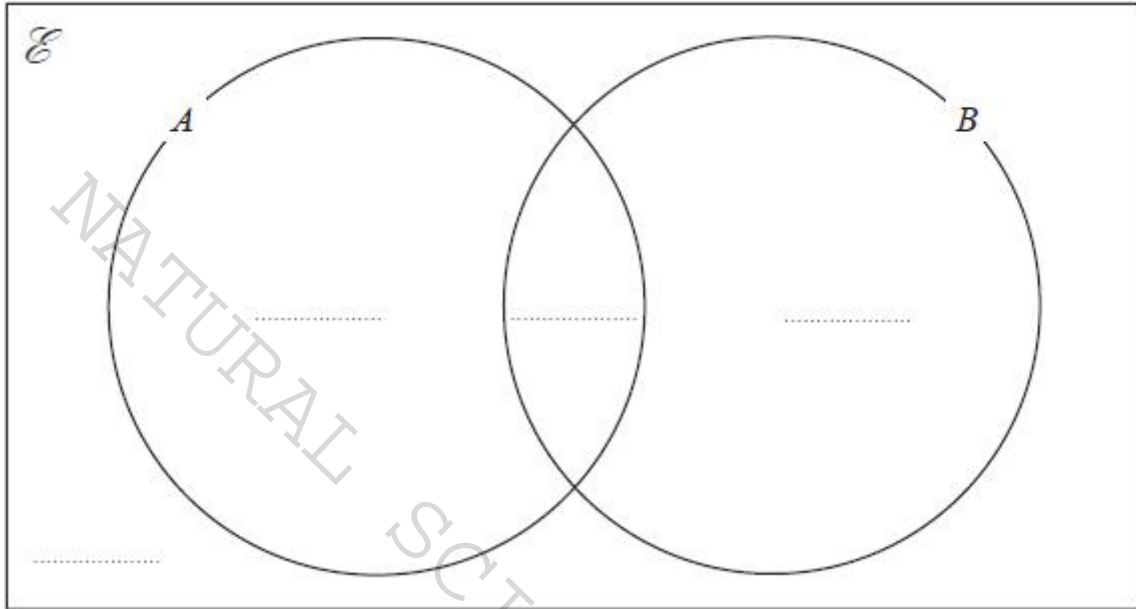
$$n(\mathcal{E}) = 36$$

$$n(B) = 21$$

$$n(A \cap B) = 8$$

$$n(A') = 18$$

(a) Complete the Venn diagram to show the **number of elements** in each region of the Venn diagram.



(3)

(b) Find $n(A \cup B)$

.....
(1)

(c) Find $n(A \cap B')$

.....
(1)

(Total for question = 5 marks)

(Q18 4MA0/4H, June 2015)

Q14.

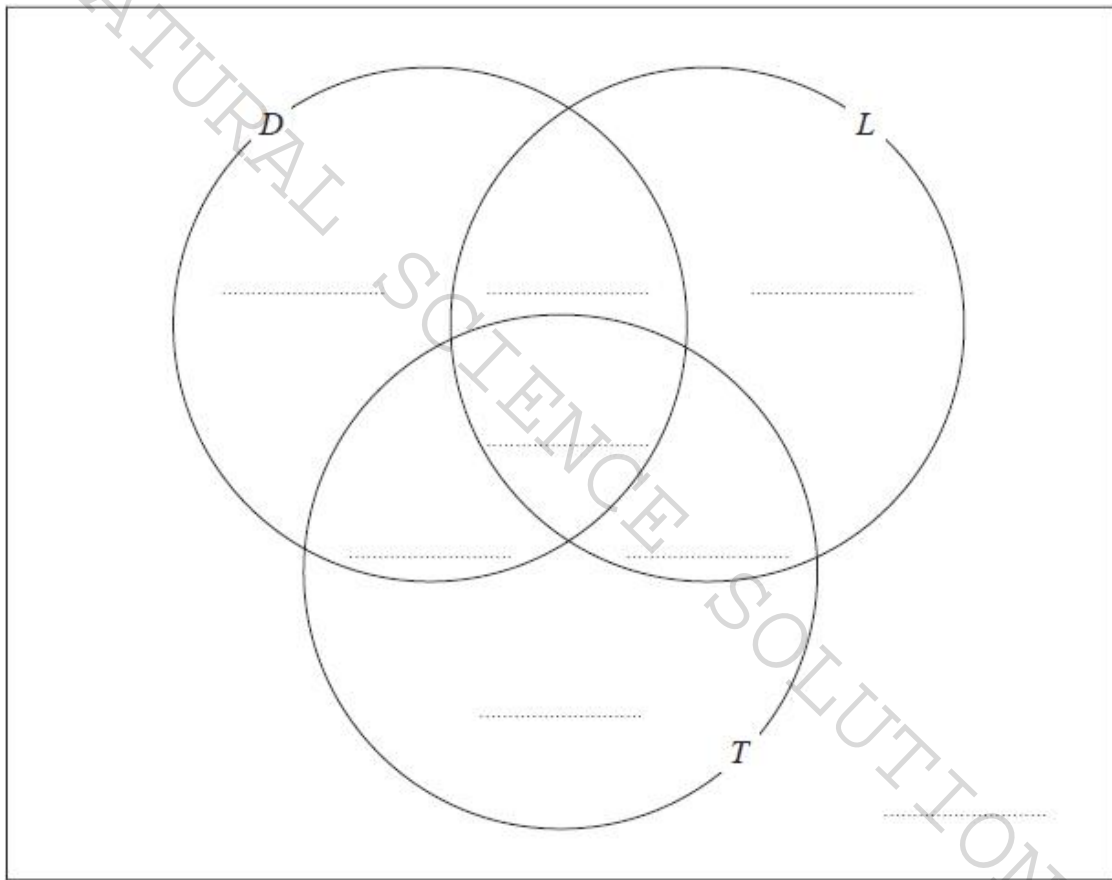
Each student in a group of 32 students was asked the following question.

"Do you have a desktop computer (D), a laptop (L) or a tablet (T)?"

Their answers showed that

- 19 students have a desktop computer
- 17 students have a laptop
- 16 students have a tablet
- 9 students have both a desktop computer and a laptop
- 11 students have both a desktop computer and a tablet
- 7 students have both a laptop and a tablet
- 5 students have all three.

(a) Using this information, complete the Venn diagram to show the number of students in each appropriate subset.



(3)

One of the students with both a desktop computer and a laptop is chosen at random.

(b) Find the probability that this student also has a tablet.

.....

(1)

(Total for question = 4 marks)
(Q21 4MA0/4H, June 2016)

Algebra

NATURALS
SCIENCE
SOLUTION

Topic-19: Subject of an equation

Q1.

Make x the subject of $y = \frac{5 - 2x}{x + 3}$

.....
(Total for question = 4 marks)
(Q15 4MA1/2H, Nov 2020)

Q2.

Make x the subject of $y = \sqrt{\frac{2x + 1}{x - 1}}$

.....
(Total for Question is 4 marks)
(Q17 4MA0/3H, June 2014)

Q3.

Make r the subject of the formula $A = 4\pi r^2$ where r is positive.

$r =$

(Total for question = 2 marks)
(Q09 4MA0/3HR, June 2015)

Q4.

Make t the subject of $5(t - g) = 2t + 7$

.....
(Total for question = 3 marks)
(Q12 4MA0/3H, Jan 2016)

Q5.

Make x the subject of the formula $y = \frac{ax + b}{cx + d}$

.....
(Total for question = 4 marks)
(Q16 4MA0/3HR, June 2017)

Q6.

Make x the subject of the formula $y = \sqrt{\frac{3x - 2}{x + 1}}$

.....
(Total for question = 4 marks)
(Q15 4MA1/2H, June 2019)

Q7.

Make y the subject of $3(y + 2x - 1) = x + 5y$

$y = \dots\dots\dots$

(Total for question is 3 marks)
(Q11 4MA0/3H, Jan 2012)

Q8.

Make h the subject of the formula $A = 2\pi r(r + h)$

$h = \dots\dots\dots$

(Total for question = 2 marks)
(Q12 4MA0/3H, Jan 2013)

Q9.

Make n the subject of the formula

$$t = \sqrt{\frac{n+3}{n}}$$

$n = \dots\dots\dots$

(Total for question = 4 marks)
(Q17 4MA0/3HR, June 2013)

Q10.

Given that y is positive, make y the subject of $y = \sqrt{ay^2 + n}$

Show clear algebraic working.

$y = \dots\dots\dots$

(Total for Question is 5 marks)
(Q16 4MA0/3H, Jan 2014)

Q11.

Make r the subject of the formula $A = 4r^2 - \pi r^2$ where r is positive.

$r = \dots\dots\dots$

(Total for Question is 3 marks)
(Q16 4MA0/3HR, Jan 2014)

Q12.

Make g the subject of $3e + 4g = 7 + 9eg$

$\dots\dots\dots$

(Total for question = 3 marks)
(Q19 4MA0/4HR, Jan 2016)

Q13.

Make t the subject of the formula $m = \frac{t+1}{t-3}$

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)
(Q18 4MA0/3H, June 2016)

Q14.

Make e the subject of $k = \sqrt{\frac{5m+2e}{3e}}$

.....
(Total for question = 4 marks)

(Q19 4MA0/3H, Jan 2017)

Q15.

Make y the subject of $\frac{y}{x} + \frac{2y}{x+4}$

Show your working clearly and give your answer as simply as possible.

NATURAL SCIENCE SOLUTION

$y = \dots\dots\dots$

(Total for question = 5 marks)

(Q22 4MA0/3H, June 2013)

Q16.

Make t the subject of $n^2 = \frac{4d+t^3}{t^3}$

$\dots\dots\dots$
(Total for question = 4 marks)

(Q15 4MA1/2HR, Jan 2022)

Topic-20: Solving linear equations

Q1.

Solve $7y - 6 = 2y + 8$

Show clear algebraic working.

$y = \dots\dots\dots$

(Total for question = 3 marks)
(Q06 4MA0/4H, June 2013)

Q2.

Solve $3(2 - 4x) = 5 - 8x$

Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q02 4MA1/1H, Jan 2023)

NATURAL SCIENCE SOLUTION

Q3.

$$\frac{3x - 2}{5} - \frac{3 - 4x}{2} = 2$$

Solve

Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 4 marks)
(Q11 4MA1/2H/EAM, Specimen papers)

Q4.

Solve $7x - 5 = 3x + 2$

Show your working clearly.

$x = \dots\dots\dots$

(Total for question is 3 marks)
(Q03 4MA0/4H, Jan 2012)

Q5.

Solve $3x + 16 = 1 - 2x$

Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q10 4MA0/4H, Jan 2013)

Q6.

Solve $6(3y + 5) = 39$
Show clear algebraic working.

$y = \dots\dots\dots$

(Total for Question is 3 marks)
(Q03 4MA0/4H, Jan 2014)

Q7.

Solve $3(2z - 5) = 4z + 11$
Show clear algebraic working.

$z = \dots\dots\dots$

(2)
(Total for Question is 3 marks)
(Q06 4MA0/3HR, June 2014)

Q8.

Solve $7x - 2 = 1 - 3x$
Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q04 4MA0/3HR, June 2015)

Q9.

Solve $3(2x + 5) = 4 - x$
Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q08 4MA0/3H, Jan 2016)

Q10.

Solve $8y - 18 = 3(y + 3)$
Show clear algebraic working.

$y = \dots\dots\dots$

(Total for question = 3 marks)
(Q02 4MA0/4H, June 2016)

Q11.

Solve $5x - 8 = x - 10$
Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q02 4MA0/3HR, June 2017)

Q12.

Solve $4(5y - 1) = 3(6y + 7)$
Show clear algebraic working.

$y = \dots\dots\dots$

(Total for question = 3 marks)

(Q06 4MA0/3H, Jan 2015)

Q13.

(a) Solve $7x - 6 = 2x + 17$
Show clear algebraic working.

$x = \dots\dots\dots$

(3)

(b) Expand and simplify fully $(x + 8)(x + 2)$

$\dots\dots\dots$

(2)

(Total for Question is 5 marks)

(Q09 4MA0/4H, June 2014)

Q14.

Solve $2y + \frac{2 - 3y}{4} = \frac{1}{4}$

Show clear algebraic working.

$y = \dots\dots\dots$

(3)

(Total for question = 3 marks)
(Q14 4MA0/4HR, June 2016)

Q15.

(a) Solve $6t - 5 = 2t + 9$

Show clear algebraic working.

$t = \dots\dots\dots$

(3)

(b) Expand and simplify $3(2y + 2) + 2(y - 4)$

$\dots\dots\dots$

(2)

(c) Simplify fully $4wxy \div (8xy)$

$\dots\dots\dots$

(2)

(Total for question = 7 marks)
(Q02 4MA0/4HR, June 2016)

Q16.

- (a) Solve $3(2x - 1) = 6$
 Show clear algebraic working.

$x = \dots\dots\dots$ (3)

- (b) Solve $\frac{2y+1}{3} = \frac{y-2}{4}$
 Show clear algebraic working.

$y = \dots\dots\dots$ (4)

(Total for question = 7 marks)
 (Q09 4MA0/3H, June 2012)

Q17.

$ABCD$ is a trapezium.

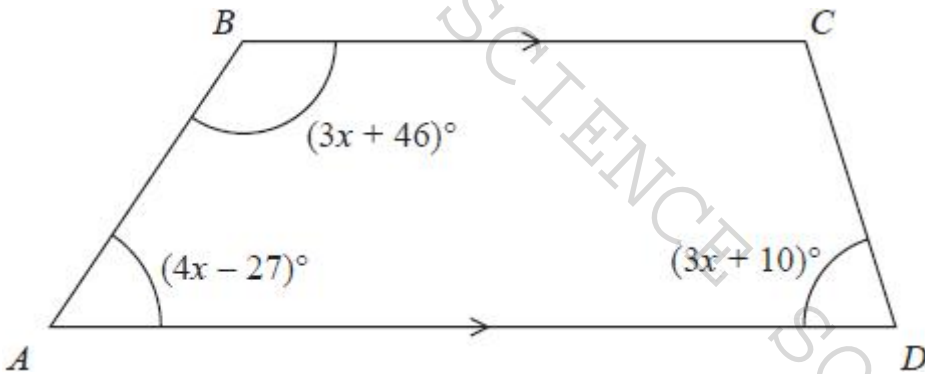


Diagram NOT accurately drawn

BC is parallel to AD

Find the size of the largest angle inside the trapezium.

$\dots\dots\dots^\circ$

(Total for question = 4 marks)
 (QU03 4MA1/2H, June 2023)

Q18.

Rectangle **A** has a width of x metres and a height of $(x + 2)$ metres.
 Rectangle **B** has a width of $2x$ metres and a height of $4x$ metres.

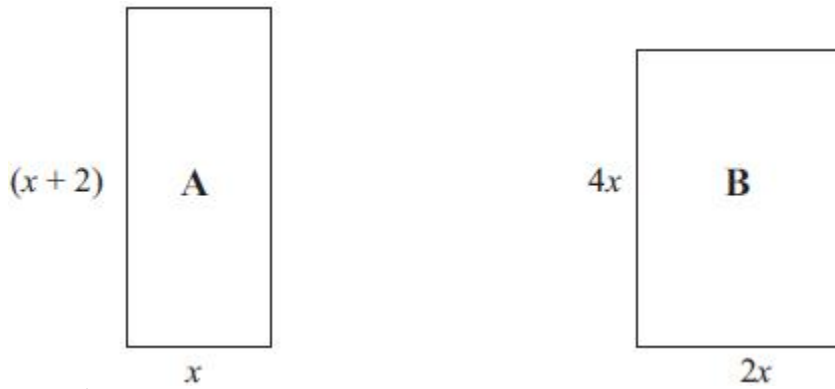


Diagram NOT accurately drawn

The perimeter of rectangle **A** is equal to the perimeter of rectangle **B**.

(i) Use this information to write down an equation in x .

(ii) Find the value of x .

.....

$x =$

(Total for question = 4 marks)

(Q02 4MA0/3H, Jan 2013)

Q19.

The diagram shows a parallelogram $ABCD$.

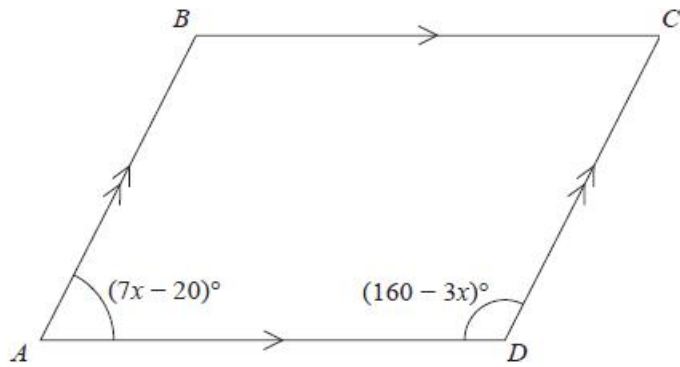


Diagram **NOT**
accurately drawn

Angle $BAD = (7x - 20)^\circ$

Angle $ADC = (160 - 3x)^\circ$

Work out the value of x .

Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q08 4MA0/4HR, Jan 2017)

Topic-21: Quadratic equations-1

Q1.

(i) Factorise $x^2 + 9x - 22$

.....
(2)

(ii) Hence, solve $x^2 + 9x - 22 = 0$

.....
(1)

(Total for question = 3 marks)
(QU11 4MA1/2H, June 2024)

Q2.

(i) Factorise $x^2 + 2x - 24$

.....
(2)

(ii) Hence solve $x^2 + 2x - 24 = 0$

.....
(1)

(Total for question = 3 marks)
(Q09 4MA1/2H, June 2021)

Q3.

(a) Simplify $(3x^2y)^0$

.....
(1)

(b) (i) Factorise $x^2 - 5x - 36$

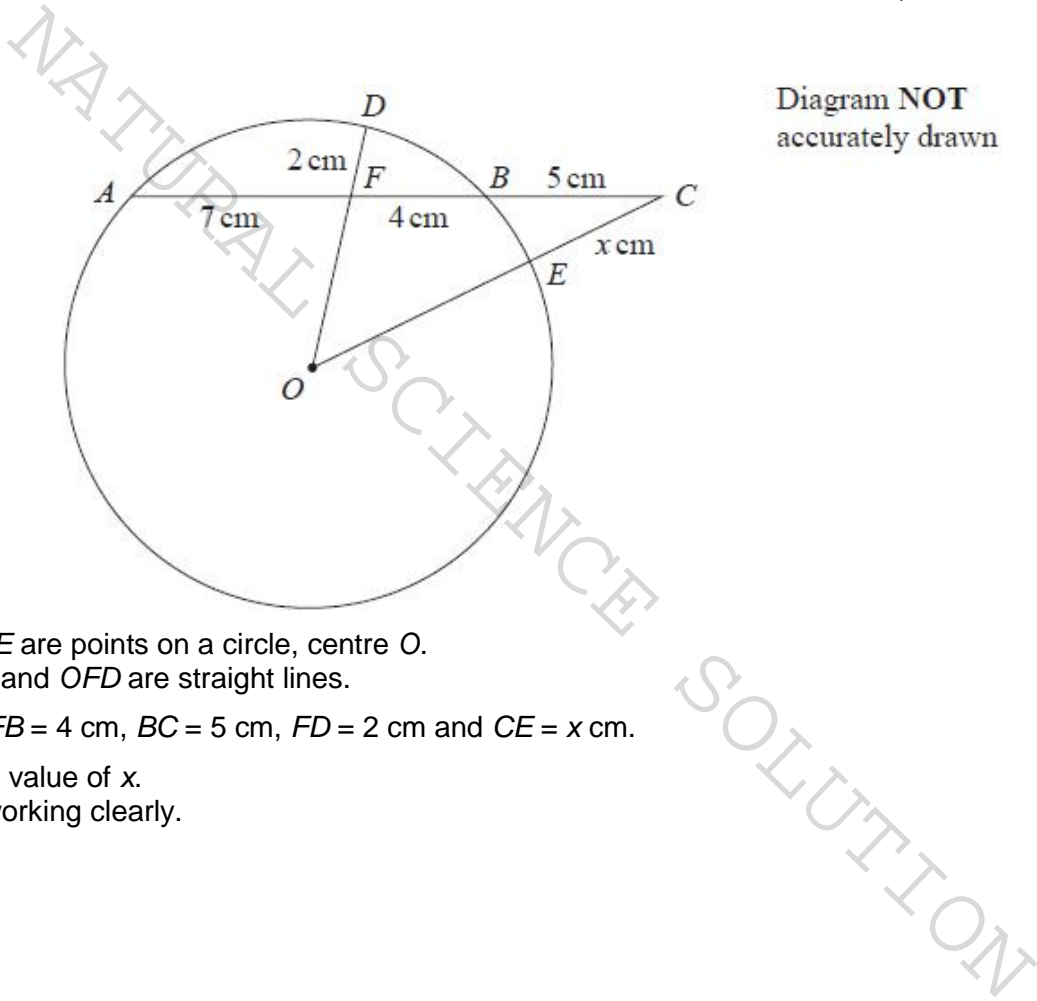
.....
(2)

(ii) Hence solve $x^2 - 5x - 36 = 0$

.....
(1)

(Total for question = 4 marks)
(Q08 4MA1/2H, Nov 2021)

Q4.



A, D, B and E are points on a circle, centre O.
AFBC, OEC and OFD are straight lines.

AF = 7 cm, FB = 4 cm, BC = 5 cm, FD = 2 cm and CE = x cm.

Work out the value of x.
Show your working clearly.

x =

(Total for question = 6 marks)
(QU22 4MA1/2H, June 2018)

Q5.

Express $3x^2 - 6x + 5$ in the form $a(x - b)^2 + c$

NATURAL SCIENCE SOLUTION

.....
(Total for question = 3 marks)

(QU19 4MA1/2H, June 2023)

Topic-22: Quadratic equation-2

Q1.

(a) Factorise $4x^2 - 1$

.....
(2)

(b) Solve $\frac{4}{2x+1} + \frac{1}{4x^2-1} = 3$

Show clear algebraic working.

.....
(4)

(Total for question = 6 marks)
(Q20 4MA0/4HR, Jan 2015)

Q2.

Solve $5x^2 + 2x - 4 = 0$

Give your solutions correct to 3 significant figures.

Show your working clearly.

.....
(Total for question = 3 marks)

(Q18 4MA0/4H, Jan 2013)

Q3.

Solve $2x^2 - 6x + 3 = 0$

Give your solutions correct to 3 significant figures.
Show your working clearly.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 3 marks)

(Q16 4MA0/4HR, June 2016)

Q4.

Solve $11x^2 - 3x - 5 = 0$

Show your working clearly.
Give your solutions correct to 2 decimal places.

.....
(Total for question = 3 marks)

(Q17 4MA0/4HR, June 2017)

Q5.

Solve $3x^2 + 2x - 7 = 0$

Give your solutions correct to 3 significant figures.

Show your working clearly.

.....
(Total for question = 3 marks)
(Q13 4MA0/4H, June 2015)

Q6.

(a) Solve $5x^2 - 6x - 2 = 0$

Give your solutions correct to 3 significant figures.

Show your working clearly.

.....
(3)

(b) Solve the inequality $\frac{m^2 + 3}{4} > 21$

Show clear algebraic working.

.....
(4)
(Total for Question is 7 marks)
(Q18 4MA0/4H, June 2014)

Q7.

(a) Solve $x^2 - 4x - 1 = 0$

Show your working clearly.

Give your solutions correct to 3 significant figures.

.....
(3)

Hence, or otherwise,

(b) solve $(x + 3)^2 - 4(x + 3) - 1 = 0$

giving your solutions correct to 3 significant figures.

.....
(1)
(Total for question = 4 marks)
(Q14 4MA0/4HR, Jan 2015)

Q8.

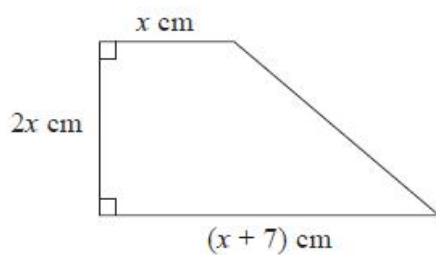


Diagram NOT
accurately drawn

The diagram shows a trapezium.
The trapezium has an area of 17 cm^2

(a) Show that $2x^2 + 7x - 17 = 0$

(3)

(b) Work out the value of x .
 Give your answer correct to 3 significant figures.
 Show your working clearly.

$x = \dots\dots\dots$

(3)

(Total for question = 6 marks)
 (Q17 4MA0/4H, Jan 2015)

Q9.

Here is a hexagon.

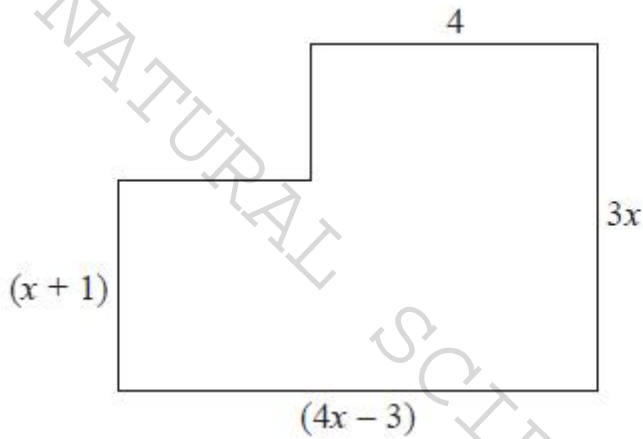


Diagram NOT
 accurately drawn

In the diagram, all the measurements are in centimetres.
 All the corners are right angles.

The area of the hexagon is 40 cm^2

(a) Show that $4x^2 + 9x - 47 = 0$

(3)

(b) Solve $4x^2 + 9x - 47 = 0$

Show your working clearly.
 Give your solutions correct to 3 significant figures.

$\dots\dots\dots$

(3)

(c) Find the length of the longest side of the hexagon.
Give your answer correct to 3 significant figures.

..... cm

(2)

(Total for Question is 8 marks)
(Q16 4MA0/4HR, June 2014)

Q10.

A rectangular piece of card has length $(3x - 13)$ cm and width $(x - 2)$ cm.
A square, with sides of length 25 cm, is removed from each corner of the card.

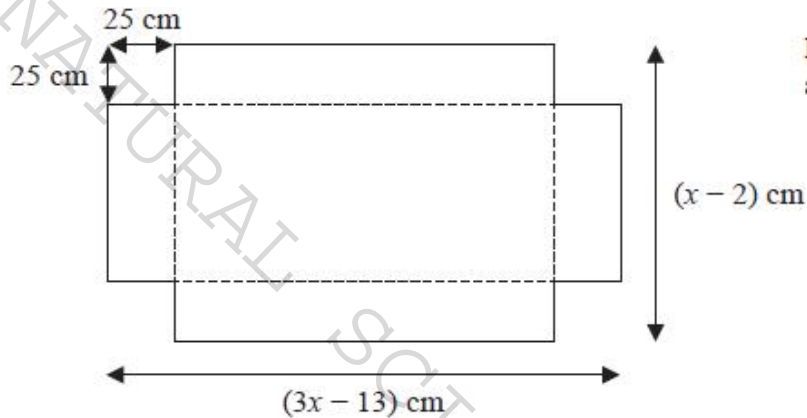
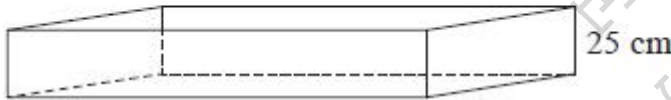


Diagram NOT accurately drawn

The card is then folded along the dashed lines to make an open box with height 25 cm as shown below.

Diagram NOT accurately drawn



(a) Show that the length of the open box is $(3x - 63)$ cm.

(1)

The volume of the open box is $81\,900 \text{ cm}^3$

(b) Find the value of x .

Show clear algebraic working.

$x =$

(5)

(Total for question = 6 marks)
(Q21 4MA0/4HR, Jan 2017)

Q11.

Clare buys some shares for \$50x.

Later, she sells the shares for \$(600 + 5x).

She makes a profit of x%

(a) Show that $x^2 + 90x - 1200 = 0$

(3)

(b) Solve $x^2 + 90x - 1200 = 0$

Find the value of x correct to 3 significant figures.

x = (3)

(Total for question = 6 marks)
(Q21. 4MA0/4H, June 2011)

Q12.

$$\frac{3}{(x+1)} + \frac{2}{(2x-3)} = 1$$

Solve.

Show clear algebraic working.

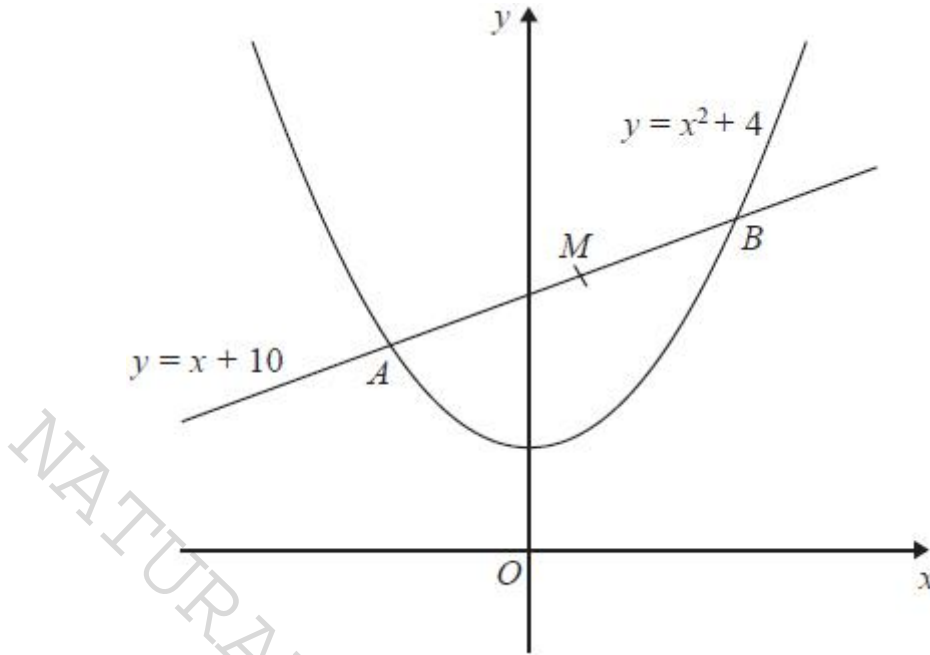
NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

(Q23 4MA0/4H, June 2013)

Q13.

The sketch shows the curve with equation $y = x^2 + 4$ and the line with equation $y = x + 10$



The line cuts the curve at the points A and B .

M is the midpoint of AB .

Find the coordinates of M .

Show clear algebraic working.

NATURAI SCIENCE SOLUTION

.....
(Total for question = 6 marks)

(Q20 4MA0/4HR, June 2016)

Q14.

A rectangular lawn has a length of $3x$ metres and a width of $2x$ metres. The lawn has a path of width 1 metre on three of its sides.

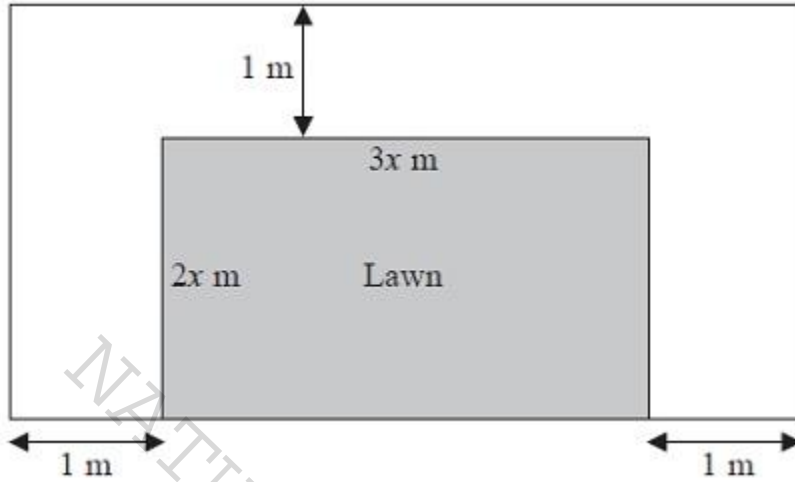


Diagram NOT accurately drawn

The total area of the lawn and the path is 100 m^2

(a) Show that $6x^2 + 7x - 98 = 0$

(2)

(b) Calculate the area of the lawn. Show clear algebraic working.

..... m^2
(5)

(Total for Question is 7 marks)

(Q18 4MA0/4H, Jan 2014)

Topic-23: Index, Bracket, Factorisation, Subject OF Equation

Q1.

(a) Simplify n^0 (1)

(b) Simplify $(3x^2y^5)^3$ (2)

(c) Factorise fully $2e^2 - 18$ (2)

(d) Make r the subject of $m = \sqrt{\frac{6a+r}{5r}}$ (2)

(4)
(Total for question = 9 marks)
(Q12 4MA1/2H, Jan 2019)

Q2.

(a) Simplify $g^6 \times g^4$ (1)

(b) Simplify $k^{10} \div k^3$ (1)

(c) Simplify $(3cd^4)^2$ (2)

(d) Solve the inequality $4x + 7 > 2$

.....

(2)
(Total for question = 6 marks)
(Q01 4MA1/2H, Nov 2020)

Q3.

(a) Simplify fully $(8e^{15})^{\frac{2}{3}}$

.....

(2)

(b) Express $\left(\frac{y}{2}\right)^{-4}$ in the form ay^n where a and n are integers.

.....

(2)

(c) Solve $\frac{4x - 2}{3} - \frac{5 - 3x}{4} = 6$

Show clear algebraic working.

$x =$

(4)
(Total for question = 8 marks)
(Q11 4MA1/2H, Nov 2020)

Q4.

(a) Solve $p = \frac{3p - 5}{10}$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

$p = \dots\dots\dots$
(3)

(b) Simplify a^0 where $a > 0$

$\dots\dots\dots$
(1)

(c) Simplify fully $\frac{3xy^3}{6x^2y}$

$\dots\dots\dots$
(2)

(d) Factorise fully $10c^3d^2 + 15cd^4$

$\dots\dots\dots$
(2)

(Total for question = 8 marks)

(QU06 4MA1/2HR, June 2022)

Q5.

(i) Factorise $x^2 + 5x - 24$

.....
(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....
(1)

(Total for question = 3 marks)
(QU11 4MA1/2H, June 2022)

Q6.

(a) Simplify $\frac{2}{y^0}$

.....
(1)

(b) Simplify fully $(16a^4)^{\frac{3}{4}}$

.....
(2)

(c) Expand and simplify $5x(3x + 4)(2x - 1)$

.....
(3)

(Total for question = 6 marks)
(Q12 4MA1/2HR, Jan 2023)

Q7.

(a) Expand and simplify $4x(2x + 5) - 3x(2x - 3)$

.....
(2)

Given that $\frac{y^5 \times y^n}{y^6} = y^{13}$

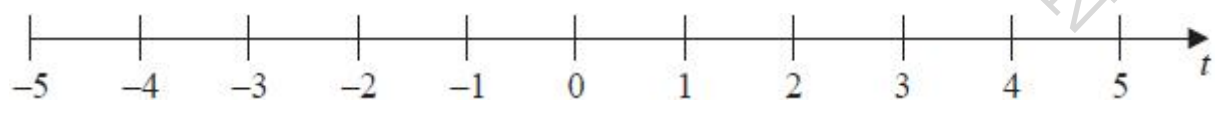
(b) work out the value of n .

$n =$
(2)

(c) (i) Solve the inequality $7t - 8 < 2t + 7$

.....
(2)

(ii) On the number line below, represent the solution set of the inequality solved in part (c)(i)



(1)

(Total for question = 7 marks)

(Q05 4MA1/2H, Jan 2021)

Q8.

(a) Solve $\frac{9a - 7}{5} - \frac{3a - 7}{4} = 4.55$

Show clear algebraic working.

$a = \dots\dots\dots$
(3)

(b) Make c the subject of the formula $p = \sqrt{\frac{ac + 8}{3 + c}}$

$\dots\dots\dots$
(4)

(Total for question = 7 marks)

(Q14 4MA1/2H, Jan 2021)

Q9.

$$P = \frac{a}{m - x}$$

- $x = 8$ correct to 1 significant figure
 $a = 4.6$ correct to 2 significant figures
 $m = 20$ correct to the nearest 10

Calculate the lower bound of P .
Show your working clearly.

(Total for question = 4 marks)

(Q18 4MA1/2H, Jan 2019)

Q10.

- (a) Expand and simplify $(5 - x)(2x + 3)(x + 4)$
Show your working clearly.

.....
(3)

(b) Make c the subject of $g = \frac{c+3}{4+c} - 7$

NATURAL SCIENCE SOLUTION

.....
(4)

(Total for question = 7 marks)

(QU14 4MA1/2H, June 2022)

Q11.

Expand and simplify $(2x + 3)(x - 5)(x + 4)$

.....
(Total for question = 3 marks)

(Q16 4MA1/2H, Nov 2023)

Q12.

$$P = m^2 - 4c$$

(a) Work out the value of P when $m = -5$ and $c = 3$

$P =$
(2)

(b) Expand and simplify $(x + 5)(x - 7)$

.....
(2)

(Total for question = 4 marks)

(QU01 4MA1/2HR, June 2023)

Q13.

(a) Expand and simplify $(x + 6)(3x - 2)(x + 6)$

.....
(3)

(b) Make e the subject of $w = \sqrt{\frac{e+g}{ef-d}}$

NATURAL SCIENCE SOLUTION

.....
(4)
(Total for question = 7 marks)
(QU17 4MA1/2H, June 2023)

Q14.

(a) Expand and simplify $(y + 4)(2 - y)$

.....
(2)

(b) Factorise fully $15b^5c - 35b^3c^9$

.....
(2)
(Total for question = 4 marks)
(Q01 4MA1/2H, Jan 2022)

Topic-24: Simplifying Fractions

Q1.

Express

$$\frac{1}{3x-2} \times \frac{9x^2-4}{3x^2-13x-10} - \frac{7}{x-1}$$

as a single fraction in its simplest form.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

(Q21 4MA1/1H, Nov 2020)

Q2.

Express $\frac{3}{4} + \frac{5-x}{6x}$ as a single fraction in its simplest terms.

.....
(Total for question = 3 marks)
(Q11 4MA1/1H, Nov 2023)

Q3.

Solve $\frac{45x^3 - 80x}{3x^2 + x - 4} \times \left(\frac{1}{3x-4} + \frac{1}{x} \right) = \frac{4(x+2)}{5x-8}$

Show clear algebraic working.

$x =$

(Total for question = 5 marks)

(Q24 4MA1/2H, Nov 2023)

Q4.

Express $\frac{5}{3} - \frac{x+2}{2x}$ as a single fraction in its simplest terms.

(Total for question = 3 marks)
(Q11 4MA1/1H, Jan 2019)

Q5.

Write

$$\frac{4x^2 - 17x - 15}{2x - 1} \times \frac{2x^2 - 7x + 3}{x^2 - 25} + (29 - 4x)$$

as a single fraction in its simplest form.

.....
(Total for question = 4 marks)
(Q26 4MA1/2HR, Jan 2023)

Q6.

Express $\left(\frac{20}{x^2 - 36} - \frac{2}{x - 6}\right) \times \frac{1}{4 - x}$ as a single fraction in its simplest form.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 3 marks)
(QU23 4MA1/2HR, June 2022)

Q7.

(a) Factorise $9x^2 - 4y^2$

.....
(2)

(b) Express $\frac{7}{8} - \frac{x+3}{4x}$ as a single fraction in its simplest form.

.....
(3)
(Total for question = 5 marks)
(QU11 4MA1/1H, June 2022)

Q8.

(a) Simplify $(64p^9q^{12})^{\frac{2}{3}}$

.....
(2)

(b) Write as a single fraction $\frac{2}{3x} + \frac{4}{5x} - \frac{9}{10x}$

Give your answer in its simplest form.

.....
(2)

(c) Expand and simplify $4x(x - 5)(2x + 3)$

Show your working clearly.

.....
(3)

(Total for question = 7 marks)

(Q12 4MA1/2H, Nov 2021)

Q9.

(a) Simplify fully $(32a^{15})^{\frac{3}{5}}$

.....
(2)

(b) Express $\left(\frac{1}{10x}\right)^{-3}$ in the form px^n where p and n are integers.

.....
(2)

(c) Solve $\frac{1-2y}{3} = \frac{4}{5} - \frac{2y-1}{2}$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

$y =$
(3)

(Total for question = 7 marks)

(QU15 4MA1/2H, June 2023)

Q10.

Express

$$\left(\frac{4}{2x-5} - \frac{3}{2x-3} \right) \div \frac{9x-4x^3}{6x^2-17x+5}$$

as a single fraction in its simplest form.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)

(Q24 4MA1/2H, Jan 2020)

Q11.

Write $\frac{5}{4x^2 - 25} - (2x + 3) \div \left(\frac{4x^2 + 16x + 15}{7} \right)$ as a single fraction in its simplest form.

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....

(Total for question = 4 marks)

(Q21 4MA1/2H/EAM, Specimen papers)

Q12.

Simplify $(x^2 - 4) \div \left(\frac{4x^2 - 7x - 2}{x} \right) - 2x$

Give your answer in the form $\frac{ax^2}{bx + c}$ where a , b and c are integers.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)

(QU23 4MA1/1HR, June 2023)

Q13.

(a) Express $\frac{4}{x-2} - \frac{3}{x+1}$ as a single fraction.
Give your answer in its simplest form.

.....
(3)

Expand and simplify $2x(x-5)(x-3)$

.....
(3)

(Total for question = 6 marks)

(Q12 4MA1/1H, Jan 2021)

Q14.

Write $\frac{25x^2 - 64}{5x^2 - 13x - 6} \times \frac{x^2 - 8x + 15}{5x + 8} - (x - 7)$

as a single fraction in its simplest form.
Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)

(Q21 4MA1/2H, Jan 2021)

Topic-25: Proportion-1

Q1.

M varies directly as the cube of h

$M = 4$ when $h = 0.5$

Find the value of h when $M = 500$

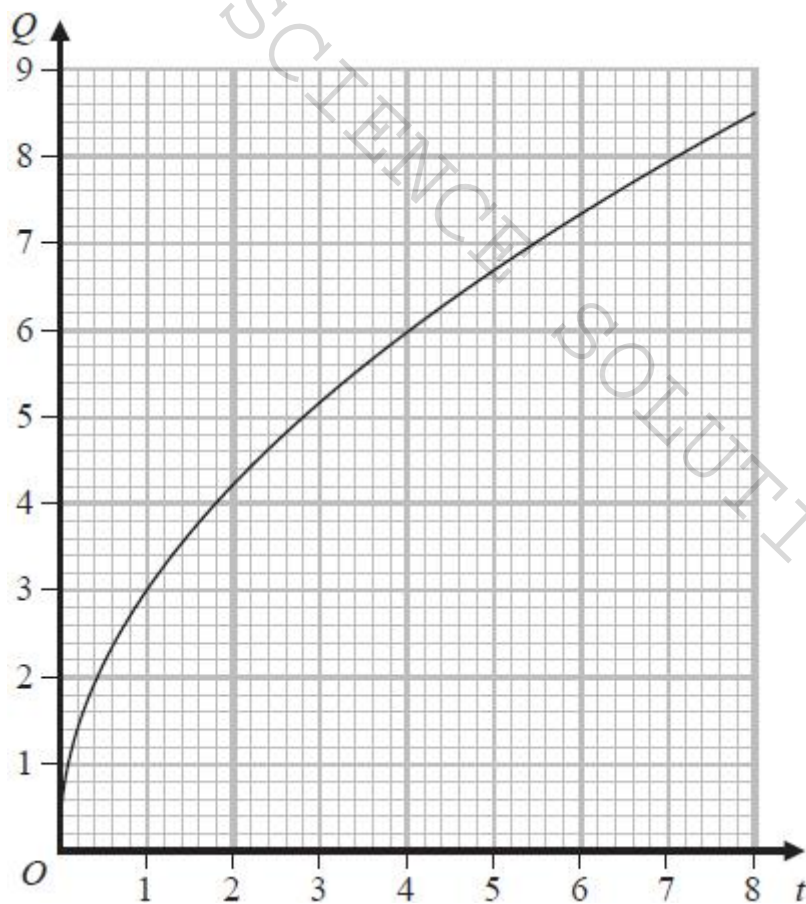
.....
(Total for question = 4 marks)

(QU17 4MA1/2H, June 2022)

Q2.

Q is directly proportional to \sqrt{t}

The graph shows the relationship between Q and t for $0 < t < 8$



(a) Find a formula for Q in terms of t

.....
(3)

Q is increased by 20%

(b) Find the percentage increase in t

..... %
(2)

(Total for question = 5 marks)

(QU16 4MA1/2H, June 2023)

Q3.

y is directly proportional to the cube of x

$y = 20h$ when $x = h$ ($h \neq 0$)

(a) Find a formula for y in terms of x and h

$y =$
(3)

- (b) Find x in terms of h when $y = 67.5 h$
Give your answer in its simplest form.

$x = \dots\dots\dots$

(2)

(Total for question = 5 marks)
(Q17 4MA1/2H, June 2019)

Q4.

A is inversely proportional to the square of r

$A = 5$ when $r = 0.3$

- (a) Find a formula for A in terms of r

$\dots\dots\dots$

(3)

- (b) Find the value of A when $r = 7.5A$

$A = \dots\dots\dots$

(3)

(Total for question = 6 marks)
(Q16 4MA1/2H, June 2021)

Q5.

y is inversely proportional to \sqrt{x}
 x is directly proportional to T^3

Given that $y = 8$ when $T = 25$

find the exact value of T when $y = 27$

$T = \dots\dots\dots$

(Total for question = 4 marks)

(Q20 4MA1/2HR, Jan 2022)

NATURAL SCIENCE SOLUTION

Topic-26: Proportion-2

Q1.

T is directly proportional to \sqrt{x}
 $T = 400$ when $x = 625$

(a) Find a formula for T in terms of x .

.....
(3)

(b) Calculate the value of T when $x = 56.25$

.....
(1)

(Total for question = 4 marks)
(Q14 4MA0/3H, Jan 2017)

Q2.

P is inversely proportional to the square of q .
When $q = 2$, $P = 12.8$

(a) Find a formula for P in terms of q .

.....
(3)

(b) Find the value of P when $q = 8$

.....
(1)

(Total for question = 4 marks)
(Q13 4MA0/4HR, Jan 2017)

Q3.

When a photograph is taken, the exposure time, t , is directly proportional to the square of the size, f , of the opening in the camera lens.

$t = 0.02$ when $f = 8$

(a) Find a formula for t in terms of f .

..... (3)

(b) Calculate the value of f when $t = 0.0098$

$f =$ (2)

(Total for question = 5 marks)

(Q21 4MA0/4H, Jan 2013)

Q4.

y is directly proportional to x^3

When $x = 10$, $y = 250$

(a) Find a formula for y in terms of x .

$x =$ (3)

(b) Calculate the value of x when $y = 54$

$x =$ (2)

(Total for question = 5 marks)

(Q17 4MA0/4HR, June 2013)

Q5.

D is directly proportional to t^2
When $t = 4$, $D = 8$

(a) Find a formula for D in terms of t .

.....
(3)

(b) Find the positive value of t when $D = 50$

$t =$
(2)

(Total for Question is 5 marks)

(Q14 4MA0/3H, Jan 2014)

Q6.

P is directly proportional to the cube of Q .
When $Q = 15$, $P = 1350$

(a) Find a formula for P in terms of Q .

$P =$
(3)

(b) Calculate the value of P when $Q = 20$

$P =$
(1)

(Total for question = 4 marks)

(Q19 4MA0/3H, June 2011)

Q7.

M is directly proportional to p^3
 $M = 128$ when $p = 8$

(a) Find a formula for M in terms of p .

.....
 (3)

(b) Find the value of M when $p = 5$

.....
 (1)

(Total for question = 4 marks)
(Q13 4MA0/4H, June 2016)

Q8.

The pressure P , of water leaving a cylindrical pipe, is inversely proportional to the square of the radius, r , of the pipe.

$P = 22.5$ when $r = 2$

(a) Find a formula for P in terms of r .

.....
 (3)

(b) Calculate the value of P when $r = 1.5$

$P =$
 (1)

(c) Calculate the value of r when $P = 10$

$r =$
 (2)

(Total for question = 6 marks)
(Q16 4MA0/4H, June 2013)

Q9.

F is inversely proportional to the square of x .
 $F = 0.8$ when $x = 5$

(a) Find a formula for F in terms of x .

.....
(3)

(b) Work out the positive value of x when $F = 320$

$x =$
(2)

(Total for Question is 5 marks)
(Q17 4MA0/4H, June 2014)

Q10.

Two small magnets attract each other with a force, F newtons.
 F is inversely proportional to the square of the distance, d cm, between them.

When $d = 2$, $F = 12$

(a) Express F in terms of d .

.....
(3)

(b) Calculate the value of F when $d = 5$

$F =$
(1)

(c) Calculate the value of d when $F = 3$.

$d = \dots\dots\dots$
(2)

(Total for question is 6 marks)
(Q15 4MA0/3H, Jan 2012)

Q11.

P is directly proportional to q^3

$P = 270$ when $q = 7.5$

(a) Find a formula for P in terms of q

NATURAL SCIENCE SOLUTION

$\dots\dots\dots$
(3)

(b) Work out the positive value of q when $P = q$

$q = \dots\dots\dots$
(2)

(Total for question = 5 marks)

(Q17 4MA0/3H, Jan 2015)

Q12.

P is directly proportional to r^3

$P = 343$ when $r = 3.5$

Find a formula for P in terms of r .

.....
(Total for question = 3 marks)
(Q15 4MA0/3H, June 2017)

Q13.

y is directly proportional to \sqrt{x}

When $x = 49$, $y = 4$

(a) Find a formula for y in terms of x .

.....
(3)

(b) Calculate the value of x when $y = 12$

$x =$

(2)

(Total for question = 5 marks)

(Q18 4MA0/4H, Jan 2016)

Q14.

A is directly proportional to x^2

A = 480 when $x = 5$

Find the value of A when $x = 1.5$

.....
(Total for question = 3 marks)

(Q18 4MA0/4HR, June 2017)

Q15.

Q is inversely proportional to t^2

Q = 320 when $t = 0.5$

Find a formula for Q in terms of t

.....
(Total for question = 3 marks)

(Q16 4MA0/4HR, Jan 2016)

Q16.

V is inversely proportional to the square of t

$V = 28$ when $t = 2.5$

(a) Express V in terms of t

.....
(3)

(b) Work out the value of V when $t = 6.25$

$V =$

(2)
(Total for question = 5 marks)
(Q14 4MA0/4HR, June 2015)

Q17.

R is **inversely** proportional to the square of c .

When $c = 4$, $R = 30$

(a) Find a formula for R in terms of c .

.....
(3)

(b) Calculate the positive value of c when $R = 1920$

$c =$

(2)
(Total for question = 5 marks)
(Q20 4MA0/3HR, Jan 2015)

Q18.

A , r and T are three variables.

A is proportional to T^2

A is also proportional to r^3

$T = 47$ when $r = 0.25$

Find r when $T = 365$

Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

.....

(Total for question = 4 marks)
(Q22 4MA0/3H, June 2015)

Topic-27: Simultaneous Equations

Q1.

Solve the simultaneous equations

$$7x + 3y = 3$$

$$3x - y = 7$$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

x =

y =

(Total for question = 3 marks)
(QU10 4MA1/2H, June 2022)

Q2.

Solve the simultaneous equations

$$4x + 5y = 4$$

$$2x - y = 9$$

Show clear algebraic working.

x =

y =

(Total for question = 3 marks)

(Q09 4MA1/2H, Jan 2019)

Q3.

Solve the simultaneous equations

$$3x + 5y = 3.1$$

$$6x + 3y = 3.75$$

Show clear algebraic working.

$x =$

$y =$

(Total for question = 3 marks)
(Q10 4MA1/2H, Jan 2022)

Q4.

Solve the simultaneous equations

$$5x + 4y = -2$$

$$2x - y = 4.4$$

Show clear algebraic working.

$x =$

$y =$

(Total for question = 3 marks)
(Q07 4MA1/2H, Jan 2023)

Q5.

Solve the simultaneous equations

$$6x + 4y = 1$$

$$3x + 5y = 8$$

Show clear algebraic working.

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for question = 3 marks)
(QU10 4MA1/2H, June 2024)

Q6.

Solve the simultaneous equations

$$5a + 2c = 10$$

$$2a - 4c = 7$$

Show clear algebraic working.

$$a = \dots\dots\dots$$

$$c = \dots\dots\dots$$

(Total for question = 3 marks)
(Q08 4MA1/2H, June 2021)

Q7.

Solve the simultaneous equations

$$x + 2y = -0.5$$

$$3x - y = 16$$

Show clear algebraic working.

$x =$

$y =$

(Total for question = 3 marks)
(Q09 4MA1/2H, June 2019)

Q8.

Solve the simultaneous equations

$$3xy - y^2 = 8$$

$$x - 2y = 1$$

Show clear algebraic working.

.....
(Total for question = 5 marks)
(Q16 4MA1/2H, Nov 2020)

Q9.

Solve the simultaneous equations

Show clear algebraic working.

$$\begin{aligned}y &= 7 - 2x \\x^2 + y^2 &= 34\end{aligned}$$

Show clear algebraic working.

.....
(Total for question = 5 marks)
(Q20 4MA1/2H, Jan 2023)

Q10.

Solve the simultaneous equations

Show clear algebraic working.

$$\begin{aligned}2y^2 + x^2 &= -6x + 42 \\2x + y &= -3\end{aligned}$$

.....
(Total for question = 5 marks)
(Q22 4MA1/2HR, Jan 2023)

Q11.

Solve the simultaneous equations

$$\begin{aligned}x - 2y &= 3 \\ x^2 - y^2 + 2x &= 10\end{aligned}$$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)
(QU21 4MA1/2HR, June 2022)

Q12.

Work out the coordinates of the points of intersection of

$$y - 2x = 1 \text{ and } y^2 + xy = 7$$

Show clear algebraic working.

(..... ,)

(..... ,)

(Total for question = 5 marks)
(QU21 4MA1/2HR, June 2023)

Q13.

Solve the simultaneous equations

$$\begin{aligned}2x^2 + 3y^2 &= 11 \\ x &= 3y - 1\end{aligned}$$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)
(QU21 4MA1/2H, June 2023)

Q14.

The straight line **L** has equation $x + y = 5$

The curve **C** has equation $2x^2 + 3y^2 = 210$

Find the coordinates of the points where **L** and **C** intersect.

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

(..... ,)(..... ,)

(Total for question = 5 marks)

(QU22 4MA1/2H, June 2024)

Q15.

The line with equation $x + 2y = 5$ intersects the curve with equation $x^2 + 3y^2 = 13$ at the points A and B
Find the coordinates of A and the coordinates of B
Show clear algebraic working.

(..... ,)

(..... ,)

(Total for question = 5 marks)
(Q21 4MA1/2H, Nov 2023)

Q16.

The straight line L has equation $x - y = 3$
The curve C has equation $3x^2 - y^2 + xy = 9$
 L and C intersect at the points P and Q .
Find the coordinates of the midpoint of PQ .
Show clear algebraic working.

(..... ,)

(Total for question = 6 marks)

(Q19 4MA1/2H, Nov 2021)

Q17.

The line with equation $2y = x + 1$ intersects the curve with equation $3y^2 + 7y + 16 = x^2 - x$ at the points A and B

Find the coordinates of A and the coordinates of B
 Show clear algebraic working.

(.....) and (.....)

(Total for question = 5 marks)

(Q18 4MA1/2HR, Jan 2022)

Q18.

The line with equation $y = x + 2$ intersects the curve with equation $x^2 + y^2 - 2y = 24$ at the points A and B .

Find the coordinates of A and B .
 Show clear algebraic working.

(.....)

(.....)

(Total for question = 5 marks)

(Q22 4MA1/2H, Jan 2020)

Q19.

Solve the simultaneous equations

$$\begin{aligned}y &= 3 - 2x \\ x^2 + y^2 &= 18\end{aligned}$$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)
(Q19 4MA1/2H, June 2021)

Q20.

The equation of the line **L** is $y = 9 - x$
The equation of the curve **C** is $x^2 - 3xy + 2y^2 = 0$

L and **C** intersect at two points.

Find the coordinates of these two points.
Show clear algebraic working.

(..... ,) and (..... ,)

(Total for question = 5 marks)
(Q20 4MA1/2H, June 2019)

Topic-28: Functions-1

Q1.

f is the function such that $f(x) = 4 - 3x$

(a) Work out $f(5)$

(1)

g is the function such that $g(x) = \frac{1}{1 - 2x}$

(b) Find the value of x that cannot be included in any domain of g

(1)

(c) Work out $fg(-1.5)$

(2)

(Total for question = 4 marks)

(Q17 4MA1/2H, Jan 2019)

Q2.

The function f is such that $f(x) = 3x - 2$

(a) Find $f(5)$

.....
(1)

The function g is such that $g(x) = 2x^2 - 20x + 9$ where $x \geq 5$

(b) Express the inverse function g^{-1} in the form $g^{-1}(x) = \dots$

$g^{-1}(x) = \dots\dots\dots$

(4)

(Total for question = 5 marks)
(Q24 4MA1/2H, June 2019)

Q3.

The functions f and g are such that

$$f(x) = 2x - 3$$

$$g(x) = \frac{x}{3x + 1}$$

(a) State the value of x that cannot be included in any domain of g

.....

(1)

(b) Find $gf(x)$

Simplify your answer.

$gf(x) = \dots\dots\dots$

(2)

(c) Express the inverse function g^{-1} in the form $g^{-1}(x) = \dots$

$g^{-1}(x) = \dots\dots\dots$

(3)

(Total for question = 6 marks)
(Q15 4MA1/2H, Nov 2021)

Q4.

The functions f and g are such that

$f(x) = x + 25$ $g(x) = x^2 - 12x$

The function h is such that $h(x) = fg(x)$

The domain of h is $x : x \leq 6$

Express the inverse function h^{-1} in the form $h^{-1}(x) = \dots$

$h^{-1}(x) = \dots\dots\dots$

(Total for question = 4 marks)

(Q23 4MA1/2HR, Jan 2022)

NATURALS SCIENCE SOLUTION

Q5.

The function f is such that $f(x) = 3x^2 - 12x + 7$ where $x \leq 2$
 Express the inverse function f^{-1} in the form $f^{-1}(x) = \dots$

$f^{-1}(x) = \dots\dots\dots$

(Total for question = 4 marks)
(Q25 4MA1/2H, Jan 2023)

Q6.

The function g is defined as

$g: x \mapsto 5 + 6x - x^2$ with domain $\{x: x \geq 3\}$

(a) Express the inverse function g^{-1} in the form $g^{-1}: x \mapsto \dots$

$g^{-1}: x \mapsto \dots\dots\dots$

(4)

(b) State the domain of g^{-1}

.....

(1)

(Total for question = 5 marks)
(Q25 4MA1/2H, Jan 2022)

Q7.

The function f is such that $f(x) = 5 + 6x - x^2$ for $x \leq 3$

(a) Express $5 + 6x - x^2$ in the form $p - (x - q)^2$ where p and q are constants.

.....
(2)

(b) Using your answer to part (a), find the range of values of x for which $f^{-1}(x)$ is positive.

.....
(5)

(Total for question = 7 marks)

(Q21 4MA1/2H, Nov 2020)

Q8.

$$f(x) = x^2 - 4$$

$$g(x) = 2x + 1$$

Solve $fg(x) > 0$

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)

(QU19 4MA1/2HR, June 2022)

Topic-29: Functions-2

Q1.

f is a function such that

$$f(x) = \frac{1}{x^2 + 1}$$

(a) Find $f(1/2)$

.....
(1)

g is a function such that

$$g(x) = \sqrt{x-1} \quad x \geq 1$$

(b) Find $fg(x)$
Give your answer as simply as possible.

$fg(x) =$
(2)

(Total for question = 3 marks)

(Q23 4MA0/4H, Jan 2013)

Q2.

The function f is defined as

$$f(x) = \frac{x-6}{2}$$

(a) Find f (8)

.....
(1)

(b) Express the inverse function f^{-1} in the form $f^{-1}(x) = \dots$

$f^{-1}(x) =$
(2)

The function g is defined as

$$g(x) = \sqrt{x - 4}$$

(c) Which values of x cannot be included in a domain of g ?

.....
(2)

(d) Express the function gf in the form $gf(x) = \dots$
Give your answer as simply as possible.

$gf(x) = \dots$
(2)

(Total for question = 7 marks)
(Q17 4MA0/4H, June 2013)

Q3.

$$f(x) = 3x - 2$$

$$g(x) = \frac{10}{x + 2}$$

(a) Express the inverse function f^{-1} in the form $f^{-1}(x) = \dots$

$f^{-1}(x) = \dots$
(2)

(b) Find $gf(x)$
Simplify your answer.

$gf(x) = \dots$
(2)

(Total for question = 4 marks)

(Q19 4MA0/4H, June 2012)

Q4.

(a) Show that $\frac{x^2 + 3x}{2x^2 + 5x - 3}$ can be written as $\frac{x}{kx - 1}$
 State the value of k .

$k = \dots\dots\dots$ (2)

(b) $f(x) = \frac{x}{2x - 1}$
 Find the inverse function f^{-1} in the form $f^{-1}(x) = \dots\dots$
 Show your working clearly.

$f^{-1}(x) = \dots\dots\dots$ (3)

(Total for question = 5 marks)

(Q23 4MA0/4HR, June 2013)

Q5.

$$f(x) = \sqrt{x - 6}$$

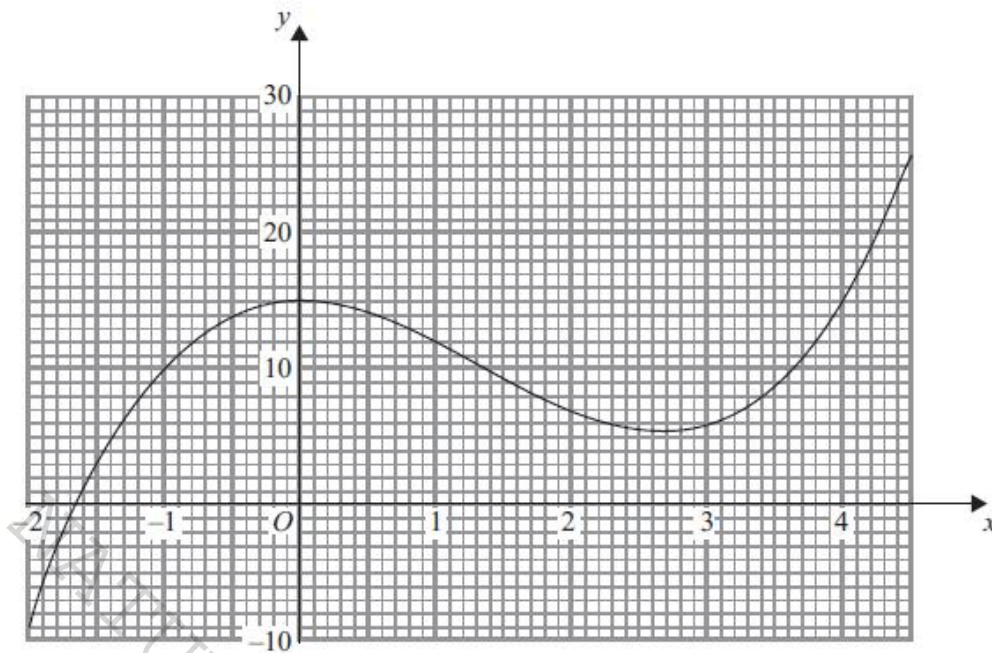
(a) Find $f(10)$

$\dots\dots\dots$ (1)

(b) State which values of x must be excluded from a domain of f

$\dots\dots\dots$ (2)

The diagram shows part of the graph of $y = g(x)$



(c) Find $g(2)$

..... (1)

(d) Find $fg(0)$

..... (2)

(e) One of the solutions of $g(x) = k$, where k is a number, is $x = 1$

Find the other solutions.

Give your answers correct to 1 decimal place.

..... (3)

(f) Find an estimate for the gradient of the curve at the point where $x = 3.5$

Show your working clearly.

..... (3)

(Total for question is 12 marks)

(Q17 4MA0/4H, Jan 2012)

Q6.

$$f(x) = \frac{2}{x}$$

$$g(x) = \frac{x+1}{x}$$

(a) State which value of x cannot be included in the domain of f or g .

..... (1)

(b) Solve $gf(a) = 3$

$a =$ (3)

(c) Express the inverse function g^{-1} in the form $g^{-1}(x)$

$g^{-1}(x) =$ (3)

(Total for question = 7 marks)
(Q20 4MA0/4H, June 2011)

Q7.

The functions f and g are such that

$$f(x) = \frac{1}{x+5} \quad \text{and} \quad g(x) = 2x + 3$$

(a) State which value of x must be excluded from any domain of f .

.....
(1)

(b) Find $g(10)$

.....
(1)

(c) Calculate $gf(-7)$

.....
(2)

(d) Express the inverse function g^{-1} in the form $g^{-1}(x) = \dots$

$g^{-1}(x) = \dots$
(2)

(Total for question = 6 marks)

(Q20 4MA0/4HR, June 2017)

Q8.

The function f is such that $f(x) = \frac{2x}{3x+5}$

(a) Find $f(-2)$

.....
(1)

The function g is such that $g(x) = \frac{3}{x+4}$

(b) Find $g^{-1}(6)$

.....
(2)

(c) Find $fg(-5)$

.....
(2)

(d) Solve the equation $f(x) = g(x)$
Show clear algebraic working.

.....
(4)

(Total for question = 9 marks)

(Q18 4MA0/4H, Jan 2017)

Topic-30: Sequence-1

Q1.

Here are the first five terms of a number sequence.

7 11 15 19 23

(a) Find an expression, in terms of n , for the n th term of this sequence.

.....
(2)

The n th term of a different number sequence is given by $80 - 2n$

(b) Write down the first 3 terms of this sequence.

..... , ,
(2)

Yuen says there are no numbers that are in both of the sequences.
Yuen is correct.

(c) Explain why.

.....
.....
(1)

(Total for question = 5 marks)

(Q04 4MA1/2H/EAM, Specimen papers)

Q2.

Here are the first five terms of an arithmetic sequence.

7 11 15 19 23

Write down an expression, in terms of n , for the n th term of this sequence.

(Total for question = 2 marks)

(Q02 4MA1/2H, Jan 2019)

Q3.

Here are the first four terms of an arithmetic sequence.

38, 31, 24, 17

Find an expression, in terms of n , for the n th term of the sequence.

.....
(Total for question = 2 marks)
(QU04 4MA1/2HR, June 2023)

Q4.

Here are the first three terms of an arithmetic sequence.

$8p, 7p - 3, 4p + 2$

The sum of the first n terms of the sequence is -1914

Work out the value of n

Show your working clearly.

$n =$

(Total for question = 5 marks)

(QU23 4MA1/2HR, June 2023)

Q5.

An arithmetic series has first term a and common difference d , where d is a prime number.

The sum of the first n terms of the series is S_n and

$$S_m = 39$$

$$S_{2m} = 320$$

Find the value of d and the value of m

Show clear algebraic working.

NATURAL SCIENCE

$d = \dots\dots\dots$

$m = \dots\dots\dots$

(Total for question = 5 marks)

(Q26 4MA1/2H, Jan 2022)

Q6.

Here are the first four terms of an arithmetic series.

$$k \quad \frac{3k}{4} \quad \frac{k}{2} \quad \frac{k}{4}$$

Given that the 15th term of the series is $(90 + 2k)$,
calculate the sum of the first 30 terms of the series.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

(Q20 4MA1/2H, Nov 2021)

Q7.

The 3rd term of an arithmetic series, A , is 19

The sum of the first 10 terms of A is 290

Find the 10th term of A .

NATURAL SCIENCE SOLUTION

.....

(Total for question = 5 marks)

(Q22 4MA1/2H/EAM, Specimen papers)

Q8.

The sum of the first 48 terms of an arithmetic series is 4 times the sum of the first 36 terms of the same series.

Find the sum of the first 30 terms of this series.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)
(QU23 4MA1/2H, June 2018)

Topic-31: Sequence-2

Q1.

The first four terms of an arithmetic sequence are

5 9 13 17

(a) Write down an expression, in terms of n , for the n th term.

.....
(2)

(b) Write down an expression, in terms of n , for the $(n + 1)$ th term.

.....
(1)

(Total for question = 3 marks)

(Q03 4MA0/3H, June 2015)

Q2.

Here are the first five terms of an arithmetic sequence.

7 10 13 16 19

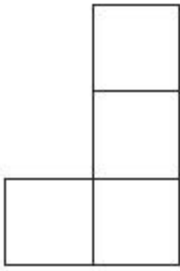
Find an expression for the n th term of the sequence.

.....
(Total for question = 2 marks)

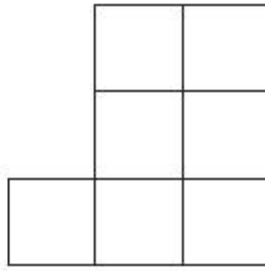
(Q01 4MA0/4H, June 2016)

Q3.

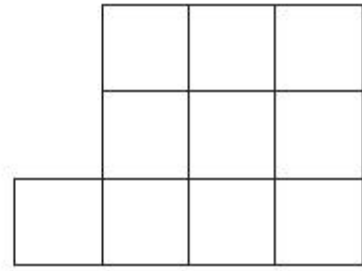
Here is a sequence of patterns made from centimetre squares.



Pattern number 1



Pattern number 2



Pattern number 3

- (a) Find an expression, in terms of n , for the total number of centimetre squares in Pattern number n .

.....
(2)

A pattern in this sequence has 88 centimetre squares.

- (b) Work out the Pattern number of this pattern.

.....
(2)

(Total for Question is 4 marks)

(Q03 4MA0/4HR, June 2014)

Q4.

Here are some rows of a number pattern.

Row number	Column 1	Column 2	Column 3
1	$1 \times 3 + 1$	4	2^2
2	$2 \times 4 + 1$	9	3^2
3	$3 \times 5 + 1$	16	4^2
⋮			
		676	
⋮			
n			

(a) Write down the Row number of the row that has 676 in Column 2

.....
(1)

(b) For Row number n ,

(i) write down an expression, in terms of n , that should go in Column 1

.....

(ii) write down an expression, in terms of n , that should go in Column 3

.....
(2)

(Total for question = 3 marks)

(Q05 4MA0/4HR, Jan 2015)

Topic-32: Differentiation (Turning point/stationary point)-1

Q1.

The point A is the only stationary point on the curve with equation $y = kx^2 + \frac{16}{x}$ where k is a constant.

Given that the coordinates of A are $\left(\frac{2}{3}, a\right)$

find the value of a .
Show your working clearly.

NATURAL SCIENCE SOLUTION

$a = \dots\dots\dots$

(Total for question = 5 marks)

(Q21 4MA1/2H, June 2021)

Q2.

$$y = x^3 - 6x^2 - 15x$$

(a) Find $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots$$

(2)

The curve with equation $y = x^3 - 6x^2 - 15x$ has two stationary points.

(b) Work out the coordinates of these two stationary points.

NATURAL SCIENCE SOLUTION

(..... ,)

(..... ,)

(4)

(Total for question = 6 marks)

(Q12 4MA1/2H/EAM, Specimen papers)

Q3.

A particle P is moving along a straight line.
The fixed point O lies on this line.

At time t seconds where $t \geq 0$, the displacement, s metres, of P from O is given by

$$s = t^3 + 5t^2 - 8t + 10$$

Find the displacement of P from O when P is instantaneously at rest.

Give your answer in the form $\frac{a}{b}$ where a and b are integers.

NATURAL SCIENCE SOLUTION

..... metres

(Total for question = 5 marks)
(Q19 4MA1/2H, Jan 2021)

Q4.

The diagram shows a solid cuboid.

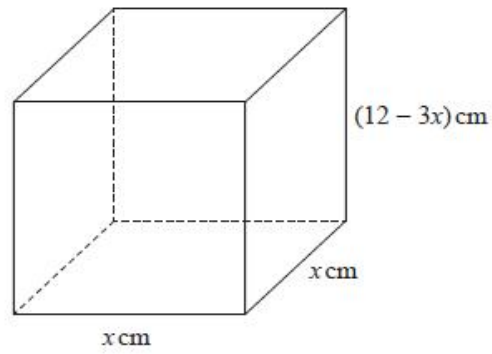


Diagram NOT
accurately drawn

The total surface area of the cuboid is $A \text{ cm}^2$

Find the maximum value of A .

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)
(Q18 4MA1/2H, June 2019)

Q5.

A particle P moves along a straight line that passes through the fixed point O

The displacement, x metres, of P from O at time t seconds, where $t \geq 0$, is given by

$$x = 4t^3 - 27t + 8$$

The direction of motion of P reverses when P is at the point A on the line.

The acceleration of P at the instant when P is at A is $a \text{ m/s}^2$

Find the value of a

$a = \dots\dots\dots$

(Total for question = 5 marks)
(Q24 4MA1/2H, Jan 2022)

Q6.

A particle is moving along a straight line that passes through the fixed point O

The displacement, s metres, of the particle from O at time t seconds is given by

$$s = 2t^3 - 5t^2 + 6t - 5$$

Find the value of t when the acceleration of the particle is 5 m/s^2

$t = \dots\dots\dots$

(Total for question = 4 marks)
(Q18 4MA1/2H, Nov 2023)

Topic-33: Differentiation (Turning point/stationary point)-2

Q1.

$$y = x^3 + 6x^2 + 5$$

(a) Find $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots$$

(2)

The curve with equation $y = x^3 + 6x^2 + 5$ has two turning points.

(b) Work out the coordinates of these two turning points.
Show your working clearly.

NATURAL SCIENCE SOLUTION

.....

(4)

(Total for question = 6 marks)
(Q21 4MA0/4H, June 2015)

Q2.

For the curve with equation $y = 4x^3 - 2x + 5$

(i) find $\frac{dy}{dx}$

.....

(ii) find the coordinates of the two points on the curve where the gradient of the curve is 1

(..... ,) and (..... ,)

(Total for Question is 6 marks)

(Q15 4MA0/4HR, Jan 2014)

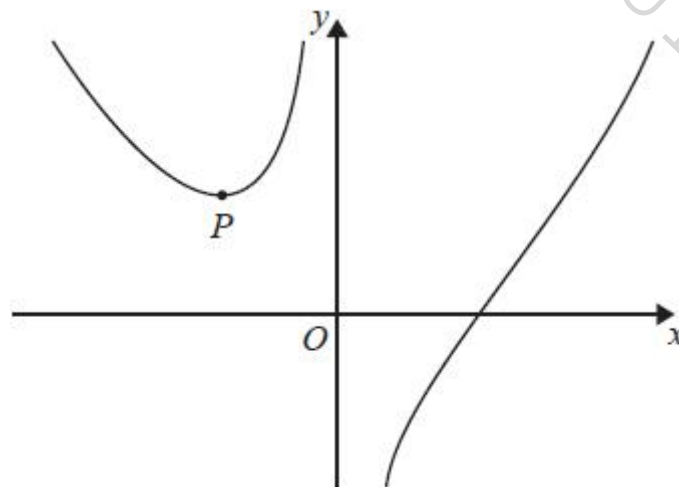
Q3.

$$y = x^2 - \frac{16}{x}$$

(a) Find $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots$$

(3)



$\frac{16}{x}$

The graph shows part of the curve with equation $y = x^2 - \frac{16}{x}$

The point P is the turning point of the curve.

(b) Work out the coordinates of P .

(..... ,)

(4)

(Total for question = 7 marks)

(Q21 4MA0/4HR, June 2015)

Q4.

A particle moves along a straight line.

The fixed point O lies on this line.

The displacement of the particle from O at time t seconds is s metres where

$$s = 4t^2 - \frac{9}{t}$$

Find the velocity of the particle at time 5 seconds.

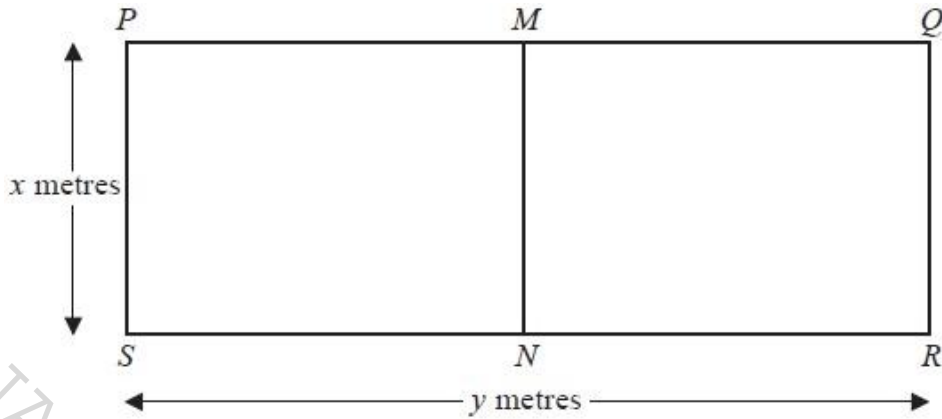
..... m/s

(Total for question = 3 marks)

(Q17 4MA0/4H, Jan 2017)

Q5.

A farmer has 120 metres of fencing.
 He is going to make a rectangular enclosure $PQRS$ with the fencing.
 He is also going to divide the enclosure into two equal parts by fencing along MN .



The width of the enclosure is x metres.
 The length of the enclosure is y metres.

(a) (i) Show that $y = 60 - 1.5x$

The area of the enclosure $PQRS$ is A m²

(ii) Show that $A = 60x - 1.5x^2$

(b) Find $\frac{dA}{dx}$

.....
 (2)

(c) Find the maximum value of A .

$A =$
 (3)

(Total for Question is 8 marks)
(Q15 4MA0/4H, Jan 2014)

Q6.

The curve C has equation $y = 3x^2 - 12x + 8$

(a) Find $\frac{dy}{dx}$

$$\frac{dy}{dx} = \dots\dots\dots (2)$$

(b) Find the coordinates of the point on C where the gradient of the curve is 18

$$(\dots\dots\dots, \dots\dots\dots) (3)$$

(Total for question = 5 marks)

(Q16 4MA0/4H, Jan 2016)

Q7.

Curve C has equation $y = 8x^3 - 3x^2 - 25x$

(a) Find $\frac{dy}{dx}$

$$\dots\dots\dots (2)$$

- (b) Find the x coordinates of the points on **C** where the gradient is 5
Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(4)

(Total for question = 6 marks)

(Q17 4MA0/4H, June 2017)

Q8.

For $y = x^3 - 6x^2 + 20$

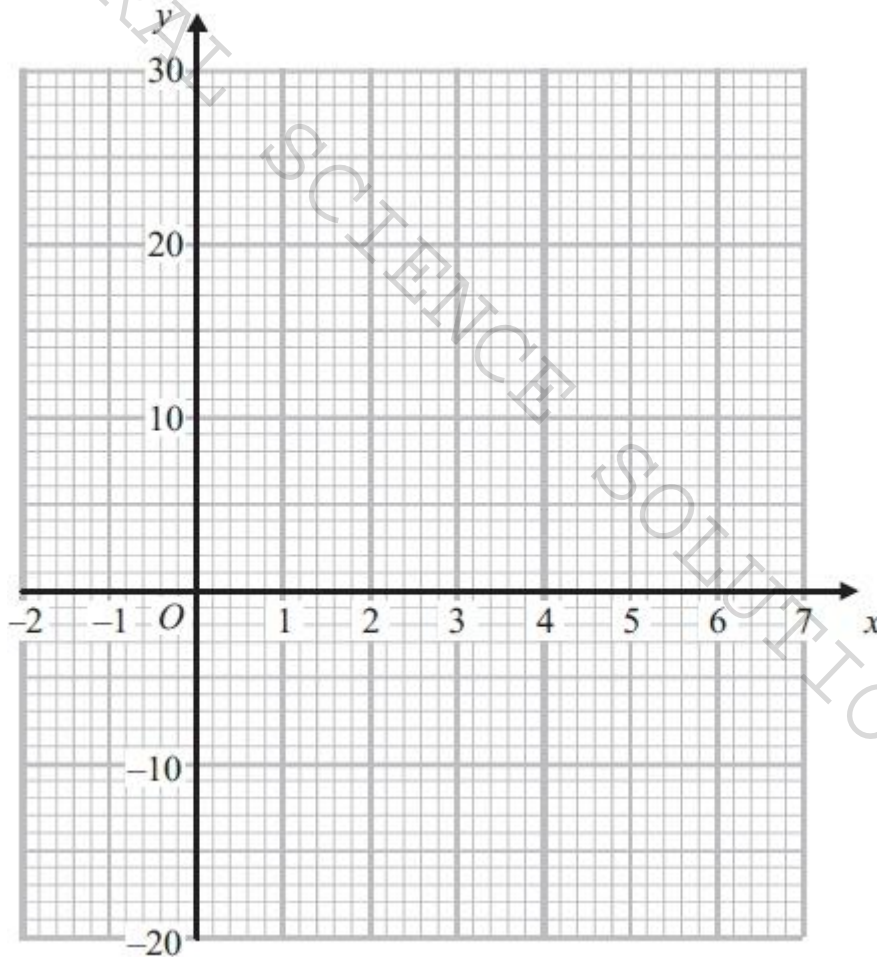
(a) (i) show that $y = 4$ when $x = 2$

(ii) complete the table of values

x	-1	0	1	2	3	4	5	6
y		20	15		-7	-12		20

(2)

(b) On the grid, draw the graph of $y = x^3 - 6x^2 + 20$ for values of x from -1 to 6



(2)

(c) For the curve with equation $y = x^3 - 6x^2 + 20$

(i) find $\frac{dy}{dx}$

(ii) find the gradient of the curve at $x = -3$

.....

.....
(4)

(Total for question = 8 marks)

(Q11 4MA0/4H, June 2013)

NATURAL SCIENCE SOLUTION

Topic-34: Algebraic proof

Q1.

Prove that the difference between two consecutive square numbers is always an odd number.
Show clear algebraic working.

(Total for question = 3 marks)

(Q17 4MA1/2H, Jan 2020)

Q2.

Using algebra, prove that, given any 3 consecutive whole numbers, the sum of the square of the smallest number and the square of the largest number is always 2 more than twice the square of the middle number.

(Total for question = 3 marks)

(Q15 4MA1/1HR, Jan 2022)

Q3.

Prove algebraically that, for any three consecutive even numbers,
the sum of the squares of the smallest even number and the largest even number is 8 more than twice
the square of the middle even number.

(Total for question = 3 marks)
(Q19 4MA1/2HR, Jan 2023)

Q4.

Using algebra, prove that, given any 3 consecutive even numbers, the difference between the square of the
largest number and the square of the smallest number is always 8 times the middle number.

(Total for question = 3 marks)
(Q17 4MA1/1H, June 2021)

Q5.

Prove that when the sum of the squares of any two consecutive odd numbers is divided by 8, the remainder is always 2

Show clear algebraic working.

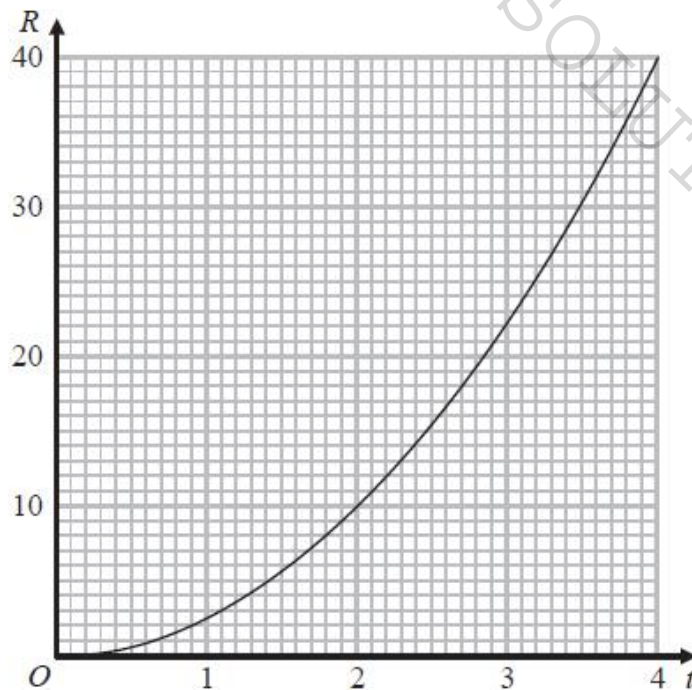
NATURAL SCIENCE SOLUTION

(Total for question = 3 marks)
(Q18 4MA1/2H, Jan 2022)

Q6.

R is proportional to t^2

The graph shows the relationship between R and t for $0 \leq t \leq 4$



(a) Find a formula for R in terms of t .

.....
(3)

Given also that $R = \frac{8}{5x}$

(b) show that t is inversely proportional to \sqrt{x} for $t > 0$

(2)

(Total for question = 5 marks)

(QU16 4MA1/2H, June 2018)

Q7.

Prove algebraically that the difference between the squares of any two consecutive odd numbers is always a multiple of 8

NATURAL SCIENCE SOLUTION

(Total for question = 4 marks)
(Q20 4MA1/1H/EAM, Specimen papers)

Q8.

Use algebra to show that

$$0.3\dot{8}\dot{1} = \frac{21}{55}$$

(Total for question = 2 marks)
(Q13 4MA1/1HR, Jan 2023)

Coordinate Geometry

Topic-35: Gradient and equation of straight line-1

Q1.

The straight line **L** passes through the points (4, -1) and (6, 4)

The straight line **M** is perpendicular to **L** and intersects the *y*-axis at the point (0, 8)

Find the coordinates of the point where **M** intersects the *x*-axis.

(..... ,)

(Total for question = 4 marks)
(Q17 4MA1/2H, June 2021)

Q2.

The points *A* and *B* are on a coordinate grid.

The coordinates of *A* are (6, 4)

The coordinates of *B* are (17, *j*) where *j* is a constant.

The midpoint of *AB* has coordinates (*k*, 15) where *k* is a constant.

Find the value of *j* and the value of *k*

j =

k =

(Total for question = 3 marks)

(Q06 4MA1/2H, Jan 2023)

Q3.

Line **L** has equation $4y - 6x = 33$

Line **M** goes through the point $A(5, 6)$ and the point $B(-4, k)$

L is perpendicular to **M**.

Work out the value of k .

(Total for question = 4 marks)
(Q21 4MA1/2H, Jan 2019)

Q4.

ABC is a triangle in which angle $ABC = 90^\circ$

p and q are integers such that

the coordinates of A are $(p, 10)$

the coordinates of B are $(-1, -5)$

the coordinates of C are $(8, q)$

Given that the gradient of AC is $-\frac{6}{7}$

work out the value of p and the value of q

$p = \dots\dots\dots$

$q = \dots\dots\dots$

(Total for question = 5 marks)

(Q22 4MA1/2HR, Jan 2022)

Q5.

A straight line passes through the points with coordinates $(0, -3)$ and $(2, 0)$

Find an equation of the line.

.....
(Total for question = 2 marks)
(Q09 4MA1/2H, Nov 2023)

Q6.

The centre O of a circle has coordinates $(4, 7)$

The point A , on the circle, has coordinates $(6, 11)$ and AOP is a diameter of the circle.

Find an equation of the tangent to the circle at the point P

.....
(Total for question = 4 marks)

(QU20 4MA1/2HR, June 2022)

Topic-36: Gradient and equation of straight line-2

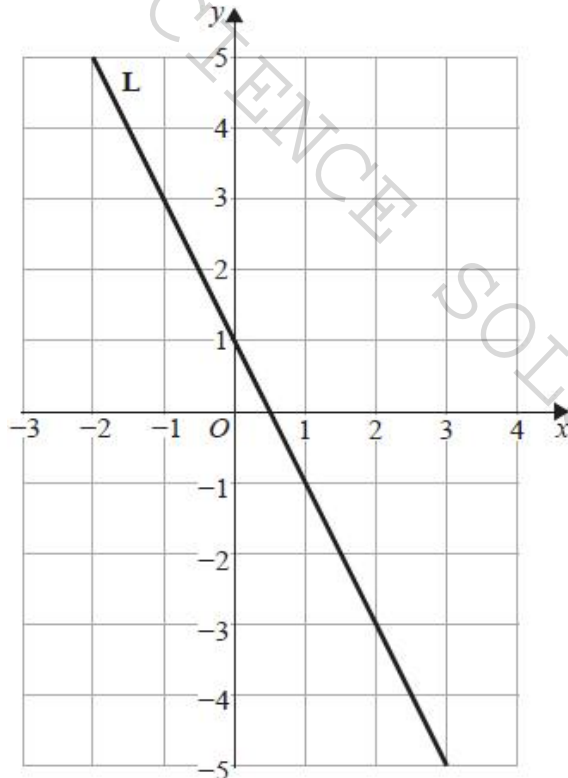
Q1.

A is the point with coordinates (1, 3)
 B is the point with coordinates (-2, -1)
 The line L has equation $3y = 4 - 2x$
 Is line L parallel to AB?
 Show your working clearly.

(Total for question = 3 marks)
 (Q18 4MA0/3H, Jan 2016)

Q2.

Here is the straight line L drawn on a grid.



Find an equation for L.

(Total for question = 2 marks)
 (Q11 4MA0/4HR, Jan 2017)

Q3.

(a) The straight line **L** passes through the points (0, 12) and (10, 4).
Find an equation for **L**.

.....
(3)

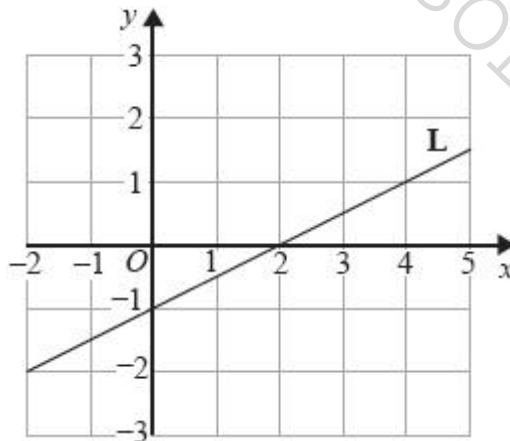
(b) Find an equation of the straight line which is parallel to **L** and passes through the point (5, -11).

.....
(2)

(Total for Question is 5 marks)
(Q13 4MA0/4HR, Jan 2014)

Q4.

The straight line **L** is shown on the grid.



(a) Find an equation of **L**.

.....
(2)

(b) Find an equation of the line that is parallel to **L** and passes through the point (5, 4)

.....
(2)
(Total for question = 4 marks)
(Q12 4MA0/4HR, June 2017)

Q5.

The line **L** passes through the points (0, -2) and (6, 1)

(a) Find an equation of the line **L**.

NATURAL SCIENCE SOLUTION

.....
(3)

(b) Find an equation of the line that is parallel to **L** and which passes through the point (4, -2)

.....
(2)
(Total for Question is 5 marks)
(Q13 4MA0/4H, June 2014)

Q6.

Find an equation of the line that is parallel to the line $y = 4 - 2x$ and passes through the point (3, 7)

.....
(Total for question = 3 marks)
(Q12 4MA0/4H, Jan 2016)

Q7.

The line **L** passes through the point (3,1) and is parallel to the line with equation $y = \frac{7}{2} - 2x$.
Find an equation for the line **L**.

.....
(Total for question = 3 marks)
(Q11 4MA0/3HR, June 2016)

Q8.

The straight line **L** (-2, 3) and (6, 9)
Find an equation of the line that is parallel to **L** and passes through the point (5, -1)
Give your answer in the form $ax + by = c$ where a , b and c are integers.

.....
(Total for question = 5 marks)
(Q13 4MA0/3H, June 2016)

Q9.

(a) Find the gradient of the line with equation $3x + 4y = 10$

.....
(3)

(b) Find the coordinates of the point of intersection of the line with equation $3x + 4y = 10$ and the line with equation $5x - 6y = 23$
Show your working clearly.

(.....,)
(5)

(Total for question is 8 marks)

(Q13 4MA0/4H, Jan 2012)

Q10.

(a) Find the gradient of the line with equation $3y - 2x = 6$

.....
(2)

(b) Find an equation of the line with gradient -3 that passes through the point $(2, 5)$.

.....
(2)
(Total for question = 4 marks)
(Q10 4MA0/3H, Jan 2015)

Q11.

The straight line **L** has equation $3x - 2y = 15$

(a) Find the gradient of **L**.

.....
(3)

(b) Find the coordinates of the point where **L** crosses the y -axis.

(..... ,)
(1)

(c) Find an equation of the line that is parallel to **L** and crosses the x -axis at $(-2, 0)$

.....
(2)
(Total for question = 6 marks)
(Q12 4MA0/4H, Jan 2017)

Q12.

B is the point with coordinates $(1, 4)$
 C is the point with coordinates $(6, 9)$
Find the coordinates of the midpoint of BC .

(.....,)
(Total for question = 2 marks)
(Q06 4MA0/4H, Jan 2016)

Q13.

Point A has coordinates $(-4, 9)$
Point B has coordinates $(1, 5)$
Find the coordinates of the midpoint of AB .

(.....,)
(Total for question = 2 marks)
(Q04 4MA0/4H, June 2017)

Q14.

The point A has coordinates $(0, 2)$
The point B has coordinates $(-4, -1)$
(a) Find the coordinates of the midpoint of AB .

.....
(2)

(b) Work out the gradient of the line AB .

.....
(2)

(c) Find an equation of the line AB .

.....
(2)
(Total for question = 6 marks)

(Q09 4MA0/3HR, Jan 2016)

Q15.

Here are the equations of four straight lines.

Line A $y = 2x + 3$

Line B $2y = 6 - 3x$

Line C $4x - 2y = 3$

Line D $y = 3 - 2x$

Two of these lines are parallel.

(a) Which two lines?

.....
(2)

Line **L** has a gradient of $-\frac{5}{2}$ and passes through the point with coordinates (1, 3)

(b) Find an equation of **L**.

Give your answer in the form $ax + by = c$ where a , b and c are integers.

.....
(3)

(Total for question = 5 marks)

(Q13 4MA0/4H, June 2017)

Q16.

A has coordinates (11, 3e)

B has coordinates (1, 7e)

The midpoint of *AB* has coordinates (x, y)

(a) Find the value of x.

x =
(1)

(b) Find an expression for y in terms of e.

Simplify your answer.

y =
(2)

(Total for question = 3 marks)

(Q06 4MA0/4H, Jan 2017)

Q17.

A is the point with coordinates (4, 11)

B is the point with coordinates (8, 3)

Work out the coordinates of the midpoint of AB.

(..... ,)

(Total for question = 2 marks)
(Q03 4MA0/3HR, Jan 2017)

Q18.

A is the point with coordinates (4, 1)

B is the point with coordinates (1, 9)

Find the coordinates of the midpoint of AB.

(..... ,)

(Total for question = 2 marks)
(Q06 4MA0/3HR, Jan 2015)

Q19.

(a) The equation of a line L is $2x - 3y = 6$
Find the gradient of L.

(b) Find the equation of the line which is parallel to L and passes through the point (6, 9).

.....
(3)

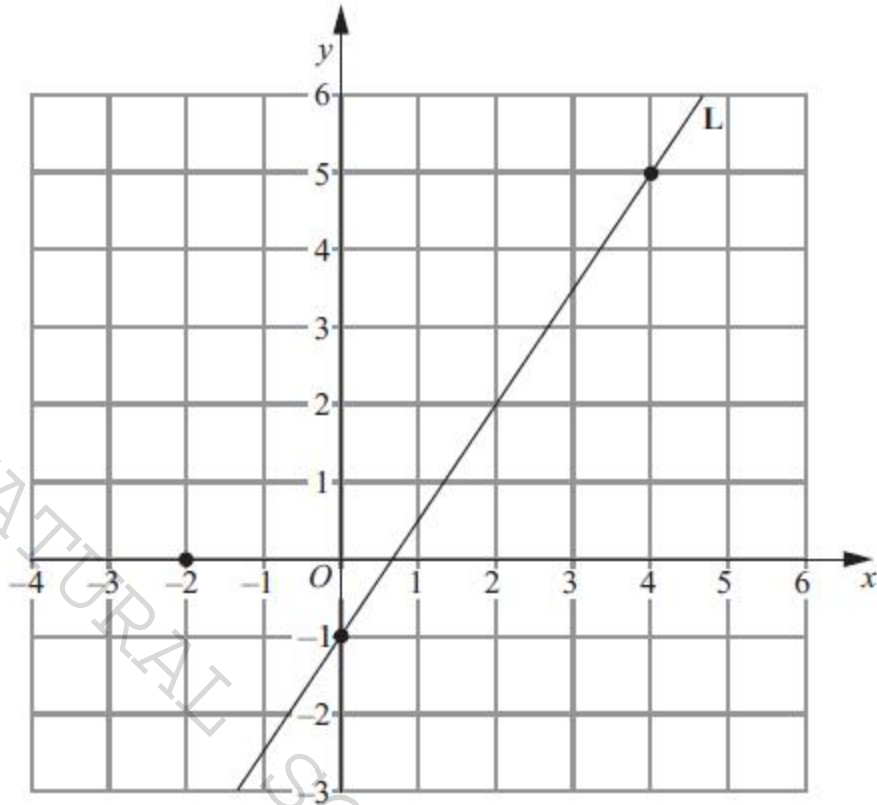
.....
(2)

(Total for question = 5 marks)

(Q14 4MA0/3H, June 2012)

Q20.

The points $(0, -1)$ and $(4, 5)$ lie on the straight line **L**.



(a) Work out the gradient of **L**.

.....
(2)

(b) Write down an equation of **L**.

.....
(1)

(c) Find an equation of the line which is parallel to **L** and passes through the point $(-2, 0)$

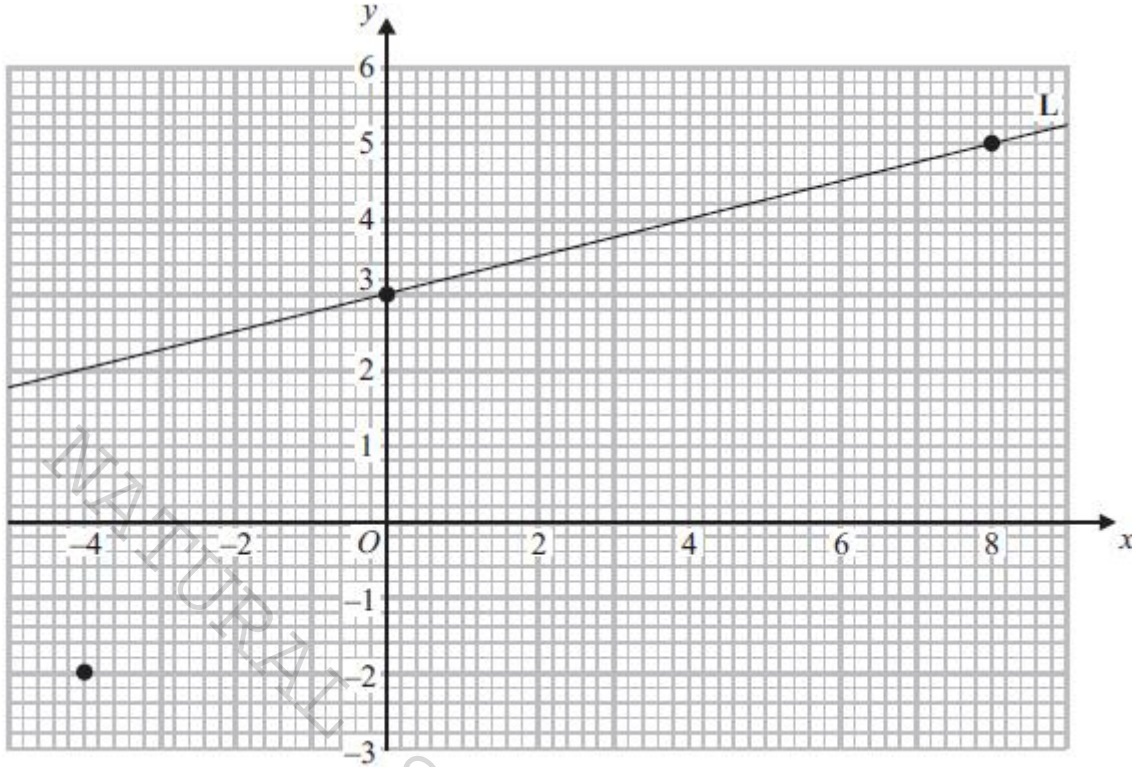
.....
(2)

(Total for question = 5 marks)

(Q10 4MA0/3H, Jan 2013)

Q21.

The points with coordinates $(0, 3)$ and $(8, 5)$ lie on the straight line **L**.



(a) Work out the gradient of **L**.

.....
(2)

(b) Write down an equation of **L**.

.....
(1)

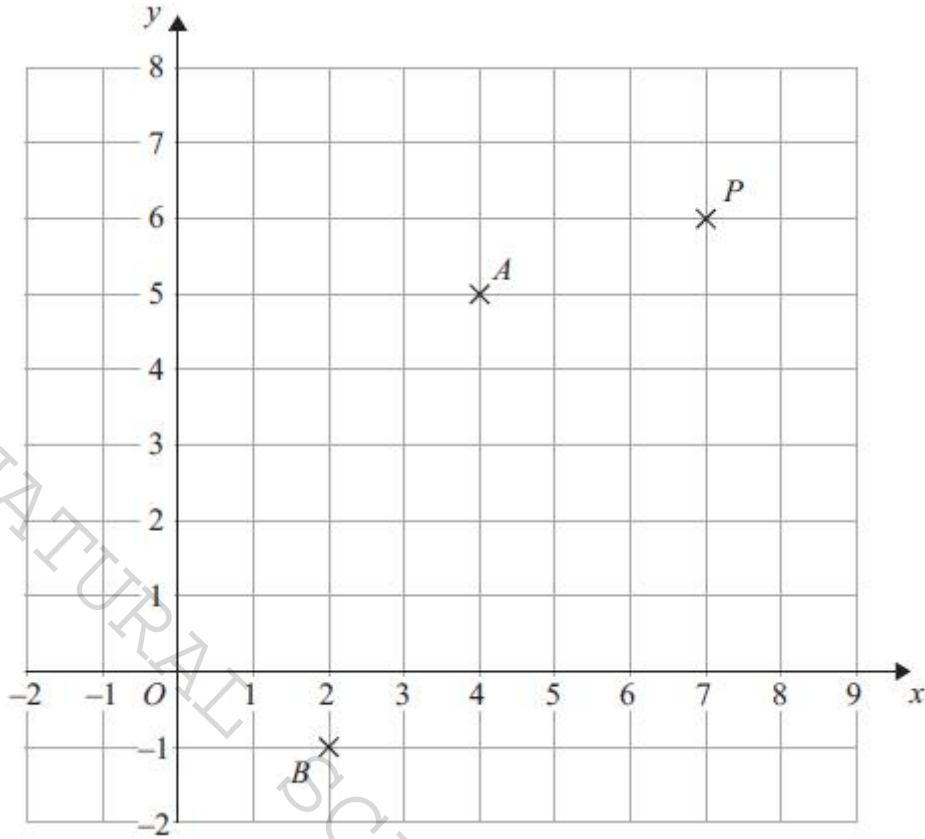
(c) Find an equation of the line which is parallel to **L** and which passes through the point $(-4, -2)$

.....
(2)

(Total for question = 5 marks)
(Q13 4MA0/3HR, June 2013)

Q22.

The diagram shows three points, A , B and P , on a centimetre grid.



The point A has coordinates $(4, 5)$ and the point B has coordinates $(2, -1)$.

(a) Find the coordinates of the midpoint of AB .

(.....,)
(2)

AB is a diameter of a circle.

P is the point $(7, 6)$

C is the point on the circle such that $PA = PC$.

(b) On the diagram, mark with a cross (\times) the point C .
Label your point C .

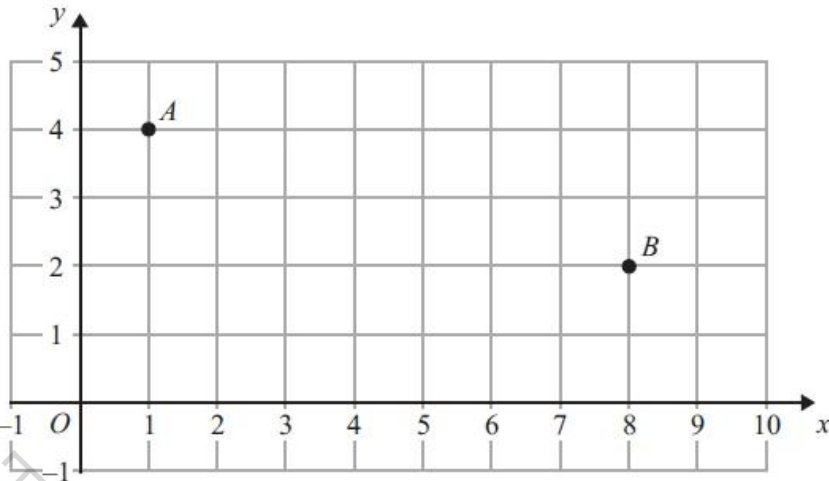
(2)

(Total for question = 4 marks)

(Q04 4MA0/4HR, June 2013)

Q23.

Two points, *A* and *B*, are plotted on a centimetre grid. *A* has coordinates (1, 4) and *B* has coordinates (8, 2).



(a) Work out the coordinates of the midpoint of *AB*.

(.....,)
(2)

(b) Use Pythagoras' Theorem to work out the length of *AB*.
Give your answer correct to 3 significant figures.

..... cm
(4)

(Total for question = 6 marks)
(Q07 4MA0/4H, June 2013)

Q24.

(a) Solve

$$3x + 3y = 9$$

$$4x + 2y = 13$$

Show clear algebraic working.

$x =$

$y =$

(4)

L is a line parallel to the line with equation $4x + 2y = 13$

L passes through the point with coordinates $(3, -1)$

(b) Find an equation for the line L.

.....

(3)

(Total for question = 7 marks)
(Q13 4MA0/3H, June 2015)

Q25.

Line **A** has equation $3x - 4y = 5$

Line **B** goes through the points $(4, 7)$ and $(-1, 3)$

Are lines **A** and **B** parallel?

Show your working clearly.

(Total for question = 4 marks)

(Q15 4MA0/3HR, Jan 2017)

Graphs

NATURAI SCIENCE SOLUTION

Topic-37: Graphs of functions-1

Q1.

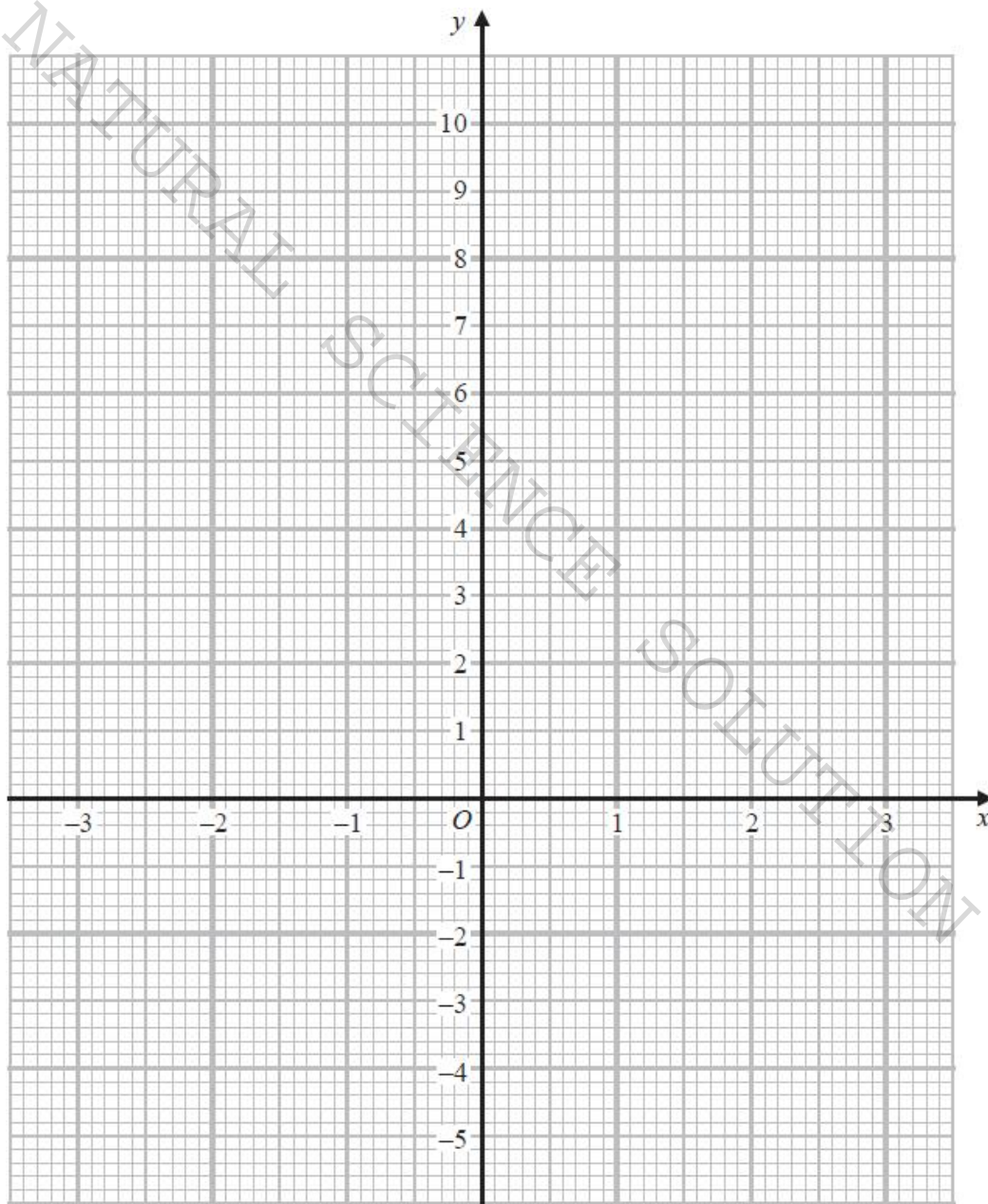
(a) Complete the table of values for $y = x^2 - x - 4$

x	-3	-2	-1	0	1	2	3
y		2			-4		

(2)

(2)

(b) On the grid below, draw the graph of $y = x^2 - x - 4$ for values of x from -3 to 3



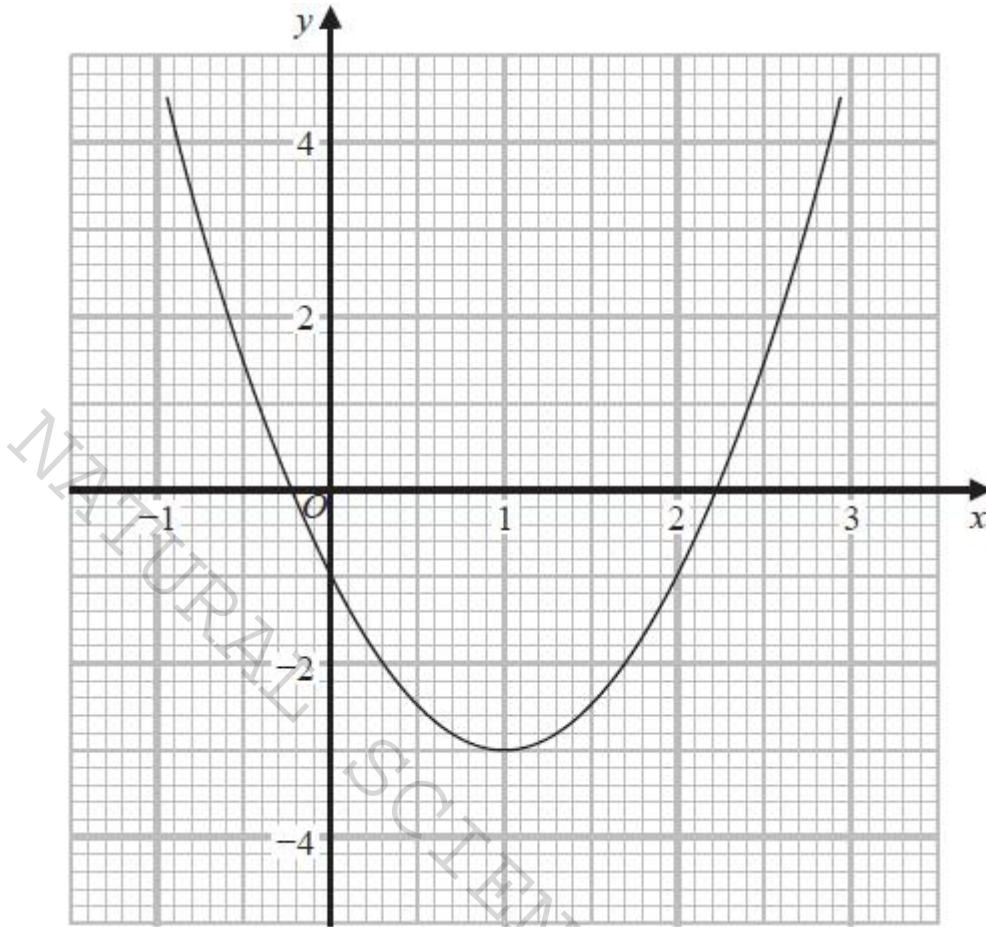
(2)

(Total for question = 4 marks)

(QU04 4MA1/2H, June 2023)

Q2.

Part of the graph of $y = 2x^2 - 4x - 1$ is shown on the grid.



- (a) Use the graph to find estimates for the solutions of the equation $2x^2 - 4x - 1 = 0$
Give your solutions correct to one decimal place.

.....
(2)

- (b) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation $x^2 - x - 1 = 0$

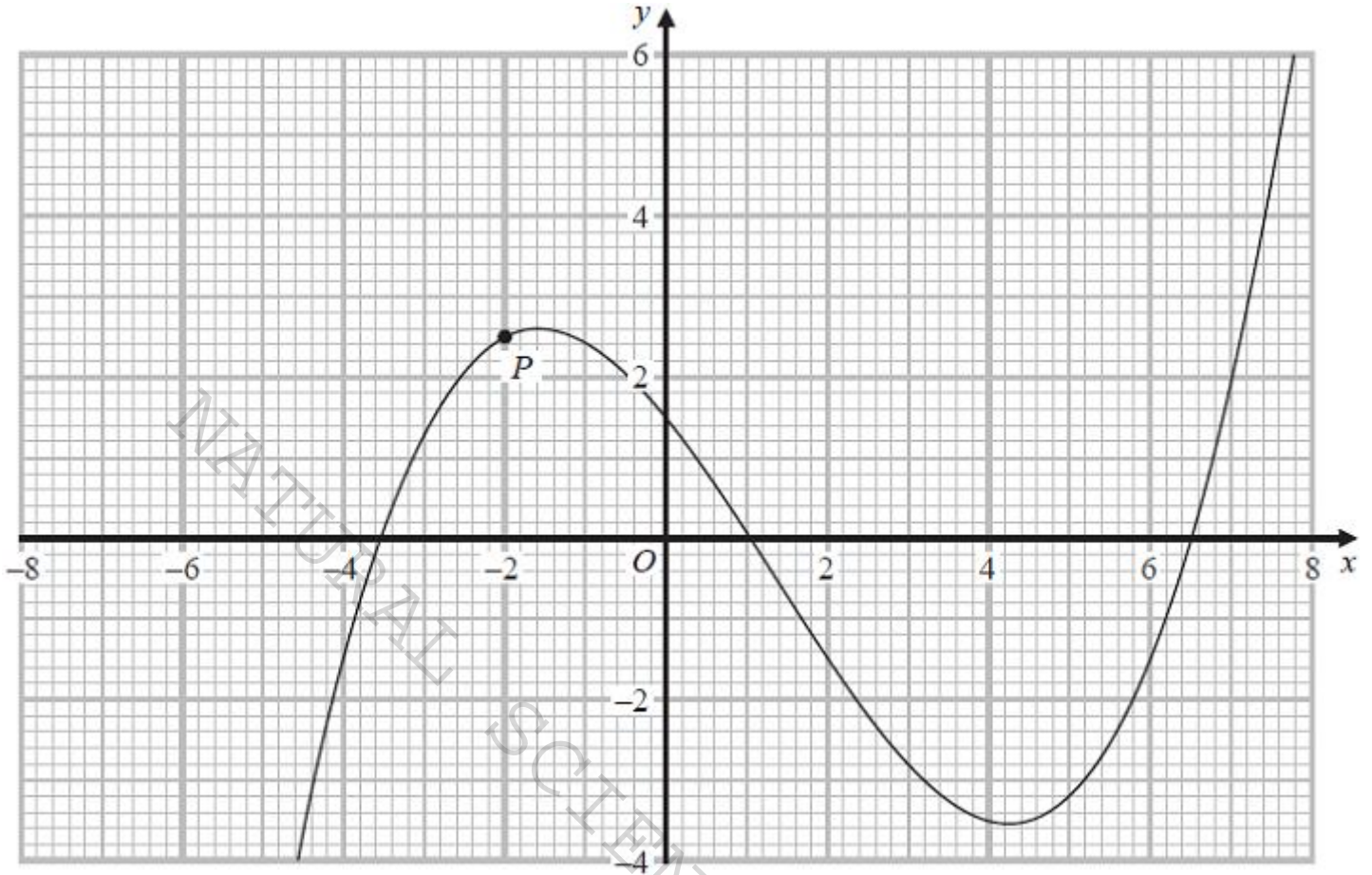
Show your working clearly.
Give your solutions correct to one decimal place.

.....
(3)

(Total for question = 5 marks)
(Q21 4MA1/2H, Jan 2022)

Q3.

The diagram shows the graph of $y = f(x)$



The point P has x coordinate -2

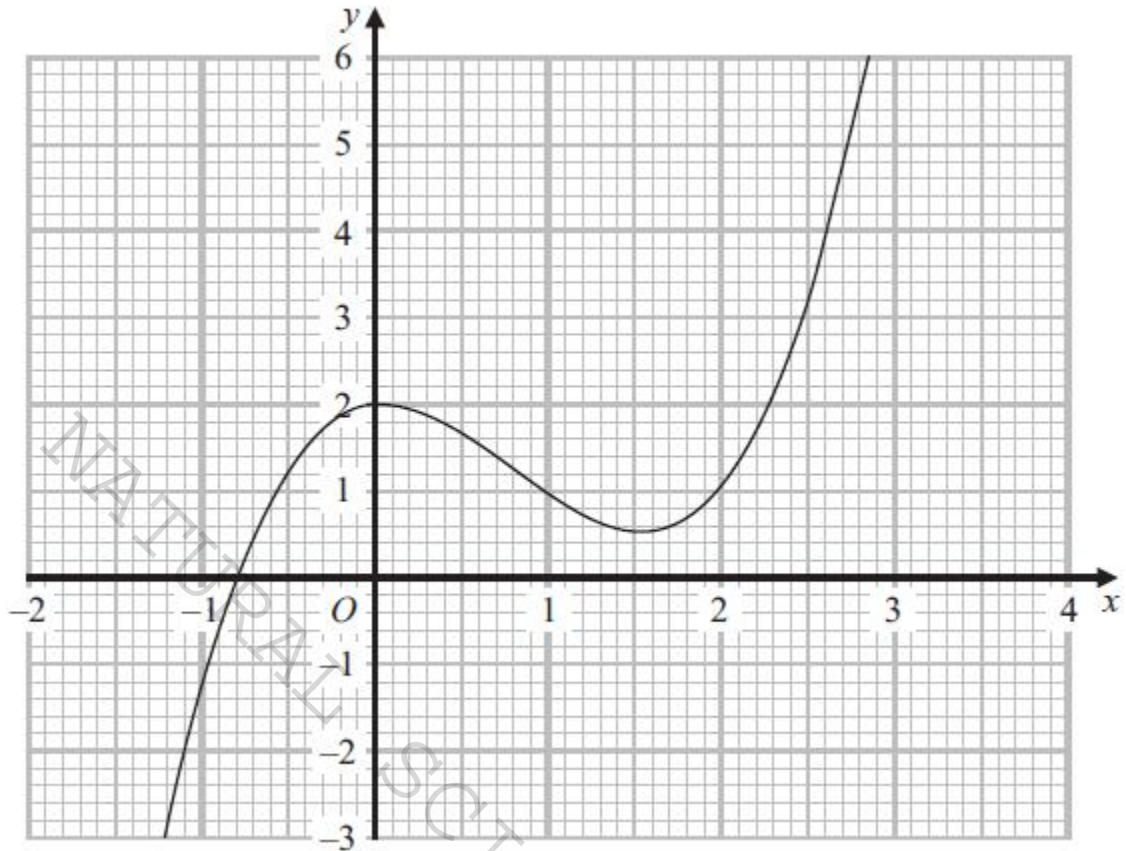
Use the graph to find an estimate for the gradient of the curve at P

.....
(Total for question = 3 marks)

(Q21 4MA1/2HR, Jan 2023)

Q4.

Part of the curve with equation $y = f(x)$ is shown on the grid.



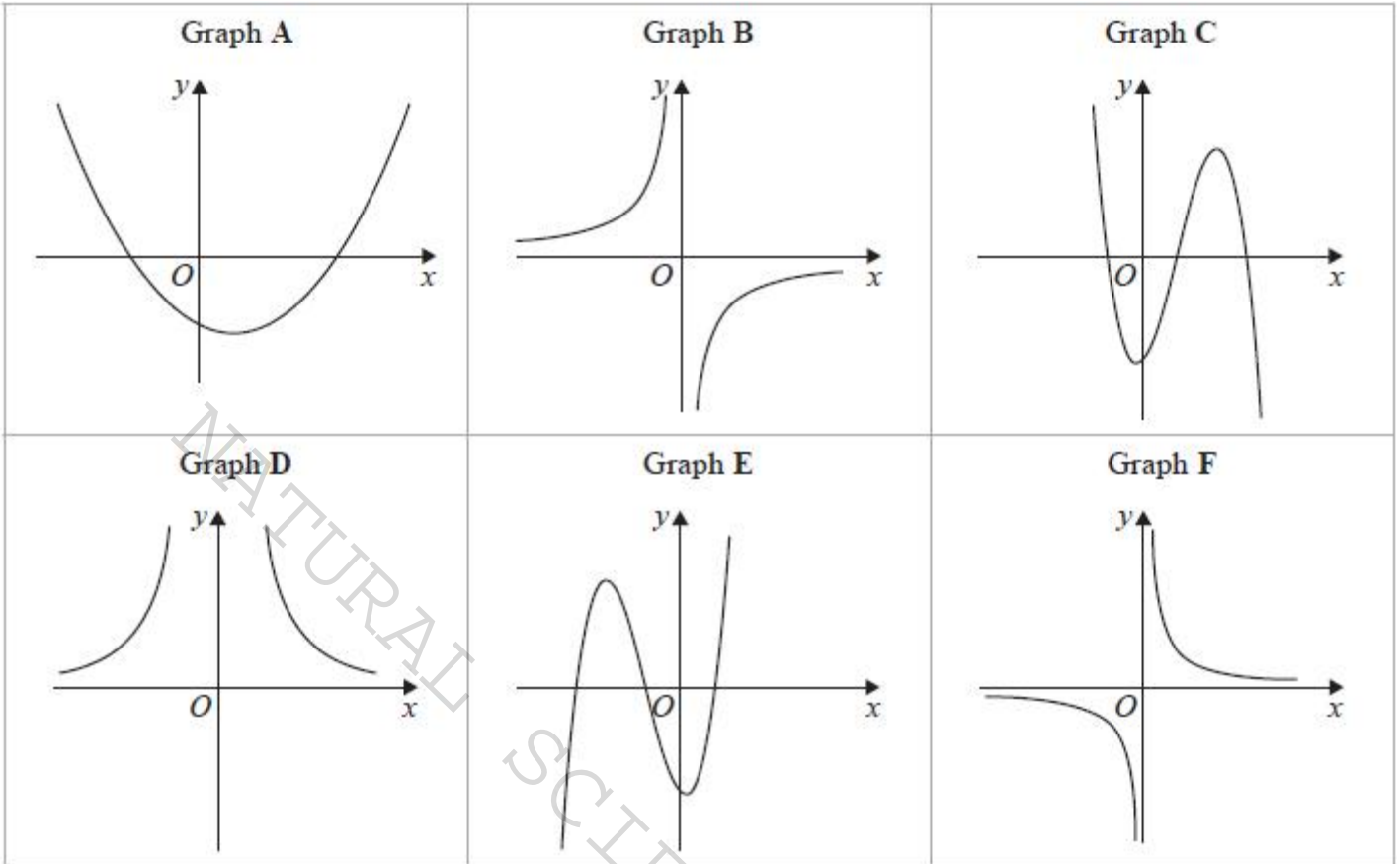
Find an estimate for the gradient of the curve at the point where $x = 2$
 Show your working clearly.

.....
 (Total for question = 3 marks)

(Q17 4MA1/2HR, Jan 2022)

Q5.

Here are six graphs.



Write down the letter of the graph of

(a) $y = \frac{10}{x^2}$

.....
(1)

(b) $y = x - 3 + 3x^2 - x^3$

.....
(1)

(c) $y = -\frac{3}{x}$

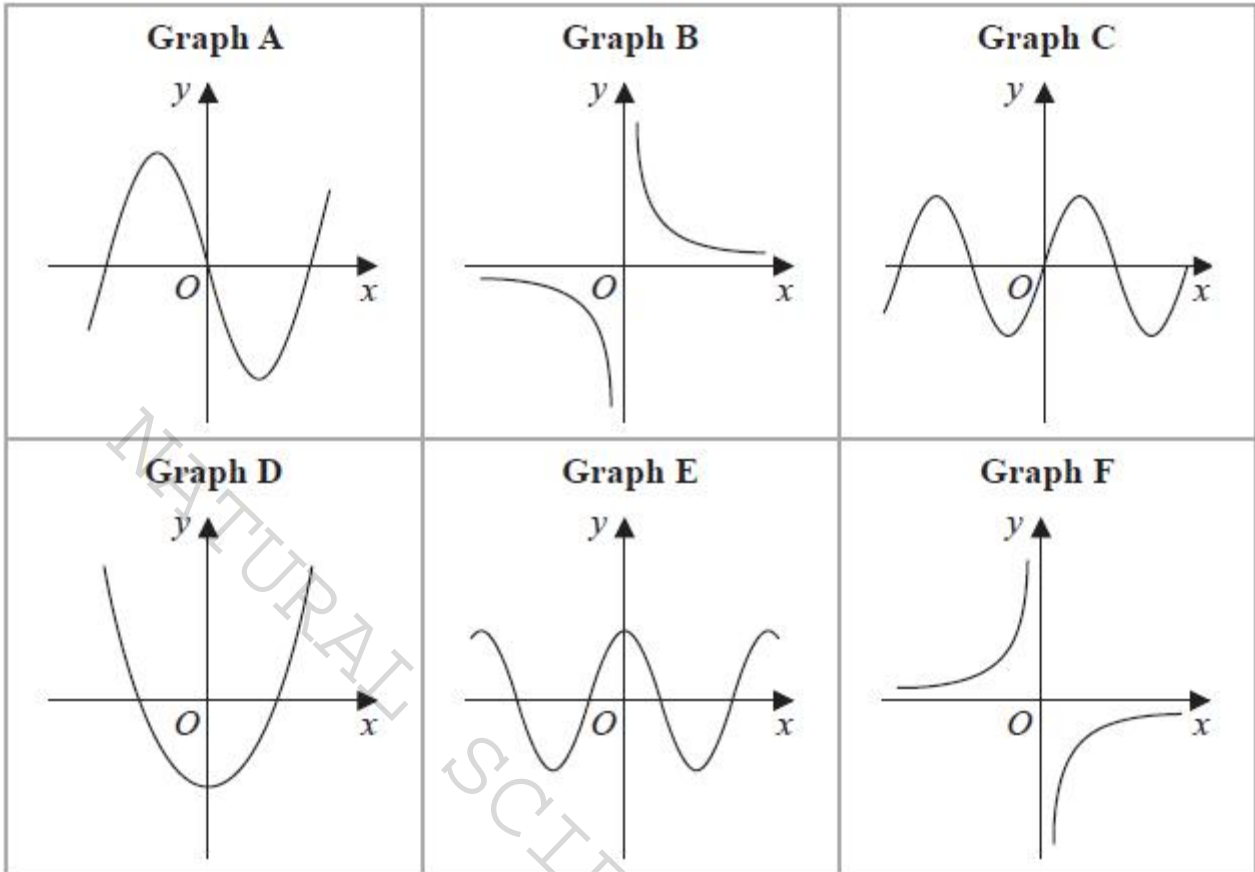
.....
(1)

(Total for question = 3 marks)

(QU12 4MA1/2HR, June 2023)

Q6.

Here are 6 graphs.



Complete the table below with the letter of the graph that could represent each given equation.

Write your answers on the dotted lines.

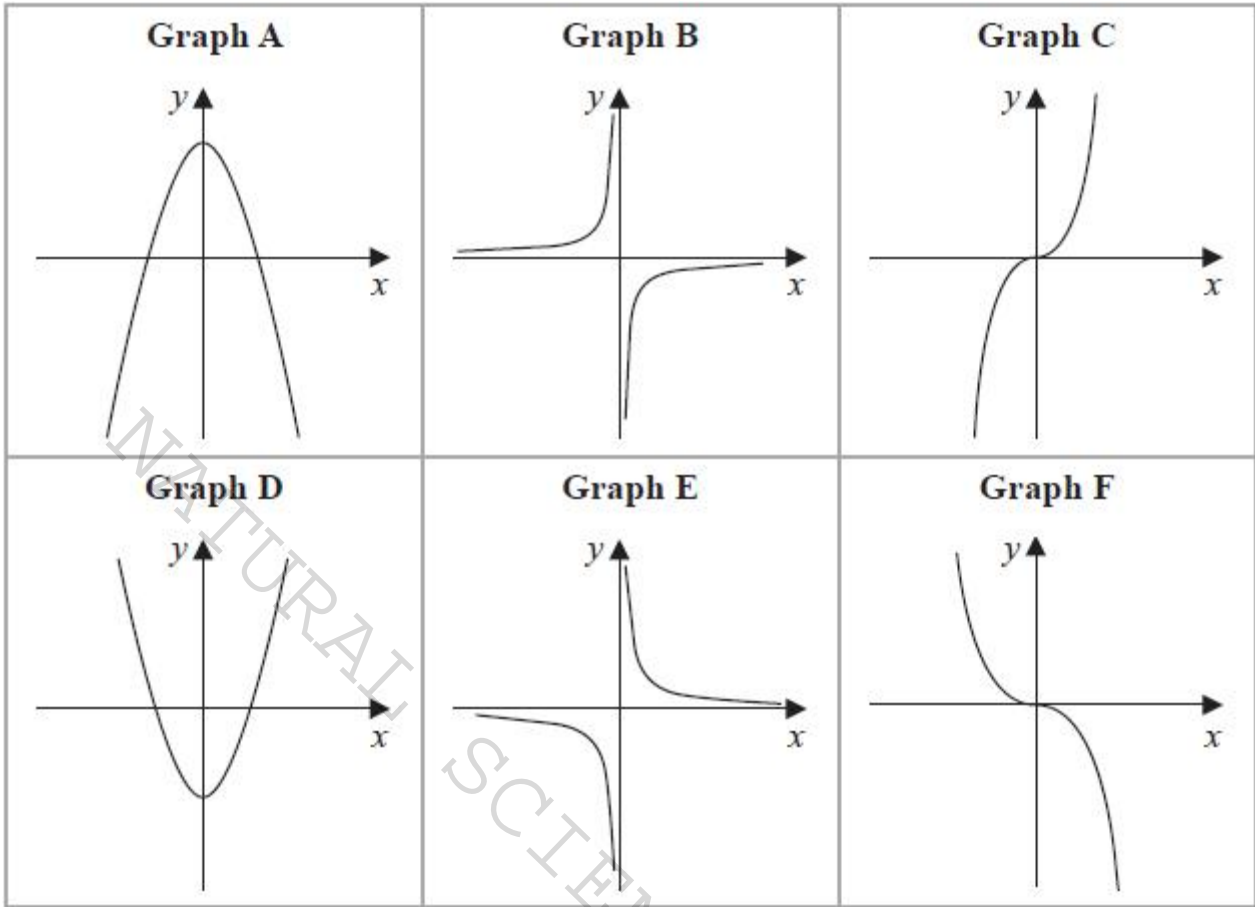
Equation	Graph
$y = \sin x$
$y = -\frac{3}{x}$
$y = 4x^3 - 5x$

(Total for question = 3 marks)

(QU18 4MA1/2H, June 2023)

Q7.

Here are six graphs.



Complete the table below with the letter of the graph that could represent each given equation. Write your answers on the dotted lines.

Equation	Graph
$y = -\frac{2}{x}$
$y = 5 - x^2$
$y = -2x^3$

(Total for question = 3 marks)

(Q11 4MA1/2H, Jan 2023)

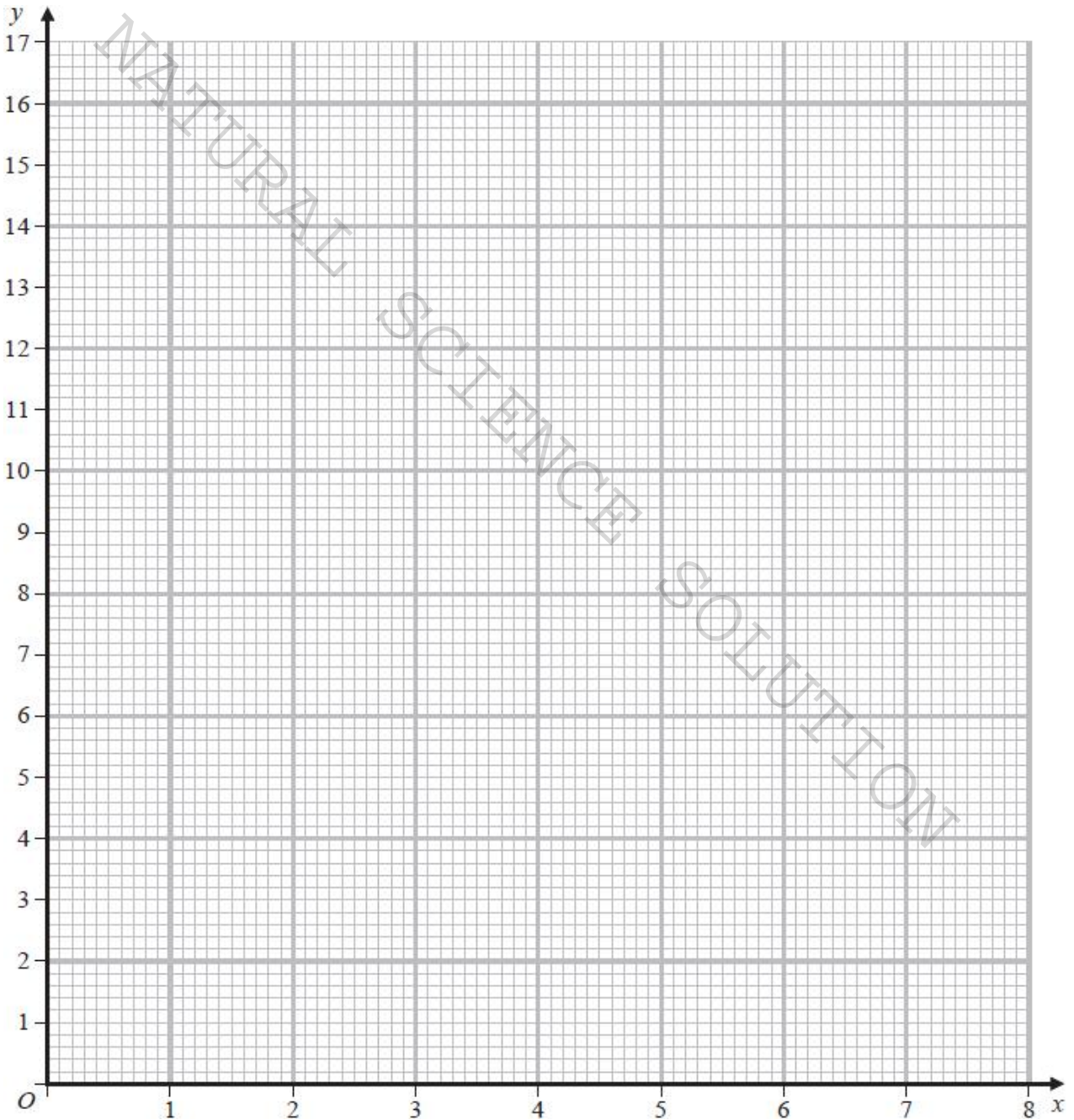
Q8.

(a) Complete the table of values for $y = \frac{1}{x}(x^2 + 4)$

x	0.25	0.5	1	2	4	8
y	16.25					8.5

(2)

(b) On the grid, draw the graph of $y = \frac{1}{x}(x^2 + 4)$ for $0.25 \leq x \leq 8$



(2)

(Total for question = 4 marks)

(Q15 4MA1/2H, June 2021)

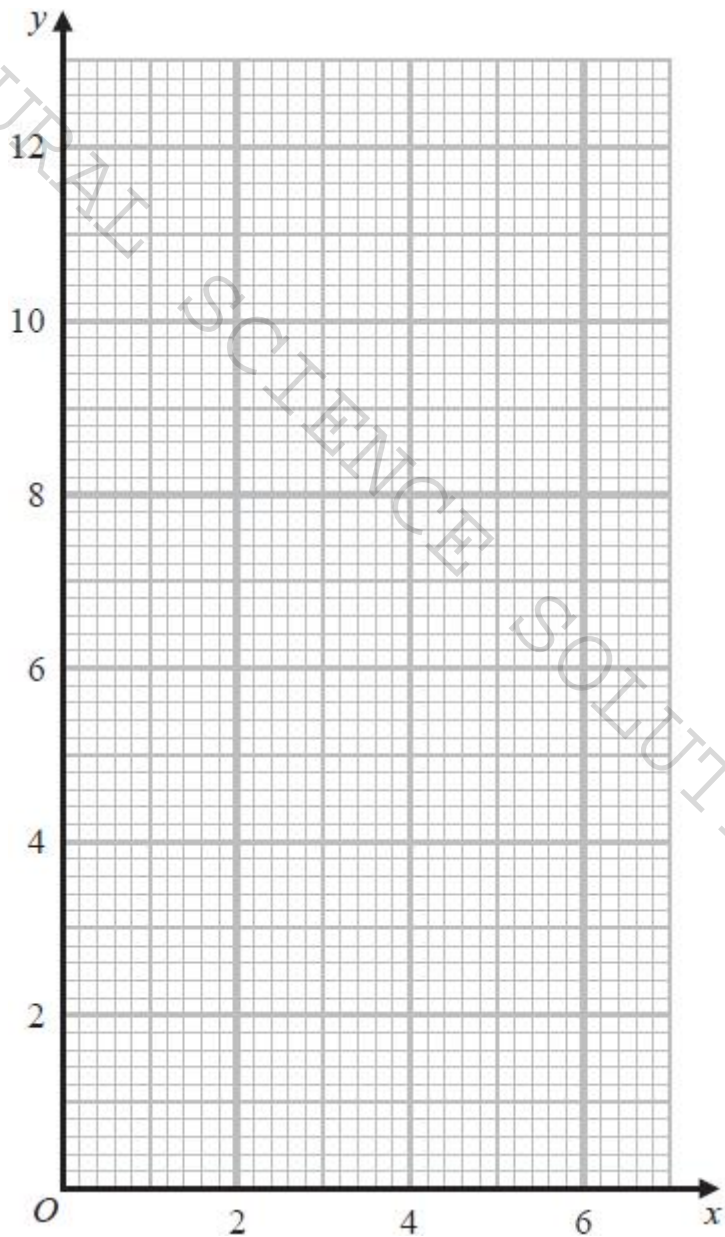
Q9.

11 (a) Complete the table of values for $y = \frac{6}{x}$

x	0.5	1	2	3	4	5	6
y		6		2			1

(2)

(b) On the grid, draw the graph of $y = \frac{6}{x}$ for $0.5 \leq x \leq 6$



(2)

(Total for question = 4 marks)

(Q11 4MA1/2HR, Jan 2022)

Topic-38: Graphs of functions-2

Q1.

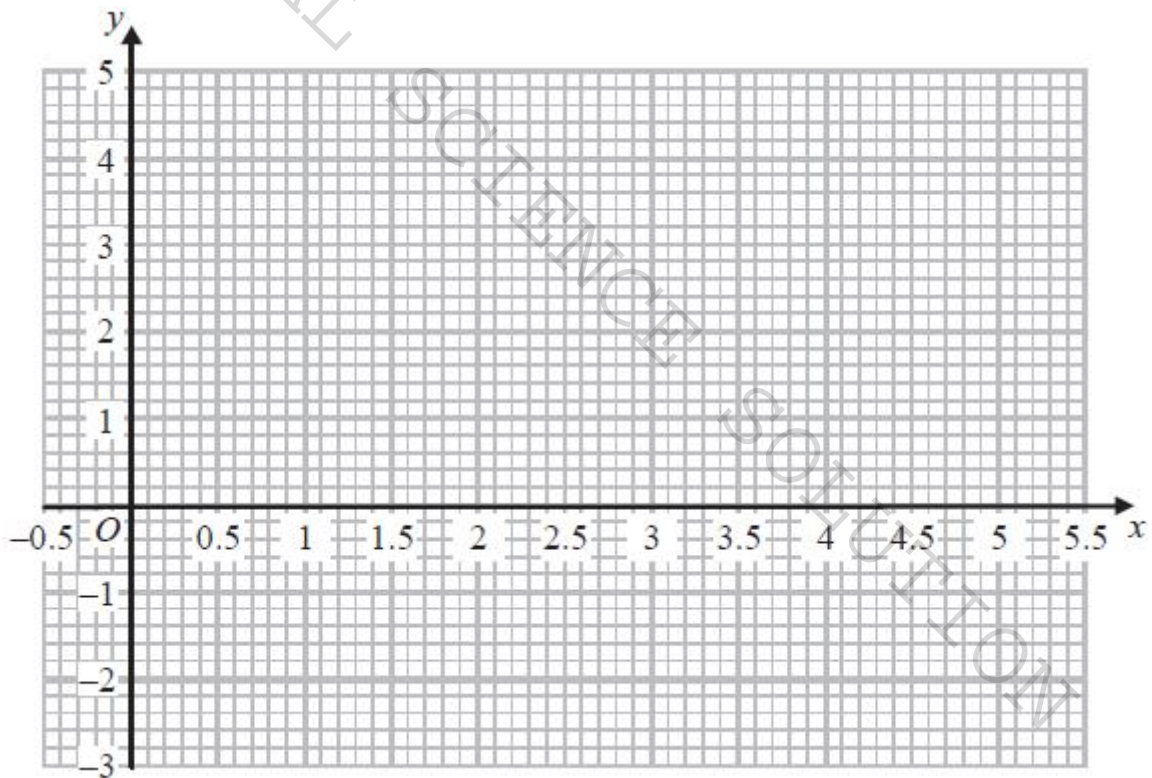
(a) Complete the table of values for $y = x^2 - 5x + 4$

x	0	1	2	3	4	5
y			-2			4

(2)

(b) On the grid, draw the graph of $y = x^2 - 5x + 4$ for all values of x from $x = 0$ to $x = 5$

(2)



(Total for Question is 4 marks)

(Q08 4MA0/3HR, June 2014)

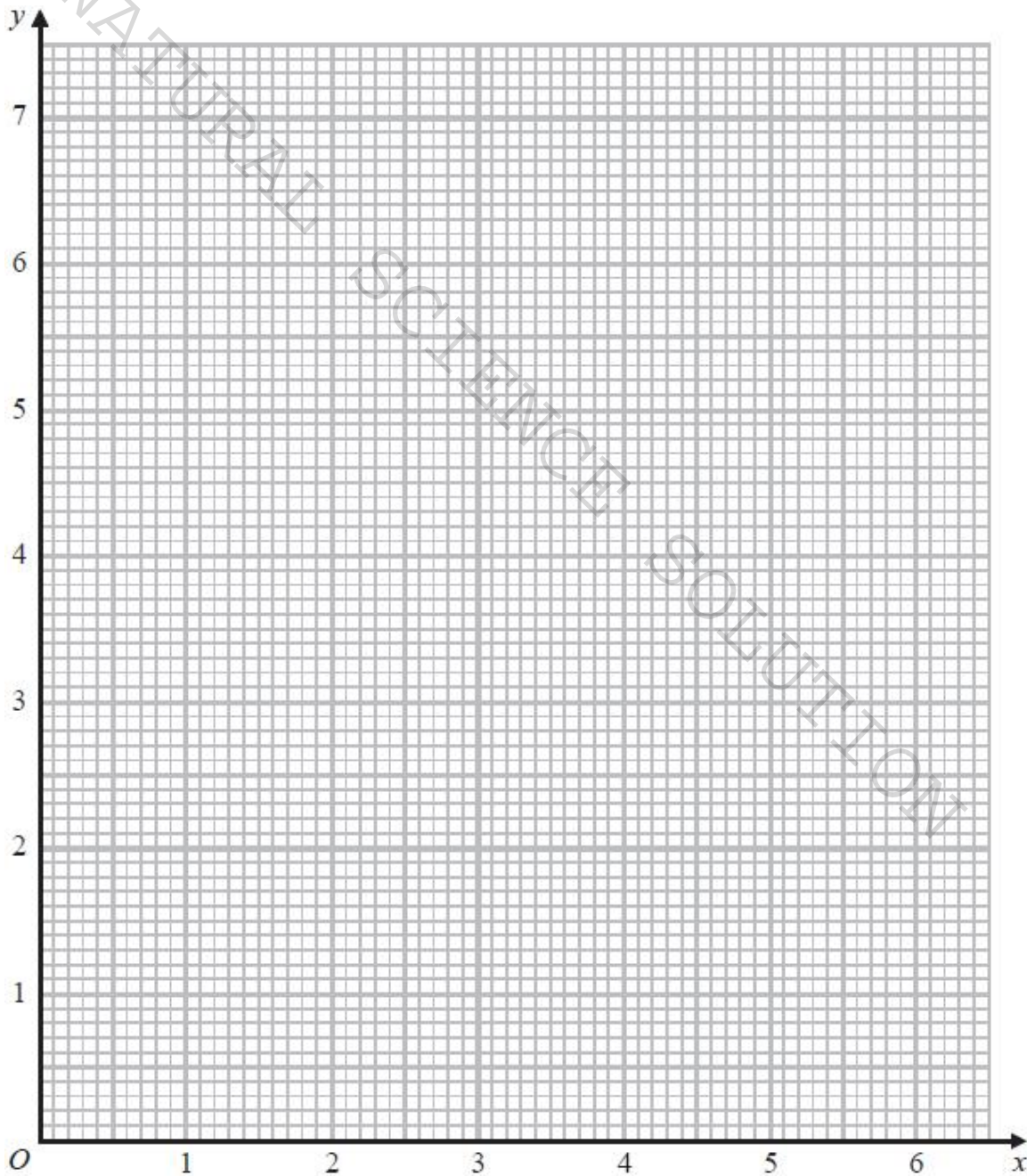
Q2.

(a) Complete the table of values for $y = \frac{1}{2}\left(x + \frac{9}{x}\right)$

x	1	1.5	2	3	4	5	6
y	5		3.25		3.125	3.4	

(2)

(b) Draw the graph of $y = \frac{1}{2}\left(x + \frac{9}{x}\right)$ for values of x from 1 to 6



(2)

$\frac{9}{x}$

(c) Use the graph to find estimates for the solutions of the equation $x + \frac{9}{x} = 7$

(2)
 (Total for question = 6 marks)
 (Q16 4MA0/3H, June 2015)

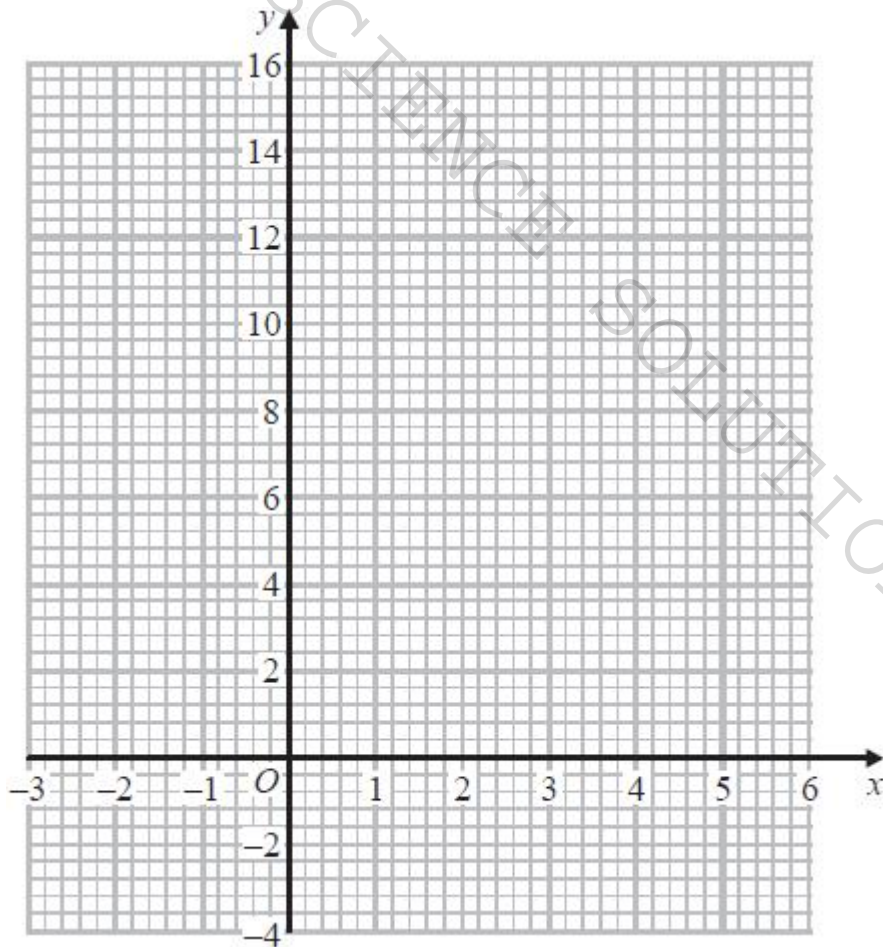
Q3.

(a) Complete the table of values for $y = x^2 - 4x + 2$

x	-2	-1	0	1	2	3	4	5
y	14		2			-1	2	

(2)

(b) On the grid, draw the graph of $y = x^2 - 4x + 2$ for values of x from -2 to 5



(2)

The point $P(k, 4)$ where $k > 0$ lies on the graph of $y = x^2 - 4x + 2$

(c) Use your graph to find an estimate for the value of k .

(1)
(Total for question = 5 marks)
(Q05 4MA0/4HR, June 2016)

Q4.

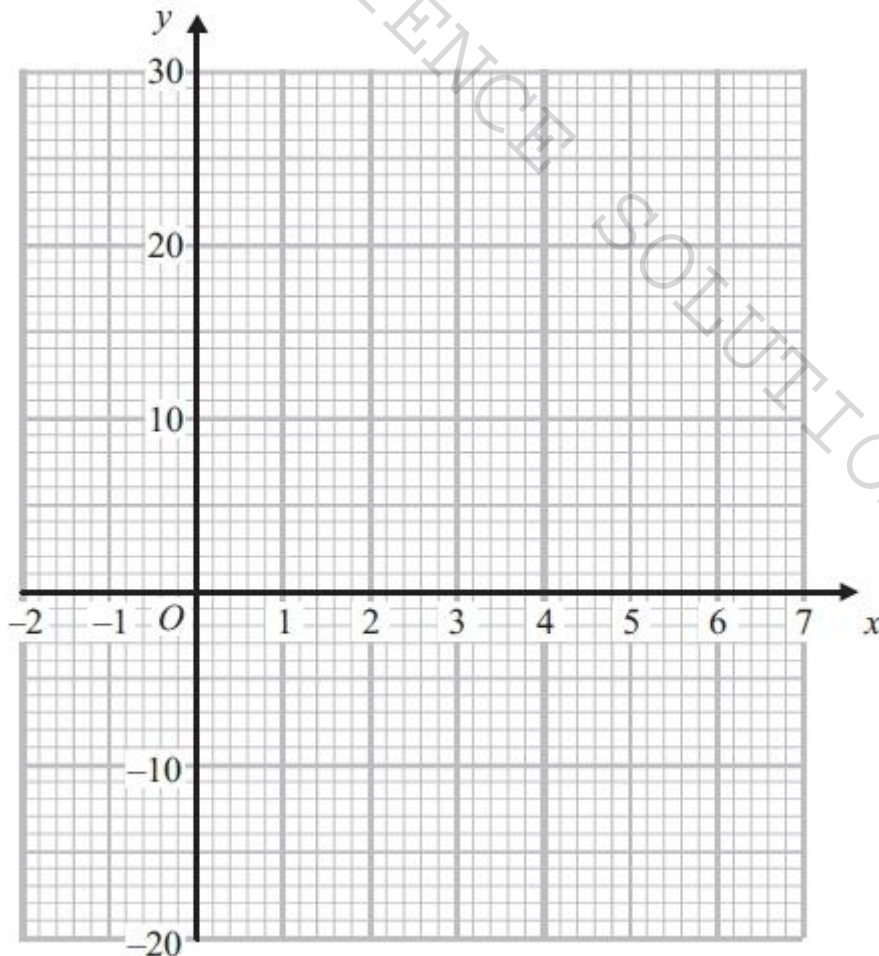
For $y = x^3 - 6x^2 + 20$

(a) (i) show that $y = 4$ when $x = 2$

(ii) complete the table of values

x	-1	0	1	2	3	4	5	6
y		20	15		-7	-12		20

(b) On the grid, draw the graph of $y = x^3 - 6x^2 + 20$ for values of x from -1 to 6



(c) For the curve with equation $y = x^3 - 6x^2 + 20$

(i) find $\frac{dy}{dx}$

..... (ii) find the gradient of the curve at $x = -3$

.....
(4)

(Total for question = 8 marks)

(Q11 4MA0/4H, June 2013)

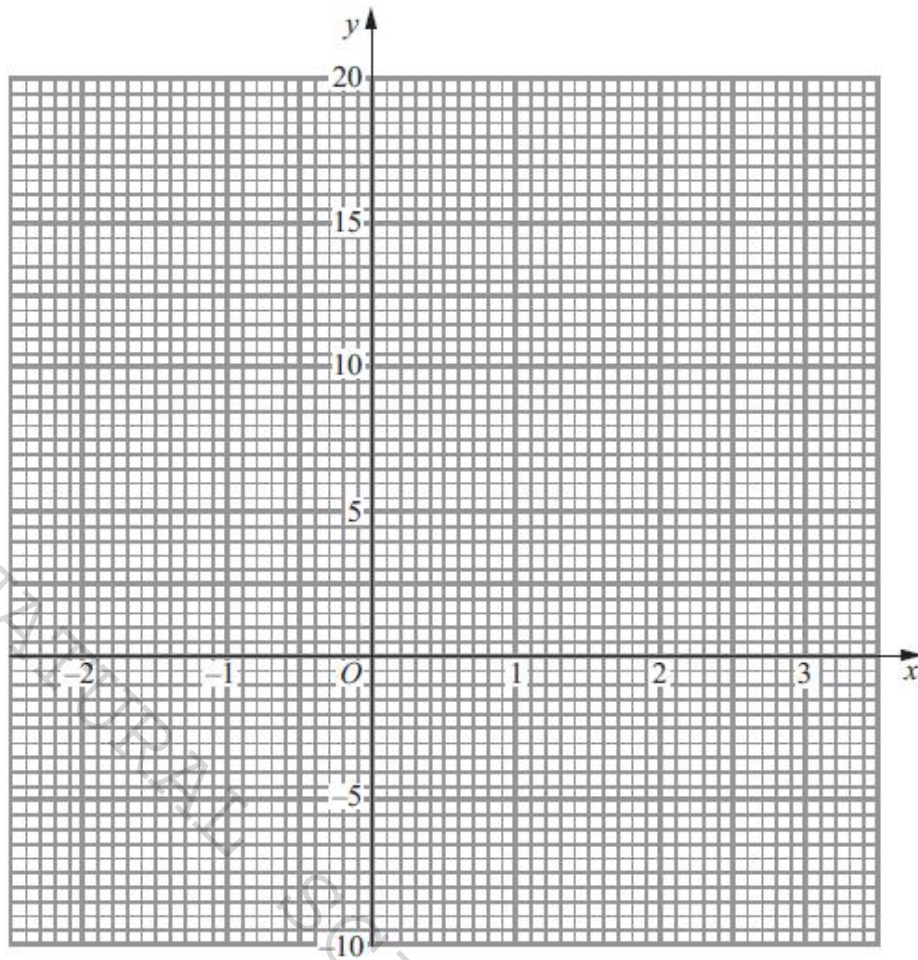
Q5.

(a) Complete the table of values for $y = x^3 - 3x - 1$

x	-2	-1	0	1	2	3
y		1				

(2)

(b) On the grid, draw the graph of $y = x^3 - 3x - 1$ for $-2 \leq x \leq 3$



(c) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation $x^3 - 3x - 6 = 0$.
Give your answer correct to 1 decimal place.

(2)

(d) For the curve with equation $y = x^3 - 3x - 1$

(2)

(i) find $\frac{dy}{dx}$

(ii) find the gradient of the curve at the point where $x = 4$

(4)

(Total for question = 10 marks)
(Q13 4MA0/4H, June 2012)

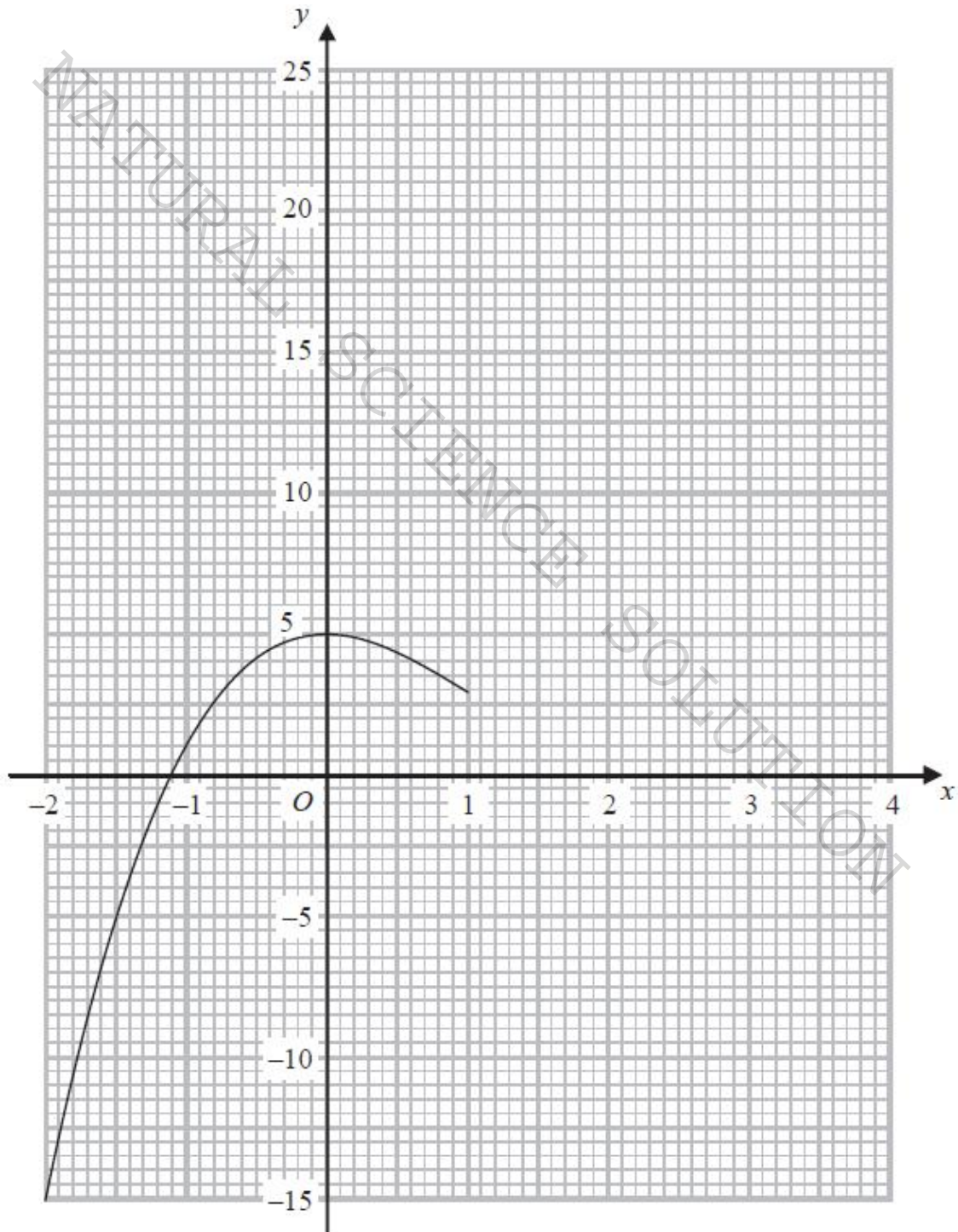
Q6.

(a) Complete the table of values for $y = x^3 - 3x^2 + 5$

x	-2	-1	0	1	2	3	4
y	-15	1	5	3			

(1)

(b) On the grid, complete the graph of $y = x^3 - 3x^2 + 5$ for $-2 \leq x \leq 4$



(1)

(c) Use the graph to find an estimate for the solution of the equation $x^3 - 3x^2 + 5 = 0$

$x = \dots\dots\dots$

(1)

(d) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation $x^3 - 3x^2 + 2x + 4 = 0$

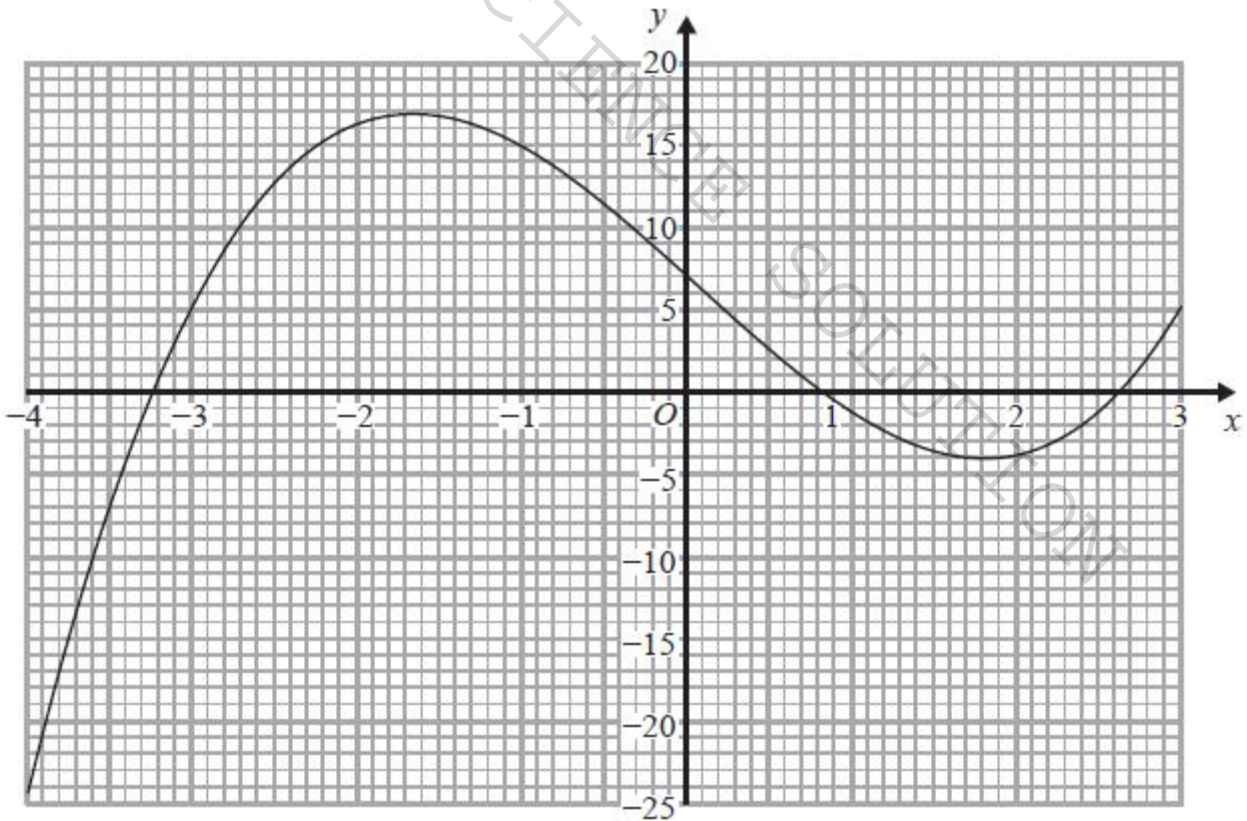
$x = \dots\dots\dots$

(3)

(Total for question = 6 marks)
(Q15 4MA0/4HR, June 2015)

Q7.

Here is the graph of $y = x^3 - 0.2x^2 - 9x + 7$ for $-4 \leq x \leq 3$



(a) Use the graph to find an estimate for the solution of the equation $x^3 - 0.2x^2 - 9x + 7 = -5$

$\dots\dots\dots$

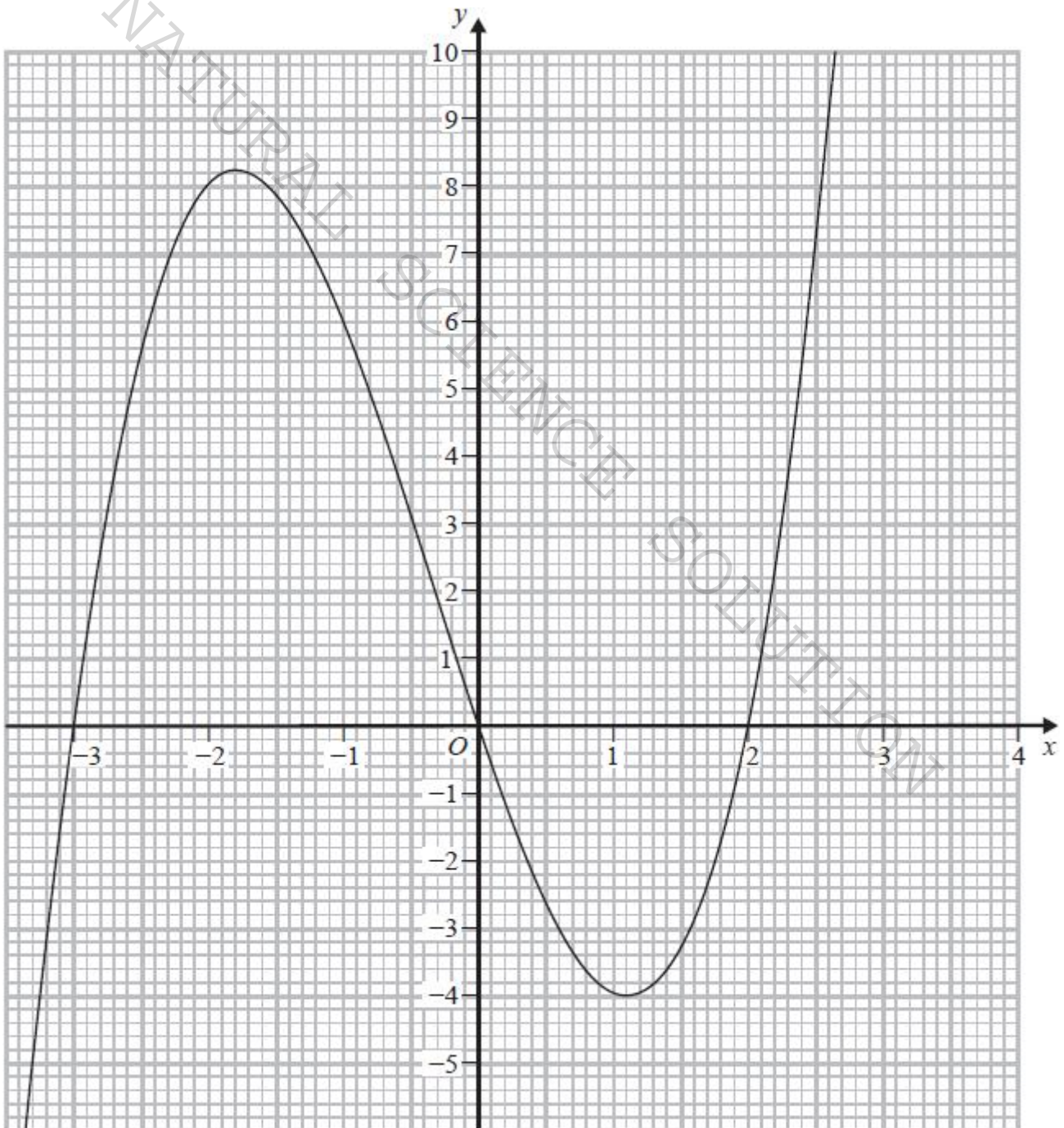
(2)

(b) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation $x^3 - 0.2x^2 - 4x + 7 = 0$

(3)
 (Total for question = 5 marks)
 (Q18 4MA0/4HR, Jan 2017)

Q8.

Here is the graph of $y = h(x)$



(a) Use the graph to find an estimate for the gradient of the curve $y = h(x)$ at $(-1,6)$

.....
(3)

(b) By drawing a suitable straight line on the grid, find an estimate for the solution of the equation $h(x) = 7 - 2x$

Give your answer correct to 1 decimal place.

.....
(2)

The equation $h(x) = k$ has 3 different solutions for $a < k < b$

(c) Use the graph to find an estimate for the value of a and the value of b .

$a =$

$b =$

(2)

(Total for question = 7 marks)

(Q19 4MA0/4H, Jan 2017)

NATURAL SCIENCE SOLUTION

Q9.

(a) Complete the table of values for $y = x^2 + 2x - 3$

x	-4	-3	-2	-1	0	1	2
y		0	-3	-4			5

(2)

(b) On the grid, draw the graph of $y = x^2 + 2x - 3$ for values of x from -4 to 2



(2)

(Total for Question is 4 marks)

(Q11 4MA0/4H, June 2014)

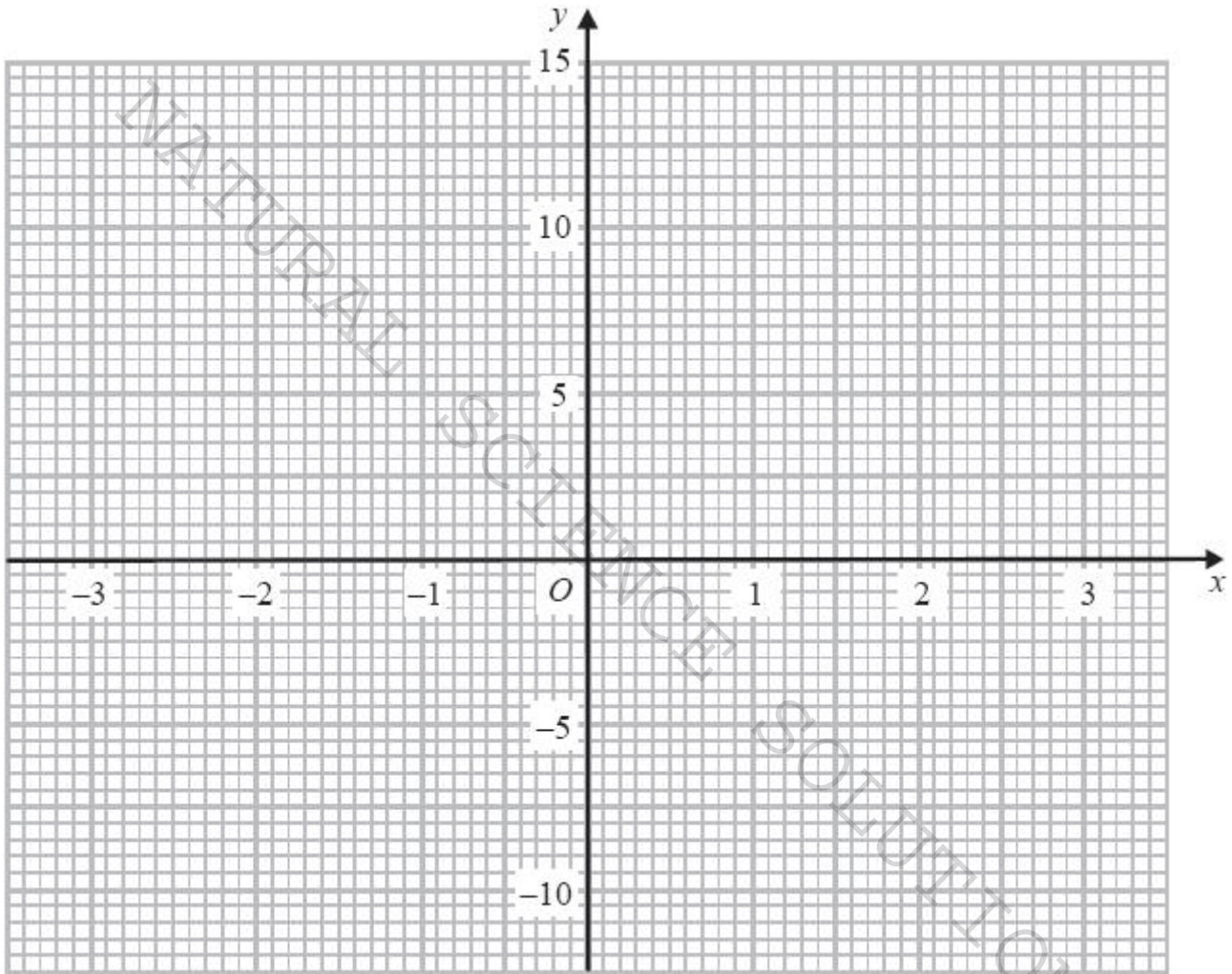
Q10.

(a) Complete the table of values for $y = x^3 - 5x + 2$

x	-3	-2	-1	0	1	2	3
y		4			-2		14

(2)

(b) On the grid, draw the graph of $y = x^3 - 5x + 2$ for $-3 \leq x \leq 3$



(2)

The equation $x^3 - 6x + m = 0$, where m is an integer, has one negative solution and two positive solutions.

(c) Given that $x = 1$ is one of the positive solutions, show that $m = 5$

(1)

(d) By drawing a suitable straight line on the grid, find an estimate for the negative solution of $x^3 - 6x + 5 = 0$

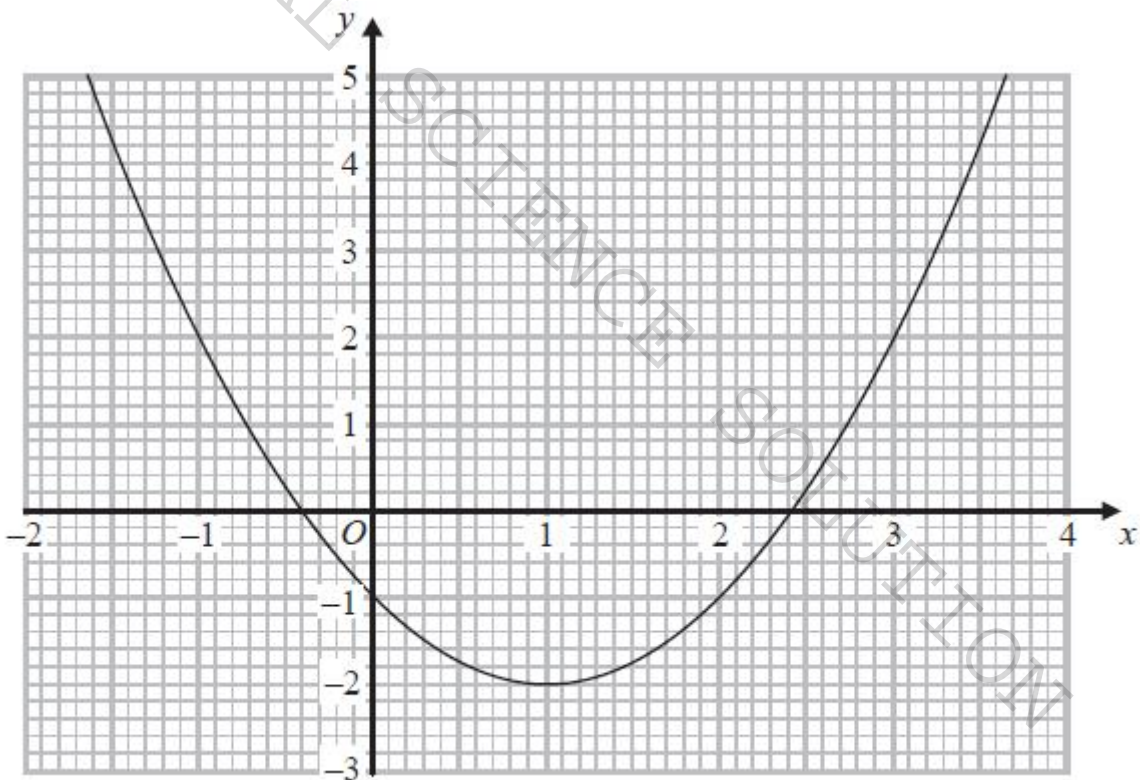
Give your estimate to 1 decimal place.

(2)

(Total for question = 7 marks)
(Q14 4MA0/4HR, Jan 2016)

Q11.

Here is the graph of $y = x^2 - 2x - 1$



(a) Use the graph to solve the equation $x^2 - 2x - 1 = 2$

(2)

The equation $x^2 + 5x - 7 = 0$ can be solved by finding the points of intersection of the line $y = ax + b$ with the graph of $y = x^2 - 2x - 1$

(b) Find the value of a and the value of b .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

(2)

(Total for question = 4 marks)
(Q15 4MA0/4H, Jan 2015)

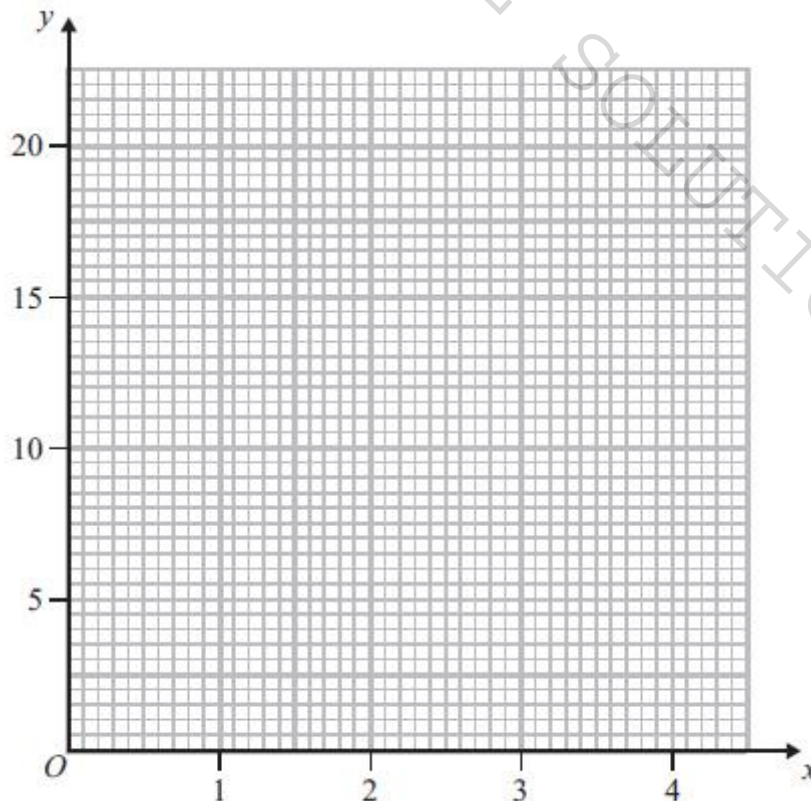
Q12.

(a) Complete the table of values for $y = x^2 + \frac{2}{x}$

x	0.1	0.2	0.5	1	1.5	2	3	4
y	20.01	10.04		3	3.58	5	9.67	

(1)

(b) On the grid, draw the graph of $y = x^2 + \frac{2}{x}$ for $0.1 \leq x \leq 4$



(2)

(c) Use your graph to find estimates for the solutions of $x^2 + \frac{2}{x} = 14$ in the interval $0.1 \leq x \leq 4$

Give your estimates correct to 1 decimal place.

.....cm²
(2)

(d) $x = 1$ is one solution of the equation $x^2 + \frac{2}{x} = mx$
(i) Find the value of m .

$m =$

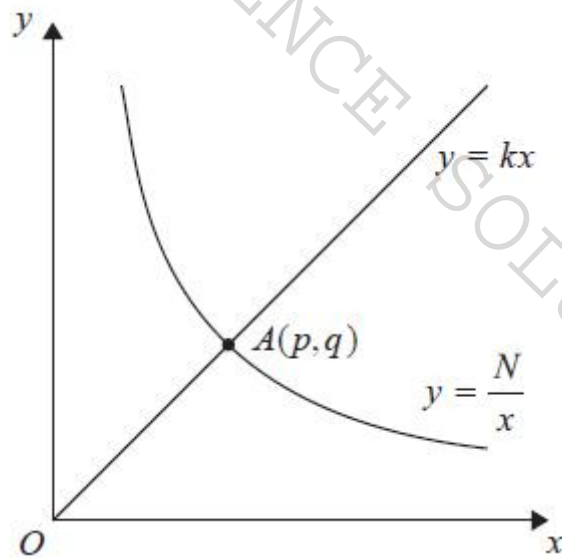
(ii) Draw a suitable straight line on your graph to find an estimate for the second positive solution of the equation $x^2 + \frac{2}{x} = mx$ for the value of m found in part (d)(i).
Give your estimate correct to 1 decimal place.

$x =$
(3)

(Total for question = 8 marks)

(Q20 4MA0/4HR, June 2013)

Q13.



The diagram shows the straight line with equation $y = kx$ intersecting the curve with equation $y = \frac{N}{x}$ at the point $A(p, q)$.

(a) Find p and find q .

Give each answer in its simplest form, in terms of k and N .

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots$$

(3)

Given that $p = 2q$

(b) find the value of k .

$$k = \dots\dots\dots$$

(2)

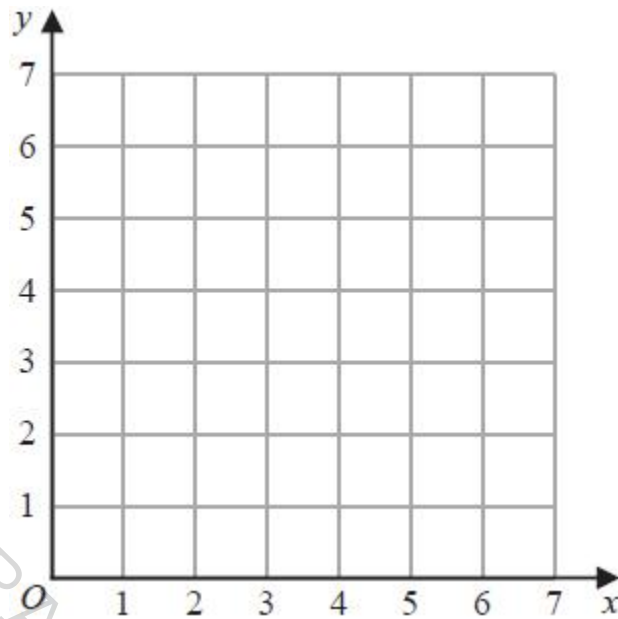
(Total for question = 5 marks)

(Q19 4MA0/4HR, Jan 2015)

NATURAL SCIENCE SOLUTION

Topic-39: Graphs of linear inequalities (linear programming)-1

Q1.



(a) On the grid, draw and **label** the straight line with equation

- (i) $x = 1.5$
- (ii) $y = x$
- (iii) $x + y = 6$

(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$$x \geq 1.5 \quad y \geq x \quad x + y \leq 6$$

Label the region **R**.

(1)

(Total for question = 4 marks)

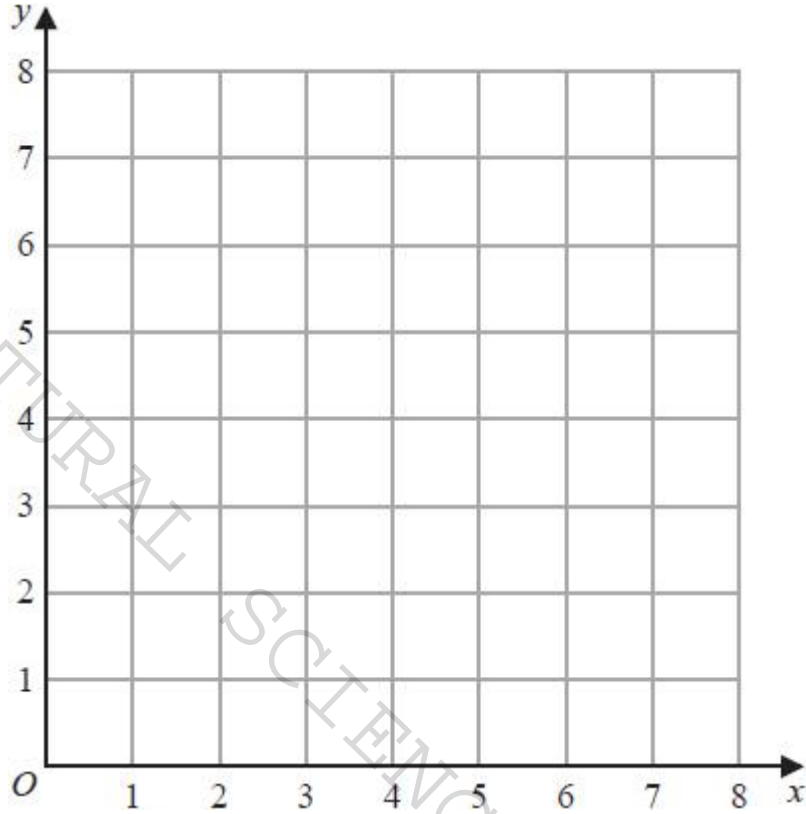
(Q04 4MA1/2H, Jan 2021)

Q2.

(a) On the grid, draw the straight line with equation

- (i) $y = 2$
- (ii) $x = 6$
- (iii) $y = x + 1$

Label each line with its equation



(3)

(b) Show, by shading on the grid, the region that satisfies all three of the inequalities

$$y \geq 2 \quad x \leq 6 \quad y \leq x + 1$$

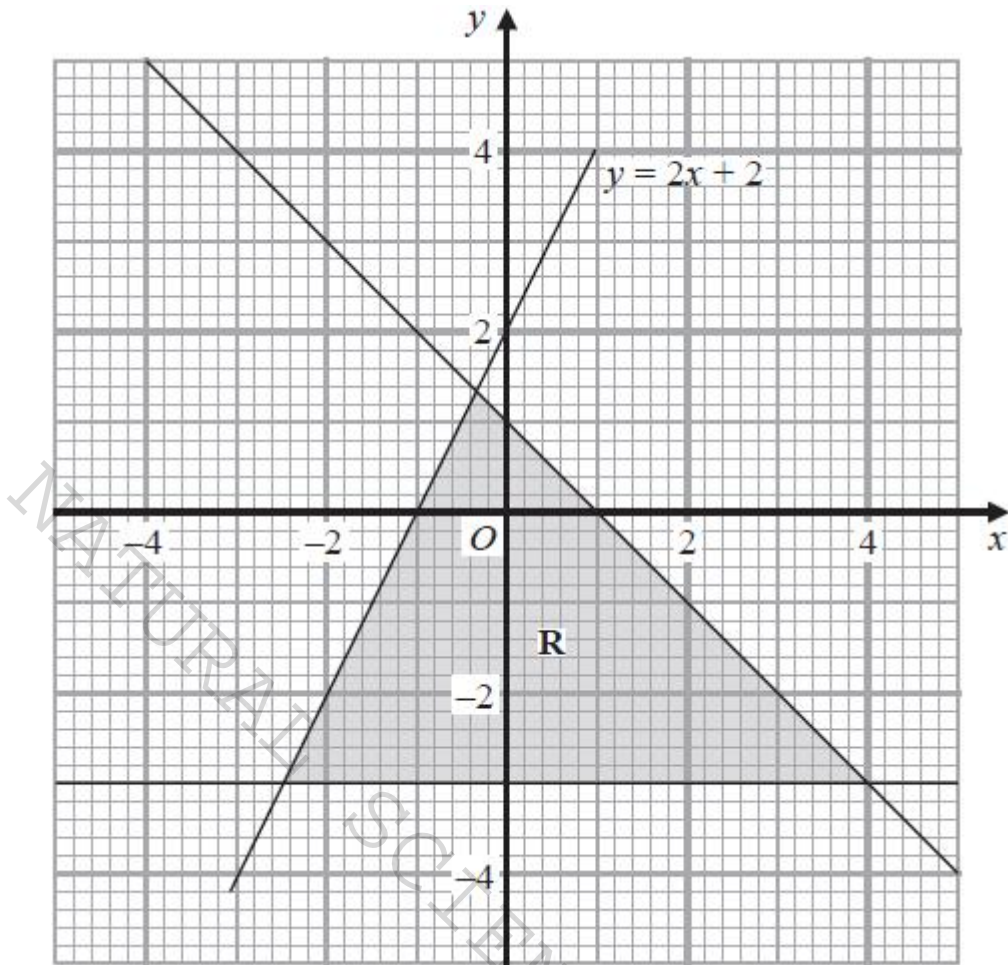
Label the region **R**

(1)

(Total for question = 4 marks)

(QU02 4MA1/2H, June 2024)

Q3.



The region **R**, shown shaded in the diagram, is bounded by three straight lines.
Write down the three inequalities that define **R**.

.....

(Total for question = 3 marks)

(Q13 4MA1/2H, Nov 2021)

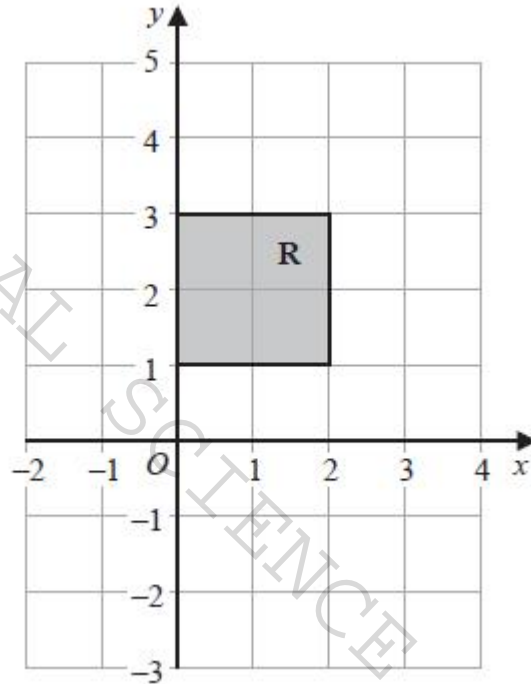
Q4.

The straight line **L** has gradient 5 and passes through the point with coordinates (0, -3)

(a) Write down an equation for **L**.

.....
(2)

(b)



The region **R**, shown shaded in the diagram, is bounded by four straight lines.

Write down the inequalities that define **R**.

NATURAL SCIENCES SOLUTION

.....
(2)

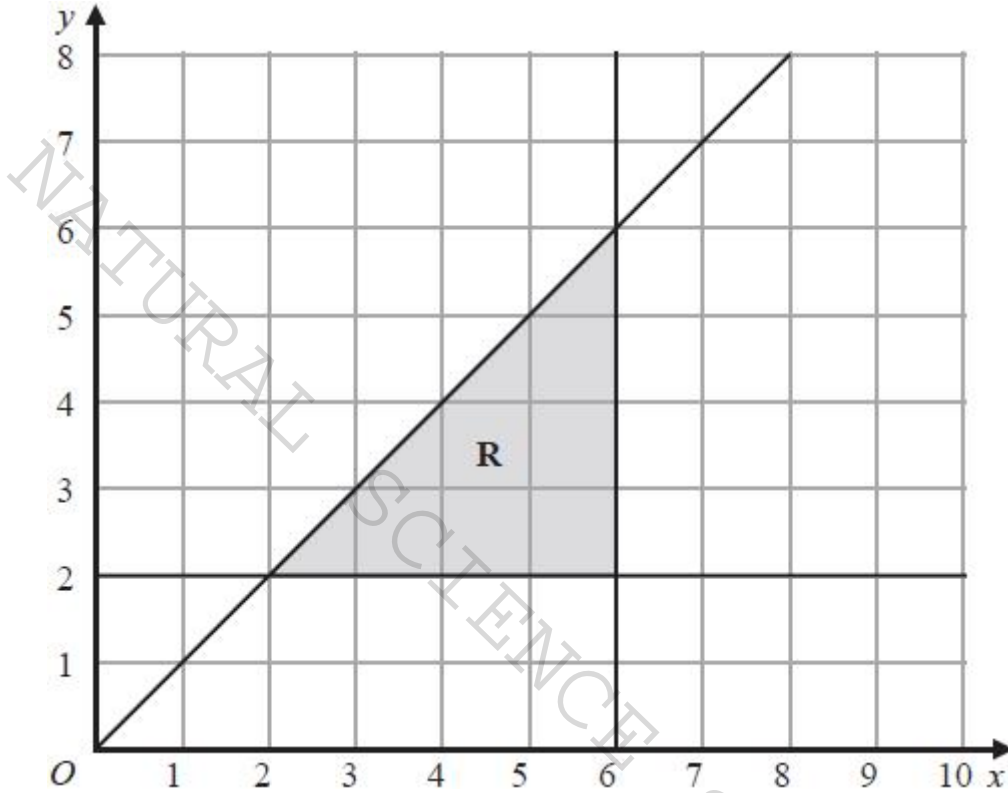
(Total for question = 4 marks)

(Q10 4MA1/2H, June 2019)

Q5.

(a) Solve $9 - 4x > 17$

.....
(2)



(b) Write down the three inequalities that represent the shaded region **R**

.....
.....
.....
(3)

(Total for question = 5 marks)

(QU08 4MA1/2HR, June 2023)

Q6.

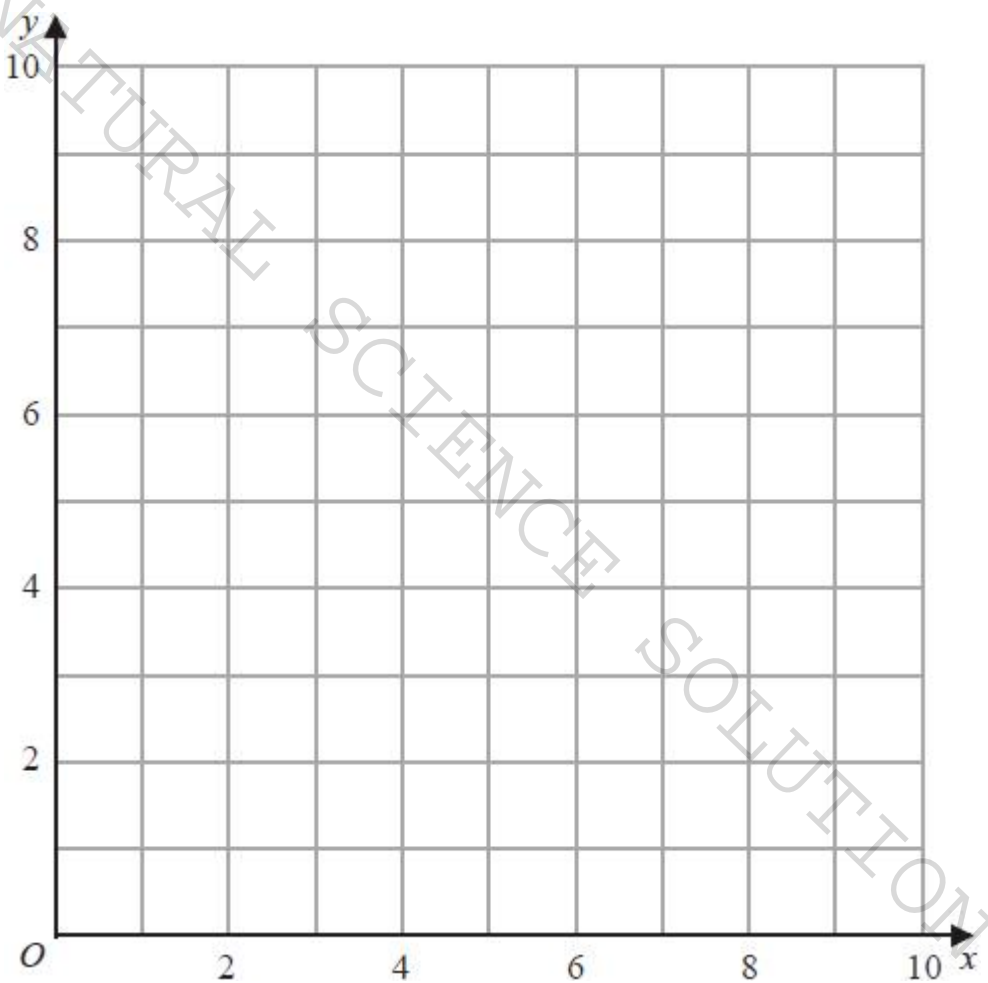
(a) Write down an equation of the straight line with gradient -3 and which passes through the point with coordinates $(0, 5)$

.....
(2)

(b) Show, by shading on the grid, the region defined by **all three** of the inequalities

$$x \leq 6 \quad y \geq 2 \quad y \leq x + 1$$

Label the region **R**



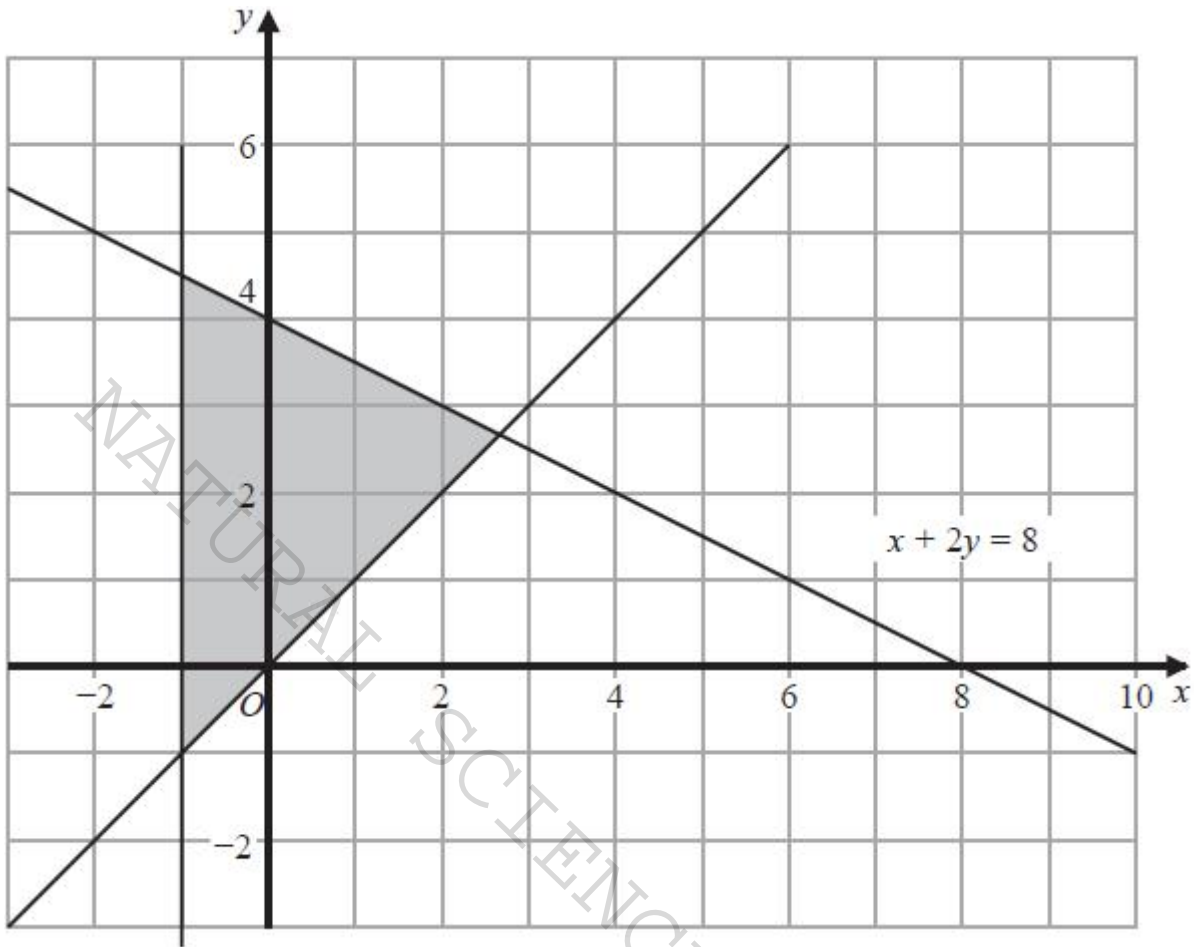
(3)

(Total for question = 5 marks)

(Q07 4MA1/2HR, Jan 2022)

Q7.

The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down three inequalities that define the shaded region.

NATURALS
SCIENCE
SOLUTION

.....

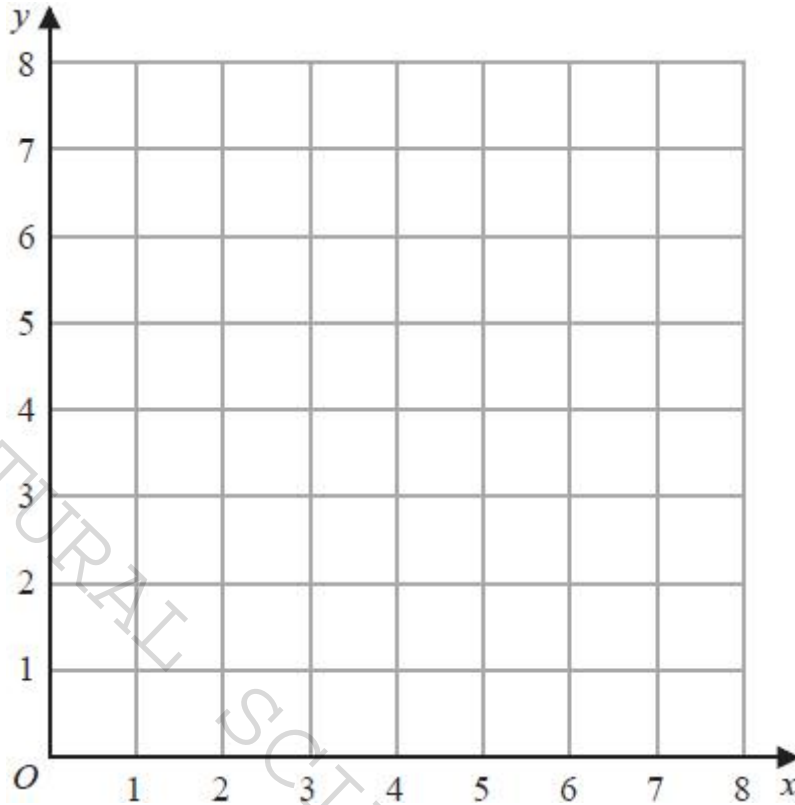
(Total for question = 3 marks)

(Q13 4MA1/2H, Jan 2022)

Q8.

(a) On the grid, draw and label with its equation the straight line with equation

(i) $y = 1$ (ii) $x = 2$ (iii) $x + y = 7$



(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$y \geq 1$ $x \geq 2$ $x + y \leq 7$

Label the region **R**.

(1)

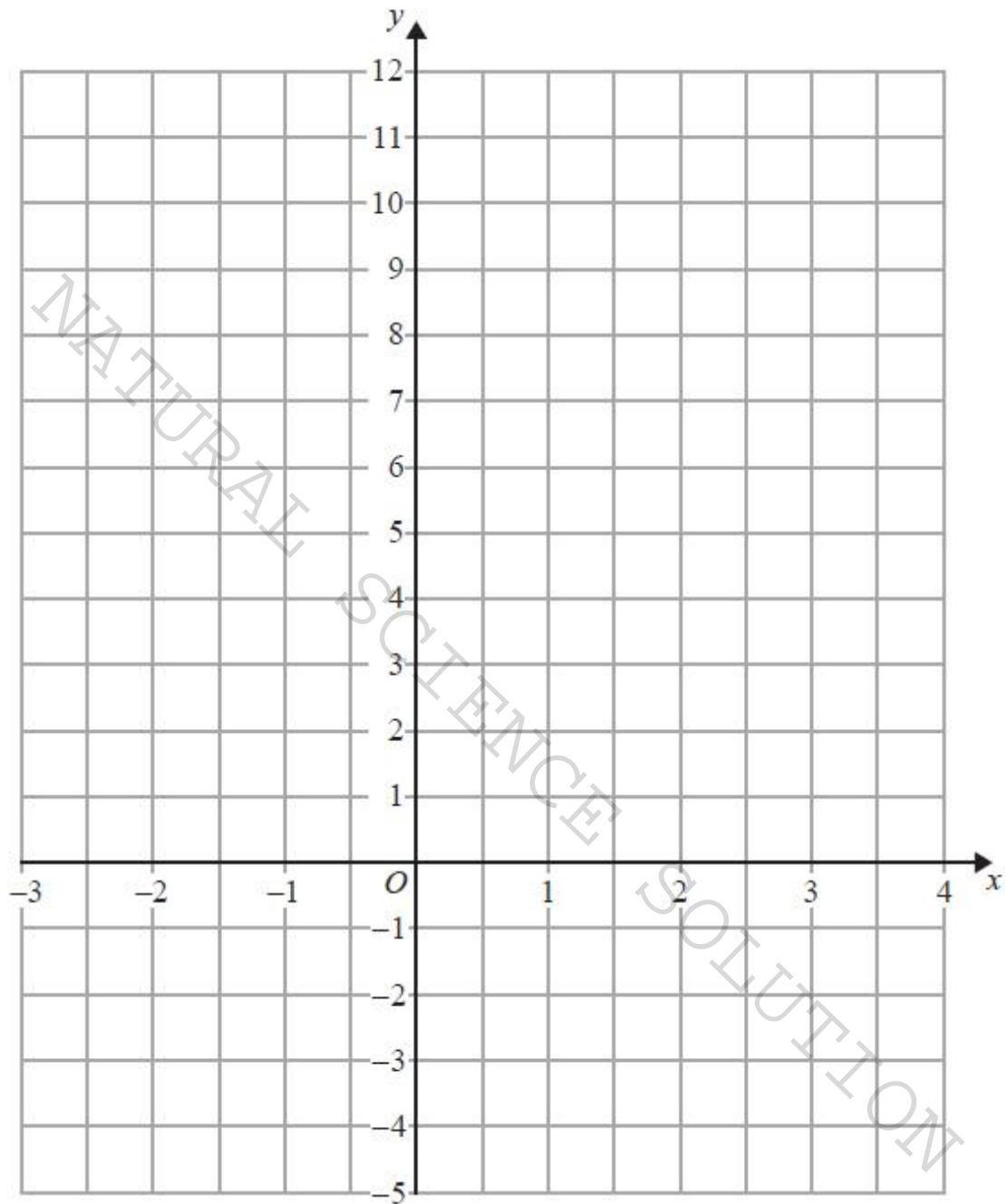
(Total for question = 4 marks)

(QU02 4MA1/2H, June 2022)

Topic-40: Graphs of linear inequalities (linear programming)-2

Q1.

(a) On the grid, draw the graph of $y = 3x + 2$ for values of x from -2 to 3



(3)

(b) Mark with a cross (x) a point on the grid that satisfies both the inequalities

$$x > 2 \text{ and } y > 3x + 2$$

Label this point P .

(2)

(Total for question = 5 marks)

(Q04 4MA0/4HR, June 2015)

Q2.

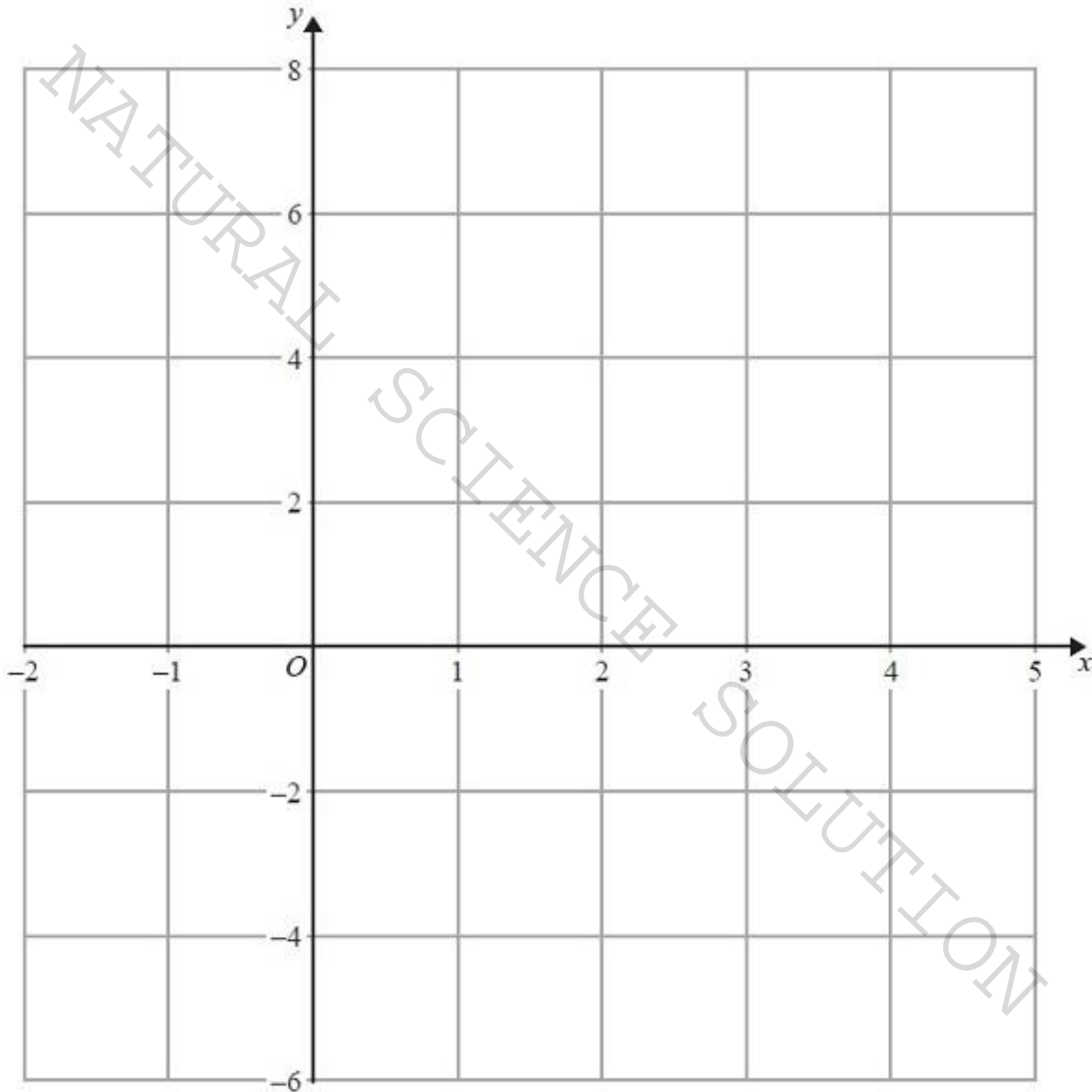
(a) Complete the table of values for $2x + y = 4$

x	-1	2	4
y			

(2)

(b) On the grid, draw the graph of $2x + y = 4$ for values of x from -1 to 4

(2)



(c) Show, by shading on the grid, the region which satisfies **all three** of the inequalities

$$x \geq -1, y \geq 2 \text{ and } 2x + y \leq 4$$

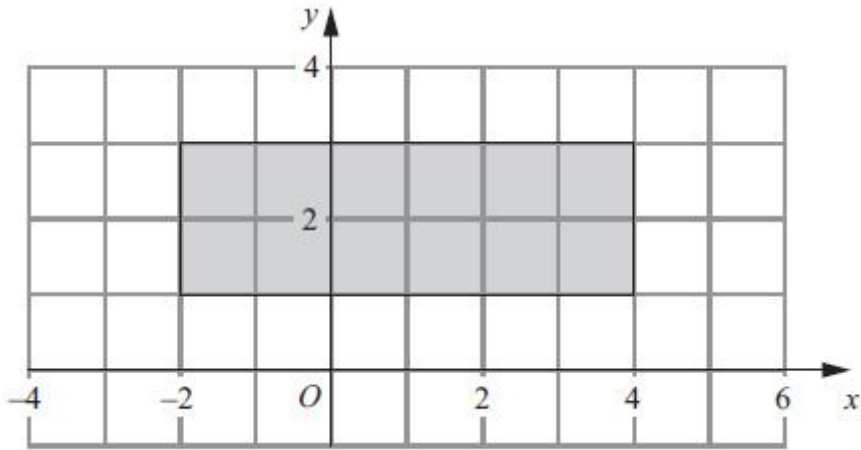
Label the region **R**.

(2)

(Total for Question is 6 marks)

(Q08 4MA0/4HR, Jan 2014)

Q3.



Write down inequalities to fully define the shaded region.

(Total for question = 3 marks)

(Q13 4MA0/4H, Jan 2013)

Topic-41: Graphs transformation

Q1.

The point A with coordinates $(-3, 2)$ lies on the straight line with equation $y = f(x)$

(a) Find the coordinates of the image of the point A on the straight line with equation

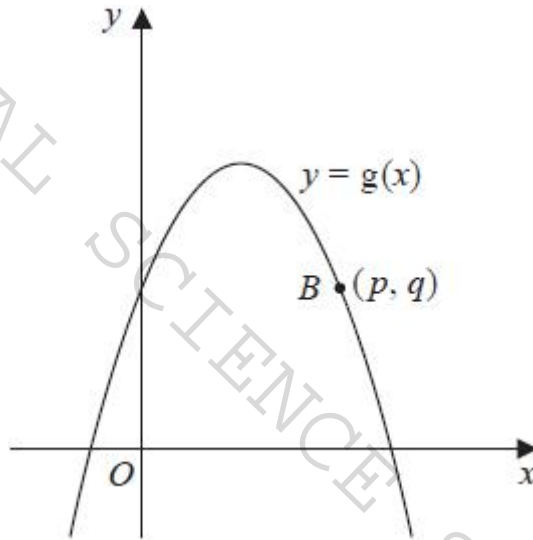
(i) $y = f(x) - 3$

(..... ,)
(1)

(ii) $y = f\left(\frac{x}{2}\right)$

(..... ,)
(1)

Here is a sketch of part of the curve with equation $y = g(x)$



The point B with coordinates (p, q) lies on the curve.

(b) Find the coordinates of the image of the point B on the curve with equation

$$y = -g(x - c)$$

where c is a constant.

(..... ,)
(2)

(Total for question = 4 marks)

(QU22 4MA1/2HR, June 2022)

Q2.

The diagram shows part of the curve with equation $y = f(x)$

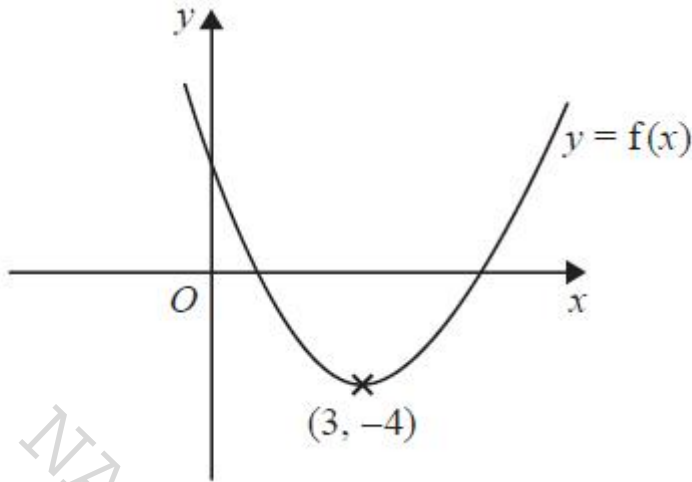


Diagram **NOT** accurately drawn

The coordinates of the minimum point on this curve are $(3, -4)$

(a) Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x - 4)$

(..... ,)

(ii) $y = 3f(x)$

(..... ,)

(iii) $y = f\left(\frac{1}{2}x\right)$

(..... ,)

(3)

The curve with equation $y = f(x)$ is translated to give curve C.

C has a minimum at the point with coordinates $(3, 5)$

The equation of C is $y = f(x) + k$

(b) Write down the value of k

$k = \dots\dots\dots$

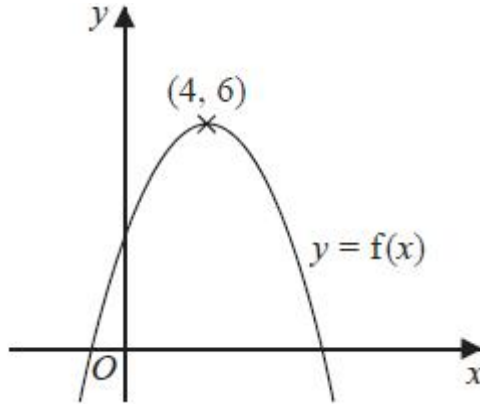
(1)

(Total for question = 4 marks)

(Q18 4MA1/2H/EAM, Specimen papers)

Q3.

The diagram shows a sketch of part of the curve with equation $y = f(x)$



There is one maximum point on this curve.
The coordinates of this maximum point are (4, 6)

(a) Write down the coordinates of the maximum point on the curve with equation

(i) $y = f(x + 4)$

(..... ,)

(ii) $y = f(2x)$

(..... ,)

(2)

The equation of a curve **C** is $y = x^2 + 3x + 4$

$$\begin{pmatrix} 4 \\ 6 \end{pmatrix}$$

The curve **C** is transformed to curve **S** under the translation

(b) Find an equation of curve **S**.

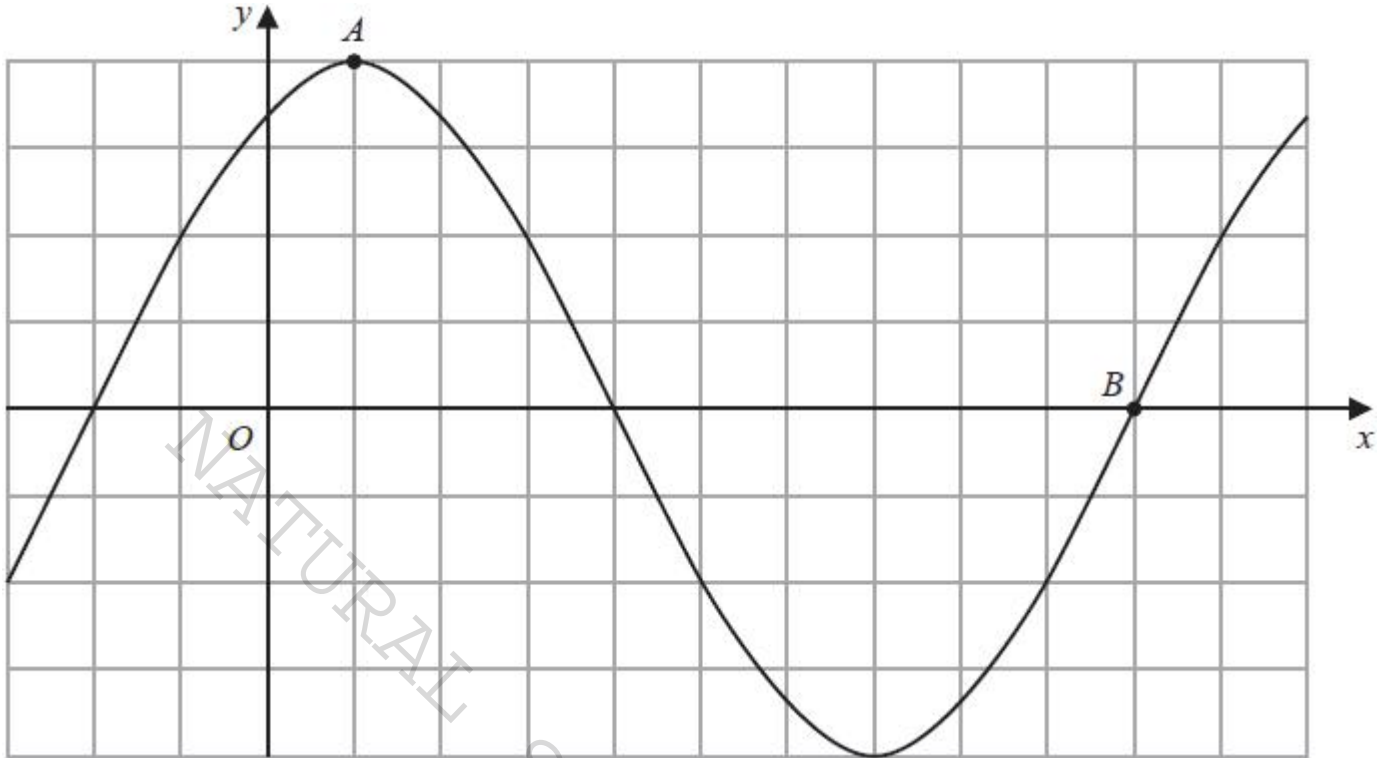
You do not need to simplify the equation.

.....
(2)
(Total for question = 4 marks)

(Q21 4MA1/2H, Jan 2020)

Q4.

The diagram shows a sketch of the graph of $y = 2\sin(x + 60)^\circ$



(i) Find the coordinates of the point A

(..... ,)
(1)

(ii) Find the coordinates of the point B

(..... ,)
(1)

(Total for question = 2 marks)
(QU25 4MA1/2H, June 2024)

Q5.

The curve **C** has equation $y = f(x)$ where $f(x) = 9 - 3(x + 2)^2$
The point A is the maximum point on **C**.

(a) Write down the coordinates of A.

(..... ,)
(1)

$$\begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

The curve **C** is transformed to the curve **S** by a translation of

(b) Find an equation for the curve **S**.

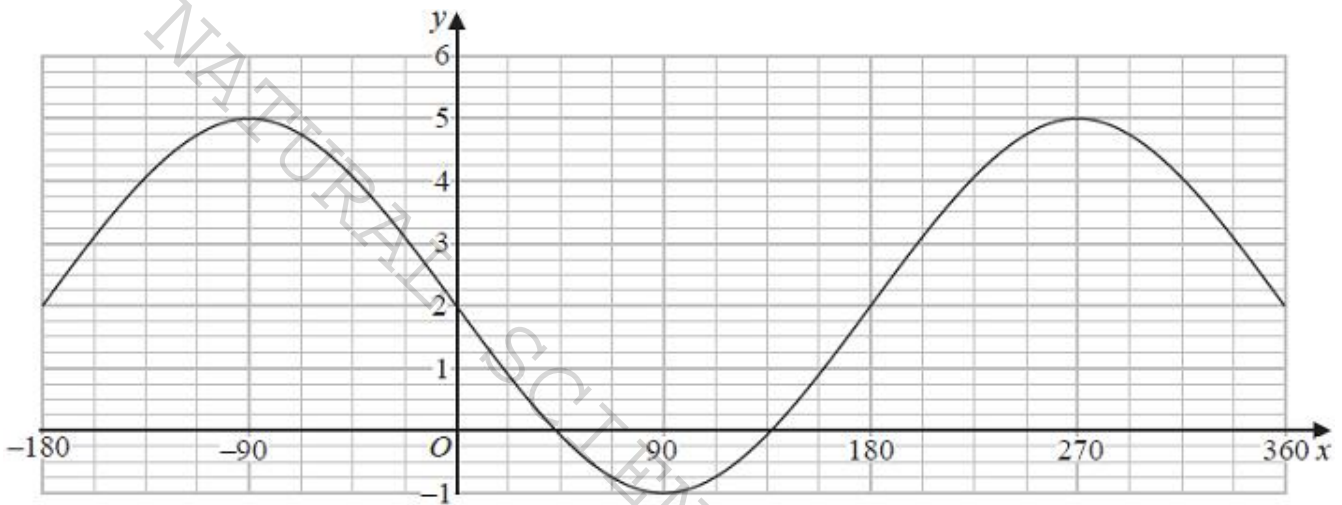
.....
(1)

The curve **C** is transformed to the curve **T**.
 The curve **T** has equation $y = 3(x + 2)^2 - 9$

(c) Describe fully the transformation that maps curve **C** onto curve **T**.

.....
 (1)

The graph of $y = a \cos(x - b)^\circ + c$ for $-180 \leq x \leq 360$ is drawn on the grid below.



(d) Find the value of a , the value of b and the value of c .

$a =$

$b =$

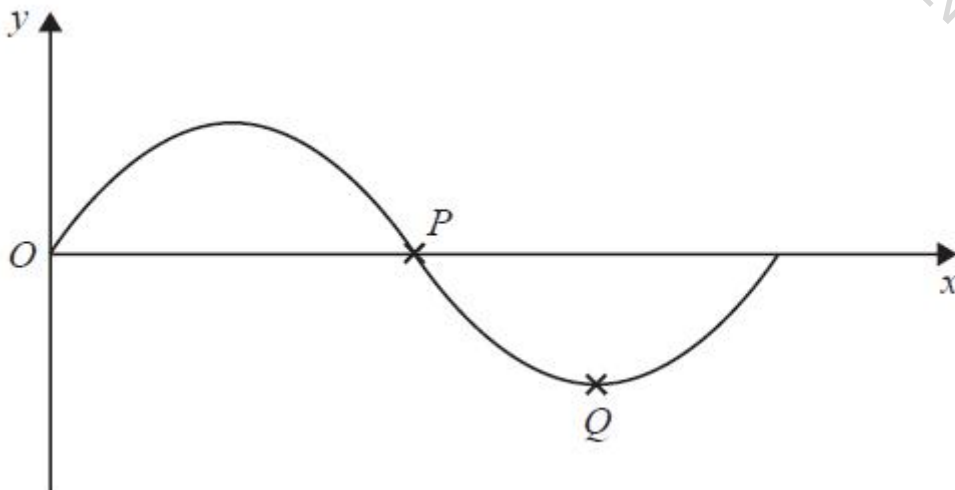
$c =$

(3)

(Total for question = 6 marks)
 (Q21 4MA1/2H, Nov 2021)

Q6.

The diagram shows part of a sketch of the curve $y = \sin x^\circ$



(a) Write down the coordinates of

(i) the point P

(..... ,)

(ii) the point Q

(..... ,)

(2)

(b) Sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$

Show the coordinates of any points of intersection with the coordinate axes.



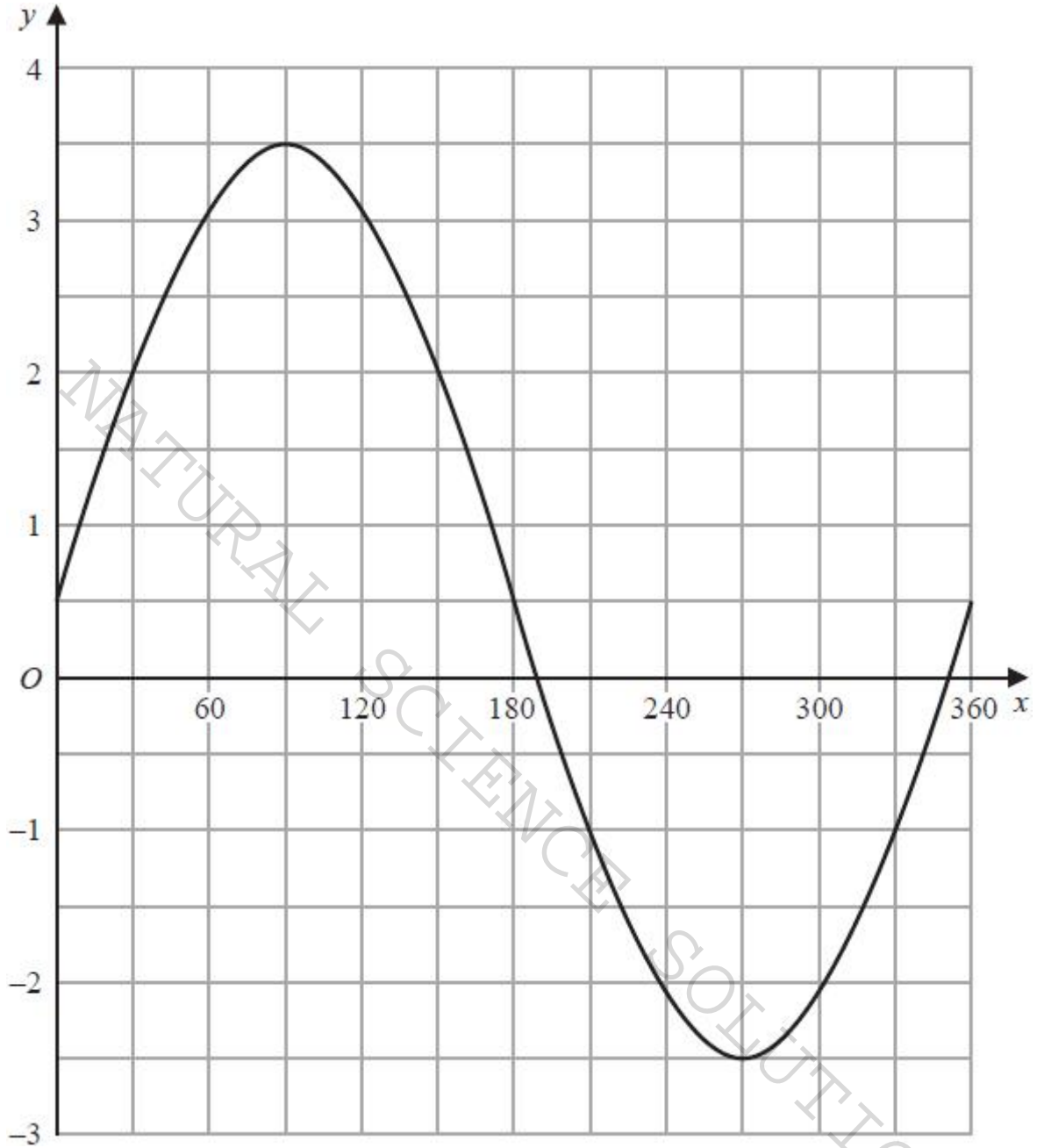
(2)

(Total for question = 4 marks)

(Q16 4MA1/2H/EAM, Specimen papers)

Q7.

The graph of $y = a \sin x^\circ + b$ is drawn on the grid.



Find the value of a and the value of b

$a = \dots\dots\dots$

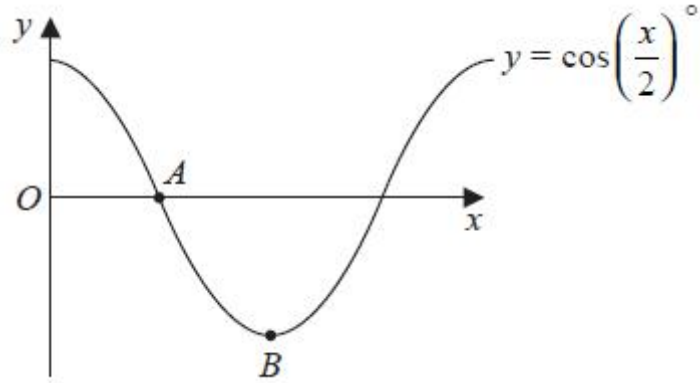
$b = \dots\dots\dots$

(Total for question = 2 marks)

(Q24 4MA1/2H, Jan 2023)

Q8.

The diagram shows a sketch of the graph of $y = \cos\left(\frac{x}{2}\right)^\circ$



(i) Find the coordinates of the point A

(..... ,)

(1)

(ii) Find the coordinates of the point B

(..... ,)

(1)

(Total for question = 2 marks)

(QU23 4MA1/2H, June 2022)

Q9.

The curve **S** has equation $y = f(x)$ where $f(x) = x^2$

The curve **T** has equation $y = g(x)$ where $g(x) = 2x^2 - 12x + 13$

By writing $g(x)$ in the form $a(x - b)^2 - c$, where a , b and c are constants, describe fully a series of transformations that map the curve **S** onto the curve **T**.

NATURAL SCIENCE SOLUTION

(Total for question = 4 marks)

(Q22 4MA1/2H, June 2021)

Geometry

Topic-42: Pythagoras theorem and angles properties

Q1.

The diagram shows a triangle.

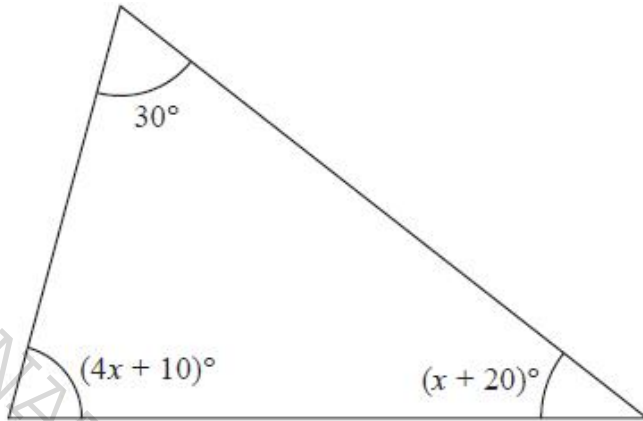


Diagram NOT accurately drawn

Work out the value of x .

$x = \dots\dots\dots$

(Total for question = 4 marks)
(Q04 4MA1/2H, Jan 2020)

Q2.

The diagram shows an isosceles triangle.

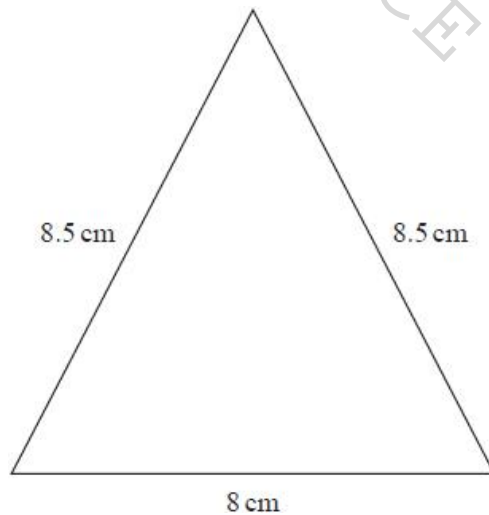


Diagram NOT accurately drawn

Work out the area of the triangle.

$\dots\dots\dots \text{ cm}^2$

(Total for question = 4 marks)

(Q08 4MA1/2H, Nov 2020)

Q3.

The diagram shows right-angled triangle ABD

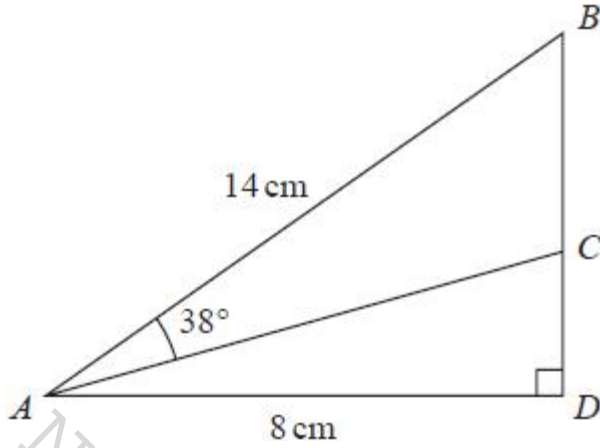


Diagram NOT accurately drawn

$AB = 14$ cm

$AD = 8$ cm

C is the point on BD such that angle $BAC = 38^\circ$

Work out the length of CD

Give your answer correct to 3 significant figures.

MATHEMATICAL SCIENCE SOLUTION

..... cm

(Total for question = 4 marks)

(QU12 4MA1/2H, June 2023)

Q4.

The diagram shows triangle ABC and triangle ECD

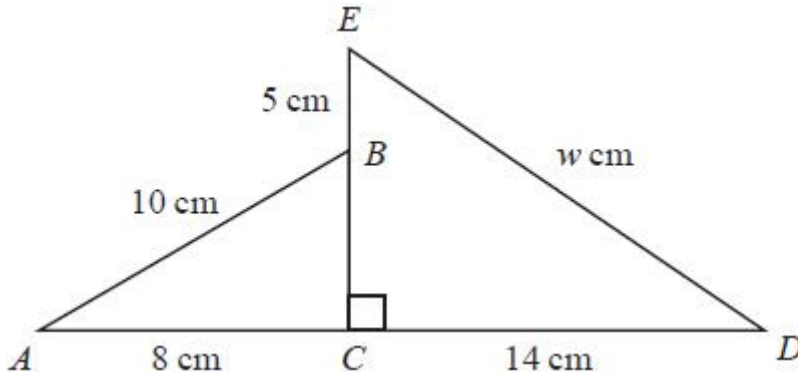


Diagram **NOT** accurately drawn

ACD and EBC are straight lines.

$AB = 10 \text{ cm}$ $AC = 8 \text{ cm}$ $EB = 5 \text{ cm}$ $CD = 14 \text{ cm}$ $ED = w \text{ cm}$

Work out the value of w

Give your answer correct to one decimal place.

$w = \dots\dots\dots$

(Total for question = 4 marks)

(Q02 4MA1/2H, Nov 2023)

Q1.

The diagram shows a triangle.

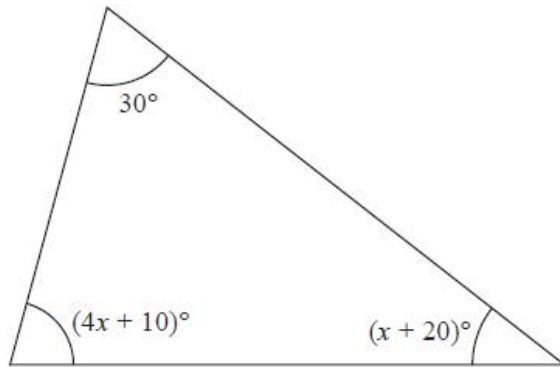


Diagram NOT accurately drawn

Work out the value of x .

$x = \dots\dots\dots$

(Total for question = 4 marks)
(Q04 4MA1/2H, Jan 2020)

Q2.

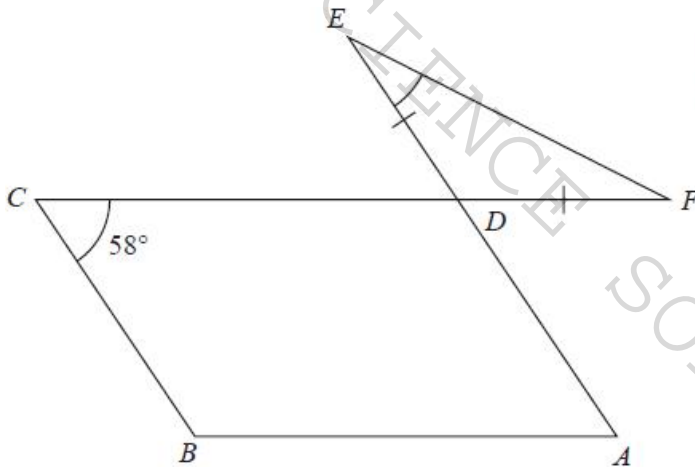


Diagram NOT accurately drawn

The diagram shows a parallelogram $ABCD$ and an isosceles triangle DEF in which $DE = DF$
 CDF and ADE are straight lines.
 Angle $BCD = 58^\circ$

Work out the size of angle DEF .
 Give a reason for each stage of your working.

$\dots\dots\dots^\circ$

(Total for question = 5 marks)

(Q03 4MA1/2H, Nov 2020)

Q3.

The diagram shows an 8-sided shape $ABCDEFGH$.

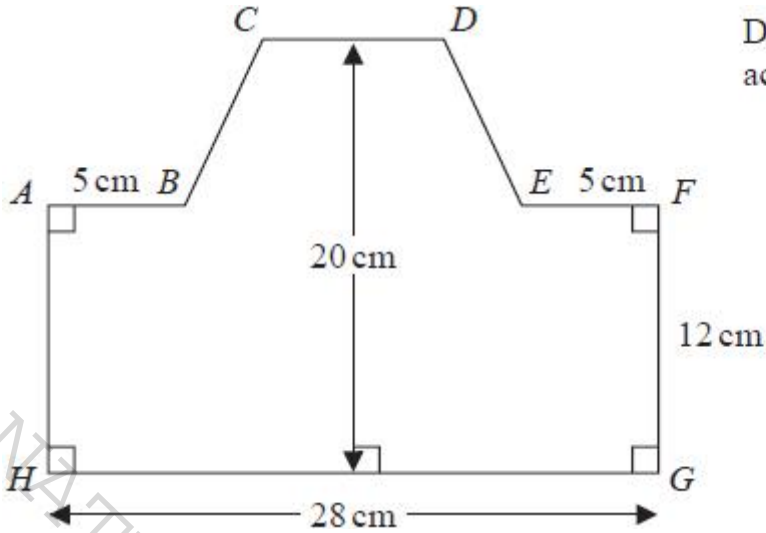


Diagram NOT accurately drawn

$HG = 28 \text{ cm}$ $FG = 12 \text{ cm}$ $AB = EF = 5 \text{ cm}$

The height of the shape is 20 cm

CD is parallel to HG

The area of shape $ABCDEFGH$ is 434 cm^2

Find the length of CD .

..... cm

(Total for question = 4 marks)

(QU05 4MA1/2H, June 2022)

Q4.

The diagram shows a shape made from a square $ABCD$ and 4 identical semicircles.

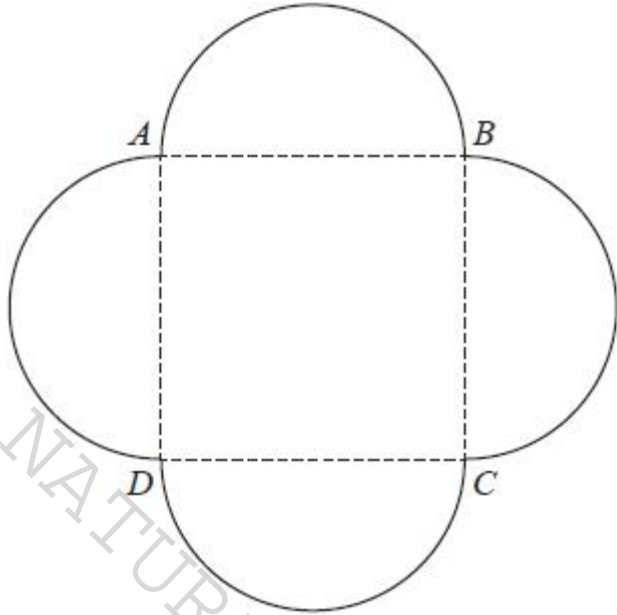


Diagram NOT accurately drawn

As shown in the diagram, the semicircles have AB , BC , CD and DA as diameters.

The area of the square is 36 cm^2

Calculate the total area of the shape.

Give your answer correct to one decimal place.

..... cm^2

(Total for question = 4 marks)

(QU05 4MA1/2HR, June 2022)

Q5.

The diagram shows a square $ABCD$ and a circle.

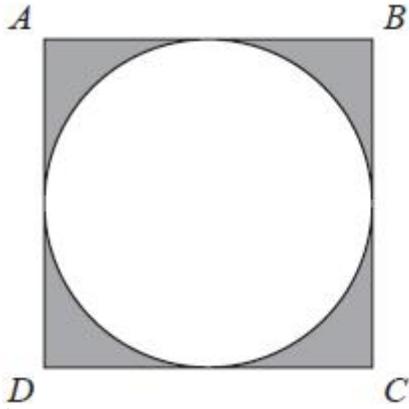


Diagram **NOT**
accurately drawn

The sides of the square are tangents to the circle.

The total area of the shaded regions is 80 cm^2

Work out the length of AC

Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 5 marks)
(QU21 4MA1/2H, June 2024)

Q6.

The diagram shows four identical circles drawn inside a square.

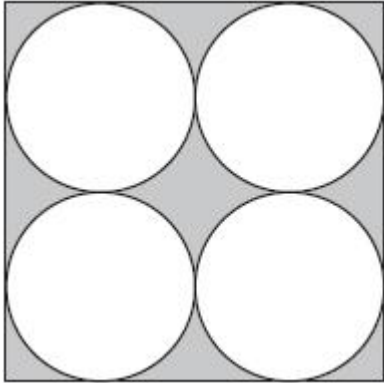


Diagram **NOT**
accurately drawn

Each circle touches two other circles and two sides of the square.

The region inside the square that is outside the circles, shown shaded in the diagram, has a total area of 40 cm^2

Work out the perimeter of the square.

Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 4 marks)

(QU20 4MA1/2H, June 2022)

Q7.

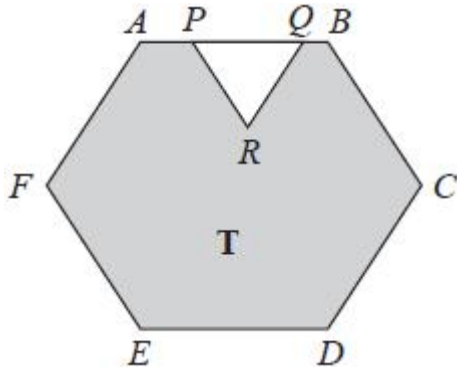


Diagram NOT accurately drawn

The diagram shows a shaded region **T** formed by removing an equilateral triangle PQR from a regular hexagon $ABCDEF$.

The points P and Q lie on AB such that $AB = 1.5 \times PQ$

Given that the area of region **T** is $72\sqrt{3} \text{ cm}^2$

work out the length of PQ .

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 4 marks)

(Q20 4MA1/2H, Jan 2021)

Q8.

The diagram shows a shaded shape $ABCD$ made from a semicircle ABC and a right-angled triangle ACD .

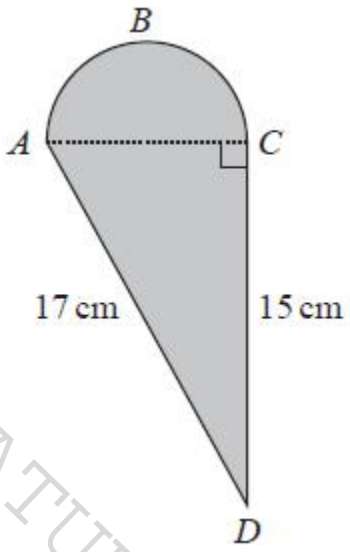


Diagram NOT accurately drawn

AC is the diameter of the semicircle ABC .

Work out the perimeter of the shaded shape.

Give your answer correct to 3 significant figures.

NATURALSCIENCE SOLUTION

..... cm

(Total for question = 5 marks)

(Q11 4MA1/2H, Jan 2020)

Q9.

The diagram shows a sector AOB of a circle with centre O

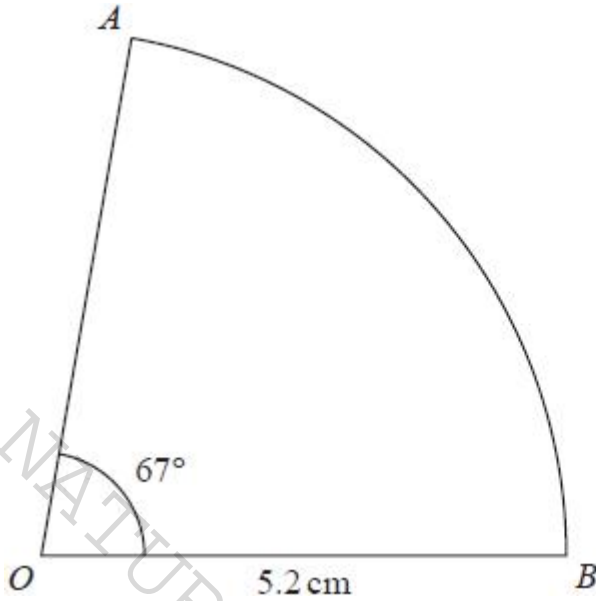


Diagram NOT accurately drawn

Angle $AOB = 67^\circ$
 $OA = OB = 5.2$ cm

Calculate the perimeter of the sector.
 Give your answer correct to 3 significant figures.

..... cm

(Total for question = 3 marks)

(QU13 4MA1/2HR, June 2022)

Q10.

The diagram shows rectangle $ABCD$

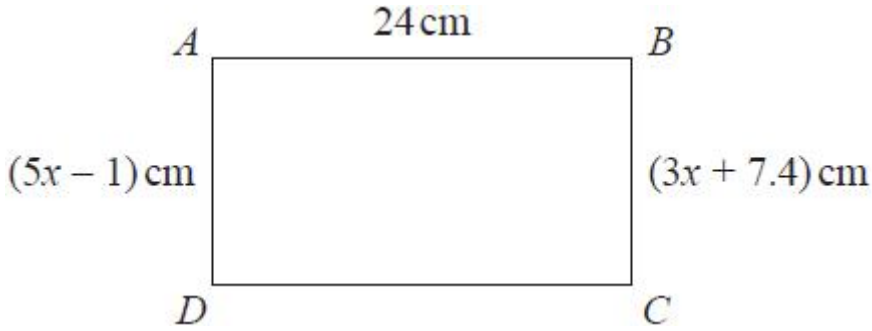


Diagram **NOT** accurately drawn

Work out the perimeter of the rectangle.
Show your working clearly.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 4 marks)

(Q04 4MA1/2H, Jan 2023)

Q11.

The diagram shows a 6-sided shape $ABCDEF$

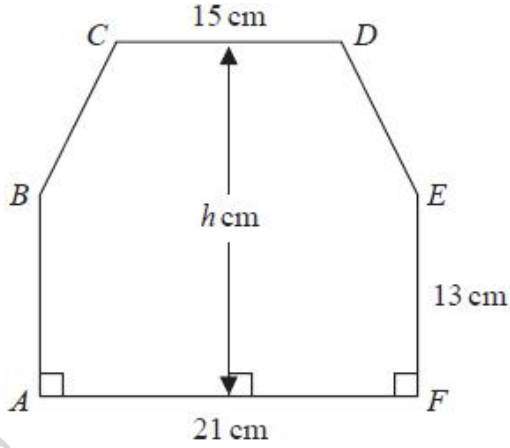


Diagram NOT accurately drawn

$AF = 21 \text{ cm}$ $CD = 15 \text{ cm}$ $AB = FE = 13 \text{ cm}$

The perpendicular height of the shape is $h \text{ cm}$

CD is parallel to AF

The area of the shape is 390 cm^2

Work out the value of h

$h = \dots\dots\dots$

(Total for question = 4 marks)

(QU07 4MA1/2H, June 2024)

Q12.

A field is in the shape of a trapezium.

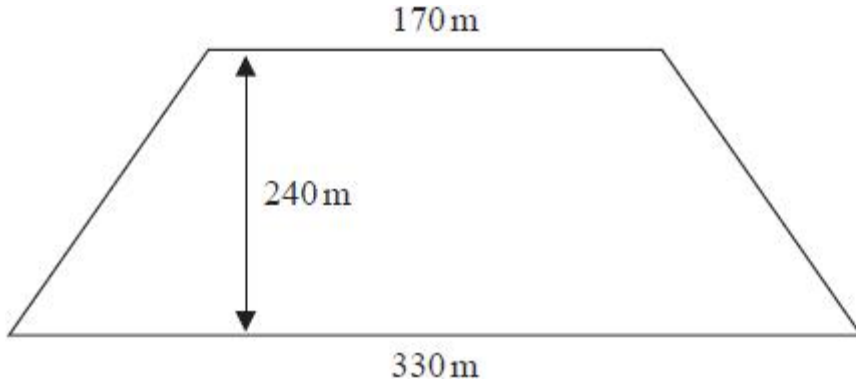


Diagram NOT accurately drawn

The field is sold for a price of \$49 650

Given that 1 hectare = 10 000 m²

work out the average price of the field per hectare.

\$

(Total for question = 4 marks)
(QU05 4MA1/2HR, June 2023)

Q13.

The diagram shows an isosceles triangle.

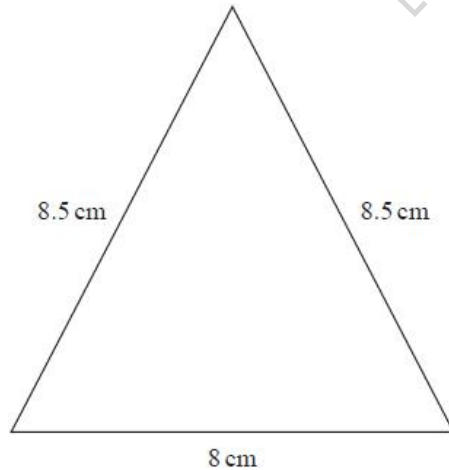


Diagram NOT accurately drawn

Work out the area of the triangle.

..... cm²

(Total for question = 4 marks)
(Q08 4MA1/2H, Nov 2020)

Q14.

The diagram shows a trapezium.

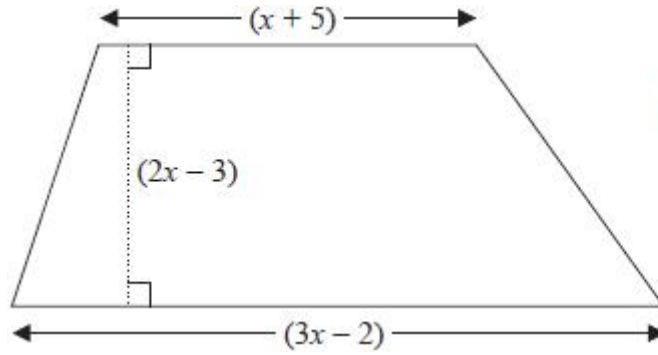


Diagram NOT
accurately drawn

All measurements shown on the diagram are in centimetres.

The area of the trapezium is 133 cm^2

(a) Show that $8x^2 - 6x - 275 = 0$

(3)

(b) Find the value of x .

Show your working clearly.

$x =$
(3)

(Total for question = 6 marks)

(Q15 4MA1/2H, Jan 2019)

Q15.

The area of a rectangle is 18 cm^2

The length of the rectangle is $(\sqrt{7} + 1) \text{ cm}$.

Without using a calculator and showing each stage of your working, find the width of the rectangle.

Give your answer in the form $a\sqrt{b} + c$ where a , b and c are integers.

..... cm

(Total for question = 3 marks)
(Q20 4MA1/2H, Jan 2020)

Q16.

Calvin has 12 identical rectangular tiles. He arranges the tiles to fit exactly round the edge of a shaded rectangle, as shown in the diagram below.

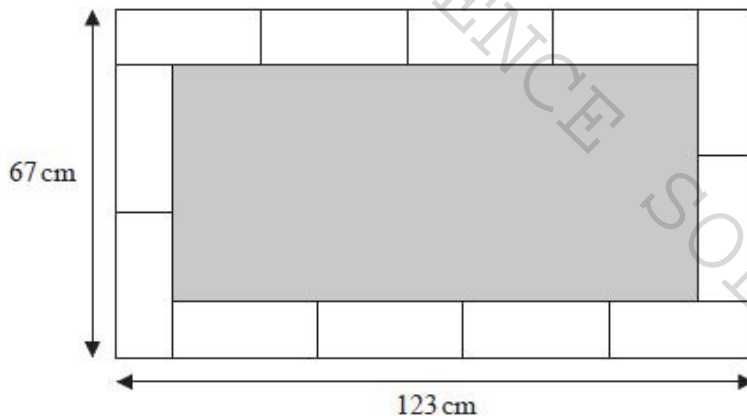


Diagram NOT accurately drawn

Work out the area of the shaded rectangle.

cm^2

(Total for question = 5 marks)
(Q05 4MA1/2H, Jan 2019)

Q17.

$ABCD$ is a trapezium with AB parallel to DC

A is the point with coordinates $(-4, 6)$

B is the point with coordinates $(2, 3)$

D is the point with coordinates $(-1, 8)$

The trapezium has one line of symmetry.

The line of symmetry intersects CD at the point E

Work out the coordinates of the point E

NATURAL SCIENCE SOLUTIONS

(..... ,)

(Total for question = 6 marks)

(Q25 4MA1/2HR, Jan 2023)

Q18.

$ABCD$ is a kite with $AB = AD$ and $CB = CD$

A is the point with coordinates $(-2, 10)$

B is the point with coordinates $\left(-\frac{27}{5}, 4\right)$

C is the point with coordinates $(4, -5)$

Work out the coordinates of D

NATURAL SCIENCE SOLUTION

(..... ,)

(Total for question = 6 marks)

(QU24 4MA1/2H, June 2023)

Q19.

The diagram shows equilateral triangle ABC with sides of length 10 cm.
 A circle is drawn inside the triangle.

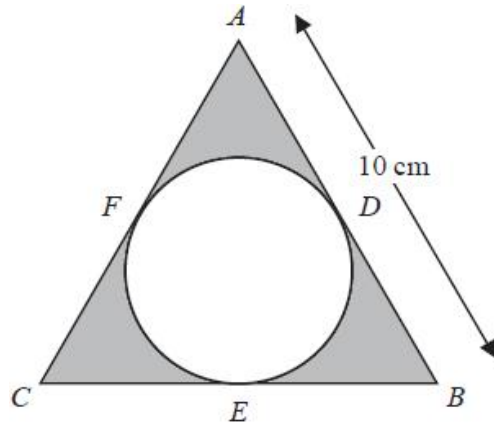


Diagram **NOT** accurately drawn

D , E and F are points on the circle.

ADB , BEC and CFA are tangents to the circle.

Calculate the total area of the regions shown shaded in the diagram.

Give your answer correct to 3 significant figures.

MATHEMATICS
 SCIENCE SOLUTION

..... cm²

(Total for question = 4 marks)
(Q20 4MA1/2H, Nov 2023)

Q20.

The diagram shows an isosceles triangle, with base length 24 cm.

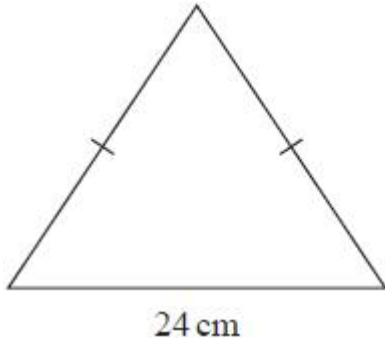


Diagram **NOT**
accurately drawn

The perimeter of the triangle is 54 cm.

Work out the area of the triangle.

NATURAL SCIENCE SOLUTIONS

..... cm²

(Total for question = 5 marks)

(Q10 4MA1/2H, Jan 2023)

Q1.

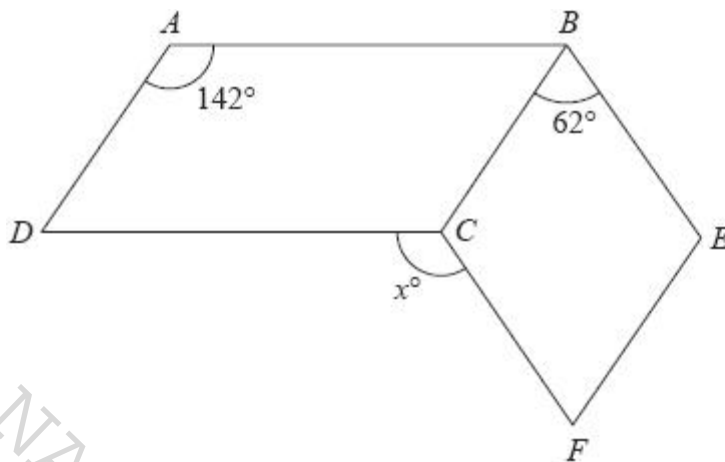


Diagram NOT accurately drawn

ABCD is a parallelogram.
BEFC is a rhombus.

Angle *DAB* = 142°
 Angle *CBE* = 62°

Calculate the value of *x*.

NATURAL SCIENCE SOLUTION

x =

(Total for question = 3 marks)

(Q03 4MA0/3HR, June 2017)

Q2.

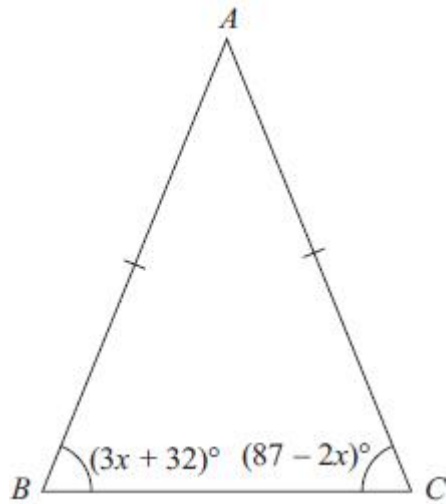


Diagram NOT accurately drawn

In the isosceles triangle ABC ,
 $AB = AC$

angle $B = (3x + 32)^\circ$

angle $C = (87 - 2x)^\circ$

Work out the value of x . Show clear algebraic working.

NATURAL SCIENCE SOLUTION

$x = \dots\dots\dots$

(Total for question = 4 marks)

(Q09 4MA0/4HR, June 2013)

Q3.

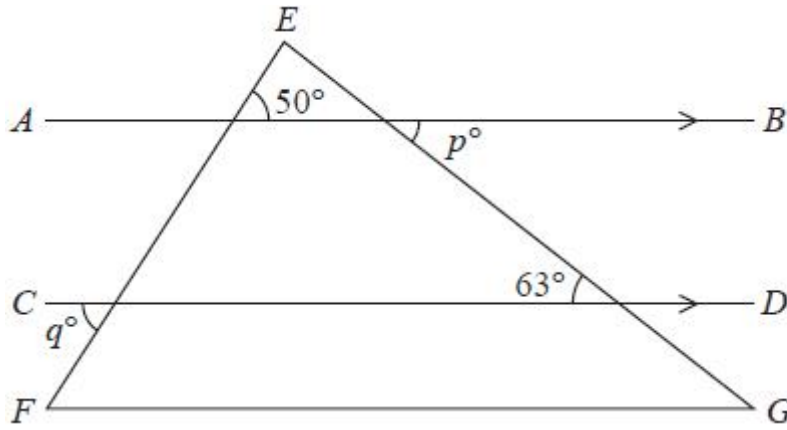


Diagram NOT accurately drawn

EFG is a triangle.
 AB is parallel to CD .

(a) Write down the value of p

$p = \dots\dots\dots$
 (1)

(b) Write down the value of q

$q = \dots\dots\dots$
 (1)

Here is a hexagon.

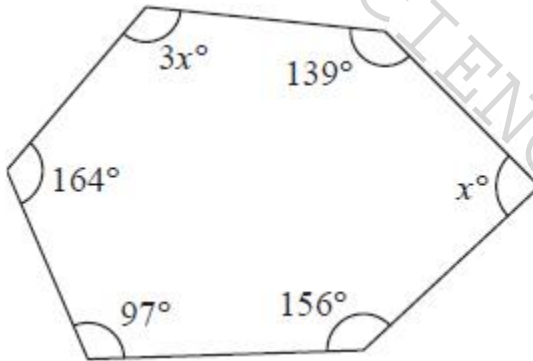


Diagram NOT accurately drawn

(c) Work out the value of x

$x = \dots\dots\dots$
 (3)

(Total for question = 5 marks)
 (Q04 4MA0/4H, June 2016)

Q1.

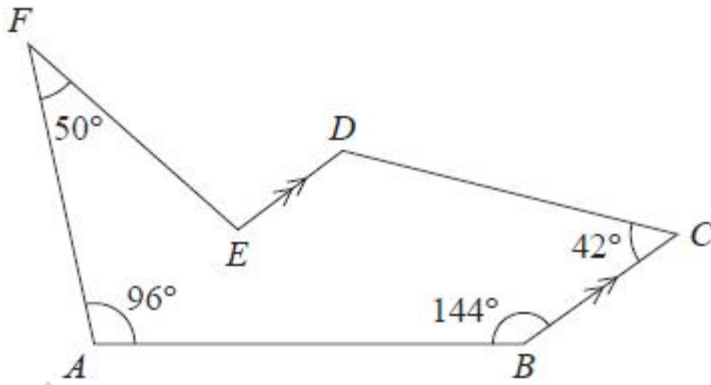


Diagram NOT accurately drawn

The diagram shows a hexagon $ABCDEF$.
 BC is parallel to ED .

Work out the size of the obtuse angle DEF .

NATURAL SCIENCE SOLUTION

..... °

(Total for question = 5 marks)

(QU12 4MA1/2H, June 2018)

Q2.

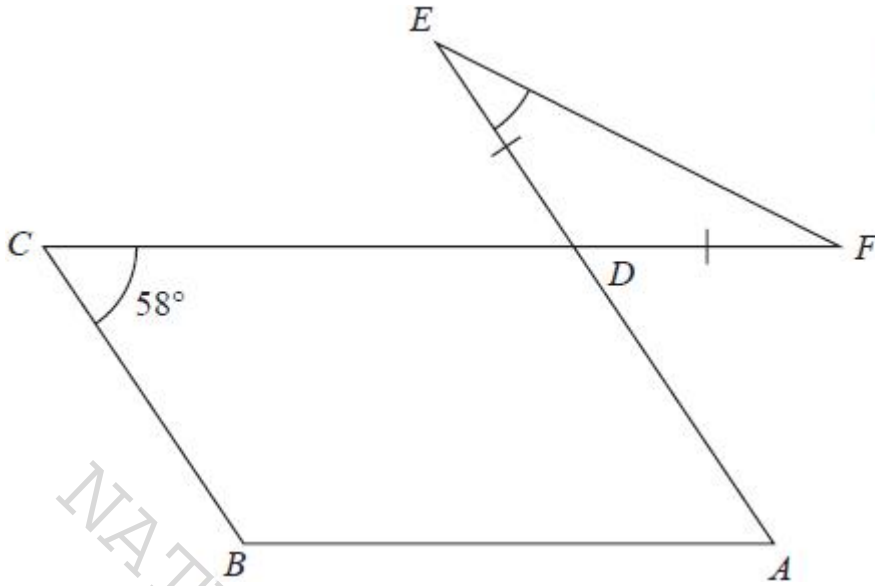


Diagram NOT accurately drawn

The diagram shows a parallelogram $ABCD$ and an isosceles triangle DEF in which $DE = DF$

CDF and ADE are straight lines.

Angle $BCD = 58^\circ$

Work out the size of angle DEF .

Give a reason for each stage of your working.

NATURAL SCIENCE SOLUTION

..... °

(Total for question = 5 marks)

(Q03 4MA1/2H, Nov 2020)

Q3.

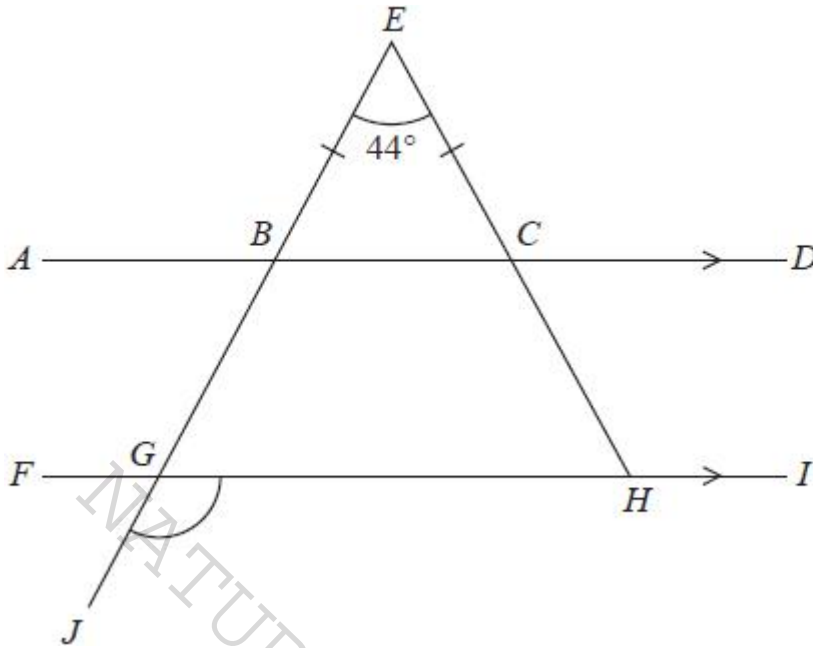


Diagram NOT accurately drawn

ABCD and *FGHI* are parallel straight lines.
EBGJ and *ECH* are straight lines.

$BE = CE$
 Angle $BEC = 44^\circ$

Work out the size of angle JGH .
 Give a reason for each stage of your working.

NATURAL SCIENCE SOLUTION

..... °

(Total for question = 5 marks)

(Q05 4MA1/2H, June 2021)

Q4.

The diagram shows triangle ABP inside the regular hexagon $ABCDEF$

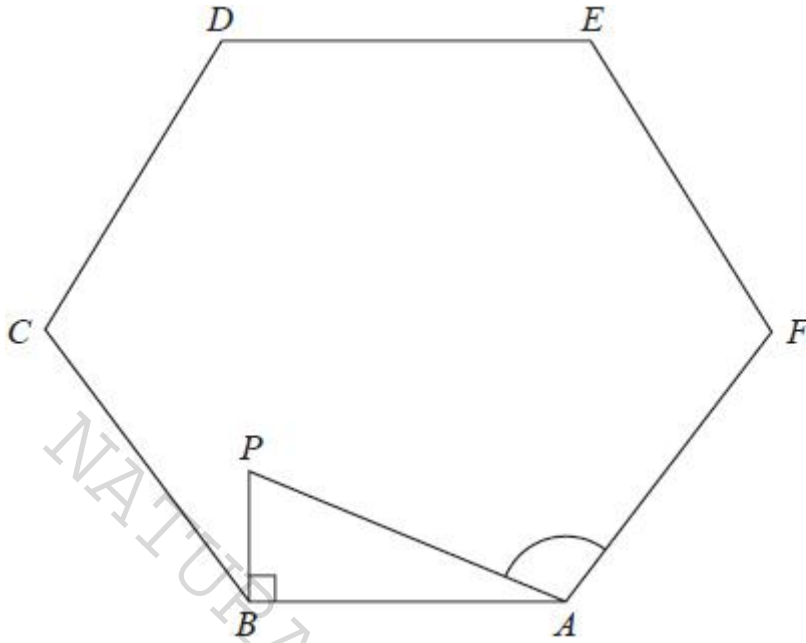


Diagram **NOT** accurately drawn

$AB = 5 \text{ cm}$

$BP = 2 \text{ cm}$

Angle $ABP = 90^\circ$

Work out the size of angle PAF
Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

..... °

(Total for question = 5 marks)

(QU10 4MA1/2HR, June 2022)

Q5.

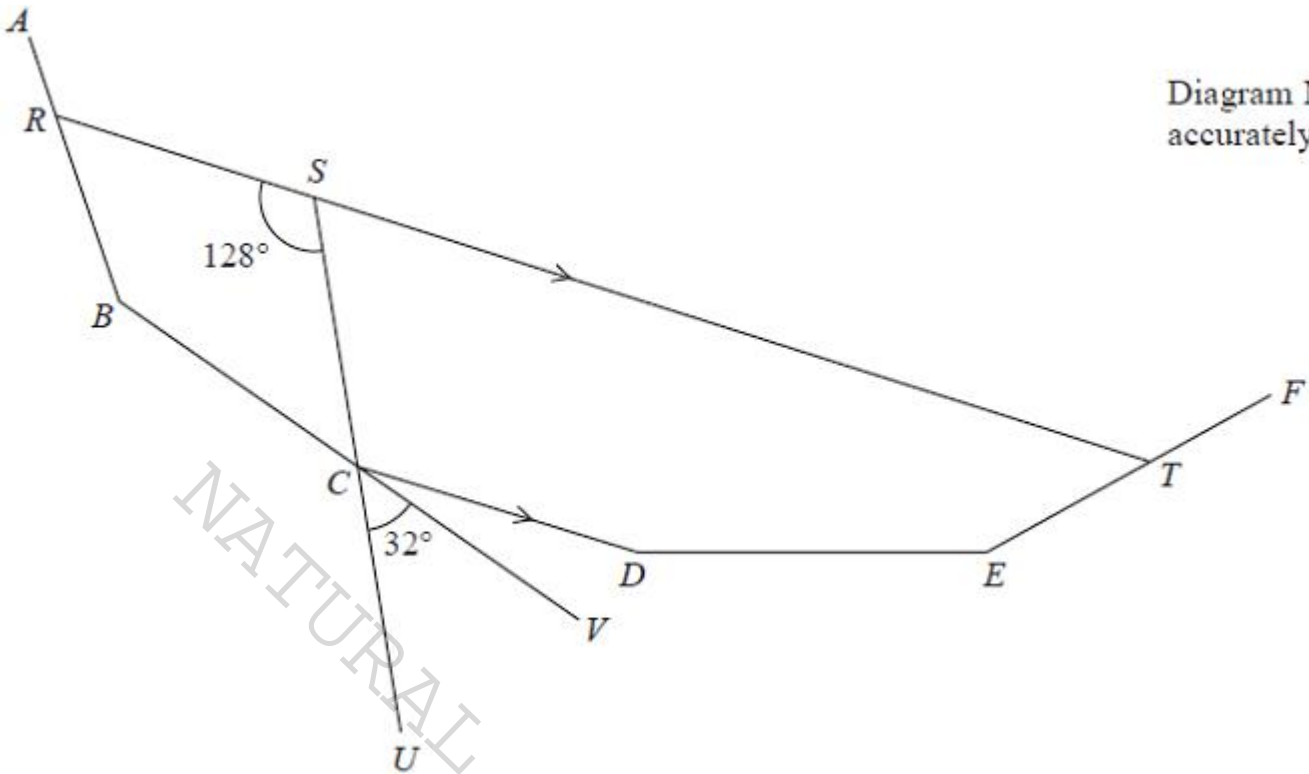


Diagram NOT accurately drawn

AB, BC, CD, DE and EF are five sides of a regular polygon.

RST, SCU and BCV are straight lines.

RST is parallel to CD

Angle $RSC = 128^\circ$

Angle $UCV = 32^\circ$

Work out how many sides the polygon has.

Show your working clearly.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 4 marks)

(Q11 4MA1/2HR, Jan 2023)

Q6.

The diagram shows a regular octagon $ABCDEFGH$ and a regular pentagon $ABIJK$

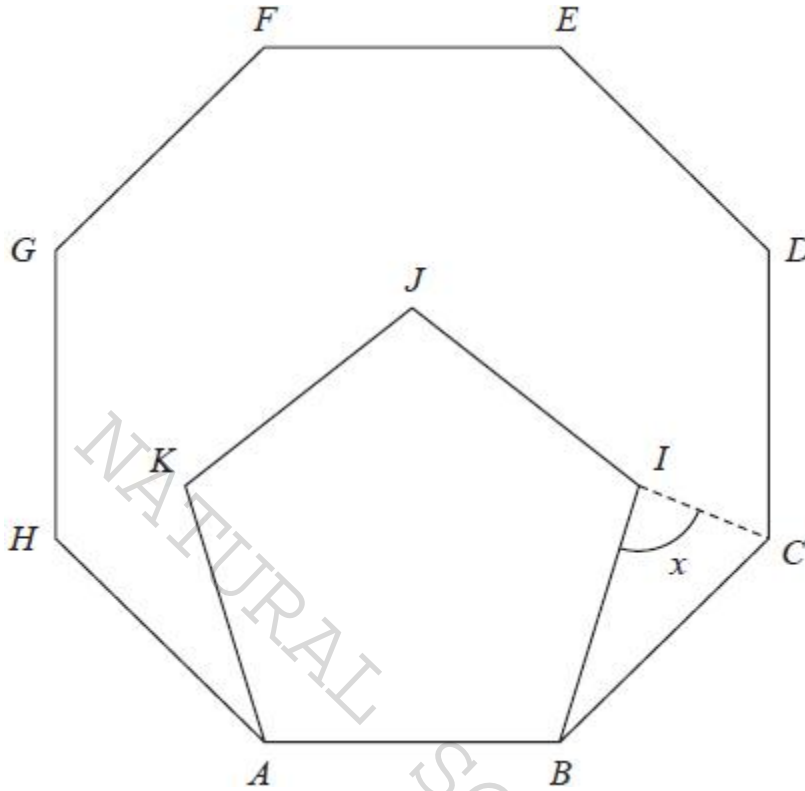


Diagram NOT
accurately drawn

Work out the size of the angle x

..... °

(Total for question = 4 marks)

(Q04 4MA1/2HR, Jan 2022)

Q7.

The diagram shows a regular octagon $ABCDHIJK$ and a pentagon $DEFGH$.

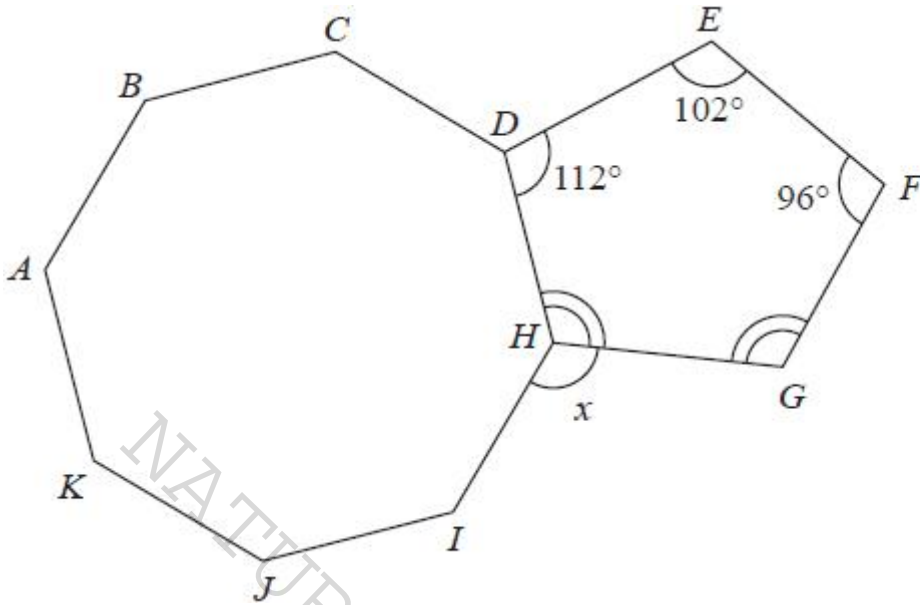


Diagram **NOT** accurately drawn

Angle $GHD =$ angle FGH .

Work out the size of the angle marked x .

Show your working clearly.

NATURALS
SCIENCE SOLUTION

..... °

(Total for question = 5 marks)

(Q05 4MA1/2H, Nov 2021)

Q8.

Here is a 9-sided regular polygon $ABCDEFGHIJ$, with centre O

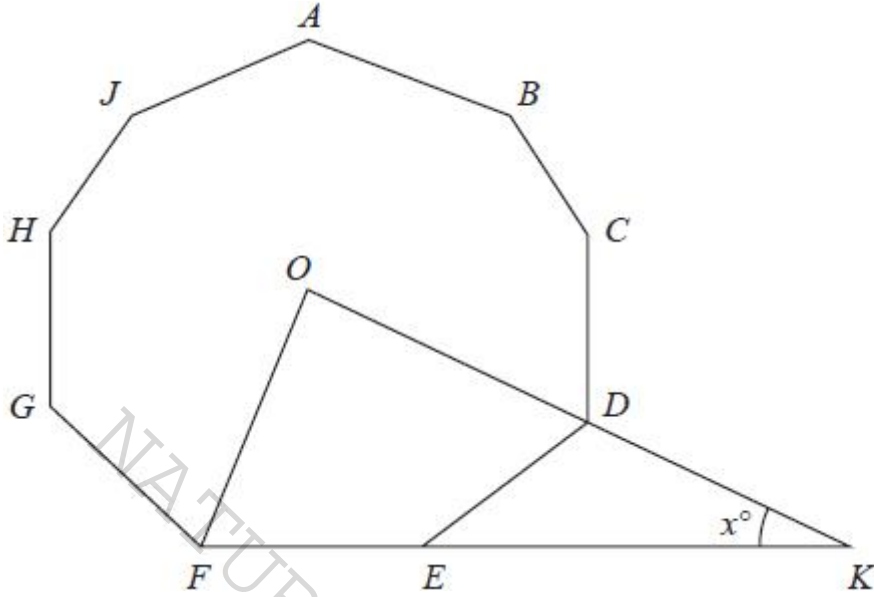


Diagram NOT accurately drawn

ODK and FEK are straight lines.

Work out the value of x

NATURAL SCIENCE SOLUTION

$x = \dots\dots\dots$

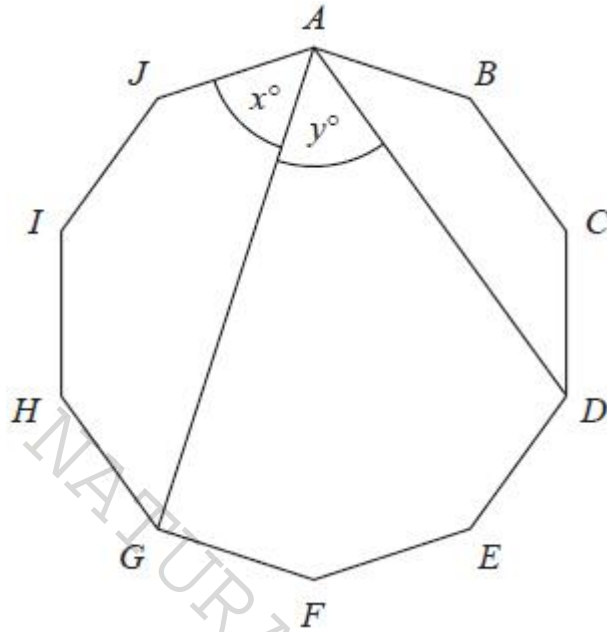
(Total for question = 3 marks)

(QU11 4MA1/2H, June 2023)

Q9.

The diagram shows a regular 10-sided polygon, $ABCDEFGHIJ$

Diagram **NOT**
accurately drawn



Show that $x = y$

(Total for question = 4 marks)

(Q11 4MA1/2H, Jan 2022)

Q10.

The diagram shows two congruent regular pentagons drawn inside a regular octagon.

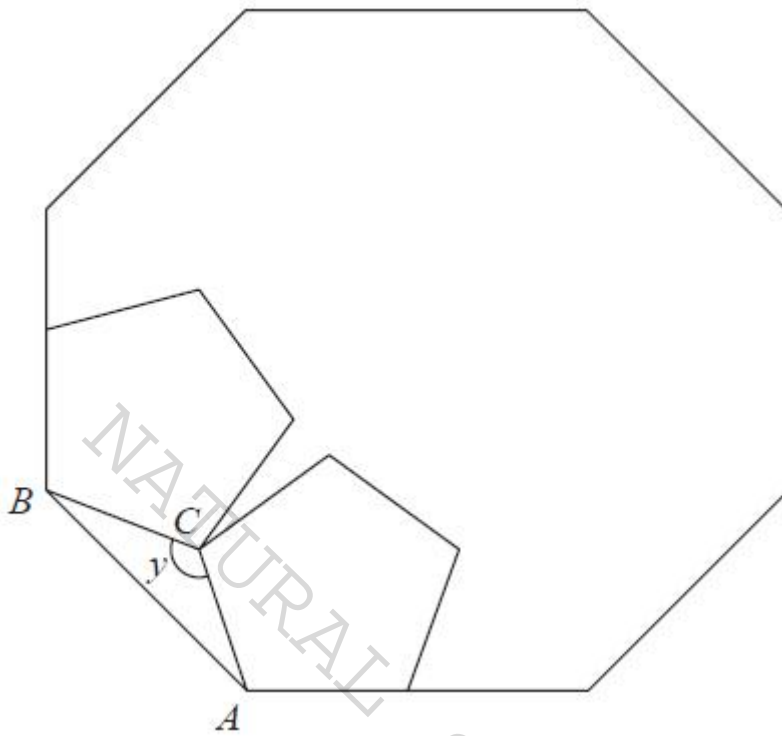


Diagram **NOT** accurately drawn

One side of each pentagon lies along a side of the octagon.

AB is a side of the octagon.

AC is a side of one of the pentagons.

BC is a side of the other pentagon.

Work out the size of angle y .

Show your working clearly.

..... °

(Total for question = 5 marks)

(Q10 4MA1/2H/EAM, Specimen papers)

Q1.

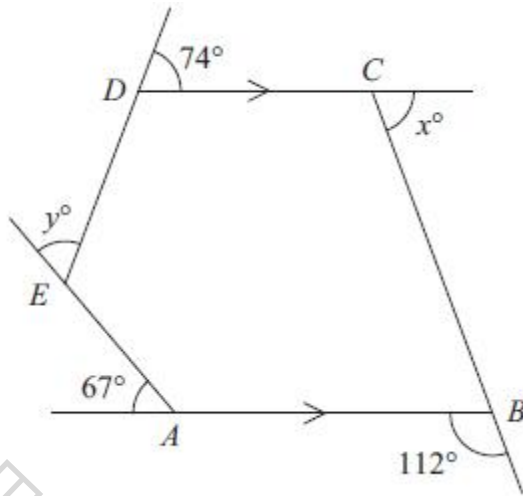


Diagram NOT accurately drawn

The diagram shows a pentagon $ABCDE$.
 DC is parallel to AB .

- The size of an exterior angle at A is 67
 - The size of an exterior angle at B is 112
 - The size of an exterior angle at C is x
 - The size of an exterior angle at D is 74
 - The size of an exterior angle at E is y
- (a) (i) Work out the value of x .

$x = \dots\dots\dots$

(ii) Work out the value of y .

$y = \dots\dots\dots$ (4)

(b) Work out the sum of the interior angles of the pentagon $ABCDE$.

$\dots\dots\dots^\circ$ (2)

(Total for question = 6 marks)

(Q06 4MA0/4HR, June 2013)

Q2.

Work out the size of each exterior angle of a regular polygon with 15 sides.

..... °

(Total for Question is 2 marks)

(Q05 4MA0/4H, June 2014)

Q3.

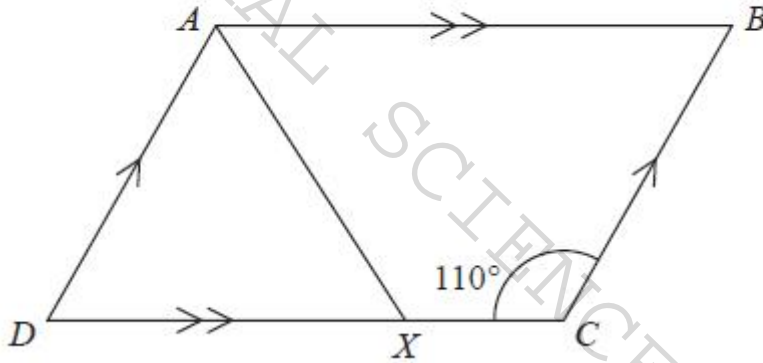


Diagram **NOT** accurately drawn

ABCD is a parallelogram.
 Angle *DCB* = 110°
X is the point on *DC* such that *AX* bisects the angle *DAB*.
 Calculate the size of angle *AXC*.

..... °

(Total for question = 4 marks)

(Q03 4MA0/4HR, Jan 2015)

Q4.

Here is a regular 10-sided polygon.

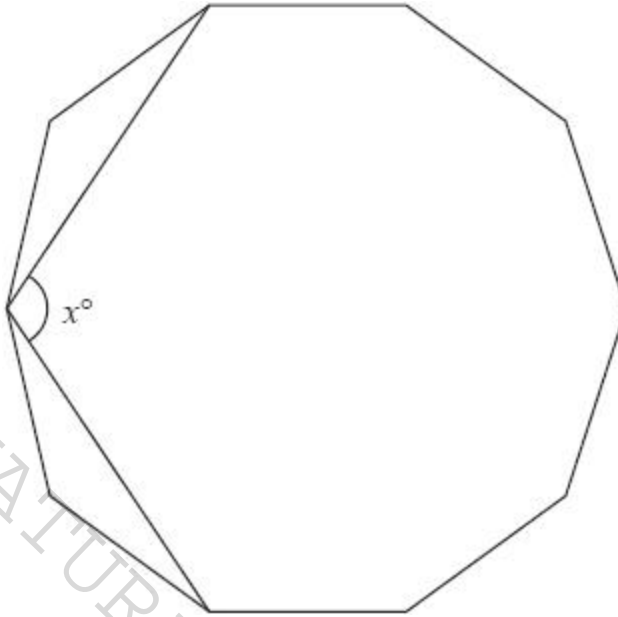


Diagram NOT
accurately drawn

Work out the value of x .
Show your working clearly.

NATURAL SCIENCE SOLUTIONS

$x = \dots\dots\dots$

(Total for question = 4 marks)

(Q13 4MA0/4H, Jan 2016)

Q5.

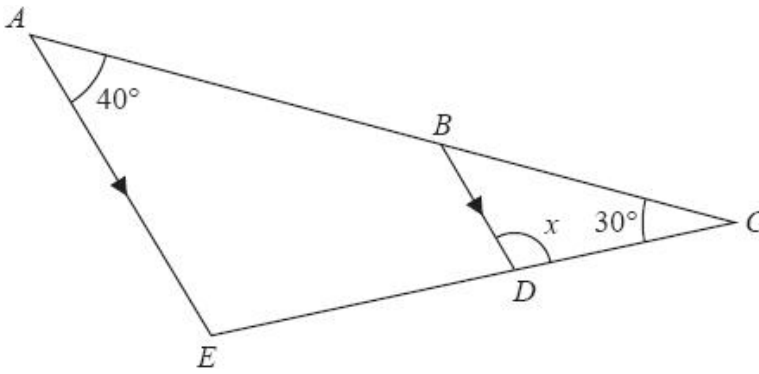


Diagram NOT accurately drawn

ABC and EDC are straight lines.
 AE is parallel to BD .
 Angle $EAC = 40^\circ$
 Angle $ACE = 30^\circ$

Work out the size of angle x .
 Give reasons for your answer.

$x = \dots\dots\dots^\circ$

(Total for question = 3 marks)
 (Q05 4MA0/4H, Jan 2016)

Q6.

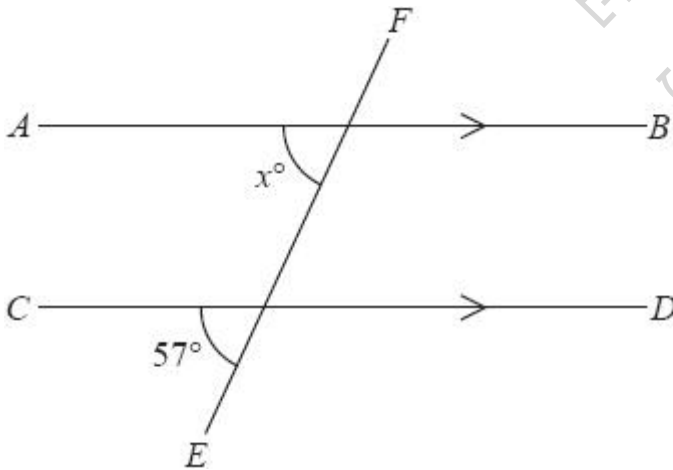


Diagram NOT accurately drawn

AB is parallel to CD
 EF is a straight line.

(a) (i) Find the value of x

$x = \dots\dots\dots$

(ii) Give a reason for your answer.

.....

(2)

Here is a pentagon.

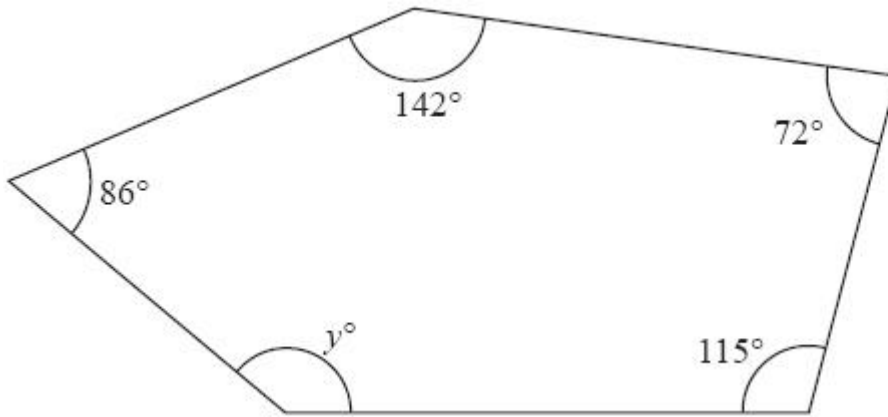


Diagram NOT accurately drawn

(b) Work out the value of y .

$y = \dots\dots\dots$
(3)

(Total for question = 5 marks)

(Q02 4MA0/4HR, Jan 2016)

Q7.

Each interior angle of a regular polygon is 156°
Work out the number of sides of the polygon.

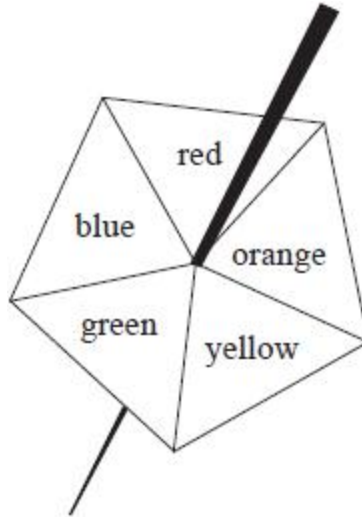
.....

(Total for question = 3 marks)

(Q08 4MA0/4H, June 2017)

Q8.

Here is a biased five-sided spinner.



When the spinner is spun, it can land on red, orange, yellow, green or blue. The probabilities that it lands on red, orange and yellow are given in the table.

Colour	red	orange	yellow	green	blue
Probability	0.4	0.2	0.1		

The probability that the spinner lands on green is the same as the probability that the spinner lands on blue. Michael spins the spinner once.

(a) Work out the probability that the spinner lands on green.

.....
(3)

Jenny spins the spinner 200 times.

(b) Work out an estimate for the number of times the spinner lands on red.

.....
(2)

(Total for question = 5 marks)

(Q02 4MA0/4H, Jan 2017)

Q9.



Diagram NOT accurately drawn

The diagram shows part of a regular polygon.
 The interior angle and the exterior angle at a vertex are marked.
 The size of the interior angle is 7 times the size of the exterior angle.

Work out the number of sides of the polygon.

NATURAL SCIENCE SOLUTION

.....
 (Total for Question is 3 marks)
 (Q19 4MA0/4H, Jan 2014)

Q10.

The diagram shows an incomplete regular polygon.

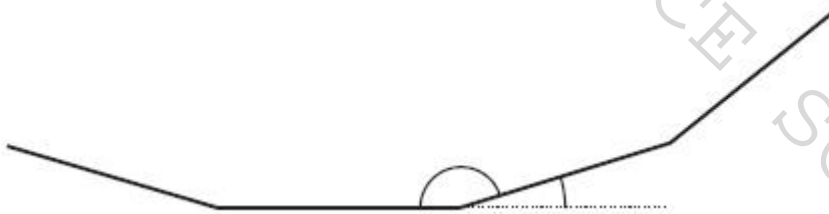


Diagram NOT accurately drawn

The size of each interior angle is 140 degrees greater than the size of each exterior angle.
 Work out the number of sides the regular polygon has.

.....
 (Total for question = 4 marks)
 (Q13 4MA0/4H, June 2013)

Q11.

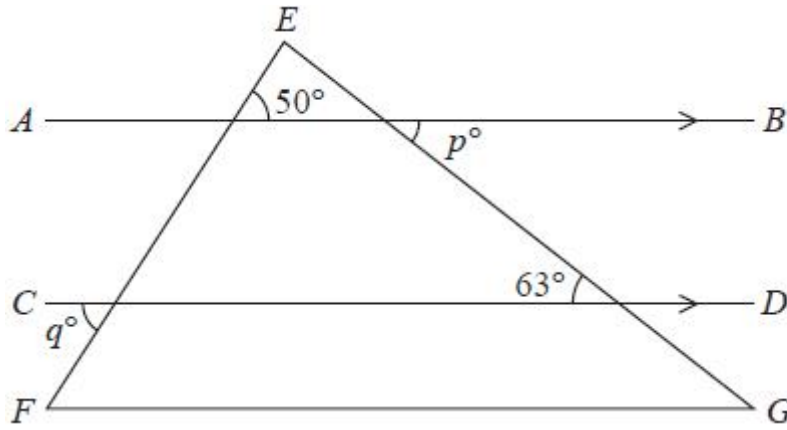


Diagram NOT accurately drawn

EFG is a triangle.
 AB is parallel to CD .

(a) Write down the value of p

$p = \dots\dots\dots$
 (1)

(b) Write down the value of q

$q = \dots\dots\dots$
 (1)

Here is a hexagon.

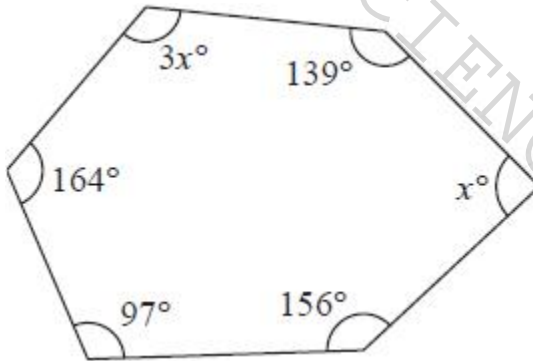


Diagram NOT accurately drawn

(c) Work out the value of x

$x = \dots\dots\dots$
 (3)

(Total for question = 5 marks)
 (Q04 4MA0/4H, June 2016)

Q12.

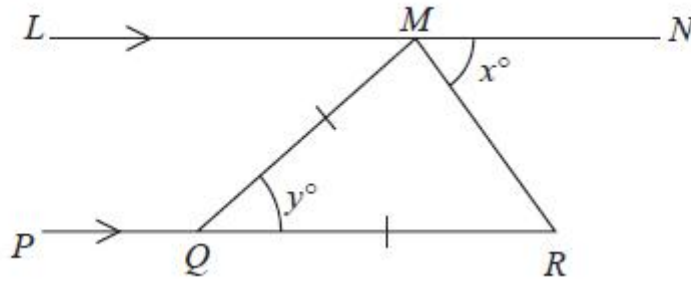


Diagram NOT accurately drawn

LMN is parallel to PQR .

$QM = QR$.

Angle $RMN = x^\circ$

Angle $MQR = y^\circ$

(a) Write down an expression for y in terms of x .

$y = \dots\dots\dots$

(2)

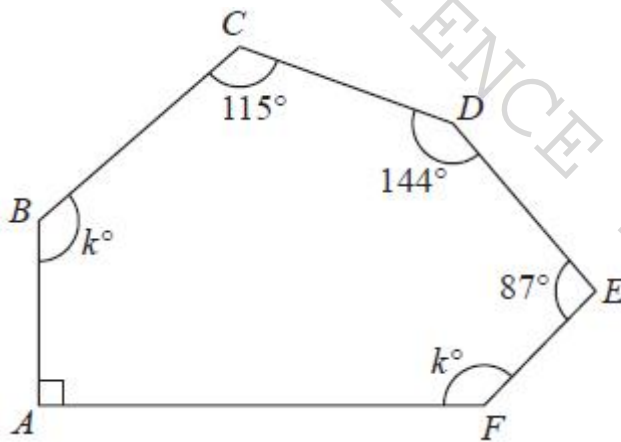


Diagram NOT accurately drawn

$ABCDEF$ is a hexagon.

(b) Work out the value of k .

$k = \dots\dots\dots$

(4)

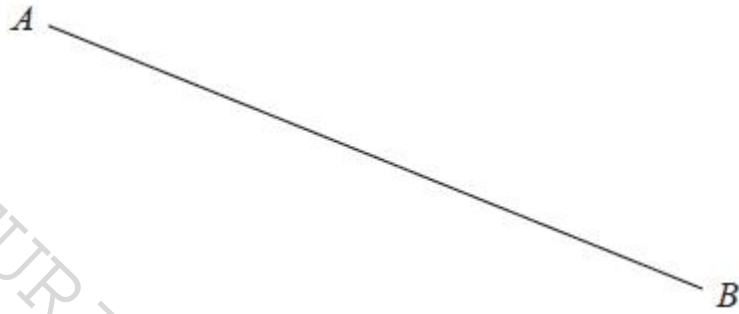
(Total for question = 6 marks)

(Q06 4MA0/4H, June 2015)

Topic-47: Constructions-1

Q1.

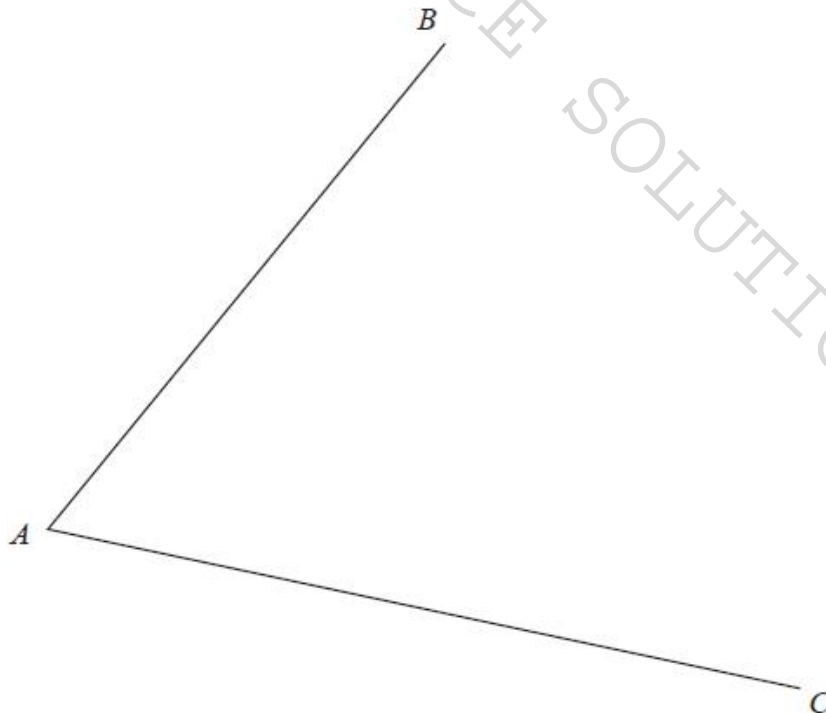
Use ruler and compasses only to construct the perpendicular bisector of line AB
You must show all your construction lines.



(Total for question = 2 marks)
(Q03 4MA1/1H, Jan 2023)

Q2.

Using ruler and compasses only, construct the bisector of angle BAC
You must show all your construction lines.

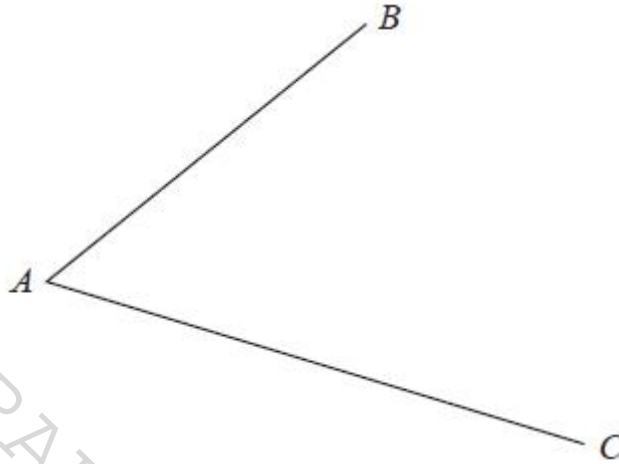


(Total for question = 2 marks)

(Q04 4MA1/2HR, Jan 2023)

Q3.

Use ruler and compasses to construct the bisector of angle BAC .
You must show all your construction lines.



(Total for question = 2 marks)
(Q05 4MA1/2H, Jan 2020)

Q4.

Use ruler and compasses to construct the perpendicular bisector of the line DE .
You must show all your construction lines.



(Total for question = 2 marks)
(Q02 4MA1/2H, June 2019)

Q5.

The straight line with equation $y - 2x = 7$ is the perpendicular bisector of the line AB where A is the point with coordinates $(j, 7)$ and B is the point with coordinates $(6, k)$

Find the coordinates of the midpoint of the line AB

Show clear algebraic working.

(..... ,)

(Total for question = 6 marks)

(QU25 4MA1/2HR, June 2023)

NATURAL SCIENCE SOLUTION

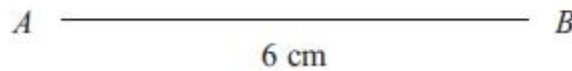
Topic-48: Constructions-2

Q1.

The lengths of the sides of a rhombus are 6 cm.
The length of the longer diagonal of the rhombus is 10 cm.
 AB is a side of the rhombus.

Construct an accurate, full-size drawing of the rhombus.
You must show all construction lines.

NATURAL SCIENCE SOLUTION

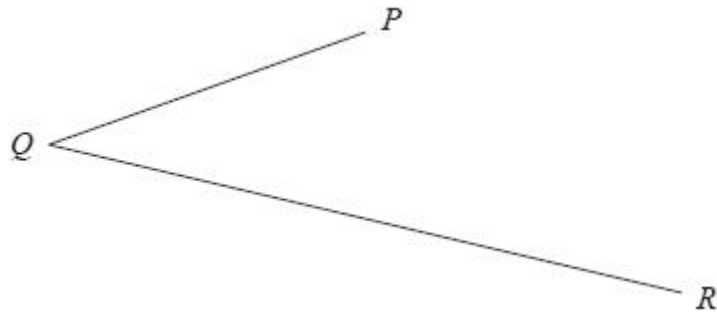


(Total for question is 4 marks)

(Q04 4MA0/3H, Jan 2012)

Q2.

Use ruler and compasses to construct the bisector of angle PQR .
You must show all your construction lines.



(Total for question = 2 marks)

(Q09 4MA0/3H, June 2017)

NATURAL SCIENCE SOLUTION

Q3.

Use ruler and compasses only to construct the perpendicular bisector of line AB .
You must show all your construction lines.



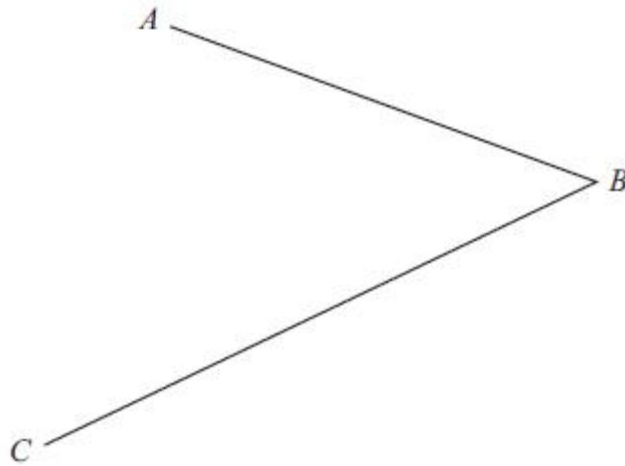
NATURAL
SCIENCE
SOLUTION

(Total for question = 2 marks)

(Q06 4MA0/3H, Jan 2016)

Q4.

Use ruler and compasses to construct the bisector of angle ABC .
You must show all your construction lines.



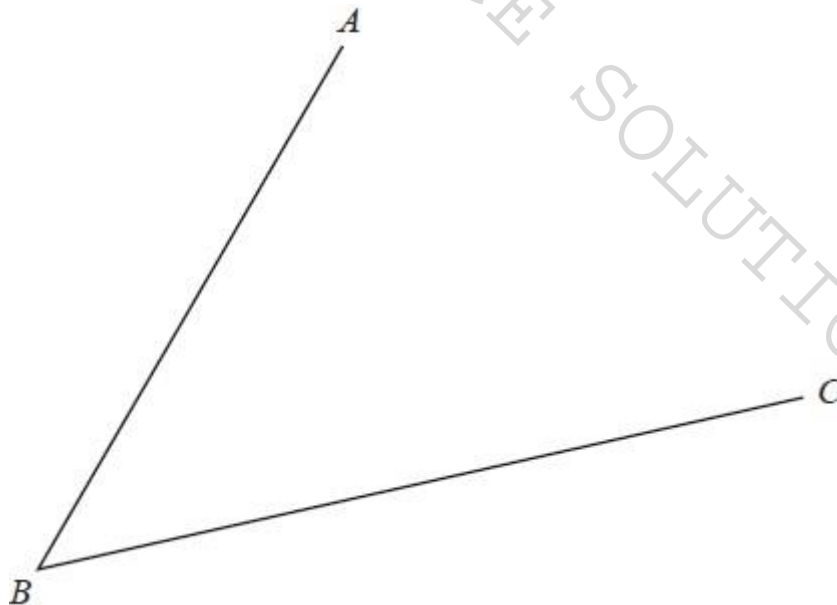
(Total for question = 2 marks)

(Q12 4MA0/4H, Jan 2013)

Q5.

Use ruler and compasses to construct the bisector of angle ABC .

You must show all of your construction lines.

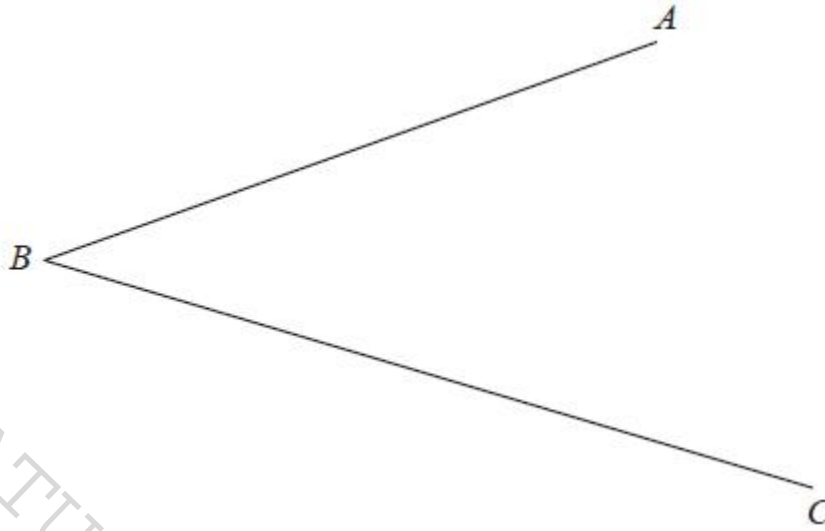


(Total for Question is 2 marks)

(Q05 4MA0/4HR, Jan 2014)

Q6.

Use ruler and compasses to construct the bisector of angle ABC .
You must show all your construction lines.



(Total for Question is 2 marks)

(Q07 4MA0/4H, June 2014)

NATURAL SCIENCE SOLUTION

Q7.

Use compasses and a ruler only to construct the perpendicular bisector of the line PQ .
You must show all construction lines.



(Total for question = 2 marks)

(Q08 4MA0/4H, June 2011)

Q8.

The diagram shows a ladder, EF , leaning against a vertical wall. The foot, E , of the ladder is on horizontal ground.

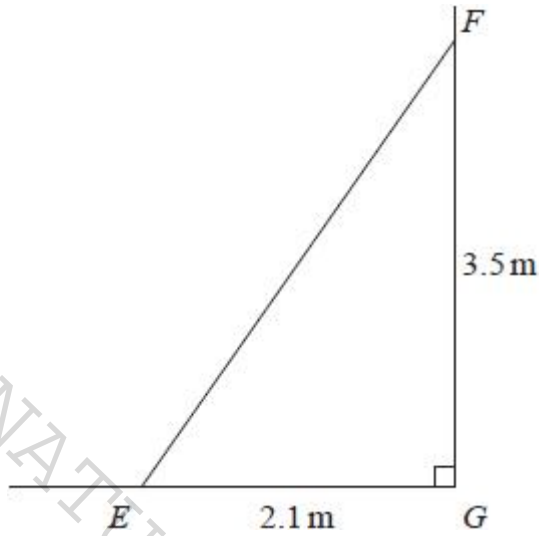


Diagram NOT accurately drawn

$EG = 2.1 \text{ m}$ $FG = 3.5 \text{ m}$ angle $EGF = 90^\circ$

- (a) Work out the length of the ladder.
Give your answer correct to 1 decimal place.

..... m
(3)

- (b) Work out the size of angle EFG .
Give your answer correct to the nearest degree.

.....^o
(3)

(Total for question = 6 marks)

(Q09 4MA0/4H, Jan 2017)

Topic-49: Congruence and similarity-1

Q1.

A and **B** are two similar vases.

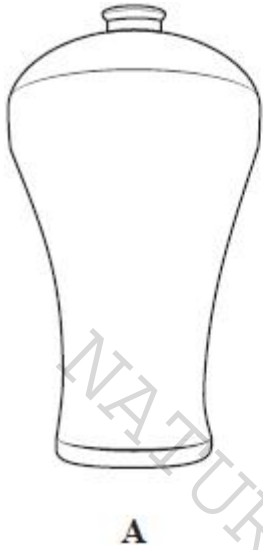


Diagram **NOT**
accurately drawn

The vases are such that

surface area of vase **B** = $\frac{25}{64}$ × surface area of vase **A**
and that

$$\text{volume of vase A} - \text{volume of vase B} = 541.8 \text{ cm}^3$$

Calculate the volume of vase **B**

..... cm³

(Total for question = 4 marks)

(Q19 4MA1/2H, Jan 2023)

Q2.

The diagram shows two cylinders, **A** and **B**.

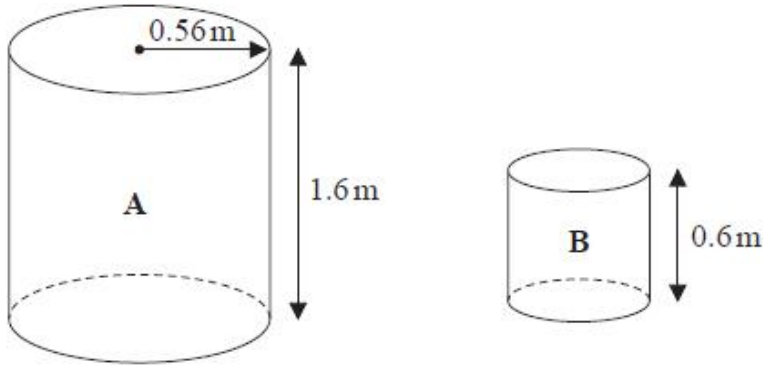


Diagram **NOT** accurately drawn

Cylinder **A** has height 1.6 m and radius 0.56 m.

(a) Work out the curved surface area of cylinder **A**.

Give your answer in m^2 correct to 3 significant figures.

..... m^2
(2)

Cylinder **B** is mathematically similar to cylinder **A**.
The height of cylinder **B** is 0.6 m.

(b) Work out the radius of cylinder **B**.

..... m
(2)

(Total for question = 4 marks)
(QU06 4MA1/2H, June 2018)

Q3.

A plane has a length of 73 metres.

A scale model is made of the plane.

The scale of the model is 1 : 200

Work out the length of the scale model.

Give your answer in centimetres.

cm

(Total for question = 3 marks)
(Q01 4MA1/2H, Jan 2019)

Q4.

Mathematically similar wooden blocks are made in a workshop.

There are small blocks and there are large blocks.

The volume of each small block is 300 cm^3

Given that

the surface area of each small block : the surface area of each large block = 25 : 36

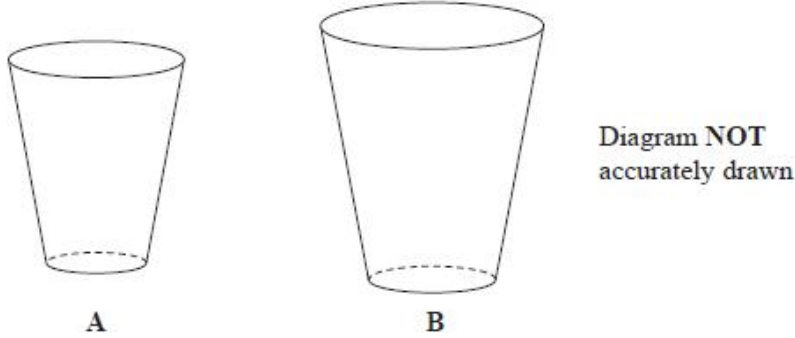
work out the volume of each large block.

..... cm^3

(Total for question = 3 marks)
(Q20 4MA1/2H, June 2021)

Q5.

The diagram shows two mathematically similar vases, **A** and **B**.



A has a volume of 405 cm^3
B has a volume of 960 cm^3
B has a surface area of 928 cm^2
 Work out the surface area of **A**.

NATURAL SCIENCE SOLUTION

..... cm^2
(Total for question = 3 marks)
(Q16 4MA1/2H, Jan 2019)

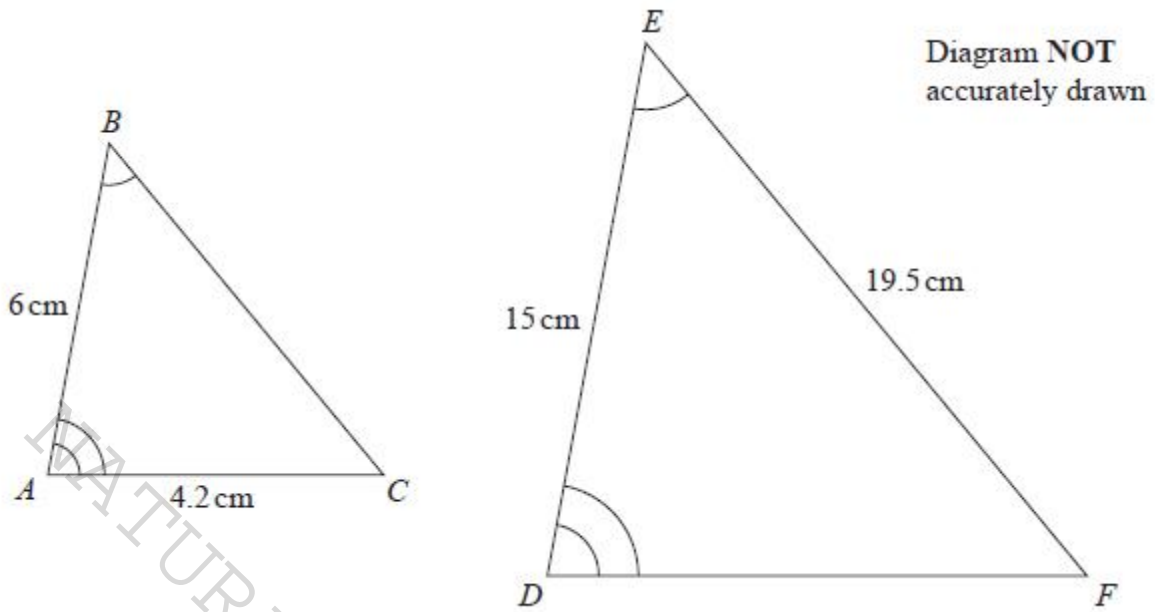
Q6.

A statue and a model of the statue are mathematically similar.
 The statue has a total surface area of 3600 cm^2
 The model has a total surface area of 625 cm^2
 The volume of the model is 750 cm^3
 Work out the volume of the statue.

..... cm^3
(Total for question = 3 marks)
(Q18 4MA1/2HR, Jan 2023)

Q7.

ABC and DEF are similar triangles.



(a) Work out the length of DF .

..... cm
(2)

(b) Work out the length of BC .

..... cm
(2)

(Total for question = 4 marks)

(Q06 4MA1/2H, June 2019)

Q8.

ABC and DEF are similar triangles.

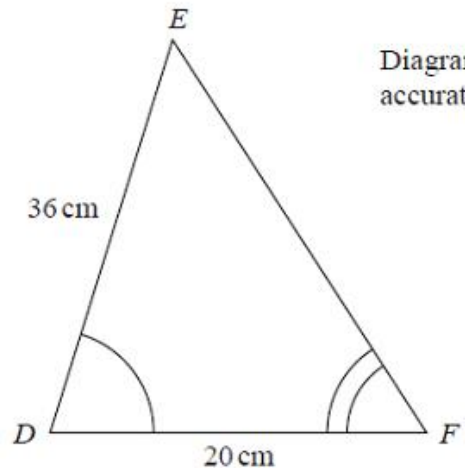
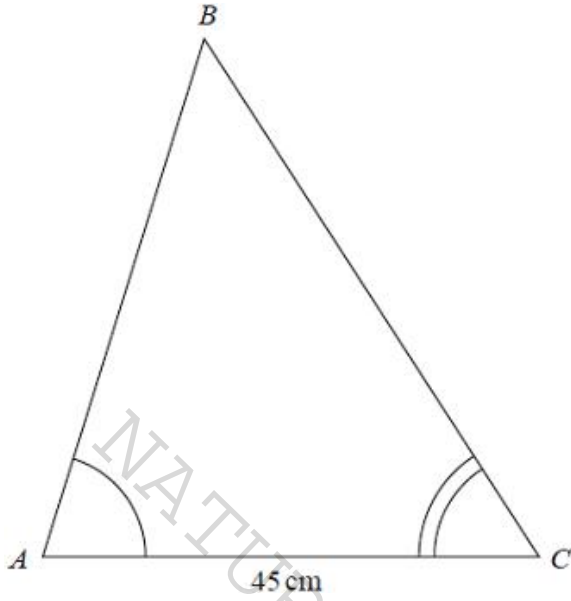


Diagram NOT accurately drawn

(a) Work out the length of AB .

..... cm
(2)

Given that $BC = 54$ cm,

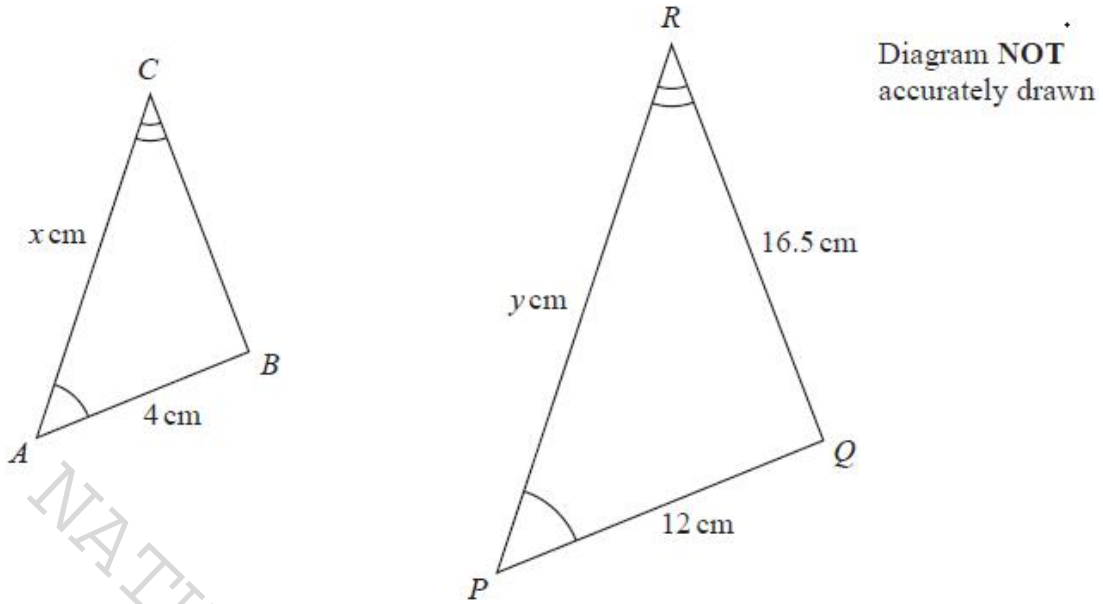
(b) work out the length of EF .

..... cm
(2)

(Total for question = 4 marks)

(Q04 4MA1/2H, Nov 2021)

Q9.



Triangle ABC is similar to triangle PQR

$AB = 4 \text{ cm}$ $PQ = 12 \text{ cm}$ $RQ = 16.5 \text{ cm}$ $AC = x \text{ cm}$ $PR = y \text{ cm}$

(a) Calculate the length of BC

..... cm
(2)

(b) Write down an expression for y in terms of x

$y =$
(1)

(Total for question = 3 marks)
(Q03 4MA1/2H, Jan 2022)

Q10.

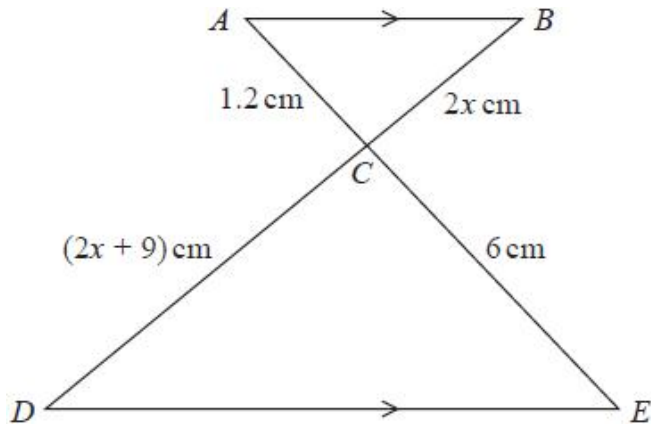


Diagram **NOT**
accurately drawn

ACE and *BCD* are straight lines.

AB is parallel to *DE*

Work out the value of *x*

NATURAL SCIENCE SOLUTION

x =

(Total for question = 3 marks)

(QU12 4MA1/2HR, June 2022)

Topic-50: Congruence and similarity-2

Q1.

$ABCDE$ and $AWXYZ$ are two mathematically similar pentagons.

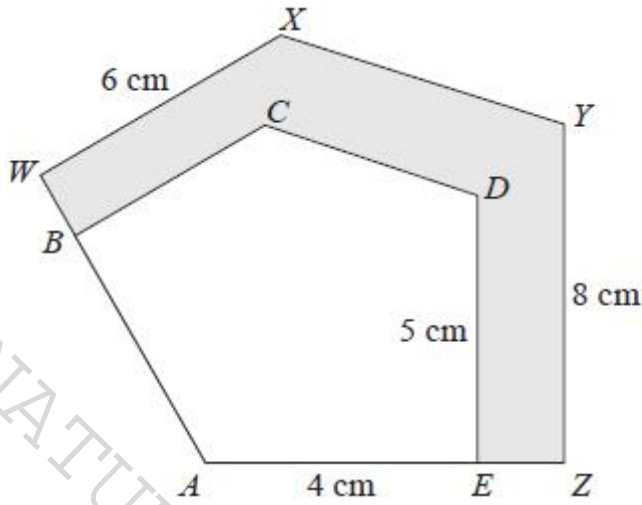


Diagram NOT accurately drawn

$AE = 4 \text{ cm}$ $WX = 6 \text{ cm}$ $DE = 5 \text{ cm}$ $YZ = 8 \text{ cm}$

(a) Calculate the length of AZ .

..... cm
(2)

(b) Calculate the length of BC .

..... cm
(2)

The area of pentagon $AWXYZ$ is 52.48 cm^2

(c) Calculate the area of the shaded region.

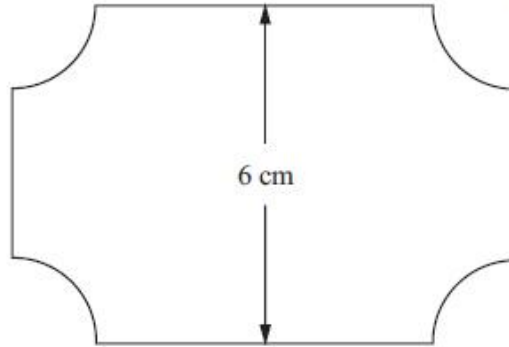
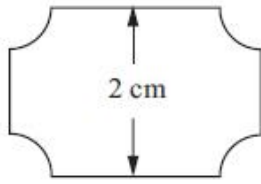
..... cm^2
(3)

(Total for question = 7 marks)

(Q14 4MA0/4HR, Jan 2017)

Q2.

Here are two supermarket price tickets.



Diagrams NOT accurately drawn

The two supermarket price tickets are mathematically similar.
 The area of the smaller ticket is 7 cm^2 .
 Calculate the area of the larger ticket.

..... cm^2
 (Total for question = 2 marks)
 (Q14 4MA0/4H, June 2011)

Q3.

L and **M** are two mathematically similar prisms.

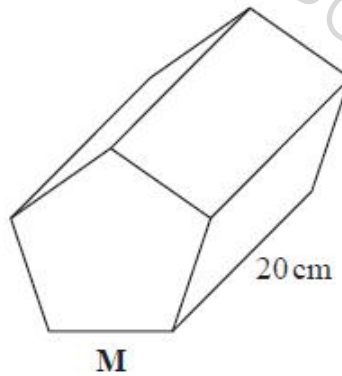
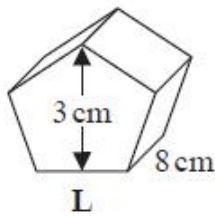


Diagram NOT accurately drawn

Prism **L** has length 8 cm.
 Prism **M** has length 20 cm.
 Prism **L** has height 3 cm.

(a) Work out the height of prism **M**.

..... cm
 (2)

Prism **M** has a volume of 1875 cm^3
 (b) Work out the volume of prism **L**.

..... cm^3

(2)

(Total for question = 4 marks)
 (Q14 4MA0/4H, June 2015)

Q4.

PQRS and *PLMN* are similar quadrilaterals.
 $PN = 12 \text{ cm}$, $NS = 8 \text{ cm}$, $PL = 9 \text{ cm}$ and $RS = 13.5 \text{ cm}$.
 LM is parallel to QR and MN is parallel to RS .

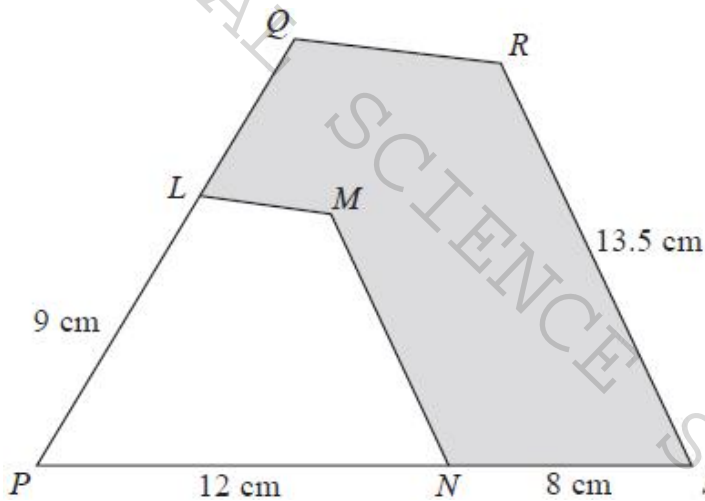


Diagram NOT
 accurately drawn

(a) Work out the length of MN .

..... cm

(2)

(b) Work out the length of LQ .

..... cm

(2)

The area of $PLMN$ is $A \text{ cm}^2$
 The area of $PQRS$ is $kA \text{ cm}^2$

(c) Find the value of k .

$k = \dots\dots\dots$
 (1)

The area of the shaded region is 105.6 cm^2
 (d) Work out the value of A .

$A = \dots\dots\dots$
 (3)

(Total for question = 8 marks)
(Q13 4MA0/4HR, June 2015)

Q5.

The diagram shows triangle ADC .

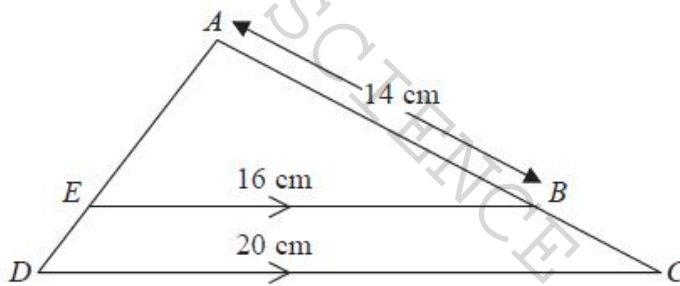


Diagram NOT accurately drawn

E is a point on AD and B is a point on AC so that EB is parallel to DC .
 $AB = 14 \text{ cm}$.
 $EB = 16 \text{ cm}$.
 $DC = 20 \text{ cm}$.

Calculate the length of BC .

$\dots\dots\dots \text{ cm}$
(Total for Question is 3 marks)
(Q12 4MA0/4H, June 2014)

Q6.

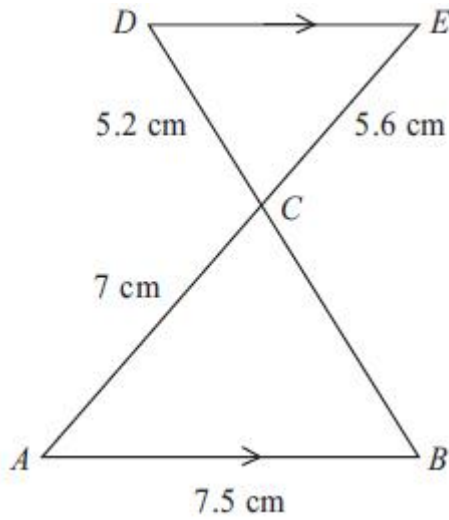


Diagram NOT accurately drawn

AB is parallel to DE.
 The lines AE and BD intersect at C.
 $AB = 7.5$ cm, $AC = 7$ cm, $CD = 5.2$ cm, $CE = 5.6$ cm.

(a) Calculate the length of BC.

.....cm
 (2)

(b) Calculate the length of DE.

.....cm
 (2)

(c) The area of triangle ABC is 21 cm^2
 Calculate the area of triangle EDC.

..... cm^2
 (3)

(Total for question = 7 marks)

(Q17 4MA0/4H, Jan 2013)

Q7.

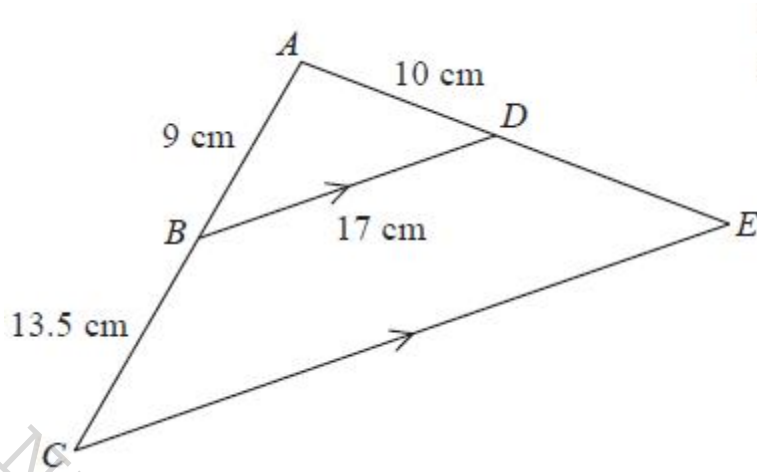


Diagram NOT accurately drawn

In the diagram ABC and ADE are straight lines.
 BD is parallel to CE .
 $AB = 9$ cm, $BC = 13.5$ cm, $AD = 10$ cm, $BD = 17$ cm

(a) Calculate the length of CE .

..... cm
 (2)

(b) Calculate the length of DE .

..... cm
 (2)

The area of triangle ABD is 36 cm²

(c) Calculate the area of quadrilateral $BDEC$.

..... cm²
 (3)

(Total for question = 7 marks)
(Q10 4MA0/4HR, Jan 2015)

Q8.

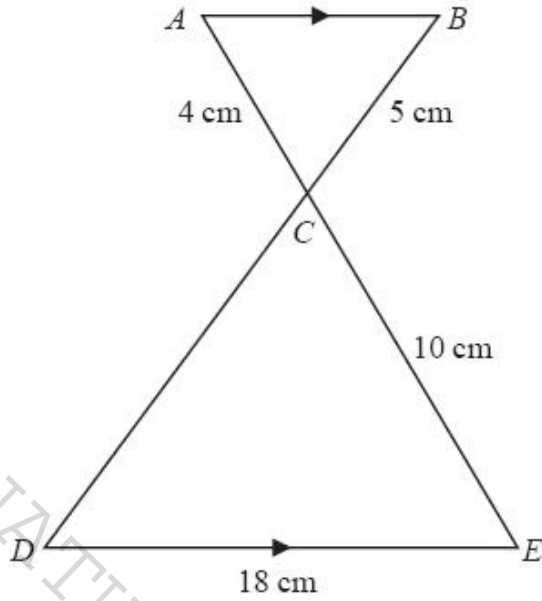


Diagram NOT accurately drawn

ACE and BCD are straight lines.
 AB is parallel to DE.

(a) Calculate the length of CD.

..... cm
 (2)

(b) Calculate the length of AB.

..... cm
 (2)

The area of triangle ABC = $T \text{ cm}^2$

(c) Find the area of triangle CDE in terms of T .

..... cm^2
 (1)

(Total for question = 5 marks)

(Q14 4MA0/4H, Jan 2016)

Q9.

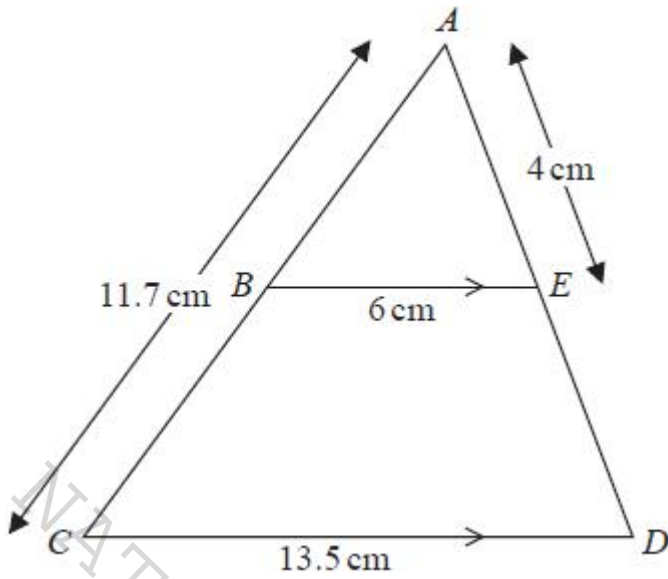


Diagram NOT accurately drawn

The diagram shows triangle ACD .
 B is a point on AC and E is a point on AD so that BE is parallel to CD .
 $AE = 4$ cm
 $AC = 11.7$ cm
 $BE = 6$ cm
 $CD = 13.5$ cm

(a) Calculate the length of AB .

..... cm
 (2)

(b) Calculate the length of ED .

..... cm
 (2)

(Total for question = 4 marks)

(Q12 4MA0/4H, June 2016)

Q10.

The diagram shows triangle ABC .

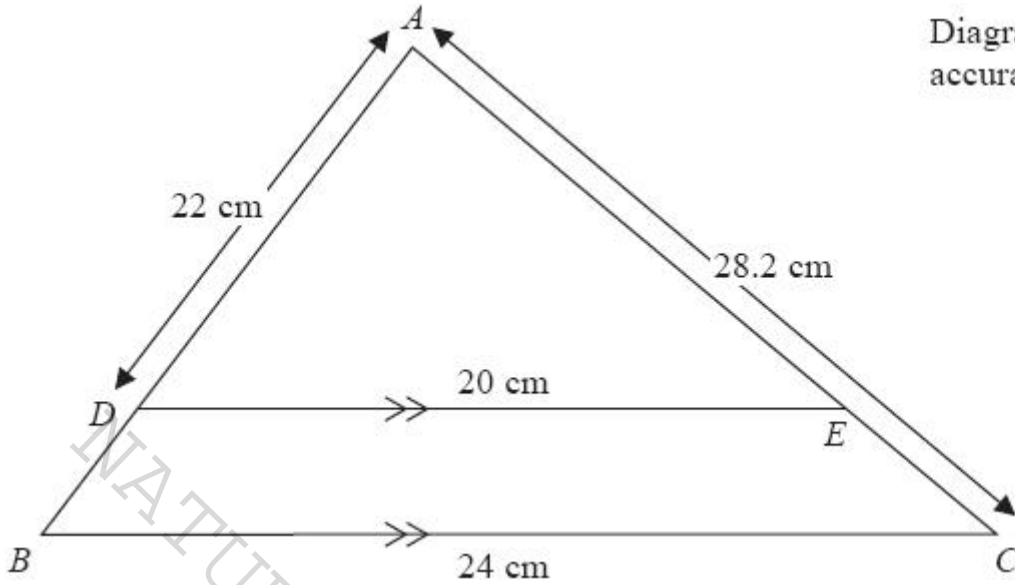


Diagram NOT accurately drawn

ADB and AEC are straight lines.
 DE is parallel to BC .
 $DE = 20$ cm, $BC = 24$ cm, $AD = 22$ cm, $AC = 28.2$ cm

(a) Work out the length of AB .

.....cm
(2)

(b) Work out the length of EC .

..... cm
(2)

(Total for question = 4 marks)

(Q13 4MA0/4HR, Jan 2016)

Topic-51: Scale drawings

Q1.

The diagram shows an accurate scale drawing of part of the boundary of a field.
The complete boundary of the field is in the shape of a quadrilateral $ABCD$.

$AB = 300$ metres.

$BC = 230$ metres.

Point B is due north of point C .

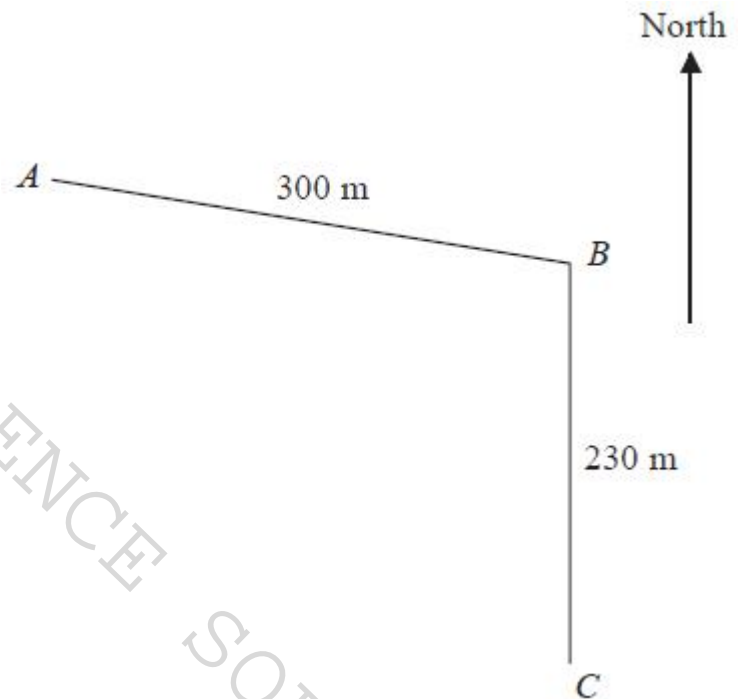
The scale of the diagram is 1 cm to 50 metres.

The bearing of D from C is 260°

$AD = 480$ metres.

Complete the scale drawing of the boundary of the field.

Mark the position of D .



(Total for Question is 2 marks)

(Q06 4MA0/3H, June 2014)

Q2.

There is a World Peace Bell in South Korea.

At its widest, the bell has a circular cross section with a diameter of 2.5 m.

(a) Work out the circumference of a circle with diameter 2.5 m.

Give your answer correct to 3 significant figures.

..... m
(2)

The World Peace Bell in South Korea has a height of 4.7 m.

At its widest, the bell has a circular cross section with a diameter of 2.5 m.

A scale model is made of the bell.

At its widest, the scale model has a circular cross section with a diameter 10 cm.

(b) Work out the height of the scale model.

Give your answer in centimetres.

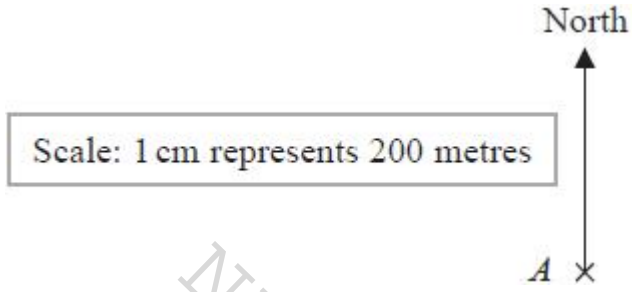
..... cm
(2)

(Total for question = 4 marks)

(Q05 4MA0/3HR, June 2017)

Q3.

The scale diagram shows the position on a map of a house, A



House C is on a bearing of 110° from A
 The distance from A to C is 700 m

- (a) Mark the position of C on the diagram with a cross (x)
 Label your cross C

(3)

- (b) Write the scale of the map in the form $1 : n$

1 :

(1)

(Total for question = 4 marks)

(Q05 4MA1/2H, Jan 2022)

Q4.

Louis makes a model of a plane.

The wingspan of the model is 50 centimetres.

The wingspan of the real plane is 80 metres.

(a) Work out the scale of the model.

Give your answer in the form 1: n

1:
(2)

The length of the real plane is 72 metres.

(b) Work out the length of the model.

Give your answer in centimetres.

..... centimetres
(2)

(Total for question = 4 marks)

(Q08 4MA0/4HR, June 2016)

Q5.

Rob is making a scale model of the Solar System on the school field.

He wants the distance from the Sun to Jupiter to be 8 metres on his scale model.

The real distance from the Sun to Jupiter is 7.8×10^8 kilometres.

(a) Find the scale of the model.

Give your answer in the form 1: n , where n is written in standard form.

1:
(3)

Rob wants to put the position of a space probe on the scale model.
The real distance of the space probe from the Sun is 1.9×10^{10} kilometres, correct to 2 significant figures.

(b) Work out the maximum distance of the space probe from the Sun on the scale model.
Give your answer in metres.

..... m
(3)

(Total for Question is 6 marks)

(Q14 4MA0/4HR, June 2014)

Q6.

The scale of a map is 1 : 25 000
On the map, the distance between two railway stations is 22 cm.

Work out the real distance between the two railway stations.
Give your answer in kilometres.

.....km

(Total for question = 3 marks)

(Q10 4MA0/4H, June 2013)

Q7.

The ocean liner Queen Mary 2 is the longest of its type.
It has a length of 345 metres.



A scale model is made of the Queen Mary 2
The scale of the model is 1 : 200

Work out the length of the scale model.
Give your answer in centimetres.

NATURAL SCIENCE SOLUTIONS

..... cm

(Total for question = 3 marks)

(Q01 4MA0/3H, June 2015)

Q8.

On a map, 4 centimetres represents a real distance of 1 kilometre.

- (a) On the map, the distance between two points is 14 cm.
Work out the real distance between these two points.
Give your answer in kilometres.

..... km
(2)

- (b) Work out the scale of the map in the form 1: n

1 :
(2)

(Total for Question is 4 marks)

(Q09 4MA0/4HR, Jan 2014)

Topic-52: Circle theorems-1

Q1.

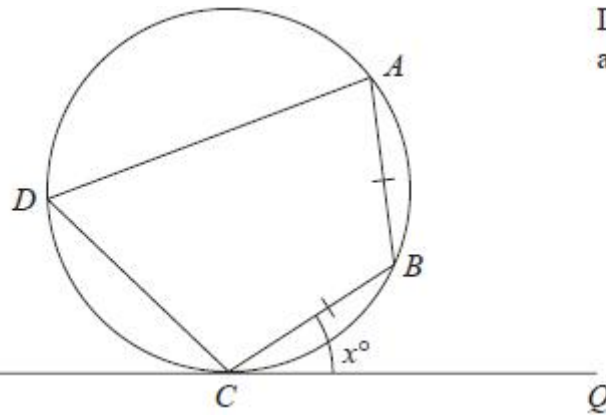


Diagram NOT
accurately drawn

A , B , C and D are points on a circle.
 PCQ is a tangent to the circle.
 $AB = CB$.

Angle $BCQ = x^\circ$

Prove that angle $CDA = 2x^\circ$

Give reasons for each stage in your working.

(Total for question = 5 marks)

(Q20 4MA1/2H, Jan 2019)

Q2.

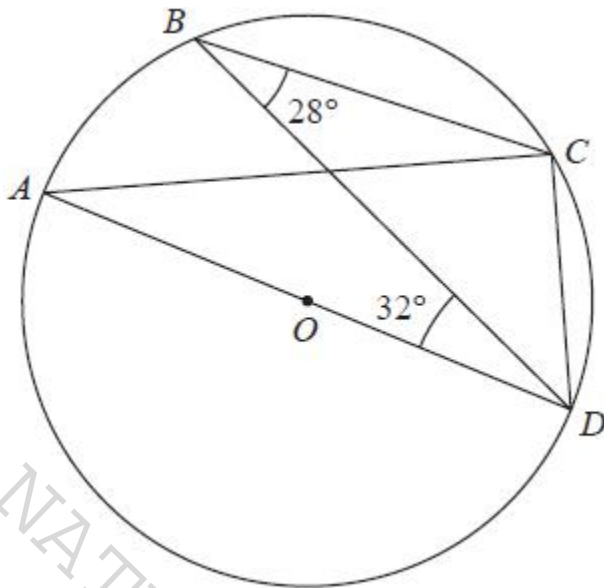


Diagram NOT accurately drawn

A , B , C and D are points on a circle, centre O .
 AOD is a diameter of the circle.

Angle $CBD = 28^\circ$
 Angle $BDA = 32^\circ$

Find the size of angle BDC .
 Give a reason for each stage of your working.

NATURAL SCIENCE SOLUTION

.....°

(Total for question = 4 marks)

(Q13 4MA1/2H, Jan 2020)

Q3.

P, Q, R, S and T are points on a circle with centre O .

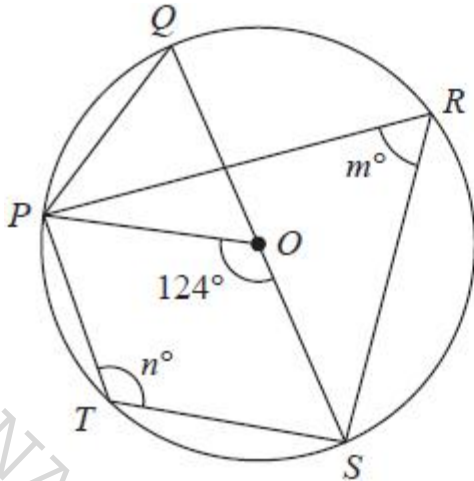


Diagram **NOT** accurately drawn

QOS is a diameter of the circle.

angle $POS = 124^\circ$ angle $PRS = m^\circ$ angle $PTS = n^\circ$

(a) Find the value of

(i) m

.....

(ii) n

.....

(2)

(b) Find the size of angle QPO .

.....^o

(1)

(Total for question = 3 marks)

(Q13 4MA1/2H, Jan 2021)

Q4.

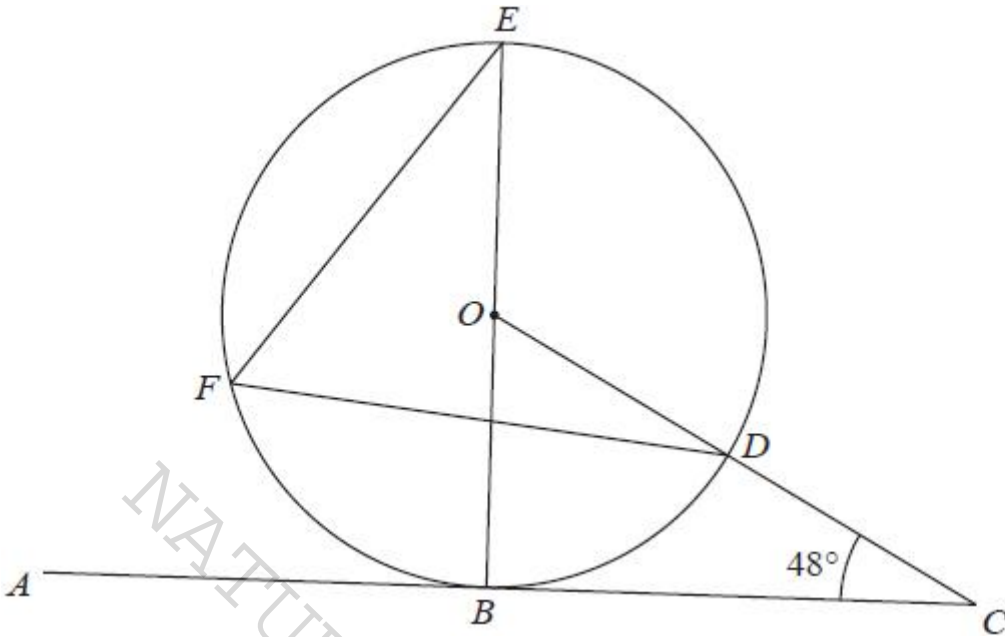


Diagram **NOT** accurately drawn

B, D, E and F are points on a circle, centre O .
 ABC is a tangent to the circle.
 ODC is a straight line.
 BOE is a diameter of the circle.
 Angle $BCD = 48^\circ$
 Find the size of angle DFE .

..... °

(Total for question = 3 marks)

(Q11 4MA1/2H, Nov 2021)

Q5.

D , E , F and G are points on a circle, centre O

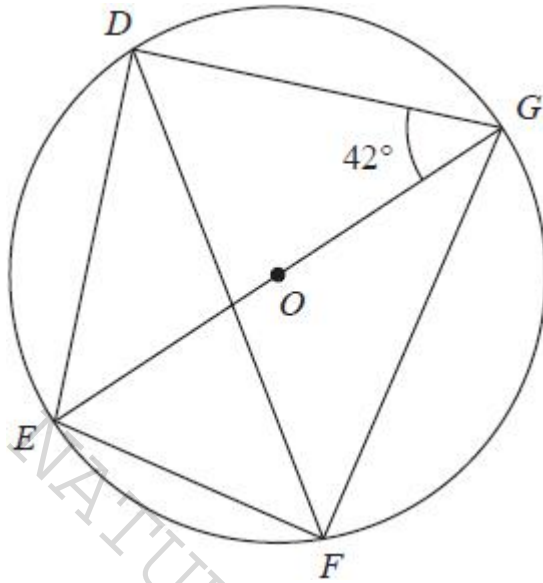


Diagram **NOT** accurately drawn

EOG is a diameter of the circle.

Angle $EGD = 42^\circ$

Calculate the size of angle DFG

Give a reason for each stage of your working.

Angle $DFG = \dots\dots\dots^\circ$

(Total for question = 4 marks)

(Q16 4MA1/2H, Jan 2022)

Q6.

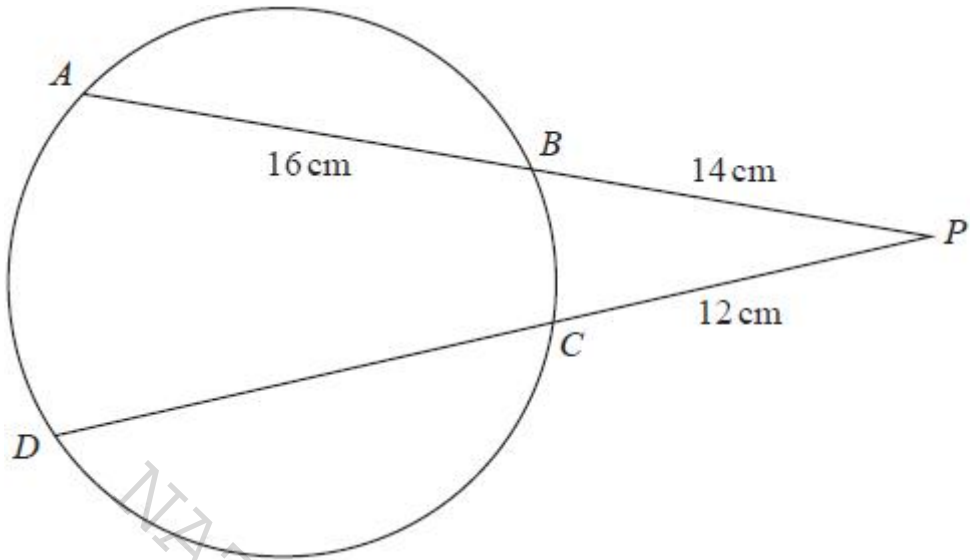


Diagram NOT accurately drawn

A , B , C and D are points on a circle.

ABP and DCP are straight lines.

$AB = 16$ cm, $BP = 14$ cm, $CP = 12$ cm

Work out the length of DC

..... cm

(Total for question = 3 marks)

(QU18 4MA1/2HR, June 2023)

Q7.

A, B and C are points on a circle.

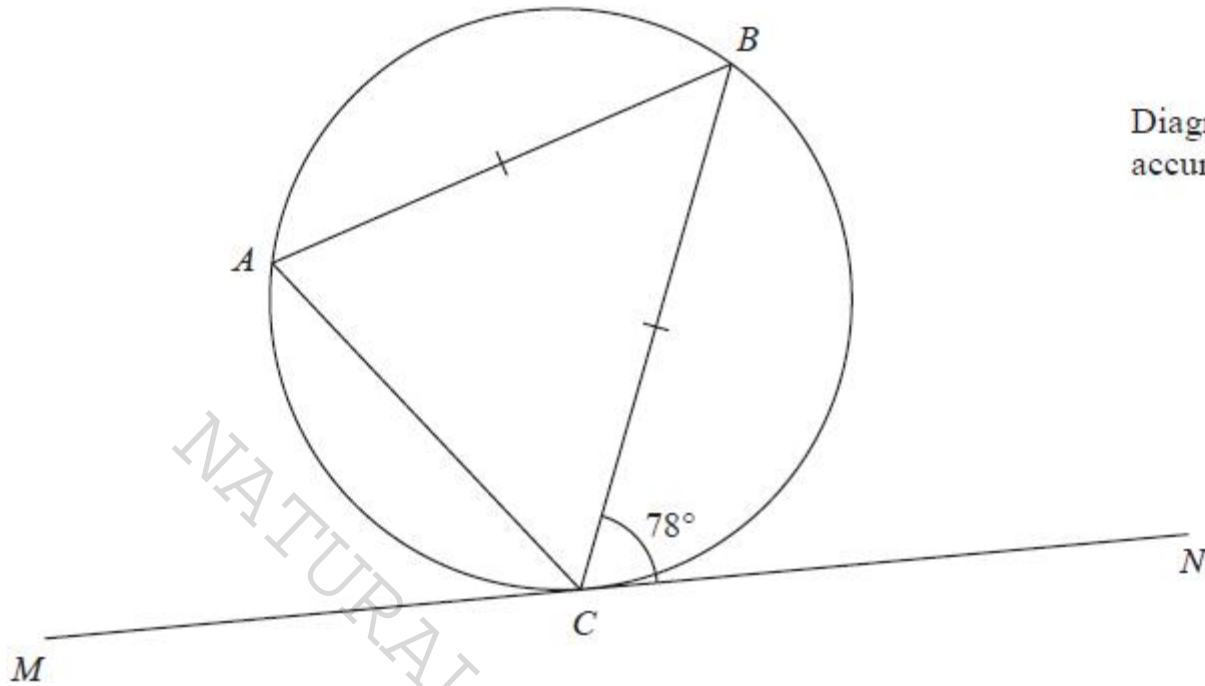


Diagram NOT accurately drawn

MN is the tangent to the circle at C

$AB = CB$

Angle $BCN = 78^\circ$

Find the size of angle ABC

.....°

(Total for question = 2 marks)

(QU20 4MA1/2HR, June 2023)

Q8.

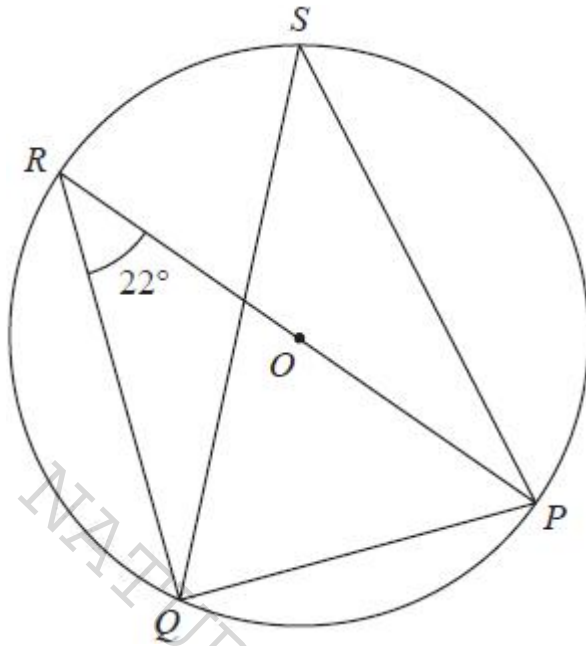


Diagram **NOT** accurately drawn

P, Q, R and S are points on a circle, centre O
 ROP is a diameter of the circle.
 Angle $PRQ = 22^\circ$

(a) (i) Find the size of angle RQP

.....^o
 (1)

(ii) Give a reason for your answer.

.....

 (1)

(b) (i) Find the size of angle PSQ

.....^o
 (1)

(ii) Give a reason for your answer.

.....

 (1)

(Total for question = 4 marks)

(QU14 4MA1/2H, June 2023)

Q9.

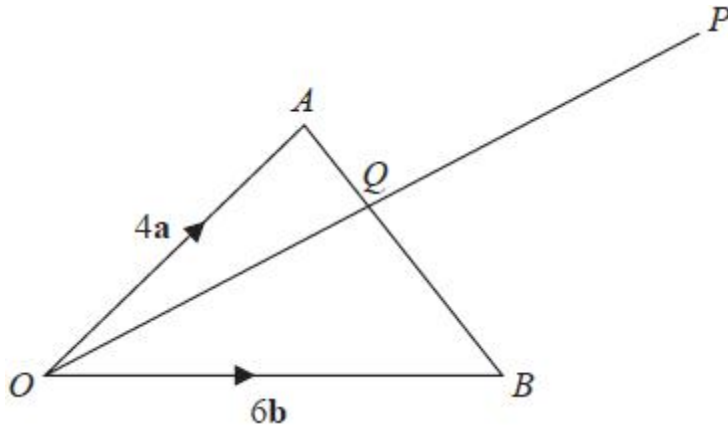


Diagram NOT accurately drawn

OAB is a triangle.

Q is the point on AB such that OQP is a straight line.

$$\vec{OA} = 4\mathbf{a} \quad \vec{OB} = 6\mathbf{b} \quad \vec{AP} = 2\mathbf{a} + 8\mathbf{b}$$

Using a vector method, find the ratio $AQ : QB$

NATURAL SCIENCE SOLUTION

$AQ:QB = \dots\dots\dots$

(Total for question = 5 marks)

(QU21 4MA1/2H, June 2022)

Q10.

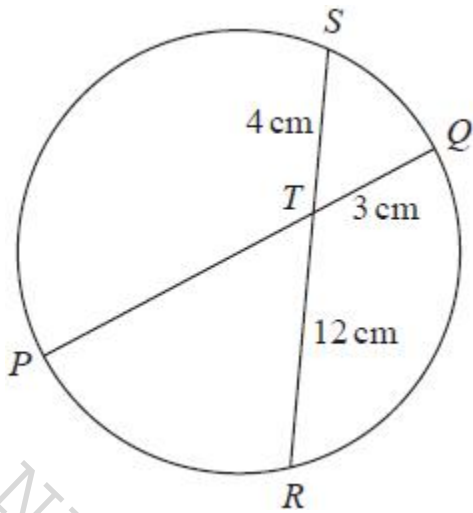


Diagram NOT
accurately drawn

PTQ is a diameter of a circle.
 RTS is a chord of the circle.

$$TQ = 3 \text{ cm} \quad ; \quad ST = 4 \text{ cm} \quad ; \quad TR = 12 \text{ cm}$$

Calculate the radius of the circle.

..... cm

(Total for question = 3 marks)

(Q19 4MA1/2H, Jan 2022)

Q11.

The diagram shows a solid cone and a solid sphere.

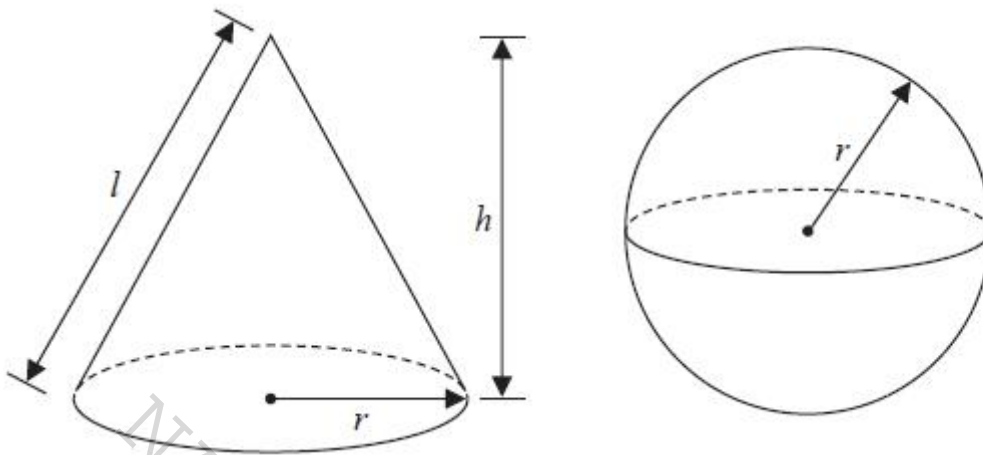


Diagram NOT
accurately drawn

The cone has base radius r , slant height l and perpendicular height h

The sphere has radius r

The base radius of the cone is equal to the radius of the sphere.

Given that

$$k \times \text{volume of the cone} = \text{volume of the sphere}$$

show that the **total** surface area of the cone can be written in the form

$$\pi r^2 \left(\frac{k + \sqrt{k^2 + a}}{k} \right)$$

where a is a constant to be found.

(Total for question = 6 marks)
(Q24 4MA1/2HR, Jan 2023)

Q12.

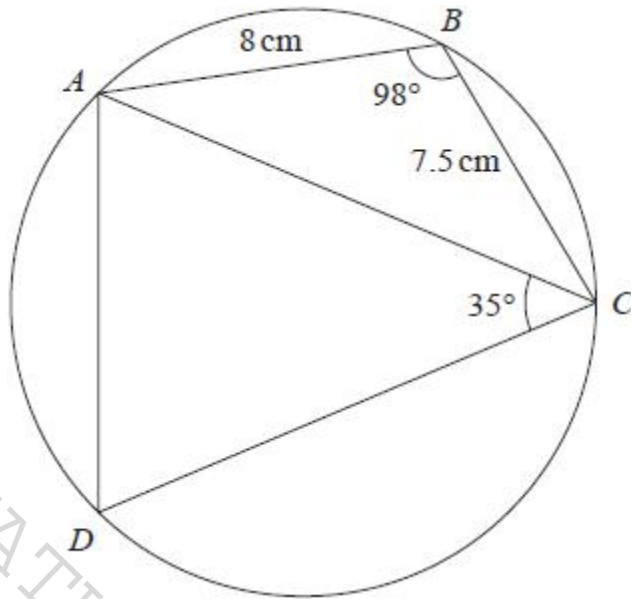


Diagram NOT accurately drawn

$ABCD$ is a quadrilateral where A , B , C and D are points on a circle.

$AB = 8$ cm

$BC = 7.5$ cm

Angle $ABC = 98^\circ$

Angle $ACD = 35^\circ$

Work out the perimeter of quadrilateral $ABCD$.

Give your answer correct to one decimal place.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 6 marks)

(Q18 4MA1/2H, June 2021)

Q13.

A, B and C are points on a circle, centre O

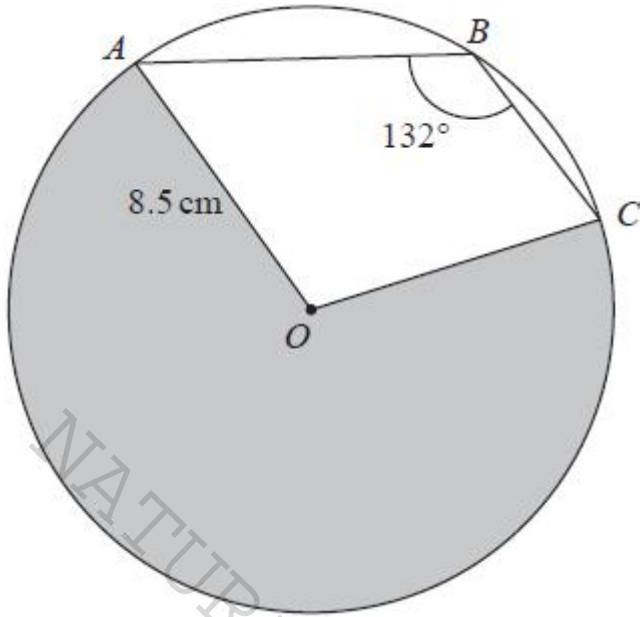


Diagram **NOT** accurately drawn

The radius of the circle is 8.5 cm
 Angle $ABC = 132^\circ$

Work out the perimeter of the shaded sector AOC
 Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 3 marks)

(Q14 4MA1/2HR, Jan 2023)

Q14.

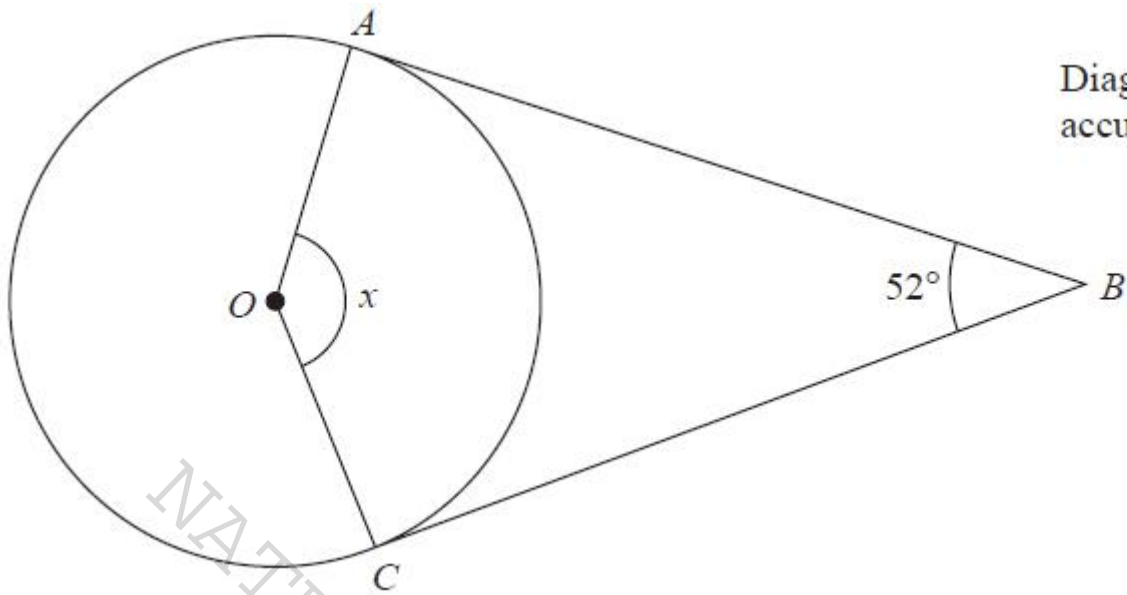


Diagram **NOT** accurately drawn

A and C are points on a circle, centre O.
 AB and CB are tangents to the circle.
 Angle $ABC = 52^\circ$

Work out the size of angle x.
 Give a reason for each stage of your working.

NATURAL SCIENCE SOLUTION

$x = \dots\dots\dots^\circ$

(Total for question = 4 marks)

(Q07 4MA1/2H/EAM, Specimen papers)

Q15.

A, B, C and D are points on a circle, centre O
 EBF is the tangent to the circle at B

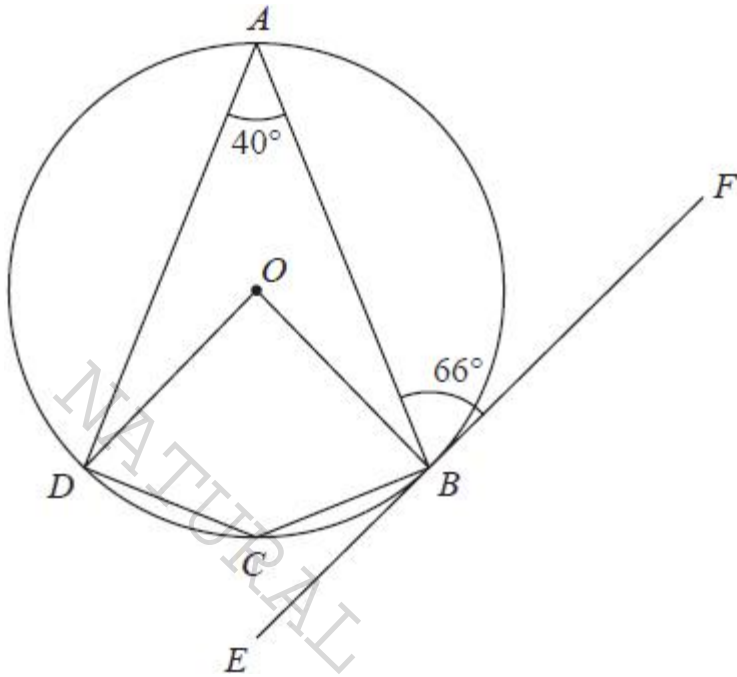


Diagram NOT
 accurately drawn

(a) (i) Work out the size of angle DCB

..... °
 (1)

(ii) Give a reason for your answer to (a)(i)

.....

(1)

(b) Work out the size of angle ADO

..... °
 (3)

(Total for question = 5 marks)

(Q14 4MA1/2H, Jan 2023)

Topic-53: Trigonometry (Sine law and cosine Law)

Q1.

$ABCD$ is a horizontal rectangular field.

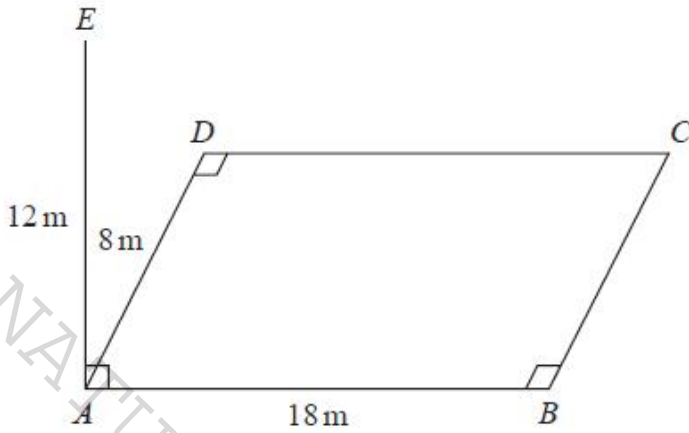


Diagram NOT accurately drawn

A vertical pole, AE , is placed at the corner A of the field.

$$AE = 12 \text{ m} \quad AB = 18 \text{ m} \quad AD = 8 \text{ m}$$

Calculate the size of the angle between EC and the plane $ABCD$

Give your answer correct to one decimal place.

..... °
(Total for question = 3 marks)
(Q19 4MA1/2HR, Jan 2022)

Q2.

The diagram shows a kite $ABCD$

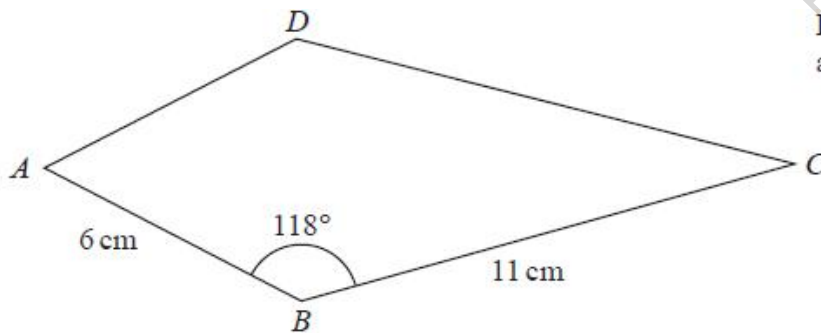


Diagram NOT accurately drawn

$$AB = 6 \text{ cm}$$

$$BC = 11 \text{ cm}$$

$$\text{Angle } ABC = 118^\circ$$

Calculate the area of the kite.
 Give your answer correct to 3 significant figures.

..... cm²

(Total for question = 3 marks)

(QU15 4MA1/2HR, June 2022)

Q3.

Here is a quadrilateral *ABCD*.

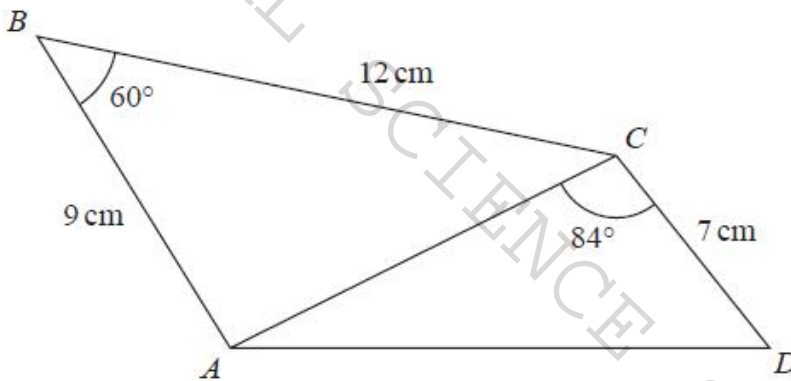


Diagram NOT accurately drawn

Calculate the area of quadrilateral *ABCD*.
 Give your answer correct to 3 significant figures.
 Show your working clearly.

..... cm²

(Total for question = 5 marks)

(Q18 4MA1/2H, Nov 2021)

Q4.

A triangle has sides of length 8 cm, 10 cm and 14 cm.
 Work out the size of the largest angle of the triangle.
 Give your answer correct to 1 decimal place.

..... °
(Total for question = 3 marks)
(QU18 4MA1/2H, June 2018)

Q5.

The diagram shows quadrilateral *ABCD*

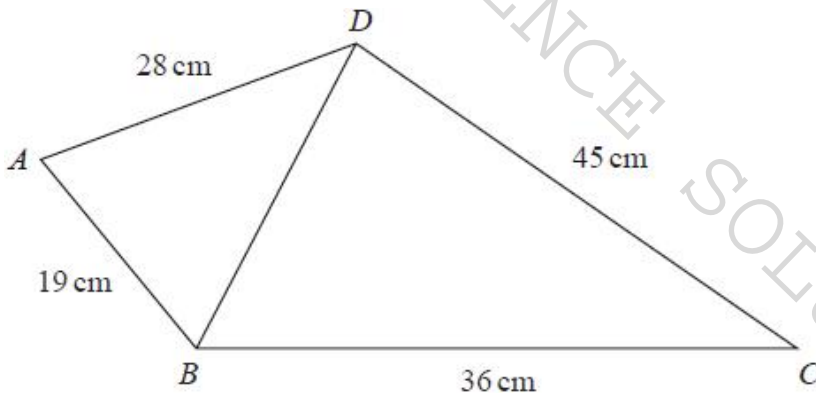


Diagram NOT accurately drawn

The angle *BCD* is acute.
 Given that the area of triangle *BCD* = 405 cm²
 work out the size of angle *ABD*
 Give your answer correct to one decimal place.

..... °
(Total for question = 5 marks)
(Q16 4MA1/2HR, Jan 2022)

Q6.

The diagram shows triangle PQR .

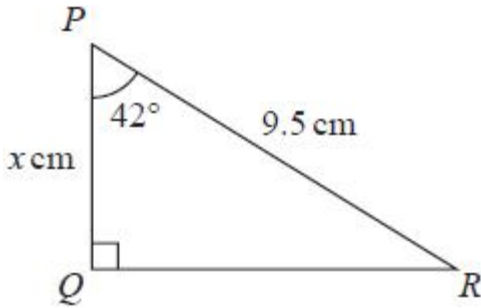


Diagram NOT accurately drawn

Work out the value of x

Give your answer correct to one decimal place.

$x = \dots\dots\dots$

(Total for question = 3 marks)

(QU06 4MA1/2H, June 2022)

Q7.

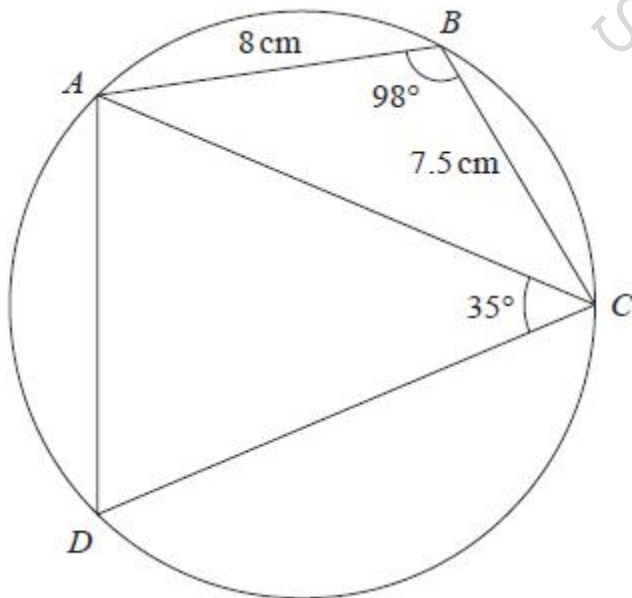


Diagram NOT accurately drawn

$ABCD$ is a quadrilateral where A , B , C and D are points on a circle.

$AB = 8$ cm

$BC = 7.5$ cm

Angle $ABC = 98^\circ$

Angle $ACD = 35^\circ$

Work out the perimeter of quadrilateral $ABCD$.
Give your answer correct to one decimal place.

..... cm

(Total for question = 6 marks)
(Q18 4MA1/2H, June 2021)

Q8.

The diagram shows right-angled triangle ABD

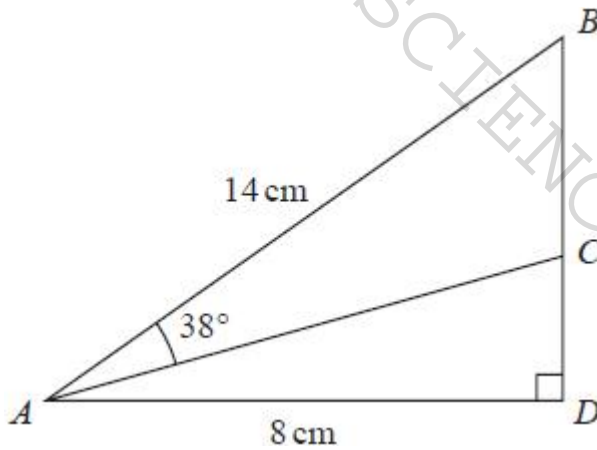


Diagram **NOT**
accurately drawn

$AB = 14\text{ cm}$

$AD = 8\text{ cm}$

C is the point on BD such that angle $BAC = 38^\circ$

Work out the length of CD

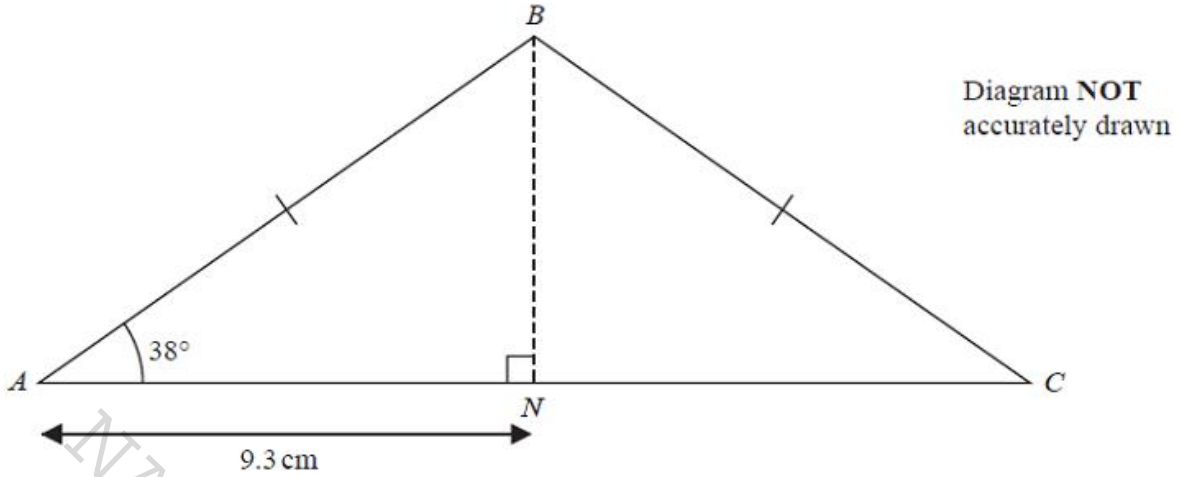
Give your answer correct to 3 significant figures.

..... cm

(Total for question = 4 marks)
(QU12 4MA1/2H, June 2023)

Q9.

ABC is an isosceles triangle with $BA = BC$.



N is the point on AC such that $AN = 9.3$ cm and BN is perpendicular to AC .

Work out the perimeter of triangle ABC .
Give your answer correct to 3 significant figures.

..... cm

(Total for question = 4 marks)

(Q10 4MA1/2H, Nov 2021)

Q10.

The diagram shows triangle PQR

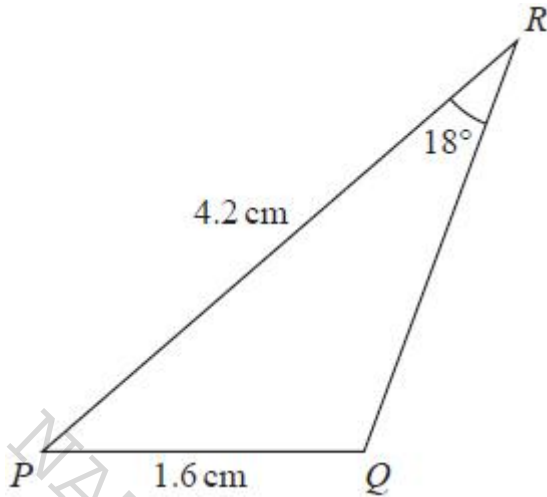


Diagram **NOT** accurately drawn

$PQ = 1.6 \text{ cm}$

$PR = 4.2 \text{ cm}$

Angle $PRQ = 18^\circ$

Given that angle PQR is obtuse,
work out the area of triangle PQR
Give your answer correct to 3 significant figures.

MATHS SCIENCE SOLUTION

..... cm^2

(Total for question = 6 marks)

(Q23 4MA1/2H, Jan 2022)

Q11.

Here is a right-angled triangle.

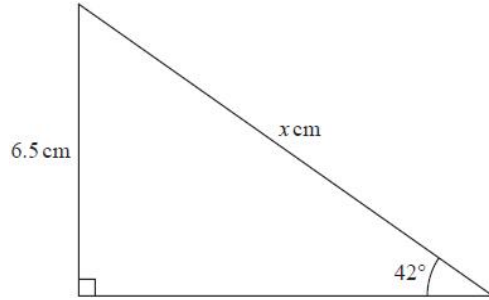


Diagram NOT accurately drawn

Work out the value of x .
Give your answer correct to one decimal place.

NATURAL SCIENCE SOLUTION

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q07 4MA1/2H, June 2021)

Q12.

The diagram shows a right-angled triangle.

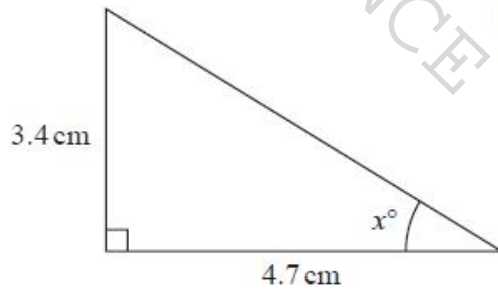


Diagram NOT accurately drawn

Calculate the value of x .
Give your answer correct to one decimal place.

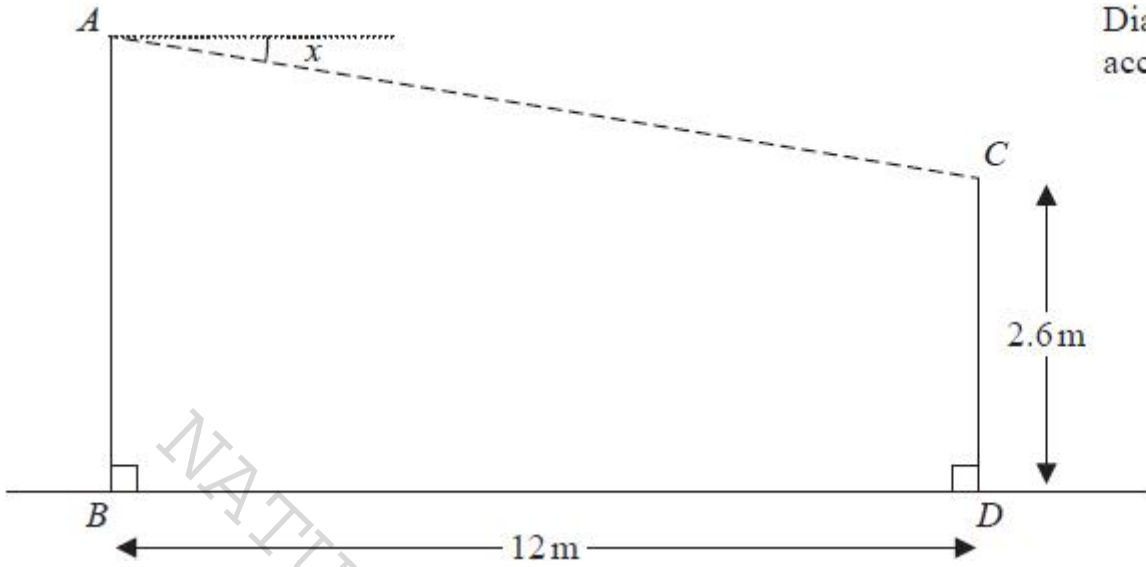
$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q07 4MA1/2H, Nov 2020)

Q13.

A zip wire is shown as the dashed line AC in the diagram.

Diagram **NOT** accurately drawn



The zip wire is supported by two vertical posts AB and CD standing on horizontal ground.

$$CD = 2.6 \text{ m} \quad BD = 12 \text{ m}$$

The zip wire makes an angle x with the horizontal, as shown in the diagram.
The design of the zip wire requires the angle x to be at least 5°

Work out the least possible height of the post AB
Give your answer correct to 3 significant figures.

NATURALSCIENCE SOLUTION

..... m

(Total for question = 3 marks)

(Q14 4MA1/2H, Jan 2022)

Q14.

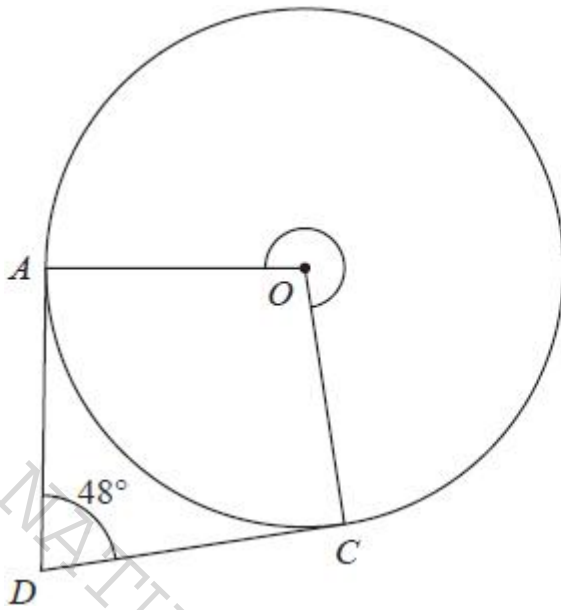


Diagram NOT accurately drawn

A and C are points on a circle, centre O
 DA is the tangent to the circle at A and DC is the tangent to the circle at C
 Angle $ADC = 48^\circ$
 Work out the size of reflex angle AOC

MATHEMATICS SCIENCE SOLUTIONS

.....°

(Total for question = 3 marks)

(QU07 4MA1/2H, June 2023)

Q15.

The diagram shows a triangle ABC and a flagpole BF

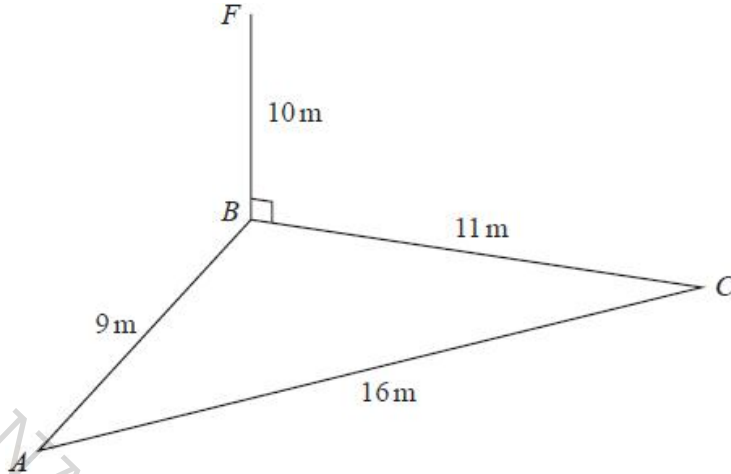


Diagram **NOT** accurately drawn

A , B and C are points on horizontal ground.

BF is vertical.

$$AB = 9 \text{ m} \quad BC = 11 \text{ m} \quad AC = 16 \text{ m} \quad BF = 10 \text{ m}$$

D is the point on AC such that angle $BDC = 90^\circ$

Work out the size of the angle of elevation of the point F from the point D

Give your answer correct to one decimal place.

MATHEMATICS SCIENCE SOLUTION

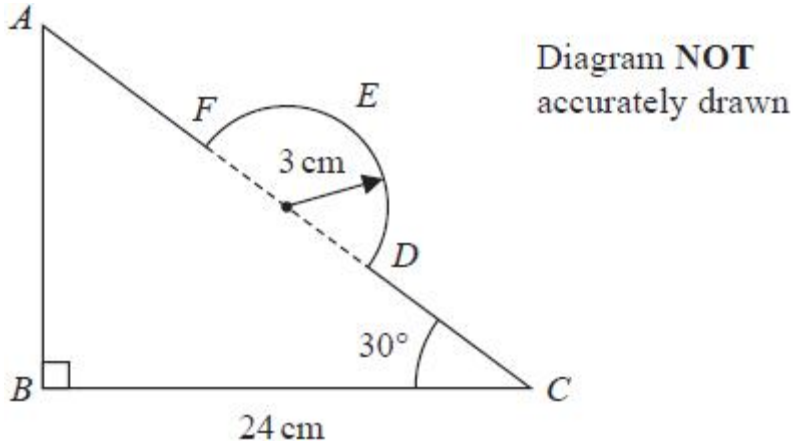
..... °

(Total for question = 5 marks)

(QU22 4MA1/2H, June 2023)

Q16.

In the diagram, ABC is a right-angled triangle and DEF is a semicircular arc.



In triangle ABC

$BC = 24 \text{ cm}$ angle $ABC = 90^\circ$ angle $BCA = 30^\circ$

The points D and F lie on AC so that DF is the diameter of the semicircular arc DEF . The radius of the semicircular arc is 3 cm.

Work out the length of $AFEDC$.
Give your answer correct to 2 significant figures.

..... cm

(Total for question = 5 marks)

(Q09 4MA1/2HR, Jan 2022)

Q17.

$ABCD$ is a trapezium.

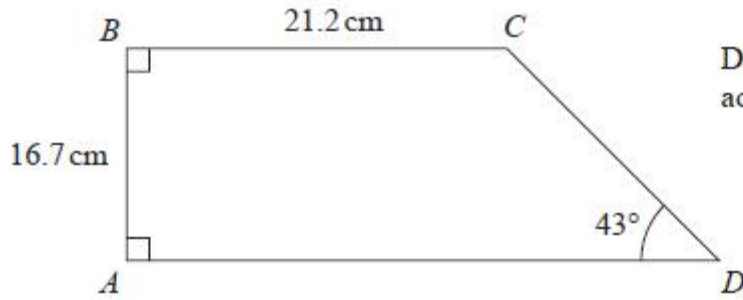


Diagram NOT accurately drawn

Calculate the perimeter of the trapezium.
Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

..... cm

(Total for question = 4 marks)
(Q12 4MA1/2H, June 2019)

Q18.

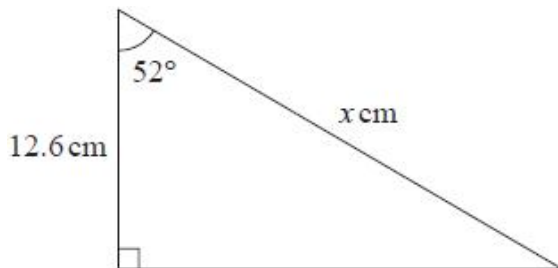


Diagram NOT accurately drawn

Work out the value of x .
Give your answer correct to 3 significant figures.

$x =$

(Total for question = 3 marks)
(QU08 4MA1/2H, June 2018)

Q19.

$ABCD$ is a quadrilateral.

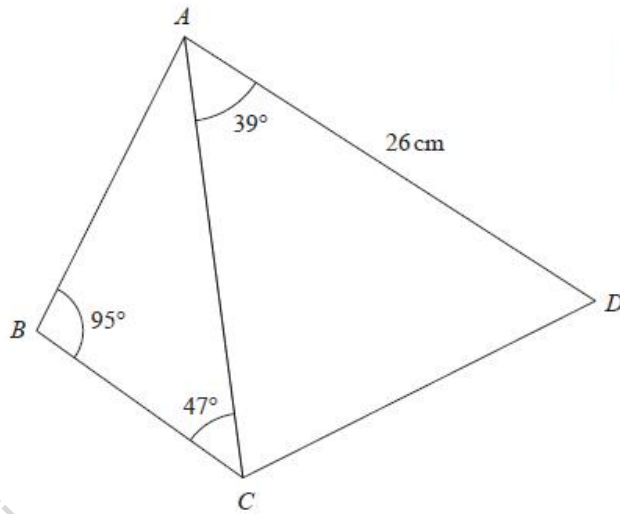


Diagram NOT accurately drawn

The area of triangle ACD is 250 cm^2

Calculate the area of the quadrilateral $ABCD$.

Show your working clearly.

Give your answer correct to 3 significant figures.

NATURAL SCIENCE SOLUTION

..... cm^2

(Total for question = 6 marks)

(Q19 4MA1/2H, June 2019)

Q20.

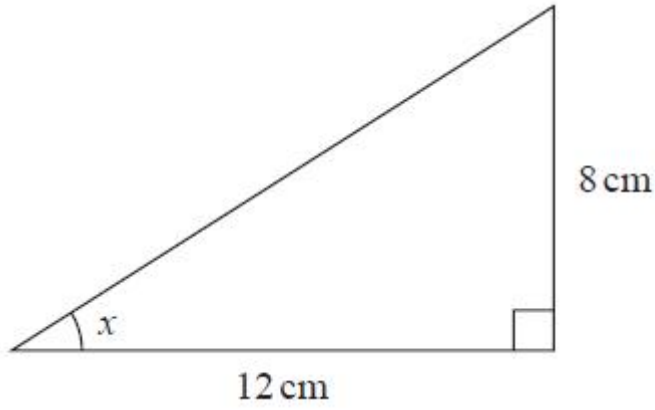


Diagram **NOT**
accurately drawn

Calculate the size of angle x .
Give your answer correct to 1 decimal place.

NATURAL SCIENCE SOLUTION

..... °

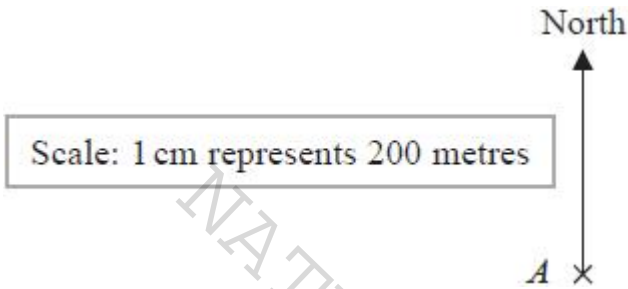
(Total for question = 3 marks)

(Q06 4MA1/2H/EAM, Specimen papers)

Topic-53: Bearing

Q1.

The scale diagram shows the position on a map of a house, A



House C is on a bearing of 110° from A
 The distance from A to C is 700 m

(a) Mark the position of C on the diagram with a cross (x)

Label your cross C

(3)

(b) Write the scale of the map in the form $1 : n$

1 :

(1)

(Total for question = 4 marks)
 (Q05 4MA1/2H, Jan 2022)

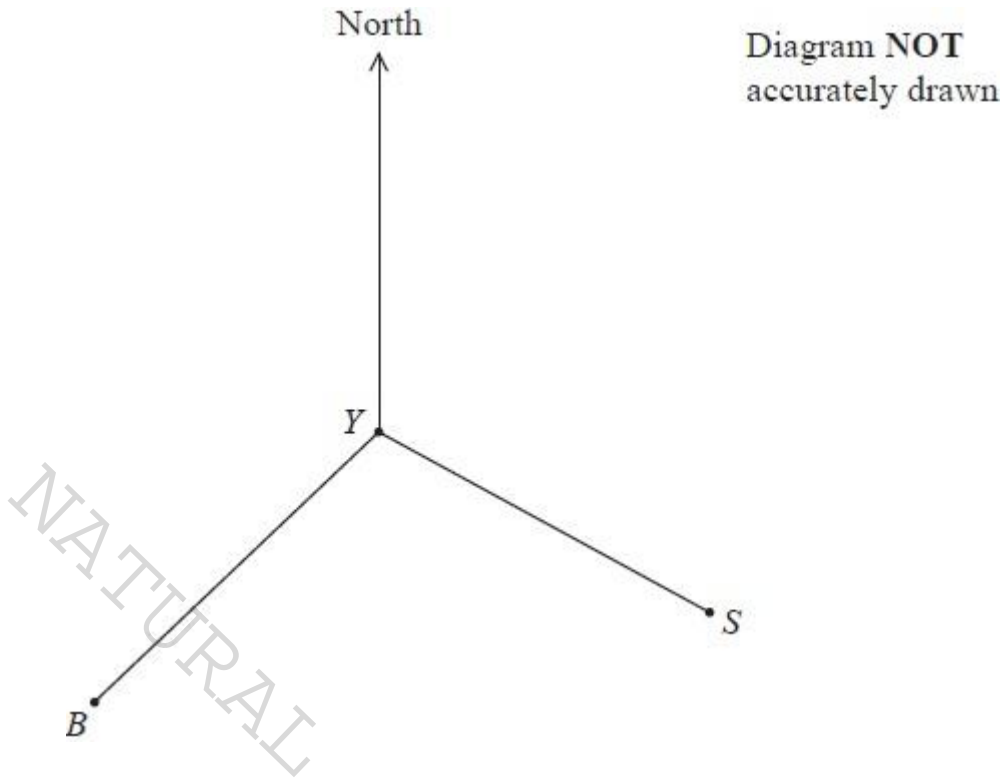
Q2.

The bearing of Paris from London is 149°
 Work out the bearing of London from Paris.

..... $^\circ$

(Total for question = 2 marks)
 (Q03 4MA1/2H, June 2021)

Q3.



The diagram shows the positions of a yacht Y , a ship S and a beacon B .
The bearing of B from Y is 228°

(a) Find the bearing of Y from B .

.....^o
(2)

The bearing of S from Y is 118°

(b) Find the size of the angle BYS .

.....^o
(1)

(c) Given also that $BY = SY$, find the bearing of S from B.

.....°

(2)

(Total for Question is 5 marks)
(Q10 4MA0/4HR, Jan 2014)

Q4.

The diagram shows the positions of three ships, A, B and C.

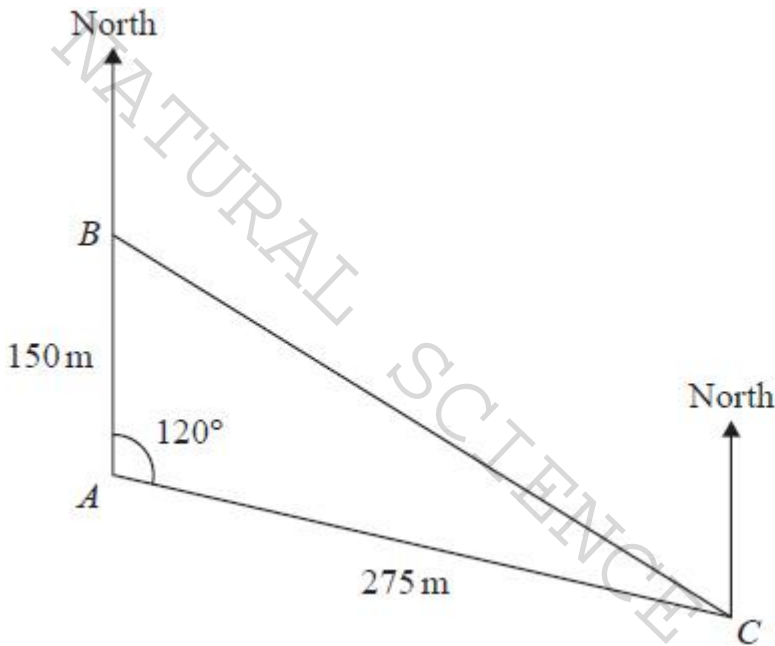


Diagram NOT
accurately drawn

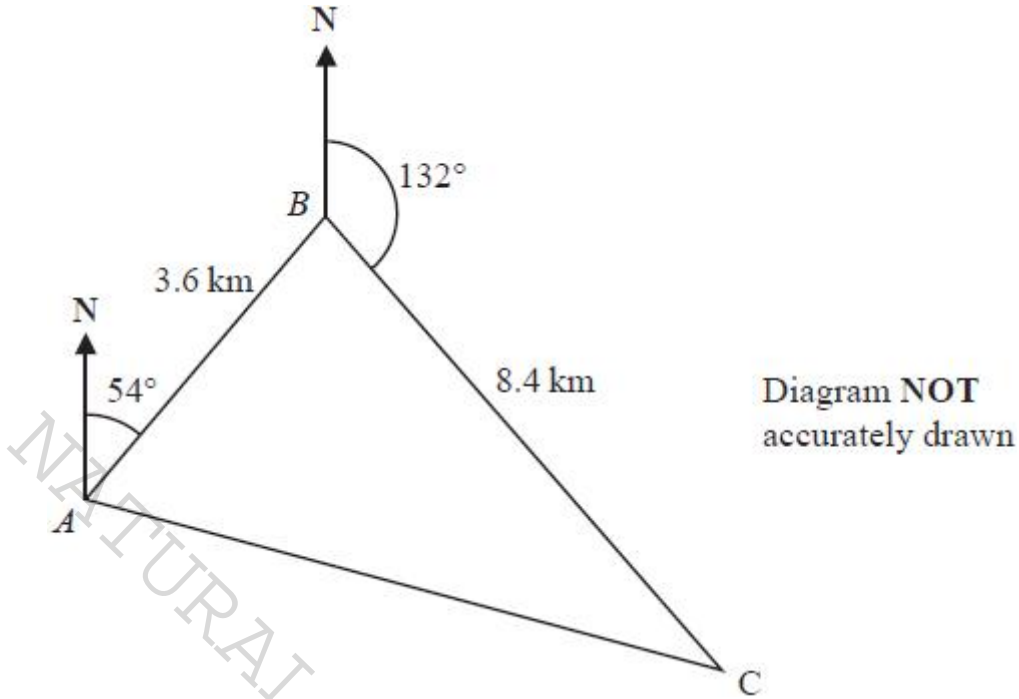
Ship B is due north of ship A.
The bearing of ship C from ship A is 120°
Calculate the bearing of ship C from ship B.
Give your answer correct to the nearest degree.

.....°

(Total for question = 5 marks)
(Q16 4MA1/1H, Jan 2021)

Q5.

The diagram shows the positions of three villages, *A*, *B* and *C*



The bearing of *B* from *A* is 054°

The bearing of *C* from *B* is 132°

Melur walks from *A* to *B*

She then walks from *B* to *C* and from *C* to *A*

Melur walks at an average speed of 6 km/h

Work out the total time Melur takes.

Give your answer in hours and minutes.

..... hours.....minutes

(Total for question = 5 marks)

(Q18 4MA1/1H, Nov 2023)

Q6.

The diagram shows two points *S* and *T*.
The bearing of *T* from *S* is 043°

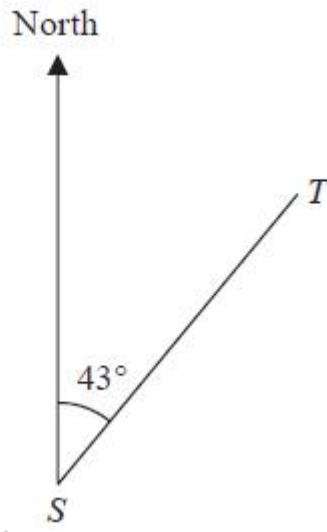


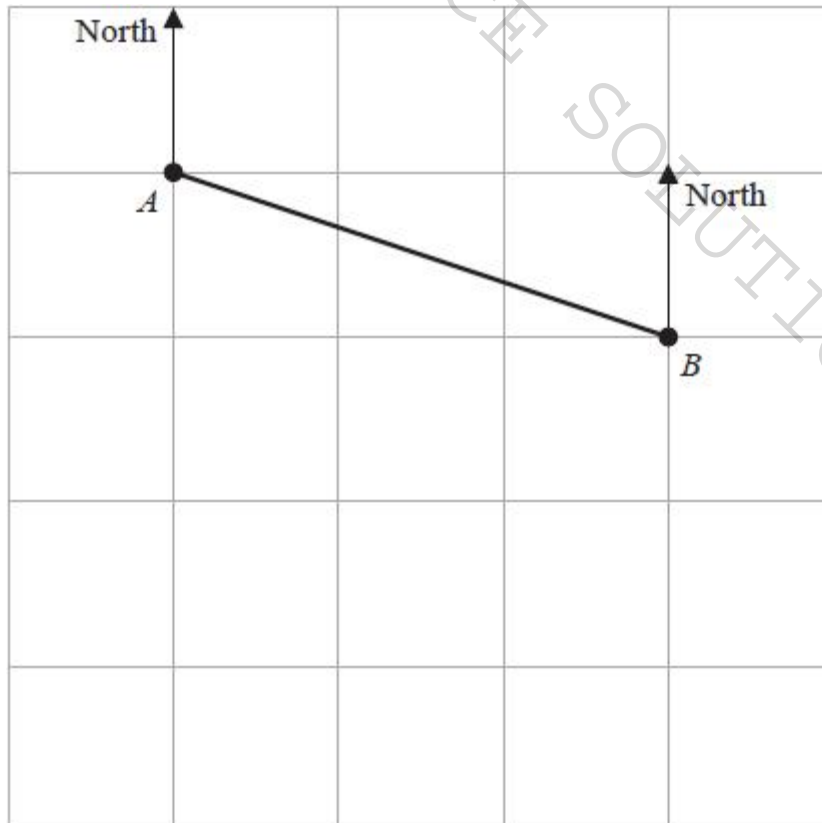
Diagram NOT
accurately drawn

Work out the bearing of *S* from *T*.

.....°

(Total for question = 2 marks)
(Q07 4MA0/4HR, June 2015)

Q7.



The diagram shows point A and point B on a map.

The point C is due south of A

The bearing of C from B is 235°

(a) Mark the point C on the map.

(2)

The bearing of a point D from B is 168°

(b) Find the bearing of B from D

.....^o

(2)

Gordon measures a length on the map as 6.3 cm correct to 1 decimal place.

(c) Write down the lower bound for this length.

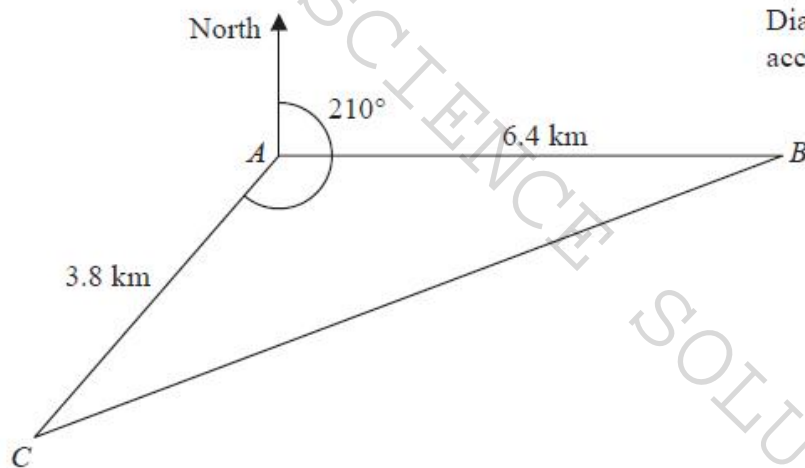
..... cm

(1)

(Total for question = 5 marks)

(Q08 4MA0/4H, Jan 2017)

Q8.



A , B and C are 3 villages.

B is 6.4 km due east of A .

C is 3.8 km from A on a bearing of 210°

Calculate the bearing of B from C .

Give your answer correct to the nearest degree.

Show your working clearly.

.....^o

(Total for Question is 6 marks)

(Q19 4MA0/4HR, June 2014)

Q9.

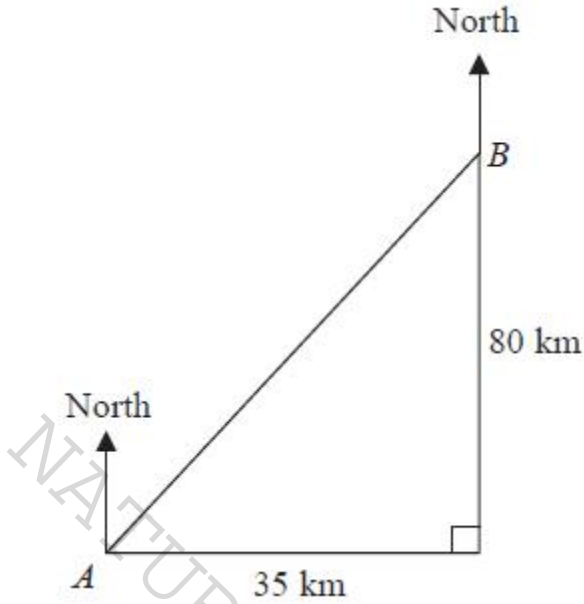


Diagram NOT accurately drawn

Town B is 35 km east and 80 km north of town A .
 Work out the bearing of A from B .
 Give your answer correct to the nearest degree.

.....°

(Total for question = 4 marks)
 (Q11 4MA0/3HR, Jan 2015)

Q10.

The diagram shows the positions of two towns, A and B .

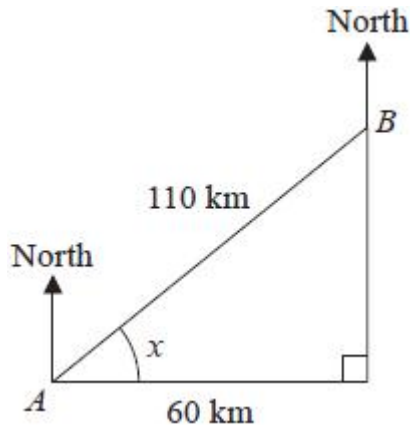


Diagram NOT accurately drawn

The distance from A to B is 110 km.

B is 60 km east of A .

(a) Work out the size of angle x .

Give your answer correct to 1 decimal place.

..... °
(3)

(b) Work out the bearing of B from A .

Give your answer correct to the nearest degree.

..... °
(2)

The distance from A to B is 110 km correct to 2 significant figures.

(c) (i) Write down the lower bound for the distance from A to B .

..... km

(ii) Write down the upper bound for the distance from A to B .

..... km
(2)

**(Total for question = 7 marks
(Q09 4MA0/4HR, Jan 2017)**

Q11.

A , B and C are three towns.

The bearing of B from A is 105°

The bearing of C from B is 230°

The distance of C from A is 180 km.

The distance of C from B is 95 km.

Calculate the distance of B from A .

Give your answer correct to 3 significant figures.

..... km

**(Total for question = 5 marks
(Q23 4MA1/1H/EAM, Specimen papers)**

Topic-54: 3D-Trigonometry

Q1.

The diagram shows a solid prism $ABCDEFGH$.

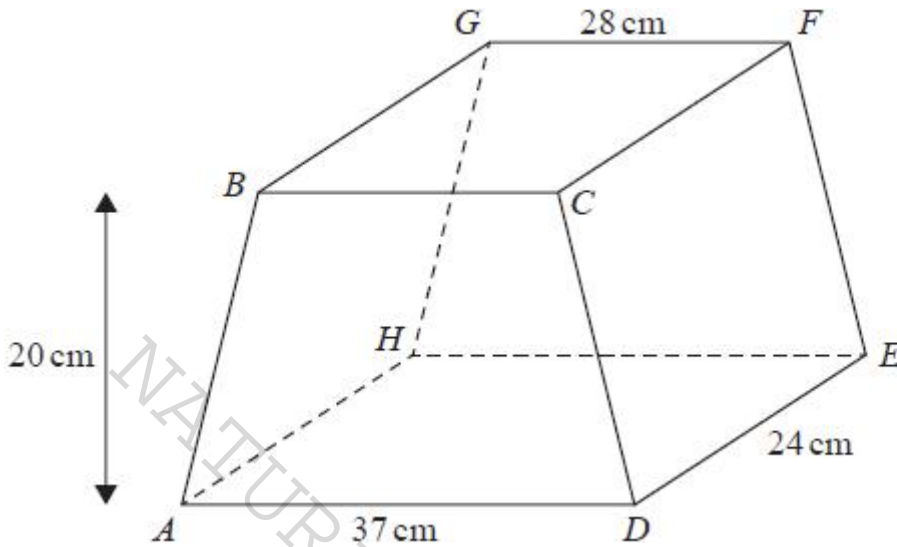


Diagram NOT accurately drawn

The trapezium $ABCD$, in which AD is parallel to BC , is a cross section of the prism.
 The base $ADEH$ of the prism is a horizontal plane.
 $ADEH$ and $BCFG$ are rectangles.
 The midpoint of BC is vertically above the midpoint of AD so that $BA = CD$.

$AD = 37 \text{ cm}$ $GF = 28 \text{ cm}$ $DE = 24 \text{ cm}$

The perpendicular distance between edges AD and BC is 20 cm .

(a) Work out the total surface area of the prism.

..... cm^2
 (4)

- (b) Calculate the size of the angle between AF and the plane $ADEH$.
Give your answer correct to one decimal place.

..... °

(3)

(Total for question = 7 marks)
(Q17 4MA1/2H, Jan 2021)

Q2.

The diagram shows cuboid $ABCDEFGH$.

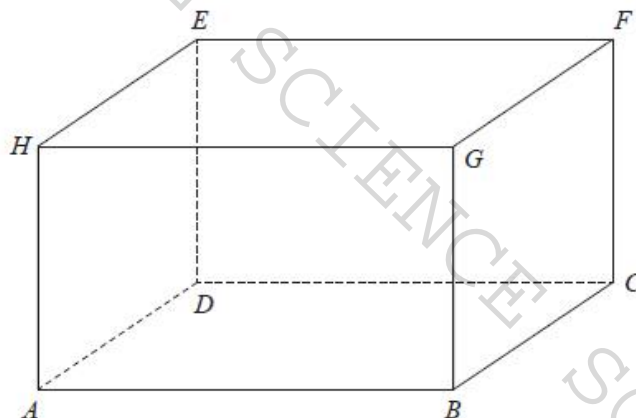


Diagram NOT
accurately drawn

For this cuboid

the length of AB : the length of BC : the length of $CF = 4 : 2 : 3$

Calculate the size of the angle between AF and the plane $ABCD$.
Give your answer correct to one decimal place.

..... °

(Total for question = 3 marks)
(Q21 4MA1/2H, June 2019)

Q3.

The diagram shows a solid prism $ABCDEFGHJIJ$

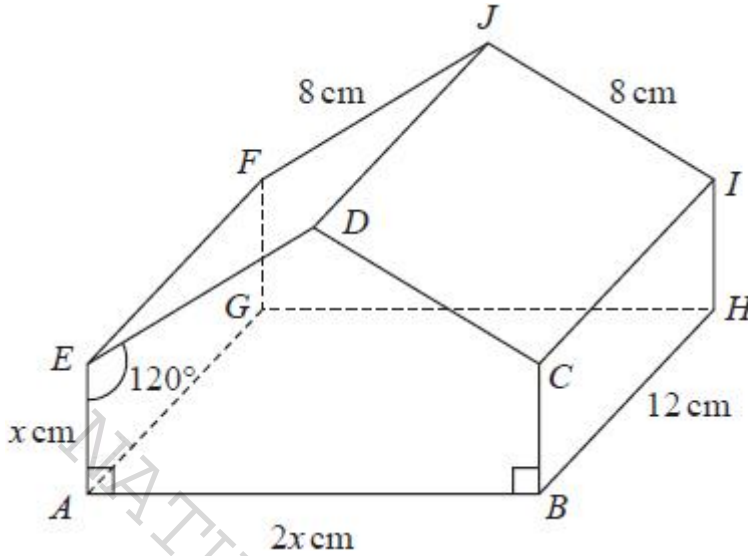


Diagram NOT accurately drawn

The prism is such that each cross section is a pentagon where

$$AE = BC = x \text{ cm} \quad AB = 2x \text{ cm} \quad ED = CD = 8 \text{ cm}$$

$$\text{angle } EAB = \text{angle } CBA = 90^\circ \quad \text{angle } AED = \text{angle } BCD = 120^\circ$$

Given that $AG = BH = EF = DJ = CI = 12 \text{ cm}$

calculate the angle that AJ makes with the base $ABHG$ of the prism.
Give your answer correct to 3 significant figures.

SCIENCE SOLUTION

..... °
(Total for question = 5 marks)
(Q23 4MA1/2H, Jan 2023)

Q4.

The diagram shows a rectangular sheet of metal $ABCD$

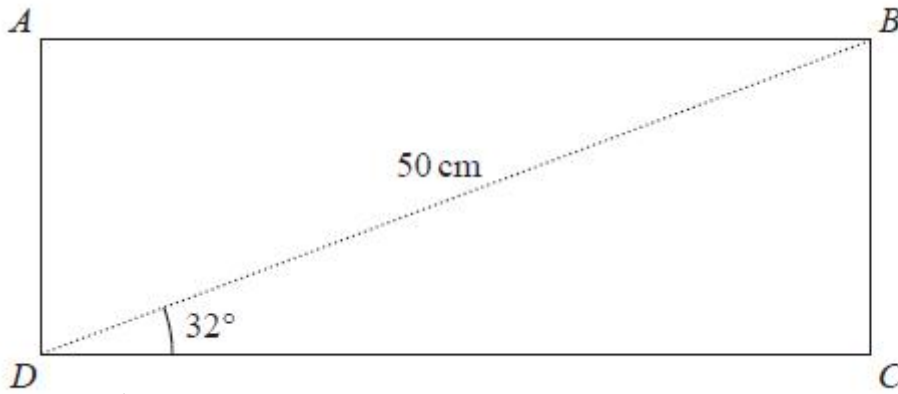


Diagram NOT accurately drawn

$BD = 50$ cm and angle $BDC = 32^\circ$

Nasser joins side AD to side BC to form a cylinder.

BC is the height of the cylinder.

DC is the circumference of the cross section of the cylinder.

Work out the volume, in cm^3 , of the cylinder.

Give your answer correct to 3 significant figures.

..... cm^3

(Total for question = 6 marks)

(QU09 4MA1/2HR, June 2023)

Q5.

Here is a cuboid $ABCDEFGH$

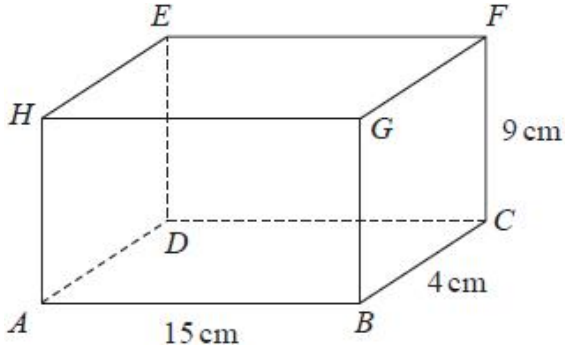


Diagram NOT accurately drawn

$AB = 15$ cm, $BC = 4$ cm, $CF = 9$ cm

(a) Work out the length of BE

Give your answer correct to 3 significant figures.

..... cm
(2)

Here is a cuboid $PQRSTUWV$

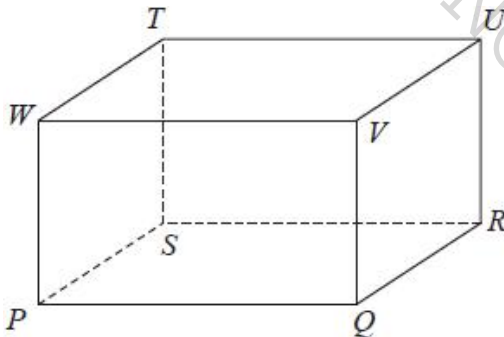


Diagram NOT accurately drawn

$PR = 42$ cm

The size of the angle between PU and the plane $PQRS$ is 30°

M is the midpoint of PR

(b) Work out the size of angle UMR

Give your answer correct to 3 significant figures.

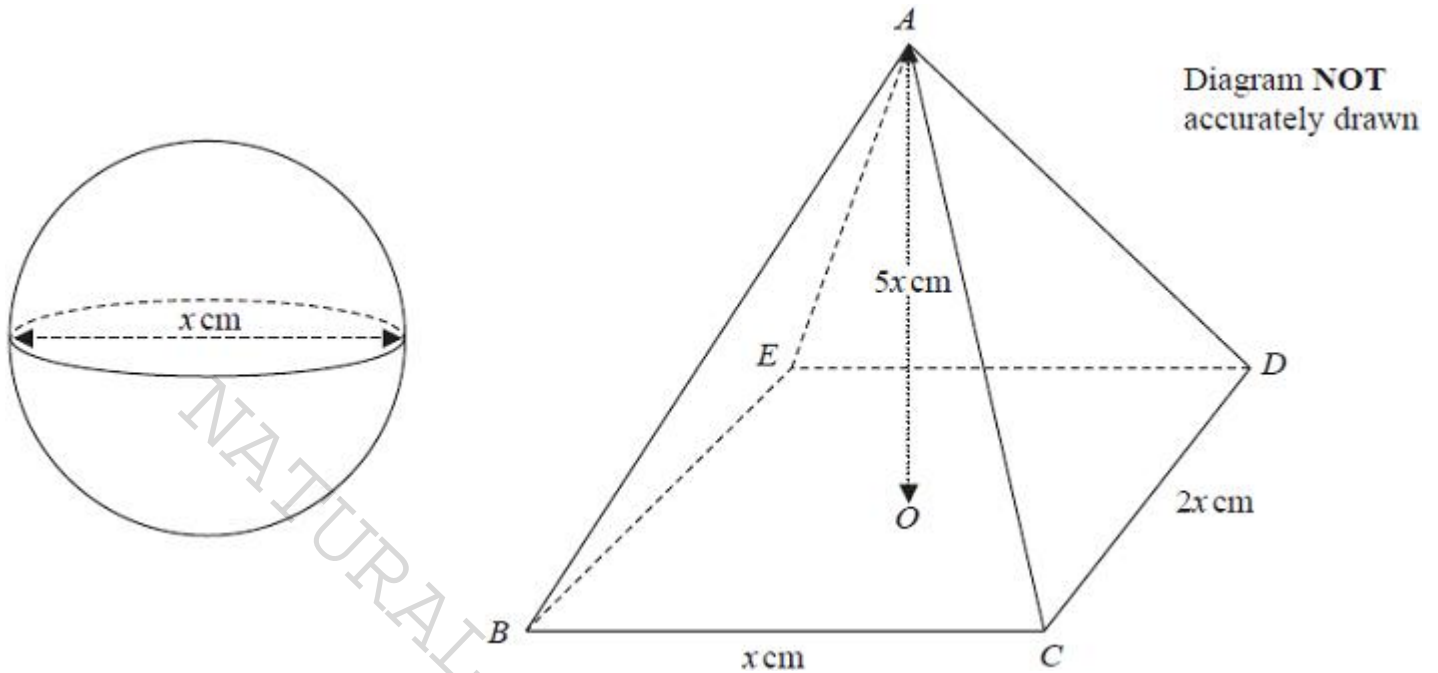
.....^o
(3)

(Total for question = 5 marks)

(QU22 4MA1/2HR, June 2023)

Q6.

The diagram shows a sphere of diameter x cm and a pyramid $ABCDE$ with a horizontal rectangular base $BCDE$.



The vertex A of the pyramid is vertically above the centre O of the base so that $AB = AC = AD = AE$.

$BC = x$ cm, $CD = 2x$ cm and $AO = 5x$ cm.

The volume of the sphere is 288π cm³

Calculate the total surface area of the pyramid.
Give your answer correct to the nearest cm²

..... cm²

(Total for question = 6 marks)

(Q22 4MA1/2H, Nov 2021)

Topic-55: 3D-Geometry

Q1.

A cylinder has diameter 14 cm and height 20 cm.
 Work out the volume of the cylinder.
 Give your answer correct to 3 significant figures.

..... cm³

(Total for question = 2 marks)
 (Q04 4MA1/2H, June 2019)

Q2.

The diagram shows a solid cylinder with radius 3 m.

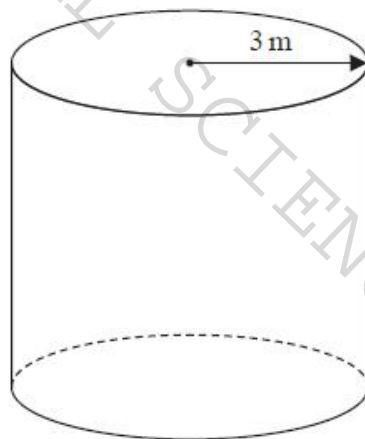


Diagram NOT
 accurately drawn

The volume of the cylinder is $72\pi \text{ m}^3$
 Calculate the **total** surface area of the cylinder.
 Give your answer correct to 3 significant figures.

..... m²

(Total for question = 5 marks)

(Q09 4MA1/2H, Nov 2020)

Q3.

The diagram shows two solids, **A** and **B**, made from two different metals.

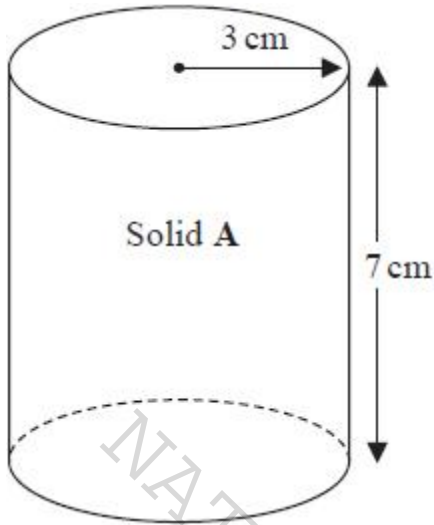
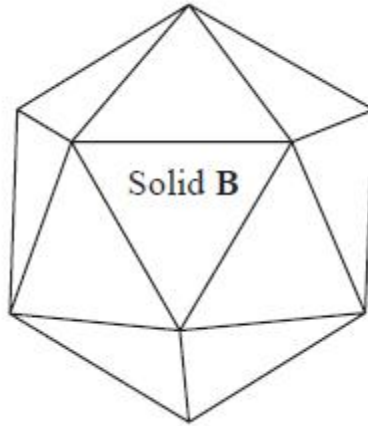


Diagram **NOT** accurately drawn



Solid **A** is in the shape of a cylinder with radius 3 cm and height 7 cm
 Solid **A** has a mass of 2000 g

Solid **B** has a mass of 3375 g
 Solid **B** has a volume of 450 cm³

All of the metal from Solid **A** and Solid **B** is melted down to make a uniform Solid **C**

Given that there is no change to mass or volume during this process

work out the density of Solid **C**

Give your answer correct to one decimal place.

..... g / cm³

(Total for question = 3 marks)

(Q10 4MA1/2HR, Jan 2023)

Q4.

Here is a frustum of a cone.

The frustum is made by removing a small cone from a similar large cone.

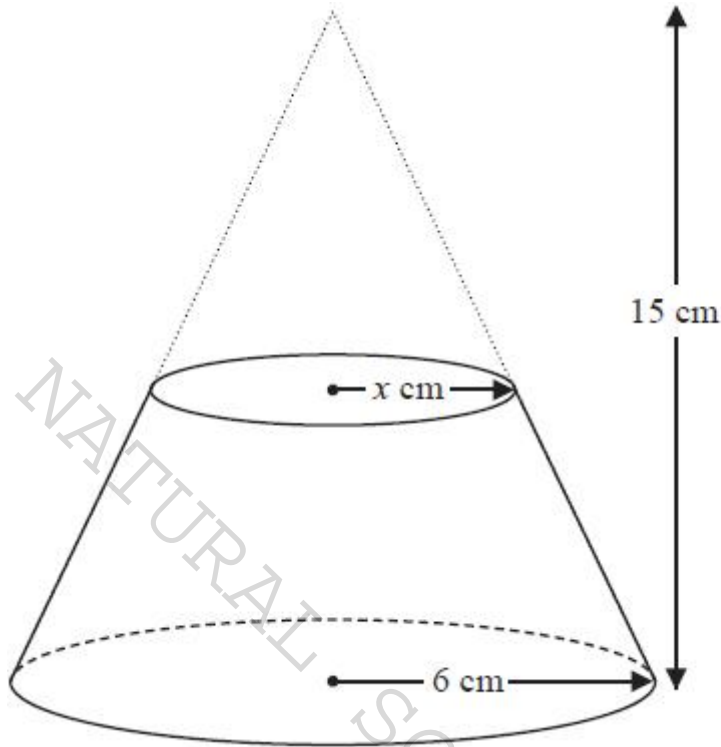


Diagram NOT accurately drawn

The height of the large cone is 15 cm.

The radius of the base of the large cone is 6 cm.

The radius of the base of the small cone is x cm.

Given that the volume of the frustum is $\frac{4212}{25}\pi \text{ cm}^3$

work out the value of x

Show clear algebraic working.

$x = \dots\dots\dots$

(Total for question = 5 marks)

(Q23 4MA1/2H, Nov 2023)

Q5.

The surface area of sphere **A** is nine times the surface area of sphere **B**

The difference between the volume of sphere **A** and the volume of sphere **B** is $117\pi \text{ cm}^3$

Find the radius of the smaller sphere.

Show your working clearly.

..... cm

(Total for question = 5 marks)
(QU24 4MA1/2HR, June 2023)

Q6.

A cone has a volume of $562.5\pi \text{ cm}^3$

The radius of the base of the cone is equal to twice the height of the cone.

Work out the curved surface area of the cone.

Give your answer correct to 3 significant figures.

..... cm^2

(Total for question = 5 marks)
(Q20 4MA1/2H/EAM, Specimen papers)

Q7.

The diagram shows a solid made from a cylinder and a hemisphere.
The cylinder and the hemisphere are both made from the same metal.

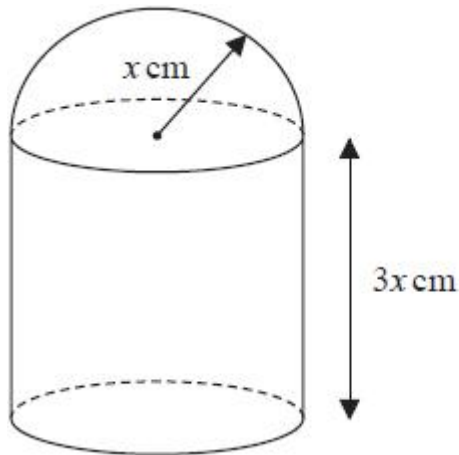


Diagram NOT accurately drawn

The plane face of the hemisphere coincides with the upper plane face of the cylinder.

The radius of the cylinder and the radius of the hemisphere are both x cm.

The height of the cylinder is $3x$ cm.

The total surface area of the solid is 81π cm²

The mass of the solid is 840 grams.

The following table gives the density of each of four metals.

Metal	Density (g/cm ³)
Aluminium	2.7
Nickel	8.9
Gold	19.3
Silver	10.5

The metal used to make the solid is one of the metals in the table.

Determine the metal used to make the solid.

Show your working clearly.

.....
(Total for question = 6 marks)
(Q21 4MA1/2HR, Jan 2022)

Q8.

Given that the surface area of a sphere is $49\pi \text{ cm}^2$
find the volume of the sphere.
Give your answer correct to the nearest integer.

..... cm^3

(Total for question = 3 marks)

(Q21 4MA1/2H, Jan 2023)

Q9.

A solid metal sphere has radius 1.5 cm.
The mass of the sphere is 109.6 grams.
Work out the density of the sphere.
Give your answer correct to 3 significant figures.

..... g / cm^3

(Total for question = 3 marks)

(QU11 4MA1/2H, June 2018)

Q10.

Here is a triangular prism.

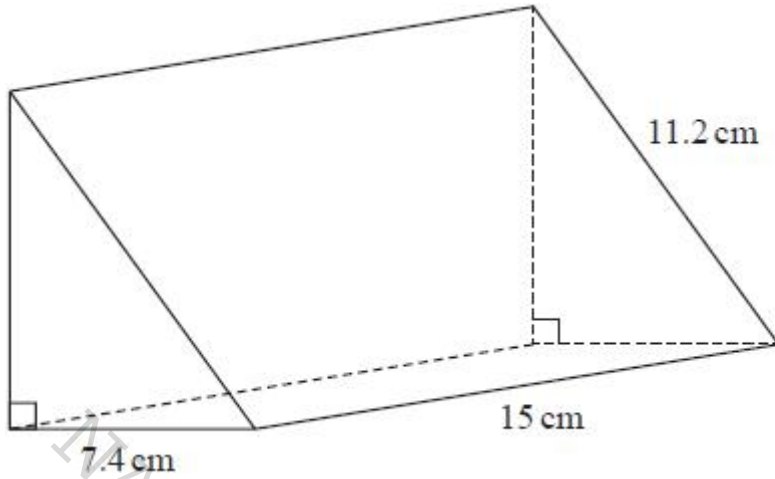


Diagram **NOT**
accurately drawn

Work out the volume of the prism.
Give your answer correct to 3 significant figures.

..... cm³

(Total for question = 5 marks)

(Q10 4MA1/2H, June 2021)

Q11.

A solid metal cube has sides of length 125 mm, correct to 3 significant figures.

The cube is melted down and the metal used to make solid spheres.

The volume of each sphere is to be 140 cm^3 , correct to the nearest 10 cm^3

Work out the greatest number of spheres that could be made from the metal.

Show your working clearly.

NATURAL SCIENCE SOLUTION

.....

(Total for question = 4 marks)

(Q17 4MA1/2H/EAM, Specimen papers)

Q12.

Here is a sector, AOB , of a circle with centre O and angle $AOB = x^\circ$

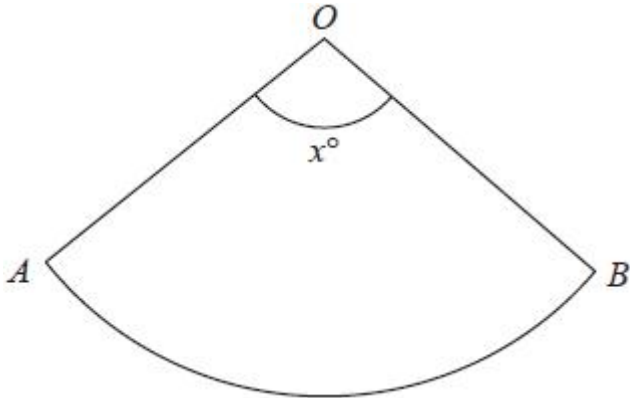


Diagram NOT accurately drawn

The sector can form the curved surface of a cone by joining OA to OB .

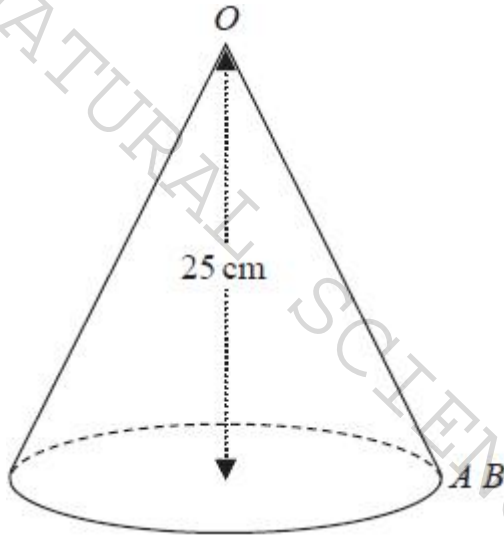


Diagram NOT accurately drawn

The height of the cone is 25 cm.
The volume of the cone is 1600 cm^3

Work out the value of x .
Give your answer correct to the nearest whole number.

NATURAL SCIENCES SOLUTION

$x = \dots\dots\dots$

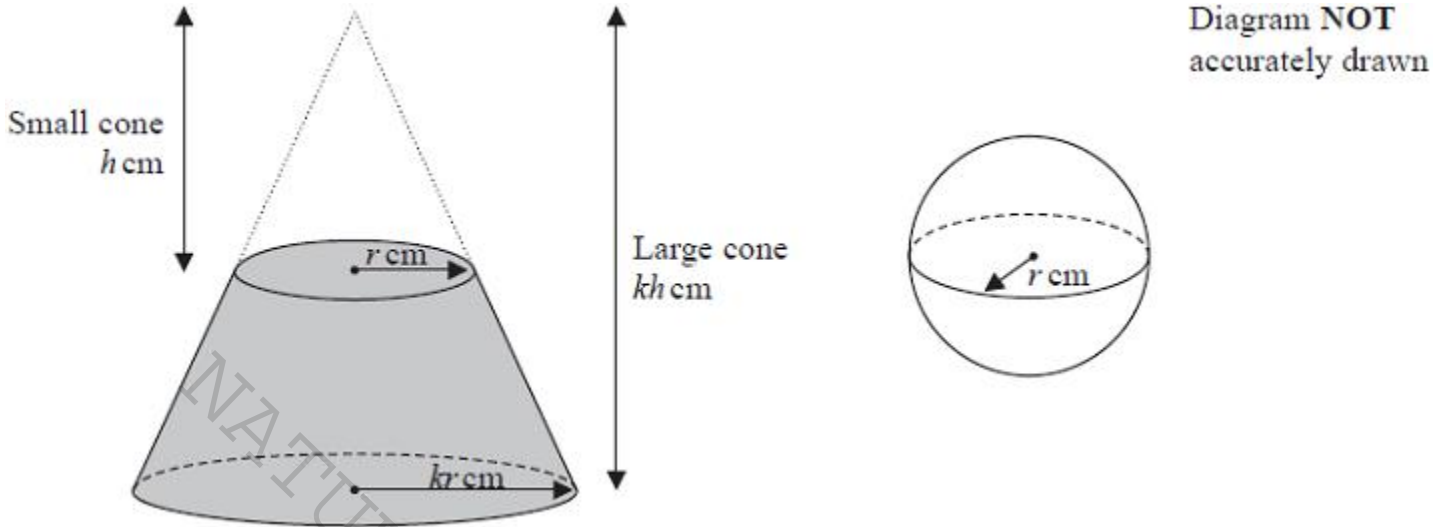
(Total for question = 6 marks)

(Q26 4MA1/2H, Jan 2020)

Q13.

The diagram shows a frustum of a cone, and a sphere.

The frustum, shown shaded in the diagram, is made by removing the small cone from the large cone. The small cone and the large cone are similar.



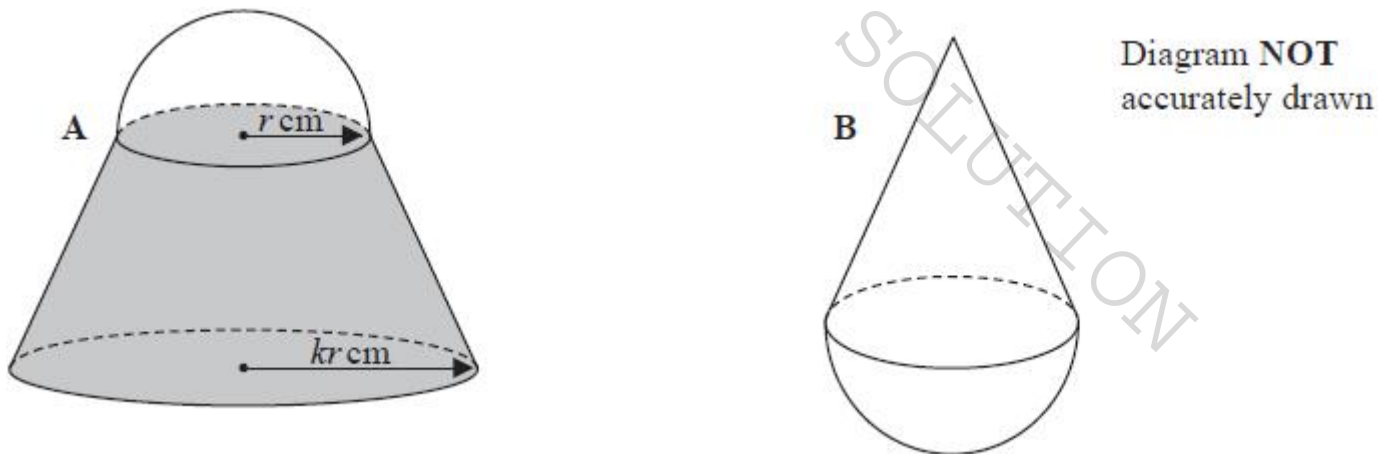
The height of the small cone is h cm and the radius of the base of the small cone is r cm. The height of the large cone is kh cm and the radius of the base of the large cone is kr cm. The radius of the sphere is r cm.

The sphere is divided into two hemispheres, each of radius r cm.

Solid **A** is formed by joining one of the hemispheres to the frustum.

The plane face of the hemisphere coincides with the upper plane face of the frustum, as shown in the diagram below.

Solid **B** is formed by joining the other hemisphere to the small cone that was removed from the large cone. The plane face of the hemisphere coincides with the plane face of the base of the small cone, as shown in the diagram below.



The volume of solid **A** is 6 times the volume of solid **B**.

Given that $k > \sqrt[3]{7}$

find an expression for h in terms of k and r

$h = \dots\dots\dots$

(Total for question = 6 marks)

(QU24 4MA1/2HR, June 2022)

Q14.

The diagram shows a cone.

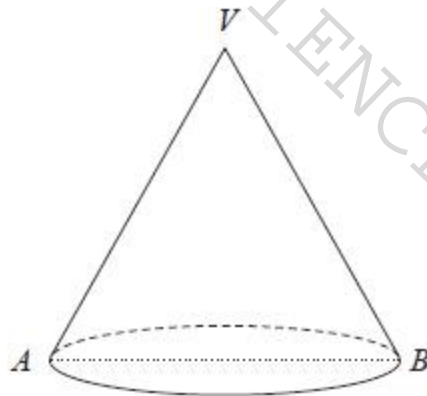


Diagram NOT accurately drawn

AB is a diameter of the cone.

V is the vertex of the cone.

Given that

the area of the base of the cone : the total surface area of the cone = 3 : 8

work out the size of angle AVB .

Give your answer correct to 1 decimal place.

(Total for question = 6 marks)

(Q22 4MA1/2H, Jan 2019)

Topic-56: Vector-1

Q1.

Here are two vectors.

$$\vec{BA} = \begin{pmatrix} -5 \\ 4 \end{pmatrix} \quad \vec{BC} = \begin{pmatrix} 9 \\ 1 \end{pmatrix}$$

Find \vec{AC} as a column vector.

NATURAL SCIENCE SOLUTION

$$\vec{AC} = \begin{pmatrix} \\ \\ \end{pmatrix}$$

(Total for question = 2 marks)

(Q16 4MA1/2HR, Jan 2023)

Q2.

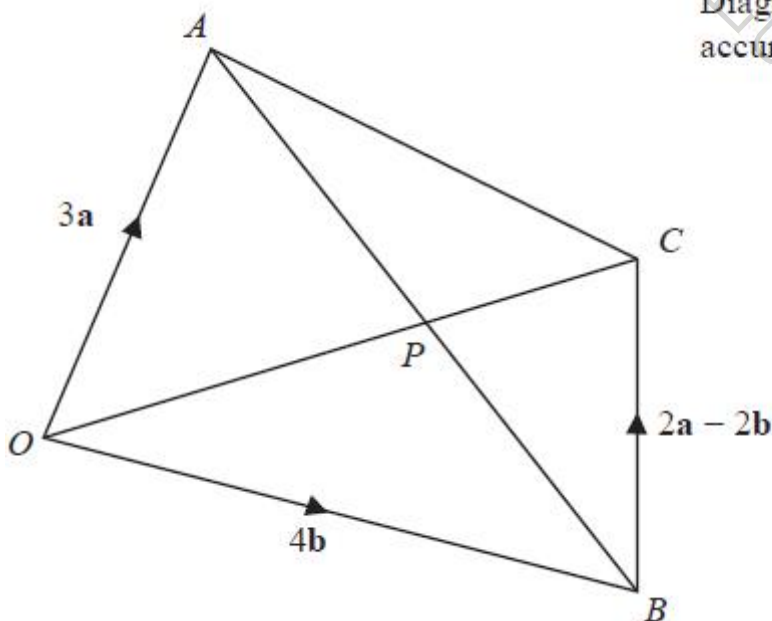


Diagram NOT accurately drawn

OACB is a quadrilateral.

$$\vec{OA} = 3\mathbf{a} \quad \vec{OB} = 4\mathbf{b} \quad \vec{BC} = 2\mathbf{a} - 2\mathbf{b}$$

- (a) (i) Find the vector \vec{OC} in terms of \mathbf{a} and \mathbf{b}
Simplify your answer.

$$\vec{OC} = \dots\dots\dots (1)$$

- (ii) Find the vector \vec{AB} in terms of \mathbf{a} and \mathbf{b}

$$\vec{AB} = \dots\dots\dots (1)$$

The point P lies on AB and on OC

- (b) Using a vector method, find the ratio $AP : PB$
Show your working clearly.

NATURAL SCIENCE SOLUTION

.....
(3)
(Total for question = 5 marks)
(Q22 4MA1/2H, Nov 2023)

Q3.

OAB is a triangle.

$$\vec{OA} = \mathbf{a} \quad \vec{OB} = \mathbf{b}$$

The point C lies on OA such that $OC : CA = 1 : 2$

The point D lies on OB such that $OD : DB = 1 : 2$

Using a vector method, prove that $ABDC$ is a trapezium.

(Total for question = 3 marks)
(Q19 4MA1/2H, Nov 2020)

Q4.

Here are two vectors.

$$\vec{AB} = \begin{pmatrix} 6 \\ -9 \end{pmatrix} \quad \vec{CB} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$$

Find the magnitude of \vec{AC}

(Total for question = 3 marks)
(Q14 4MA1/2H, June 2019)

Q5.

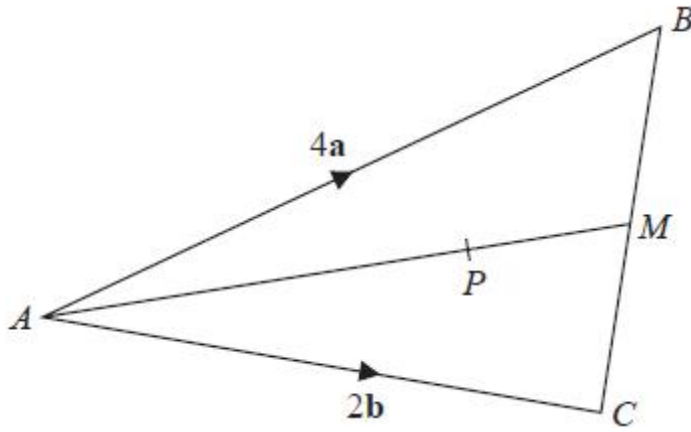


Diagram NOT
accurately drawn

ABC is a triangle.
The midpoint of BC is M .
 P is a point on AM .

$$\vec{AB} = 4\mathbf{a}$$

$$\vec{AC} = 2\mathbf{b}$$

$$\vec{AP} = \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}$$

Find the ratio $AP : PM$

.....
(Total for question = 3 marks)
(Q23 4MA1/2H, Jan 2020)

Q6.

$ABCD$ is a parallelogram and ADM is a straight line.

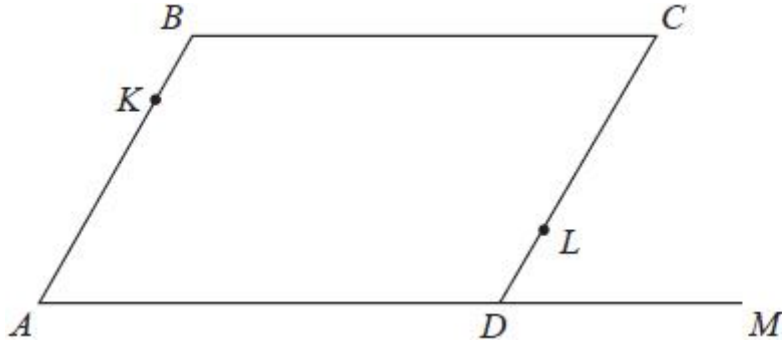


Diagram **NOT** accurately drawn

$$\vec{AB} = \mathbf{a} \quad \vec{BC} = \mathbf{b} \quad \vec{DM} = \frac{1}{2} \mathbf{b}$$

K is the point on AB such that $AK : AB = \lambda : 1$
 L is the point on CD such that $CL : CD = \mu : 1$
 KLM is a straight line.

Given that $\lambda : \mu = 1 : 2$

use a vector method to find the value of λ and the value of μ

$\lambda = \dots\dots\dots$
 $\mu = \dots\dots\dots$

(Total for question = 5 marks)

(QU25 4MA1/2HR, June 2022)

Topic-57: Vector-2

Q1.

$ABCD$ is a parallelogram.

$$\vec{BC} = \begin{pmatrix} 5 \\ -1 \end{pmatrix} \quad \vec{DC} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

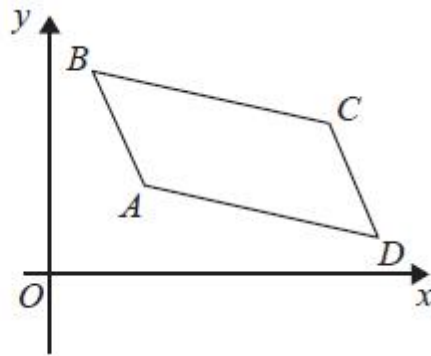


Diagram NOT accurately drawn

Find \vec{BD} as a column vector.

$\begin{pmatrix} \\ \end{pmatrix}$

(Total for question = 2 marks)
(Q17 4MA0/4H, June 2015)

Q2.

Here is the parallelogram $ABCD$.

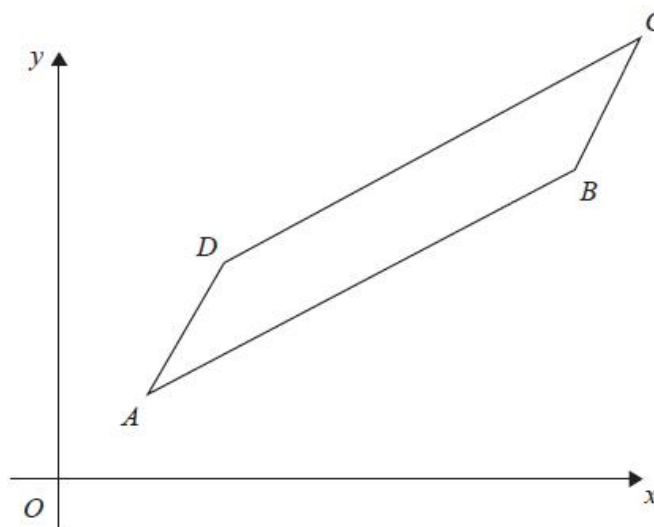


Diagram NOT accurately drawn

$$\vec{AD} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \vec{AB} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$$

(a) Find the magnitude of \vec{AD} .

Give your answer correct to 3 significant figures.

.....
(2)

The point A has coordinates $(4, 2)$

(b) Work out the coordinates of the point C .

.....
(3)

The diagonals of the parallelogram $ABCD$ cross at the point E .

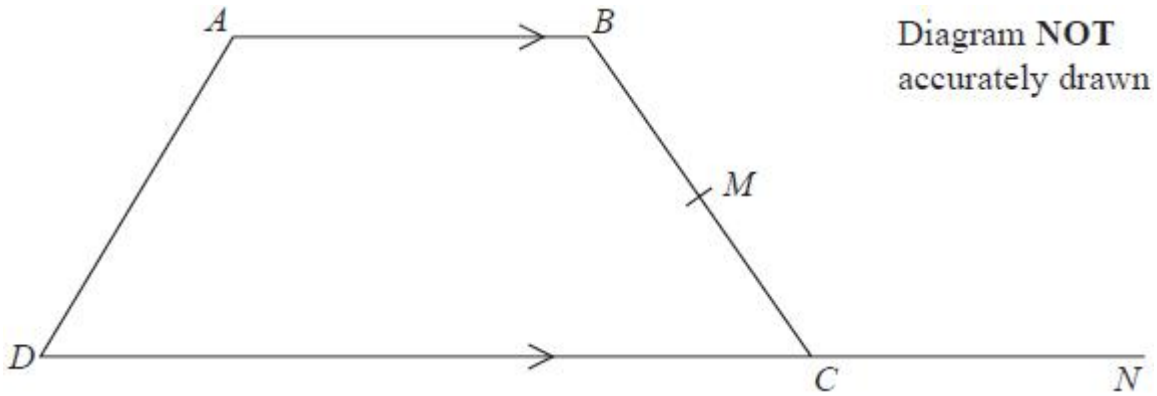
(c) Find as a column vector, \vec{OE} .

.....
(3)

(Total for question = 8 marks)

(Q15 4MA0/4HR, Jan 2015)

Q3.



AB is parallel to DC
 $DC = 2AB$
 M is the midpoint of BC

$$\vec{AD} = 2\mathbf{b}$$

$$\vec{AB} = 4\mathbf{a}$$

(a) Find \vec{BM} in terms of \mathbf{a} and \mathbf{b} .

Give your answer in its simplest form.

.....
(2)

N is the point such that DCN is a straight line and $DC : CN = 2 : 1$

(b) Show that AMN is a straight line.

(2)

(Total for question = 4 marks)
(Q19 4MA0/4HR, June 2016)

Q4.

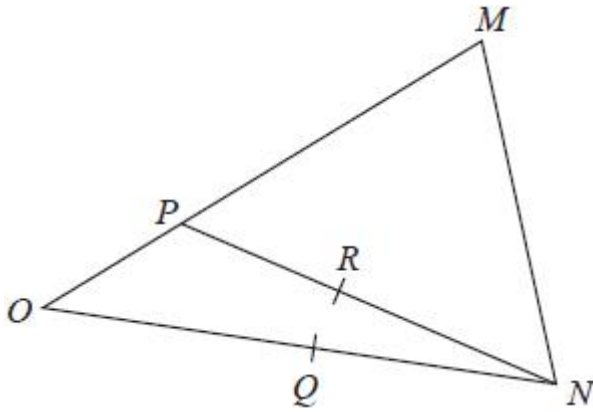


Diagram NOT accurately drawn

OMN is a triangle.

P is the point on OM such that $OP = \frac{1}{4} OM$

Q is the midpoint of ON

R is the midpoint of PN

$\vec{OP} = \mathbf{p}$ $\vec{OQ} = \mathbf{q}$

(a) Find, in terms of \mathbf{p} and \mathbf{q} ,

(i) \vec{MN}

.....

(ii) \vec{PR}

.....

(2)

(b) Use a vector method to prove that QR is parallel to OP

(2)

(Total for question = 4 marks)

(Q22 4MA0/4H, June 2016)

Q5.

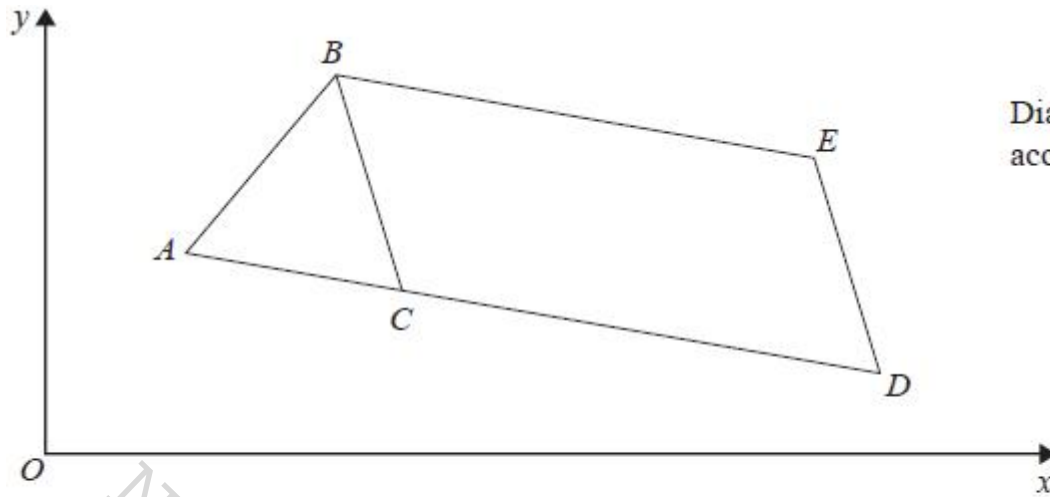


Diagram NOT
accurately drawn

$$\vec{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \text{ and } \vec{AC} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$$

(a) Find, as a column vector, \vec{BC}

.....
(2)

$BCDE$ is a parallelogram.

$$\vec{CD} = 2\vec{AC}$$

(b) Find the length of CE .

Give your answer correct to 2 decimal places.

.....
(3)

(Total for question = 5 marks)
(Q15 4MA0/4H, Jan 2017)

Q6.

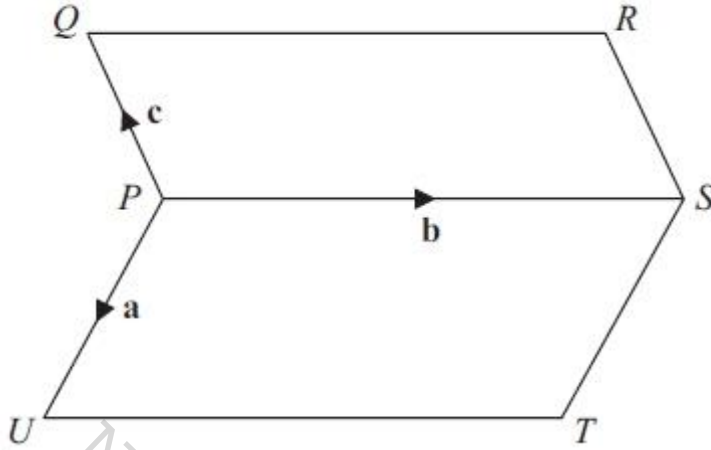


Diagram NOT accurately drawn

$PQRS$ and $PSTU$ are parallelograms.

$$\vec{PU} = \mathbf{a} \quad \vec{PS} = \mathbf{b} \quad \vec{PQ} = \mathbf{c}$$

Find, in terms of \mathbf{a} , \mathbf{b} and \mathbf{c}

(i) \vec{TQ}

(ii) \vec{PX} where X is the midpoint of TQ .
Simplify your answer as much as possible.

(Total for question = 3 marks)
(Q21 4MA0/4H, June 2013)

Q7.

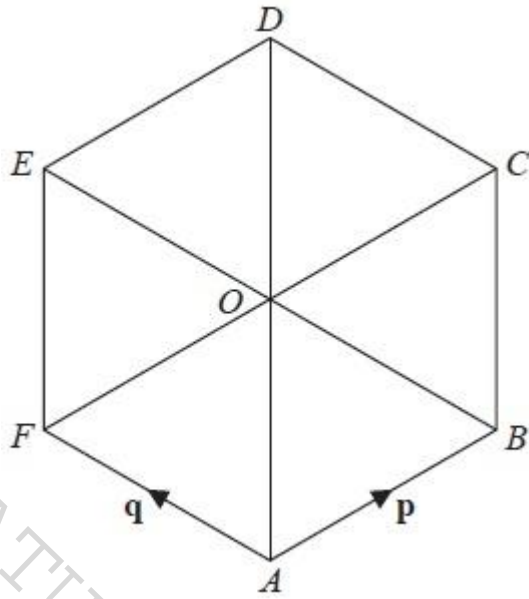


Diagram NOT accurately drawn

$ABCDEF$ is a regular hexagon, centre O .

$\vec{AB} = \mathbf{p}$ and $\vec{AF} = \mathbf{q}$

(a) Express in terms of \mathbf{p} and \mathbf{q}

(i) \vec{AO}

.....

(ii) \vec{AD}

.....

(iii) \vec{AC}

.....

(3)

(b) Given that $\mathbf{p} = \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix}$ centimetres, find the length of a side of the hexagon.

..... cm

(2)

(Total for Question is 5 marks)
(Q18 4MA0/4HR, Jan 2014)

Q8.

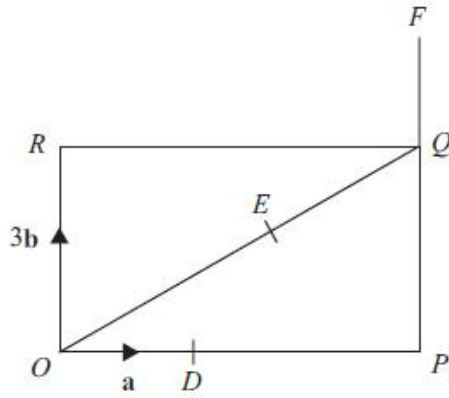


Diagram NOT accurately drawn

$OPQR$ is a rectangle.

D is the point on OP such that $OD = \frac{1}{3}OP$.

E is the point on OQ such that $OE = \frac{2}{3}OQ$.

PQF is the straight line such that $QF = \frac{1}{3}PQ$.

$\vec{OD} = \mathbf{a}$ $\vec{OR} = 3\mathbf{b}$

(a) Find, in terms of \mathbf{a} and \mathbf{b} ,

(i) \vec{OQ}

.....

(ii) \vec{OE}

.....

(iii) \vec{DE}

.....

(3)

(b) Use a vector method to prove that DEF is a straight line.

(2)

(Total for question is 5 marks)

(Q22 4MA0/4H, Jan 2012)

Q9.

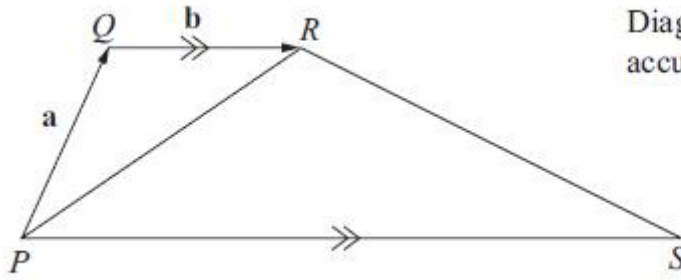


Diagram NOT accurately drawn

The diagram shows a trapezium $PQRS$.
 PS is parallel to QR . $PS = 4QR$.

$\vec{PQ} = \mathbf{a}$ $\vec{QR} = \mathbf{b}$

(a) Find, in terms of \mathbf{a} and/or \mathbf{b} ,

(i) \vec{PS}

.....

(ii) \vec{PR}

.....

(iii) \vec{RS}

.....

(3)

The point T lies on the line PR such that $PT : TR = 4 : 1$

(b) Given that $\vec{TS} = k\vec{QT}$, find the value of k .

$k =$

(3)

(Total for question = 6 marks)

(Q24 4MA0/4H, June 2011)

Q10.

$$\mathbf{a} = \begin{pmatrix} 5 \\ -2 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} 1 \\ 7 \end{pmatrix} \quad \mathbf{c} = \begin{pmatrix} -7 \\ 0 \end{pmatrix}$$

(a) Write, as a column vector, $2\mathbf{a}$

$\begin{pmatrix} \\ \end{pmatrix}$

(1)

(b) Write, as a column vector, $3\mathbf{b} - \mathbf{c}$

$\begin{pmatrix} \\ \end{pmatrix}$

(2)

(c) Work out the magnitude of \mathbf{a}
Give your answer as a surd.

(2)

(Total for question = 5 marks)

(Q19 4MA0/4H, Jan 2015)

Q11.

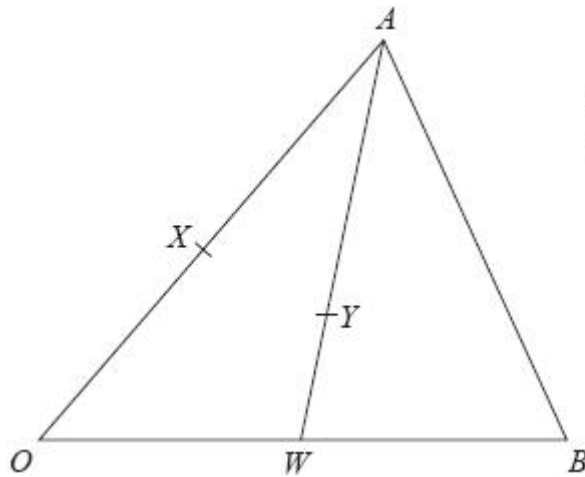


Diagram NOT accurately drawn

OAB is a triangle.

X is the midpoint of OA and W is the midpoint of OB .

Y is the point on AW such that $AY : YW = 2 : 1$

$\vec{OX} = 3\mathbf{a}$ and $\vec{OW} = 3\mathbf{b}$

(a) Express in terms of \mathbf{a} and \mathbf{b}

(i) \vec{AW}

.....

(ii) \vec{AY}

.....

(iii) \vec{XB}

.....

(3)

(b) Show by a vector method that XYB is a straight line.

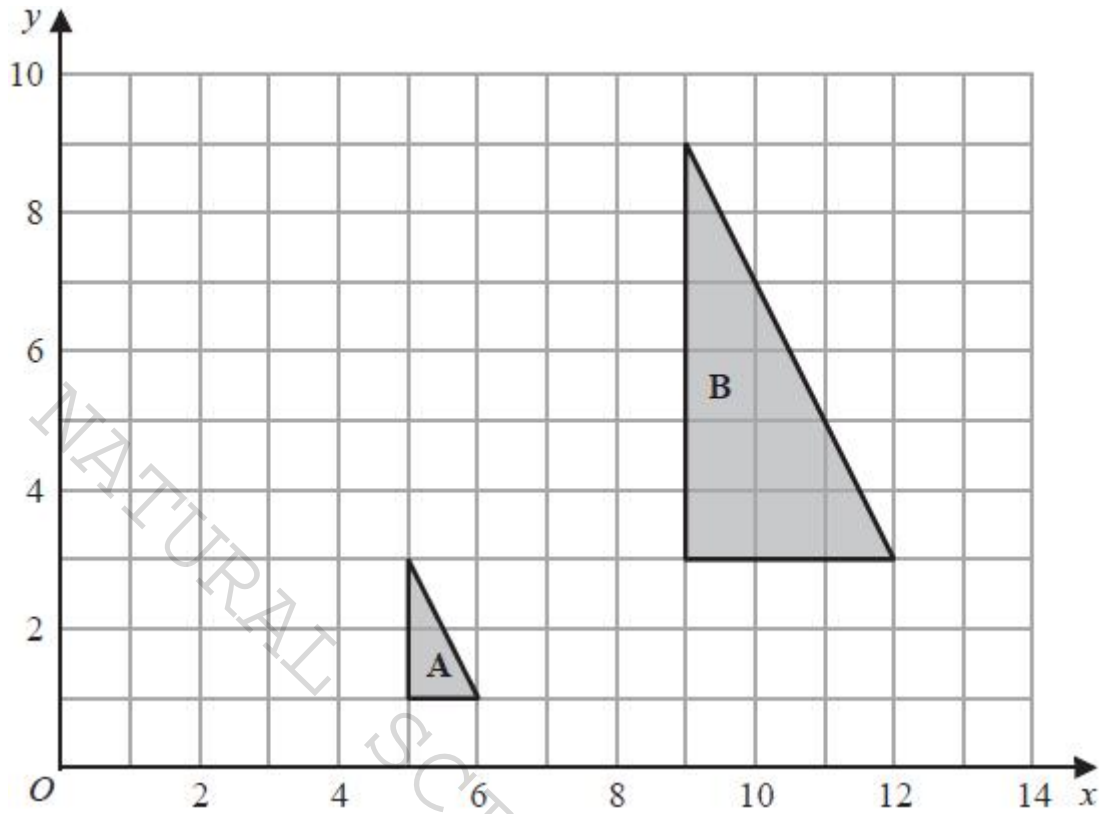
(2)

(Total for question = 5 marks)

(Q21 4MA0/4HR, June 2017)

Topic-58: Transformation-1

Q1.



(a) Describe fully the single transformation that maps triangle **A** onto triangle **B**

.....

(3)

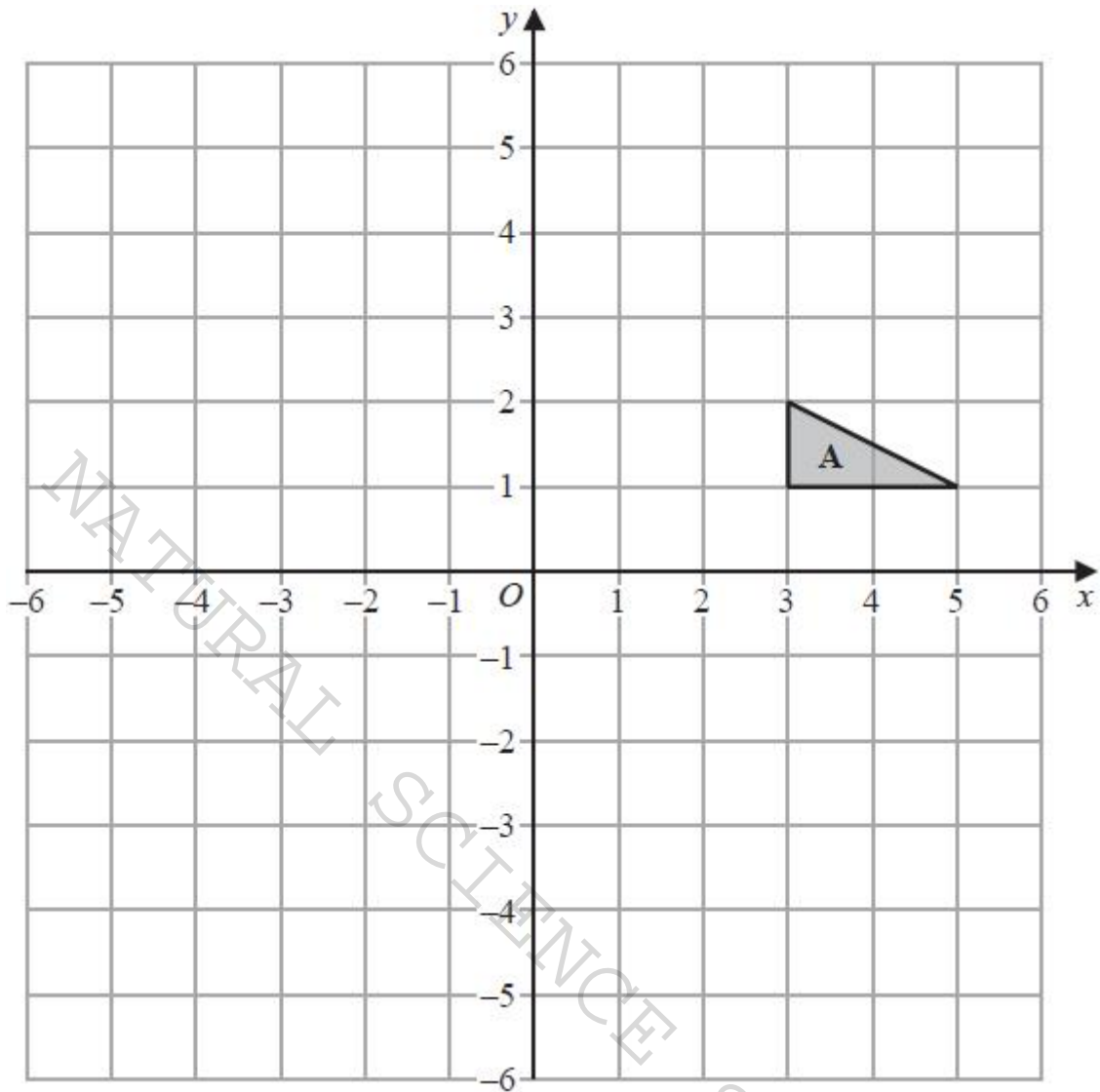
(b) On the grid above, translate triangle **A** by the vector $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$
 Label your triangle **C**

(1)

(Total for question = 4 marks)

(QU01 4MA1/2HR, June 2022)

Q2.



- (a) On the grid, rotate triangle **A** 180° about $(1, -1)$
Label the new triangle **B**

(2)

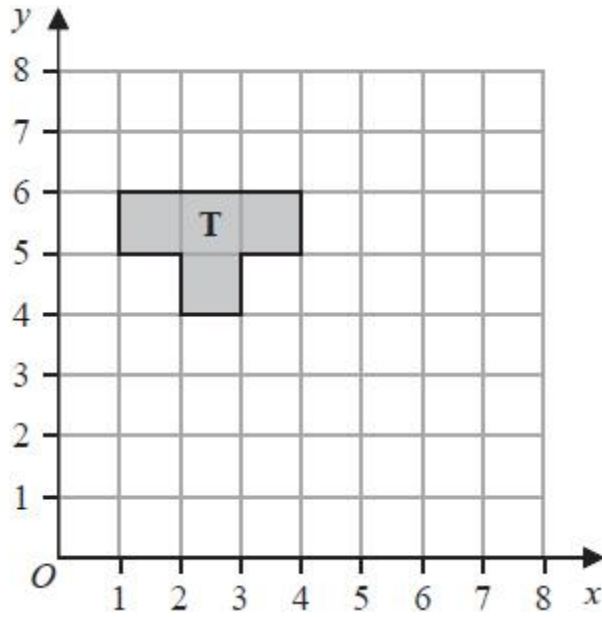
- (b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} -7 \\ 3 \end{pmatrix}$
Label the new triangle **C**

(1)

(Total for question = 3 marks)

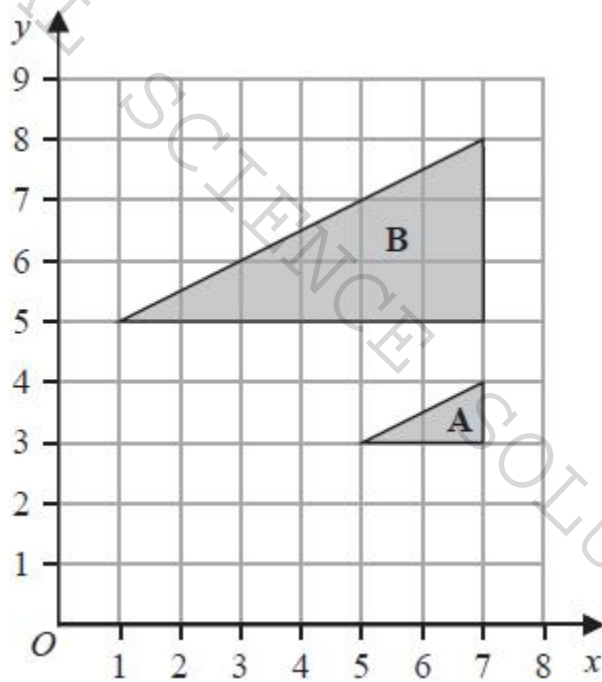
(Q02 4MA1/2HR, Jan 2023)

Q3.



(a) Reflect shape **T** in the line $y = x$

(2)



(b) Describe fully the single transformation that maps triangle **A** onto triangle **B**

.....

(3)

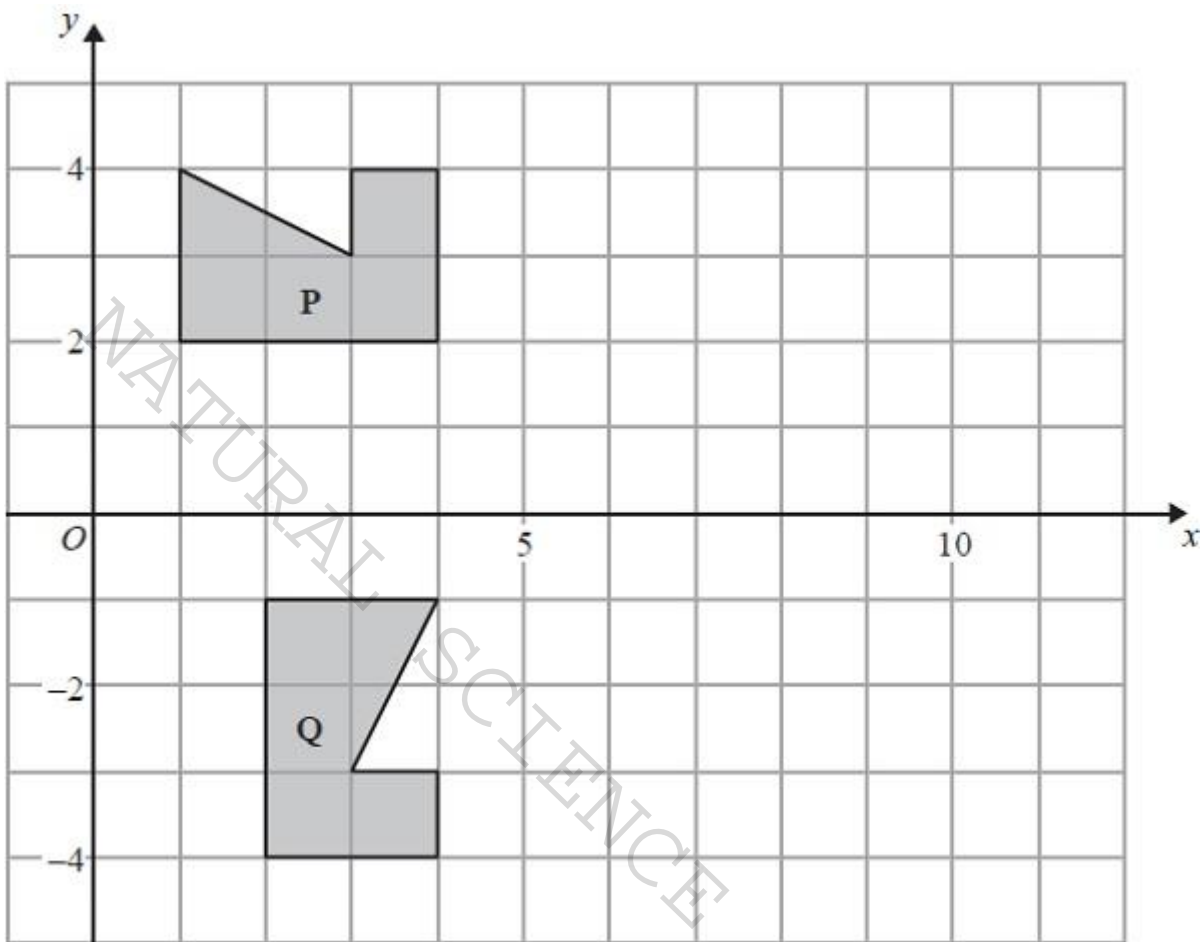
(Total for question = 5 marks)

(Q03 4MA1/2H, Nov 2023)

Topic-59: Transformation-2

Q1.

The diagram shows a shape **P**, and a shape **Q**.



Describe fully the single transformation which maps shape **P** onto shape **Q**.

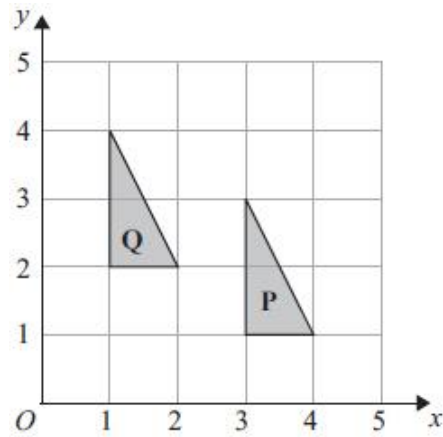
.....

.....

(Total for Question is 3 marks)

(Q05 4MA0/4H, Jan 2014)

Q2.



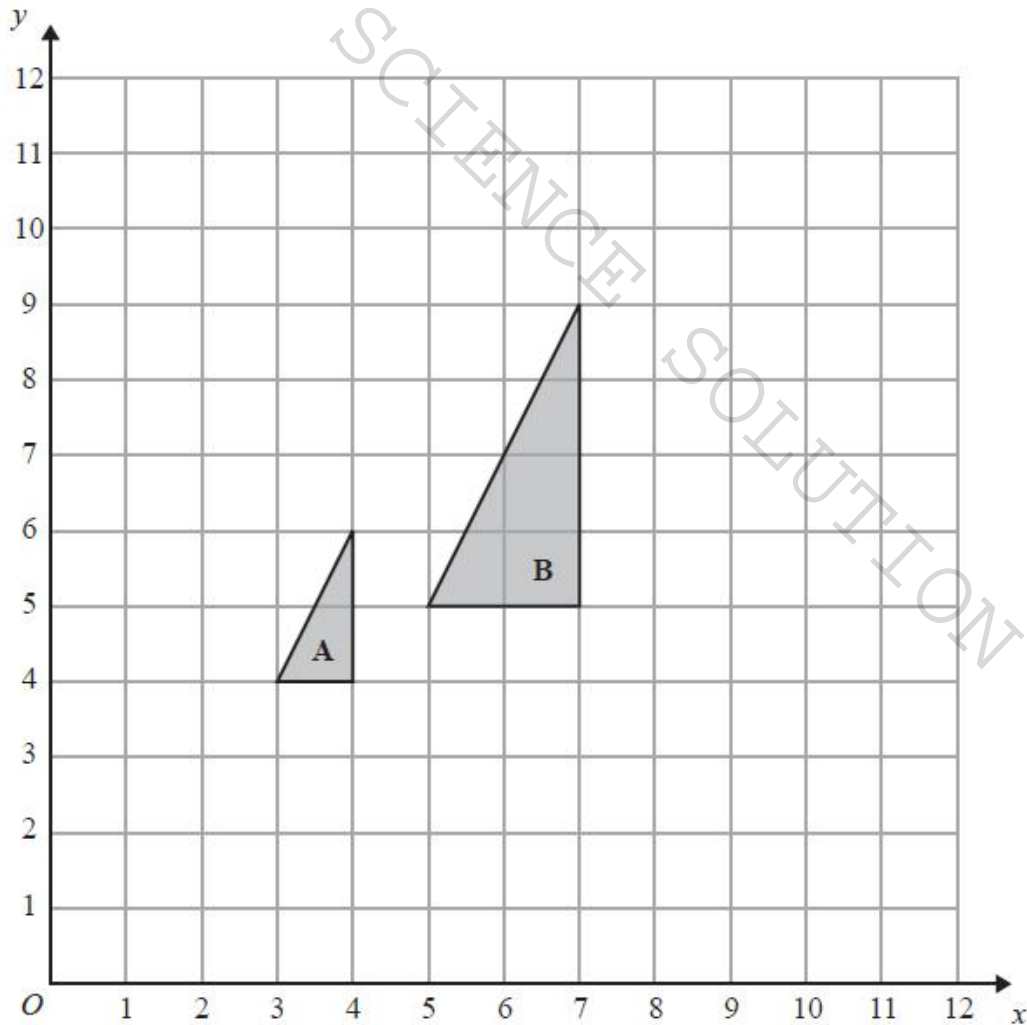
Describe fully the single transformation which maps triangle **P** onto triangle **Q**.

.....

.....

(Total for question = 2 marks)
(Q02 4MA0/4HR, June 2013)

Q3.



(a) Describe fully the single transformation that maps triangle **A** onto triangle **B**.

.....

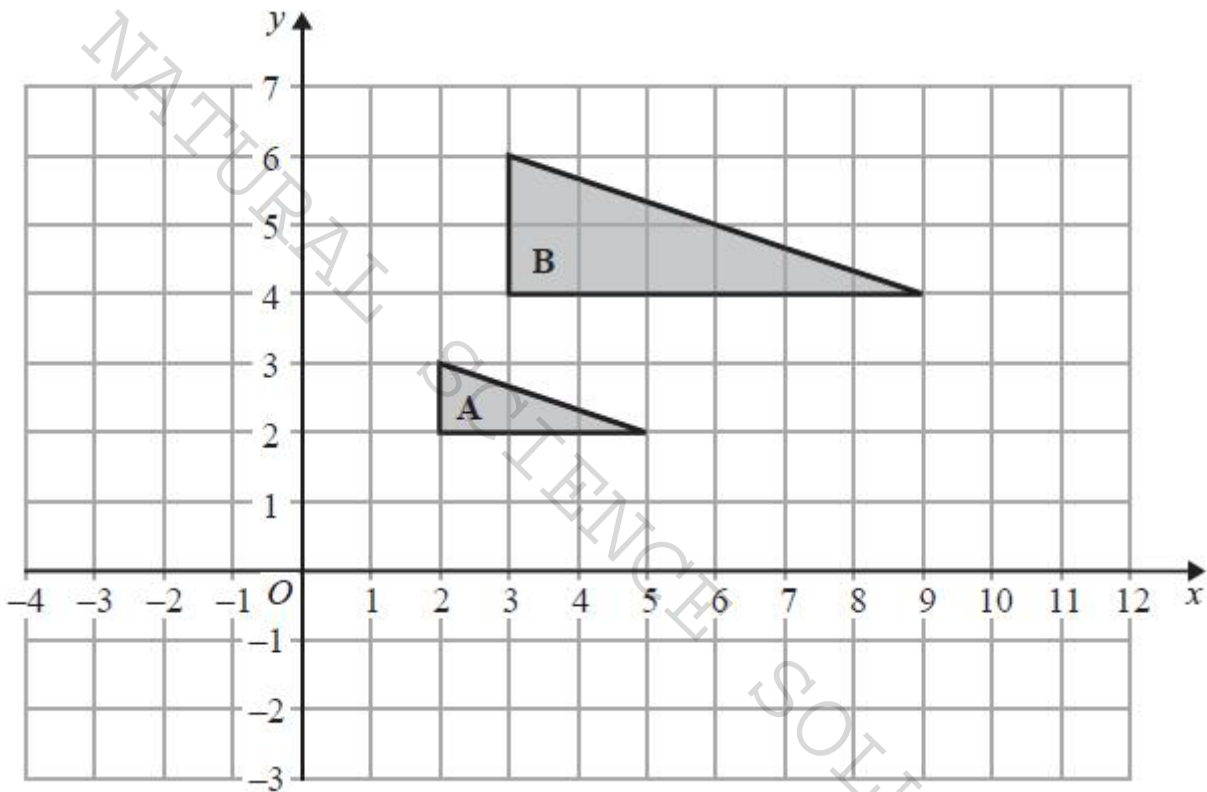
(3)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$

(1)

(Total for question = 4 marks)
 (Q05 4MA0/4H, Jan 2015)

Q4.



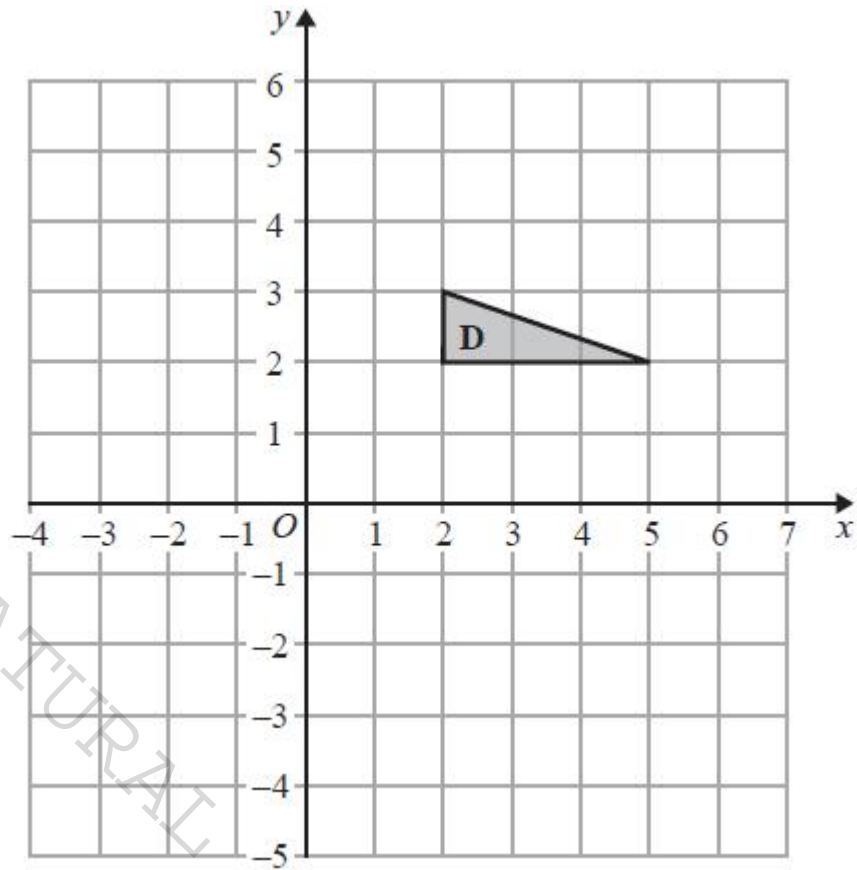
(a) Describe fully the single transformation that maps triangle **A** onto triangle **B**.

.....

(3)

(b) On the grid, translate triangle **A** by the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$
 Label the new shape **C**.

(1)



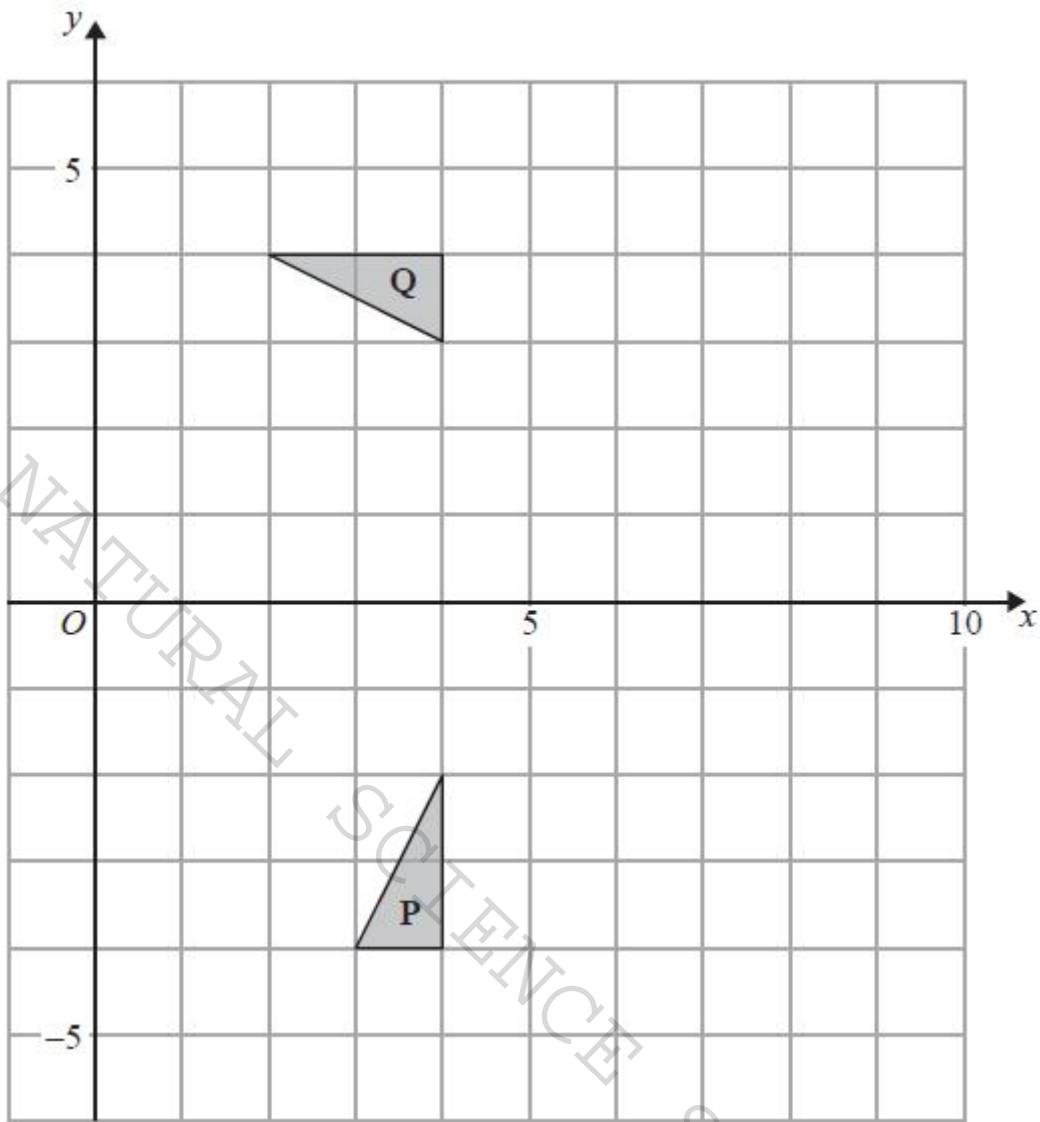
(c) On the grid, rotate triangle **D** 90° anticlockwise with centre (3, 1)

(2)

(Total for question = 6 marks)

(Q08 4MA0/4H, June 2016)

Q5.



(a) Describe fully the single transformation that maps triangle **P** onto triangle **Q**.

.....

(3)

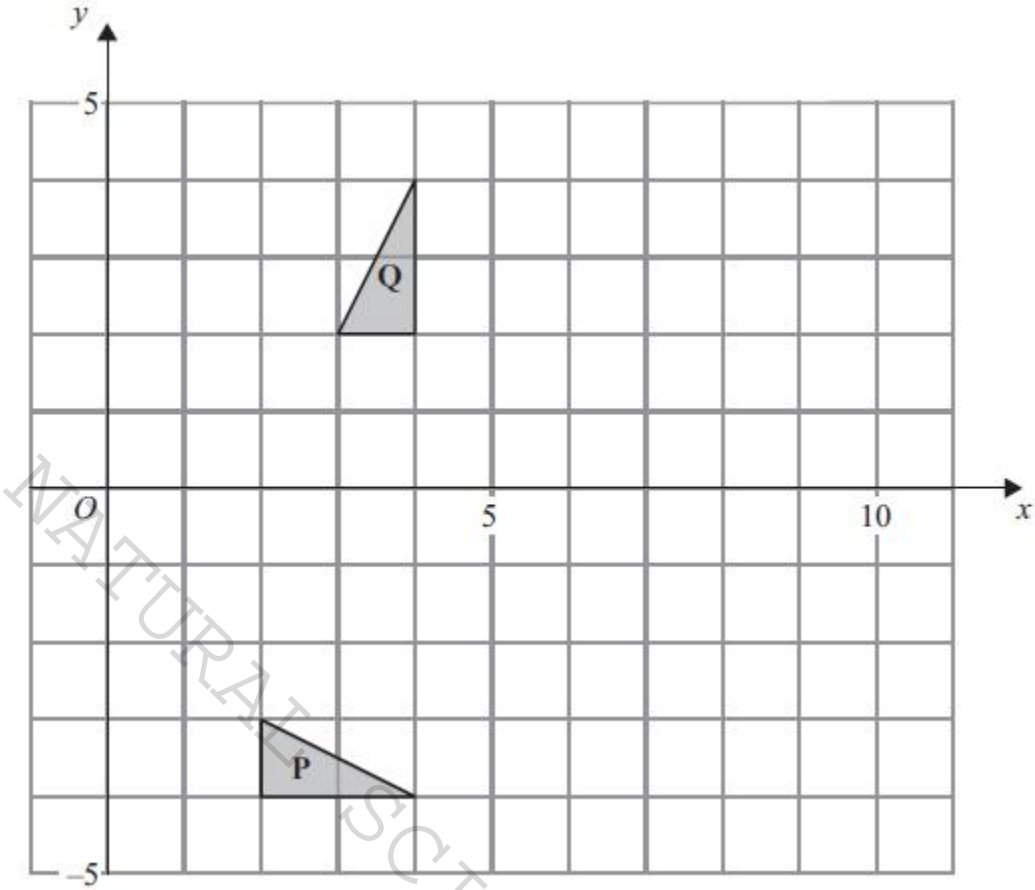
(b) On the grid, translate triangle **P** 3 squares to the right and 5 squares up. Label the new triangle **R**.

(1)

(Total for Question is 4 marks)

(Q04 4MA0/4HR, June 2014)

Q6.



(a) Describe fully the single transformation which maps triangle **P** onto triangle **Q**.

.....

.....

(3)

(b) On the grid, translate triangle **Q** by the vector $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$.
Label the new triangle **R**.

(1)

(c) Describe fully the single transformation which maps triangle **P** onto triangle **R**.

.....

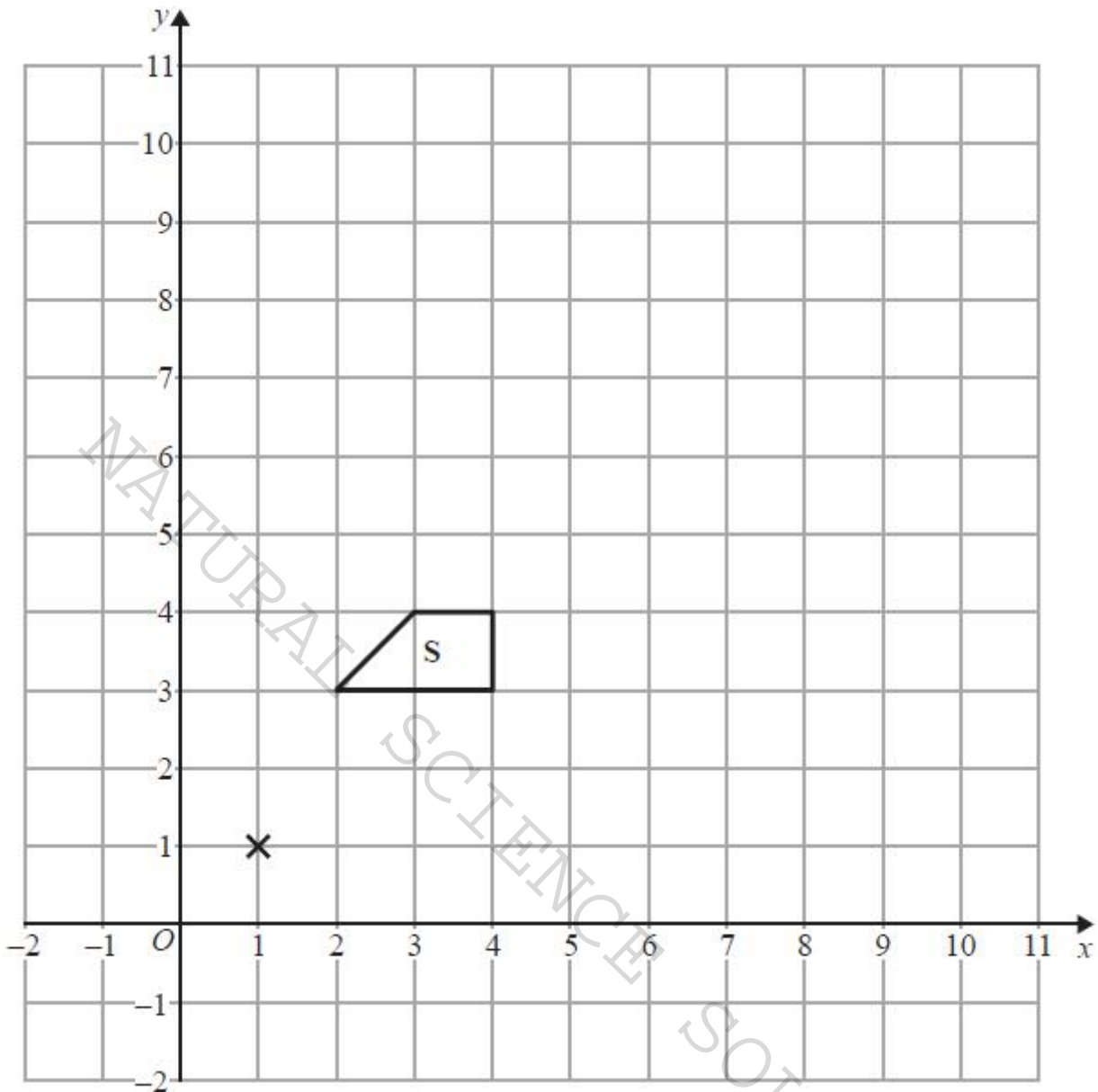
.....

(2)

(Total for question is 6 marks)

(Q12 4MA0/4H, Jan 2012)

Q7.



(a) Enlarge shape **S**, by scale factor 2, centre (1,1).

Label the new shape **T**.

(2)

(b) Describe fully the single transformation that maps shape **T** onto shape **S**.

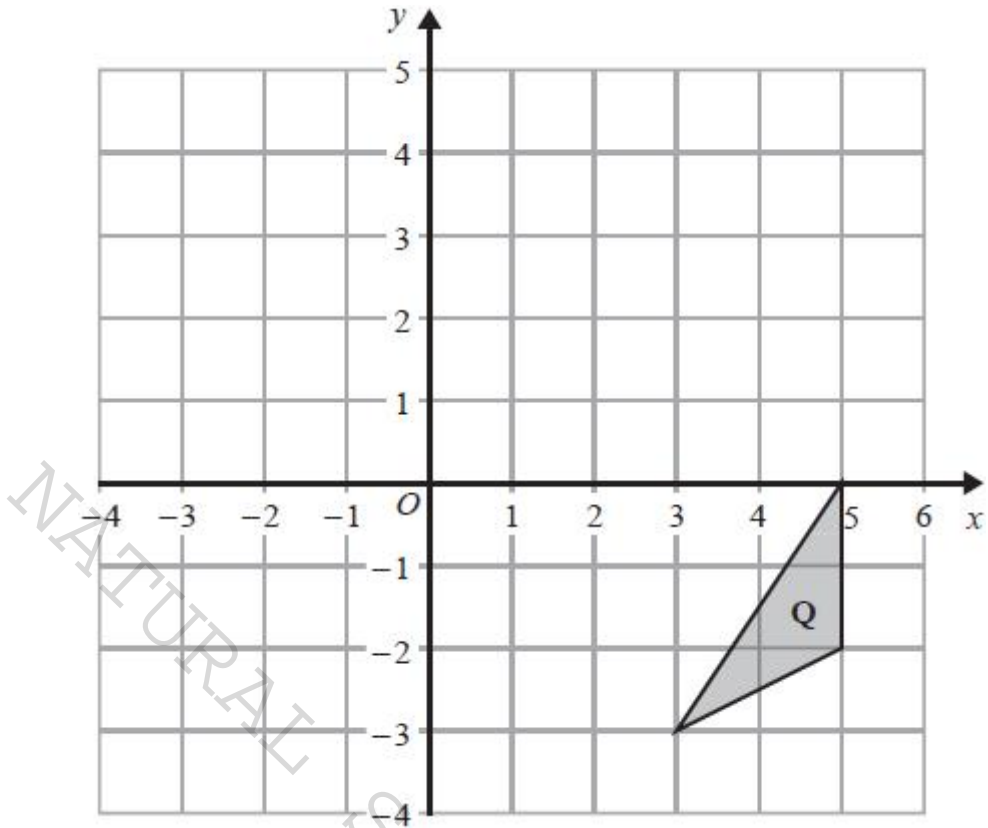
.....

(1)

(Total for question = 3 marks)

(Q01 4MA0/4HR, June 2016)

Q8.



- (a) On the grid, reflect triangle **Q** in the line $x = 1$
Label the new triangle **R**.

(2)

Triangle **R** is mapped onto triangle **S** by a reflection in the line $y = 0$

- (b) Describe fully the single transformation that maps triangle **Q** onto triangle **S**.

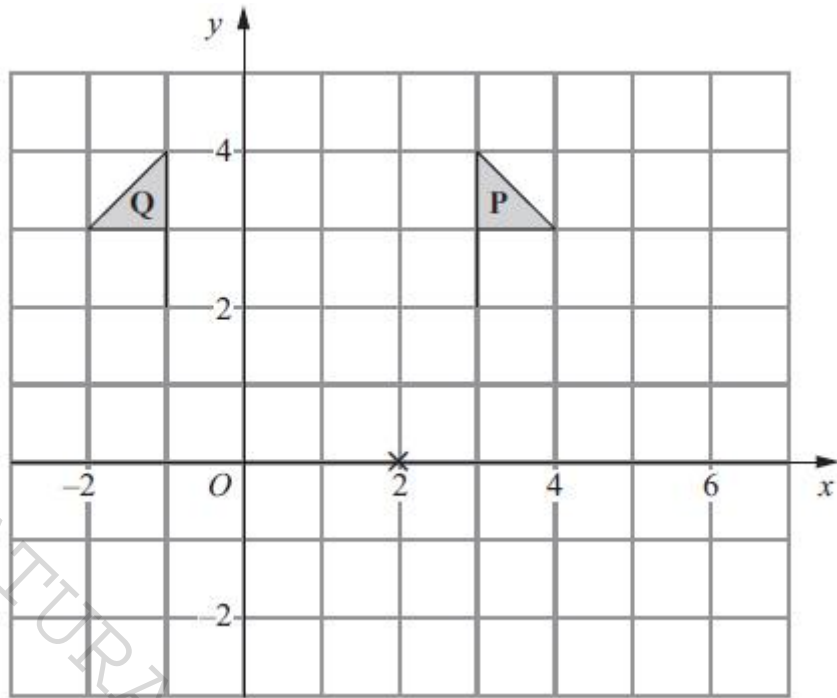
.....
.....

(3)

(Total for question = 5 marks)

(Q11 4MA0/4H, Jan 2017)

Q9.



(a) Describe fully the single transformation that maps shape **P** onto shape **Q**.

(2)

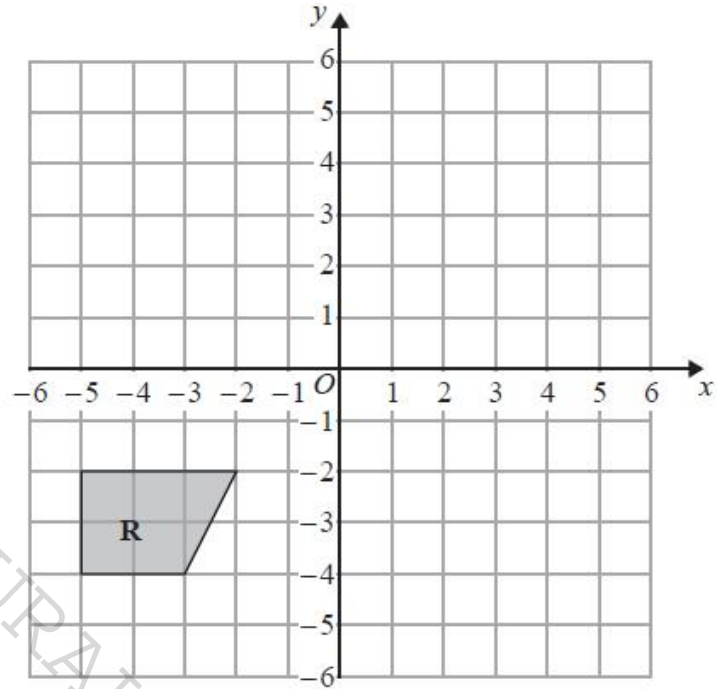
(b) On the grid, rotate shape **P** 90° clockwise about the point $(2, 0)$.
Label the new shape **R**.

(2)

(Total for question = 4 marks)

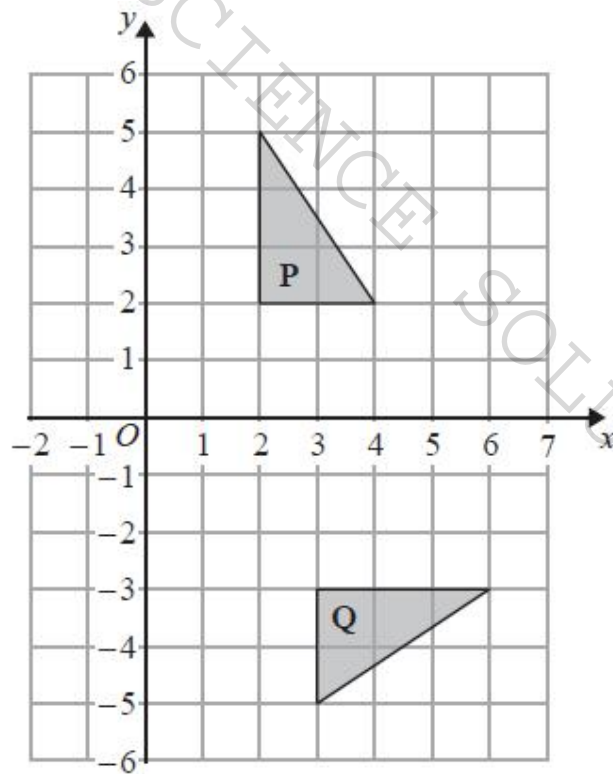
(Q04 4MA0/4H, June 2012)

Q10.



(a) On the grid above, reflect shape **R** in the line $y = -x$

(2)

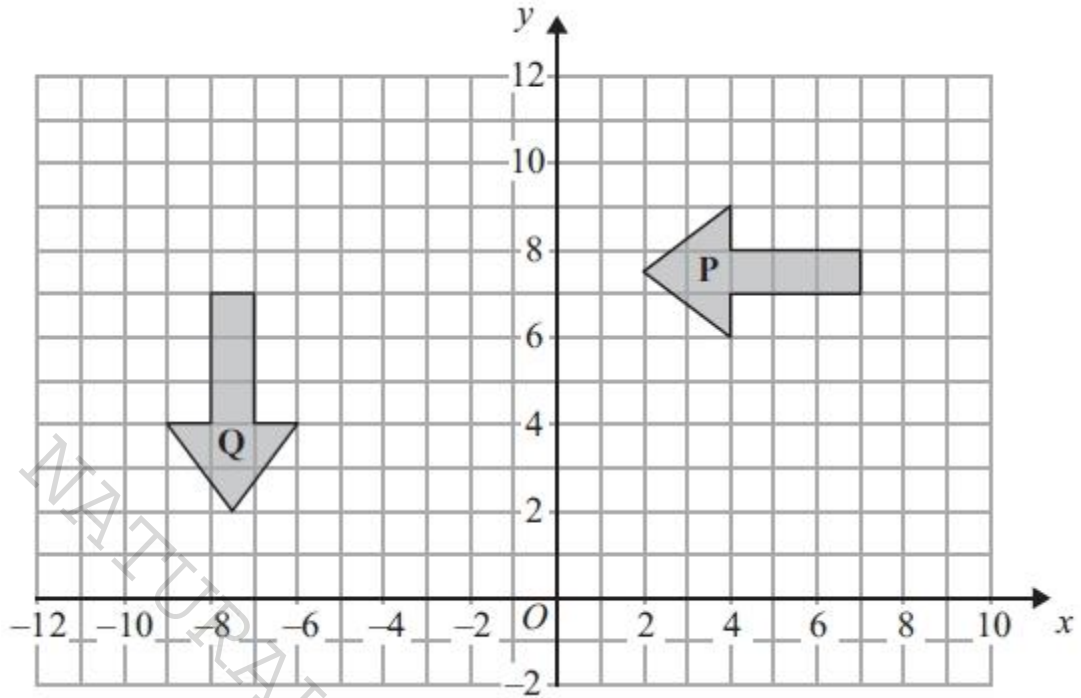


(b) Describe fully the single transformation that maps triangle **P** onto triangle **Q**.

(3)

(Total for question = 5 marks)
(Q05 4MA0/4H, June 2015)

Q11.



(a) Describe fully the single transformation that maps shape **P** onto shape **Q**.

.....

(3)

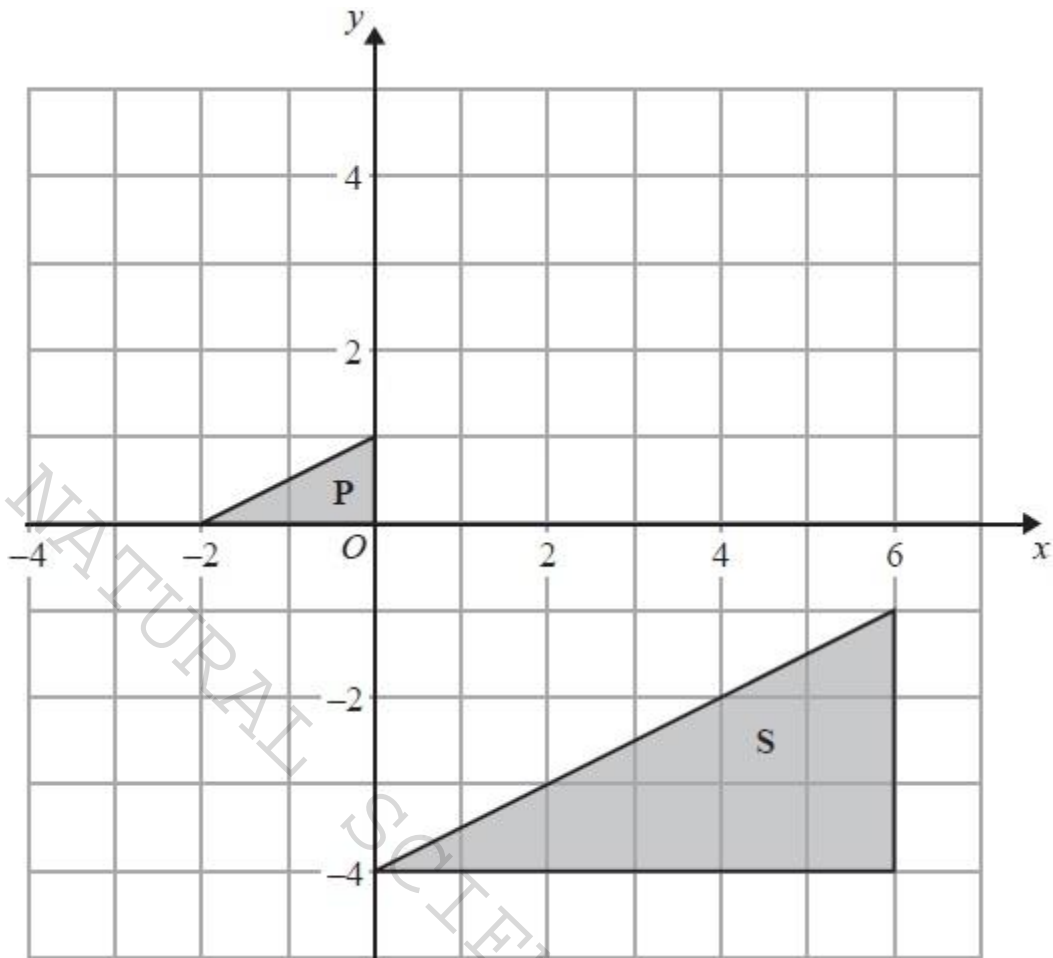
(b) On the grid, translate shape **P** by the vector $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$.
 Label the new shape **R**.

(2)

(Total for question = 5 marks)

(Q04 4MA0/4H, June 2013)

Q12.



(a) On the grid, translate triangle **P** by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$

Label the new triangle **Q**.

(1)

(b) Describe fully the single transformation that maps triangle **P** onto triangle **S**.

.....

.....

(3)

(Total for Question is 4 marks)

(Q07 4MA0/4HR, Jan 2014)

Statistics

Topic-60: Mean, Median, and Mode

Q1.

The mean of four numbers is 2.6
 One of the four numbers is 5

Find the mean of the other three numbers.

.....
(Total for Question is 3 marks)

(Q10 4MA0/4H, Jan 2014)

Q2.

The table shows information about the times, in minutes, taken by 50 people to get to work.

Time taken (t minutes)	Frequency
$0 < t \leq 10$	6
$10 < t \leq 20$	10
$20 < t \leq 30$	19
$30 < t \leq 40$	15

Work out an estimate for the mean time taken to get to work.

..... minutes

(Total for Question is 4 marks)

(Q10 4MA0/4H, June 2014)

Q3.

The table shows information about the snowfall in Ottawa in January one year.

Snowfall (s cm)	Number of days
$0 \leq s < 2$	19
$2 \leq s < 4$	8
$4 \leq s < 6$	3
$6 \leq s < 8$	0
$8 \leq s < 10$	1

Work out an estimate for the total snowfall in January.

.....cm
(Total for question = 3 marks)
(Q09 4MA0/4H, June 2012)

Q4.

The table shows information about the amount of money, in dollars, spent in a shop in one day by 80 people.

Money spent (x dollars)	Frequency
$0 < x \leq 20$	24
$20 < x \leq 40$	20
$40 < x \leq 60$	9
$60 < x \leq 80$	12
$80 < x \leq 100$	15

Work out an estimate for the total amount of money spent in the shop that day.

..... dollars
(Total for question = 3 marks)
(Q12 4MA0/4H, June 2013)

Q5.

The table below shows information about the number of goals scored by a football club in each of its last 45 games.

Number of goals	Number of games
0	7
1	14
2	8
3	10
4	5
5	0
6	1

Find the median number of goals.
Show your working clearly.

.....
(Total for question = 2 marks)
(Q01 4MA0/4H, Jan 2017)

Q6.

Here are Ryan's scores in nine French tests.

4 6 4 7 8 a 6 7 7

The mean of Ryan's nine scores is 6
Work out the value of a .

$a =$

(Total for Question is 3 marks)
(Q02 4MA0/4HR, Jan 2014)

Q7.

Here are the heights, in millimetres, of 11 seedlings.

16 12 19 17 24 27 19 15 23 27 10

Work out the interquartile range of these heights.

..... mm

(Total for question = 3 marks)
(Q12 4MA0/4H, June 2017)

Q8.

Becky counted the number of matches in each of 50 boxes.
 The table shows information about her result

Number of matches	Frequency
45	3
46	7
47	12
48	23
49	4
50	1

Work out the mean number of matches.

.....
(Total for question = 3 marks)
(Q01 4MA0/4H, Jan 2015)

Q9.

The table shows information about the marks of 20 students in a science test.

Mark	Frequency
6	2
7	4
8	5
9	8
10	1

Work out the mean mark of the 20 students.

.....
(Total for question = 3 marks)
(Q03 4MA0/4H, Jan 2013)

Q10.

Jordan's school awards certificates for outstanding work.
 The table shows information about the numbers of certificates awarded in Jordan's class during a term.

Number of certificates	Number of students
0	4
1	9
2	7
3	1
4	6
5	3

(a) Work out the median number of certificates awarded.

.....
 (2)

(b) Work out the interquartile range of the numbers of certificates awarded.

.....
(3)

(Total for question = 5 marks)

(Q05 4MA0/4HR, June 2015)

Q11.

The table gives information about the numbers of goals scored by a football team in 30 matches.

Number of goals scored	Frequency
0	2
1	10
2	7
3	6
4	3
5	2

Find the mean number of goals scored.

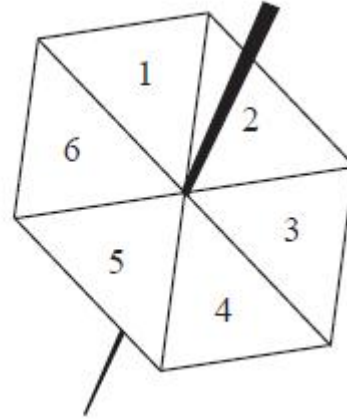
.....
(Total for Question is 3 marks)

(Q04 4MA0/4H, Jan 2014)

Q12.

Becky has a biased 6-sided spinner.
 She spins the spinner 25 times.
 She records the score for each spin.
 The table shows information about her scores.

Score	Frequency
1	9
2	6
3	3
4	2
5	1
6	4



(a) Find her median score.

.....
 (2)

(b) Work out her mean score.

.....
 (3)

(Total for question = 5 marks)

(Q04 4MA0/4H, June 2015)

Q13.

Six numbers have a mean of 5
Five of the numbers are

3 2 7 6 2

The other number is x .
Work out the value of x .

$x = \dots\dots\dots$

(Total for question = 3 marks)
(Q07 4MA0/4H, June 2011)

Q14.

Mr Rowland has a class of 30 students.
He gave them 24 words to spell.
The table shows information about the number of correct spellings for each student.

Number of correct spellings	Frequency
0 – 4	1
5 – 9	5
10 – 14	6
15 – 19	10
20 – 24	8

(a) Write down the modal class.

.....
(1)

(b) Work out an estimate for the mean number of correct spellings.
Give your answer to 1 decimal place.

.....
(4)
(Total for question = 5 marks)

(Q07 4MA0/4HR, Jan 2016)

Q15.

The frequency table shows information about the distances 60 office workers travel to work each day.

Distance travelled (d km)	Frequency
$0 < d \leq 10$	5
$10 < d \leq 20$	12
$20 < d \leq 30$	17
$30 < d \leq 40$	20
$40 < d \leq 50$	6

(a) Write down the modal class.

.....
(1)

(b) Work out an estimate for the mean distance travelled to work by these office workers.
Give your answer correct to 1 decimal place.

..... km
(4)

(Total for question = 5 marks)

(Q06 4MA0/4HR, June 2017)

Q16.

The table gives information about the number of vehicles passing a point on a road in each of 70 intervals of equal length.

Number of vehicles	Frequency
1 to 5	8
6 to 10	10
11 to 15	18
16 to 20	20
21 to 25	10
26 to 30	4

(a) Write down the modal class interval.

.....
(1)

(b) Calculate an estimate for the mean.

.....
(4)
(Total for question = 5 marks)

(Q06 4MA0/4HR, Jan 2015)

Q17.

Three positive whole numbers have a median of 7 and a mean of 5
Find the range of these three numbers.

.....
(Total for question is 3 marks)

(Q04 4MA0/4H, Jan 2012)

Q18.

Students in class 9Y took part in a sponsored swim.
The table gives information about the amount of money, in £, raised by each student.

Money raised (£ x)	Frequency
$0 \leq x < 6$	4
$6 \leq x < 12$	6
$12 \leq x < 18$	8
$18 \leq x < 24$	9
$24 \leq x < 30$	3

Work out an estimate for the total amount of money raised by the students in class 9Y.

£

(Total for question = 3 marks)

(Q06 4MA0/4H, June 2016)

Q19.

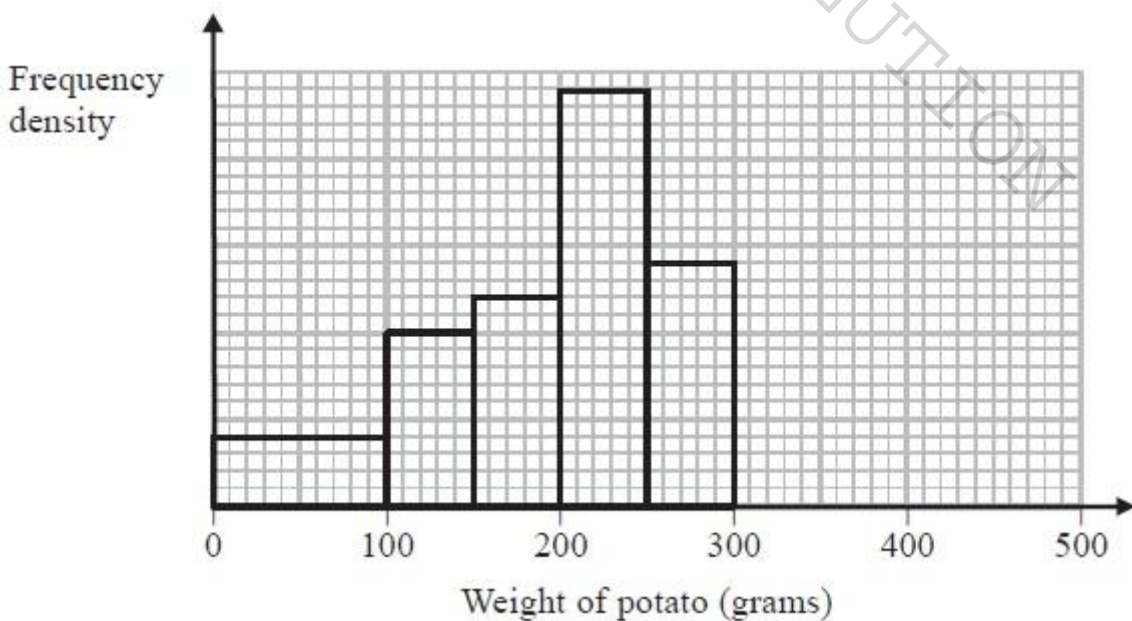
Loma grows tomatoes in her garden.
The table shows information about the weights, in grams, of some of her tomatoes.

Weight of tomato (w grams)	Number of tomatoes
$0 < w \leq 10$	2
$10 < w \leq 20$	8
$20 < w \leq 30$	16
$30 < w \leq 40$	10
$40 < w \leq 50$	4

(a) Work out an estimate for the total weight of these tomatoes.

..... grams
(3)

Loma also grows potatoes.
The incomplete histogram shows information about the weights, in grams, of some of her potatoes.



There were 10 potatoes with weights between 100 grams and 150 grams.

(b) How many potatoes had weights less than 100 grams?

.....
(2)

There were 12 potatoes with weights between 300 grams and 450 grams.

(c) Show this information on the histogram.

(2)

(Total for Question is 7 marks)
(Q12 4MA0/4HR, Jan 2014)

Q20.

The table shows information about the number of letters in the first name of each of 50 people.

Number of letters	Frequency
3	2
4	5
5	14
6	19
7	10

(i) Work out the mean number of letters in the first names of the 50 people.

(ii) One more person joins the 50 people.

The mean number of letters in the first names of the 51 people is less than the mean number of letters in the first names of the 50 people.

Write down the greatest number of letters in the first name of the person who joins the group.

.....
(Total for question = 4 marks)
(Q03 4MA0/4HR, June 2013)

Q21.

Here is a list of numbers written in order of size.

3 6 x y

The numbers

 have a median of 8

 have a mean of 11

Find the value of x and the value of y .

$x =$

$y =$

(Total for question = 3 marks)
(Q06 4MA0/4HR, June 2016)

Q22.

There are 30 apples in a box.

The mean weight of these 30 apples is 120 grams.

There are 10 apples in a bag.

The mean weight of these 10 apples is 95 grams.

Work out the mean weight of the 40 apples.

..... grams

(Total for question = 3 marks)
(Q09 4MA0/4HR, June 2016)

Q23.

Three positive whole numbers are all different.
The numbers have a median of 8 and a mean of 6
Find the three numbers.

.....
(Total for question = 2 marks)
(Q09 4MA0/4H, Jan 2015)

Q24.

Here are the points that Carmelo scored in his last 11 basketball games.

23 20 14 23 17 24 24 18 16 22 21

(a) Find the interquartile range of these points.

.....
(3)

Kobe also plays basketball.

The median number of points Kobe has scored in his games is 18.5

The interquartile range of these points is 10

(b) Which of Carmelo or Kobe is the more consistent points scorer?

Give a reason for your answer.

.....
.....
(1)

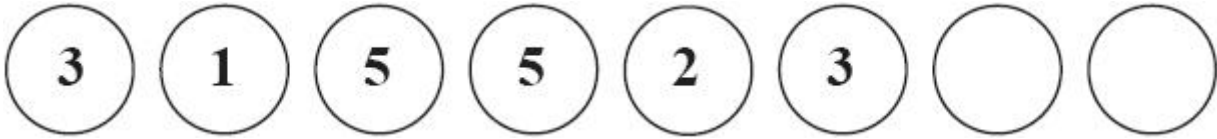
(Total for Question is 4 marks)

(Q13 4MA0/4HR, June 2014)

Q25.

Here are 8 cards.

There is a number on each of six cards.
Two cards are blank.



Uzma wants the mean of the numbers on the 8 cards to be 4
She wants the range of the numbers on the 8 cards to be 9
Find the numbers that she should write on the two blank cards.

NATURAL SCIENCE SOLUTION

..... and

(Total for question = 3 marks)

(Q03 4MA0/4H, Jan 2016)

Q26.

a , b , c and d are four integers.
Their mean is 8
Their mode is 7
Their median is 7.5

(a) Find the value of the largest of the four integers.

.....

(2)

(b) Find the mean value of the numbers $(2a - 3)$, $(2b - 3)$, $(2c - 3)$ and $(2d - 3)$.

.....
(2)

(Total for Question is 4 marks)

(Q11 4MA0/4HR, June 2014)

Q27.

A group of students take a test.
The group consists of 12 boys and 8 girls.
The mean mark for the boys is 18
The mean mark for the girls is 16.5
Calculate the mean mark for the whole group.

.....
(Total for question = 4 marks)

(Q02 4MA0/4H, June 2012)

Topic-61: Cumulative frequency

Q1.

The grouped frequency table gives information about the ages of 200 elephants.

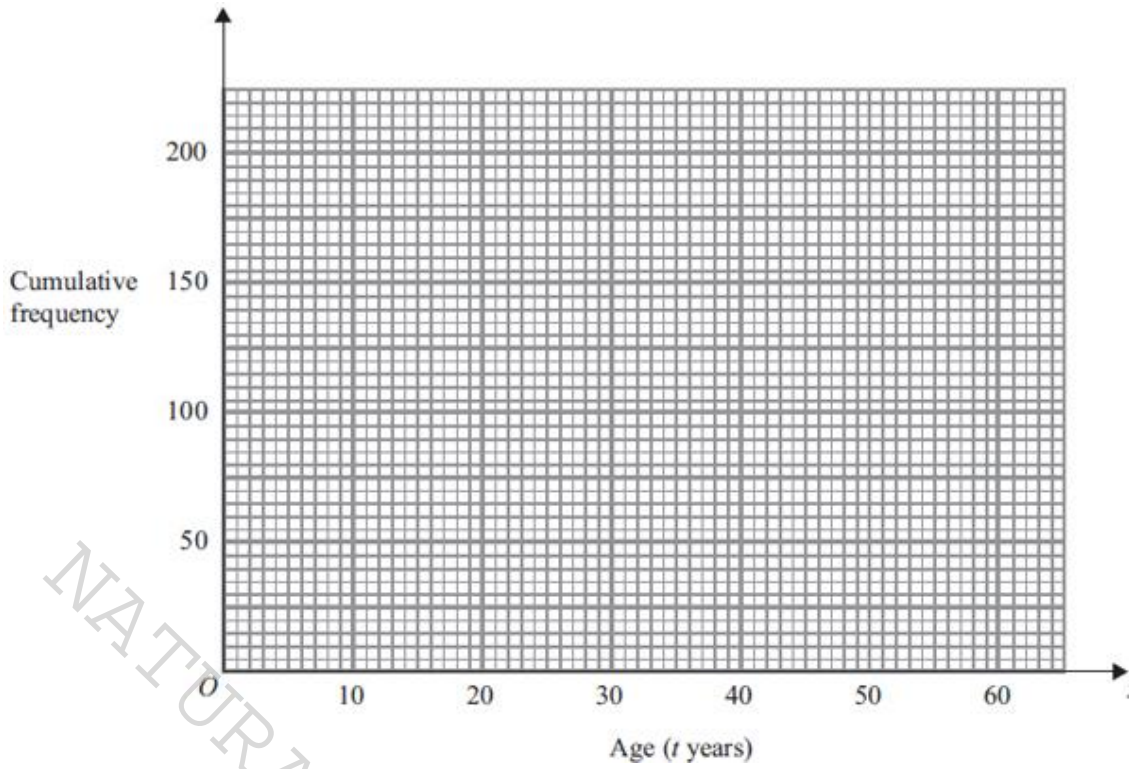
Age (t years)	Frequency
$0 < t \leq 10$	55
$10 < t \leq 20$	60
$20 < t \leq 30$	40
$30 < t \leq 40$	22
$40 < t \leq 50$	13
$50 < t \leq 60$	10

(a) Complete the cumulative frequency table.

Age (t years)	Cumulative frequency
$0 < t \leq 10$	
$0 < t \leq 20$	
$0 < t \leq 30$	
$0 < t \leq 40$	
$0 < t \leq 50$	
$0 < t \leq 60$	

(b) On the grid, draw a cumulative frequency graph for your table.

(1)



(2)

(c) Use the graph to find an estimate for the number of elephants with ages of more than 26 years.

.....
 (2)
(Total for question is 5 marks)
(Q14 4MA0/4H, Jan 2012)

Q2.

The grouped frequency table gives information about the weights of 180 airmail letters.

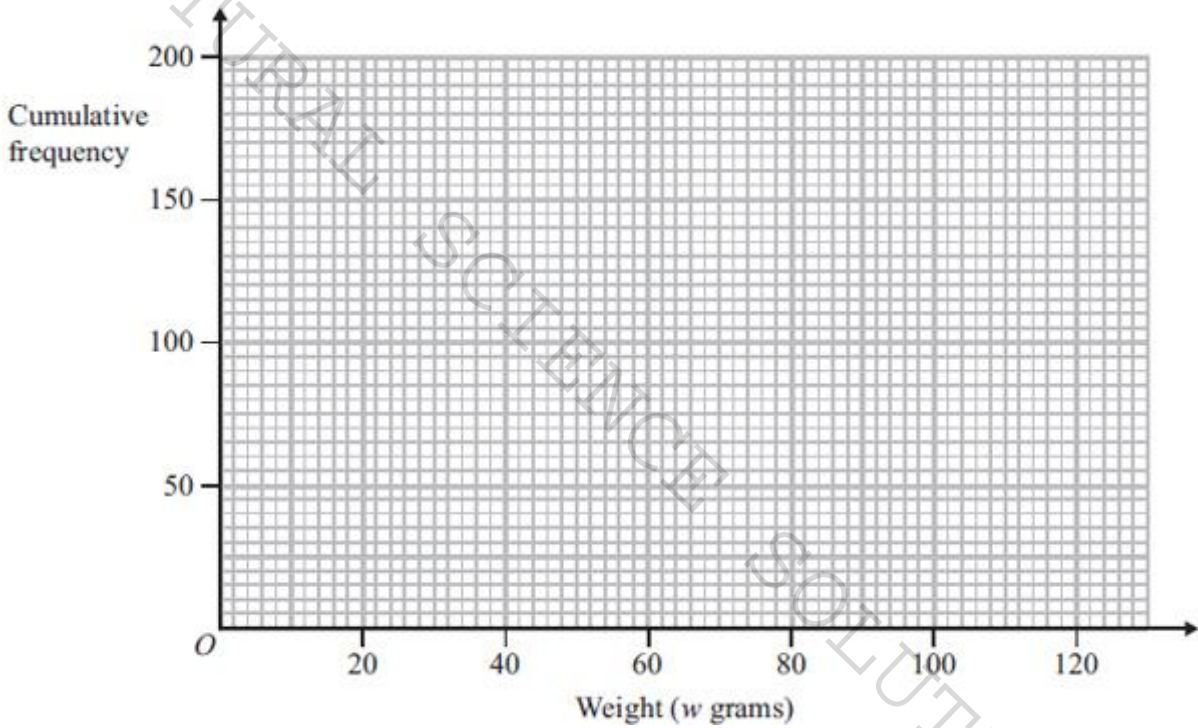
Weight (w grams)	Frequency
$0 < w \leq 20$	15
$20 < w \leq 40$	25
$40 < w \leq 60$	47
$60 < w \leq 80$	70
$80 < w \leq 100$	18
$100 < w \leq 120$	5

(a) Complete the cumulative frequency table.

Weight (w grams)	Frequency
$0 < w \leq 20$	
$20 < w \leq 40$	
$40 < w \leq 60$	
$60 < w \leq 80$	
$80 < w \leq 100$	
$100 < w \leq 120$	

(1)

(b) On the grid, draw a cumulative frequency graph for your table..



(c) Find an estimate for the upper quartile of the weights of the 180 letters.

.....grams
(2)

(Total for question = 5 marks)

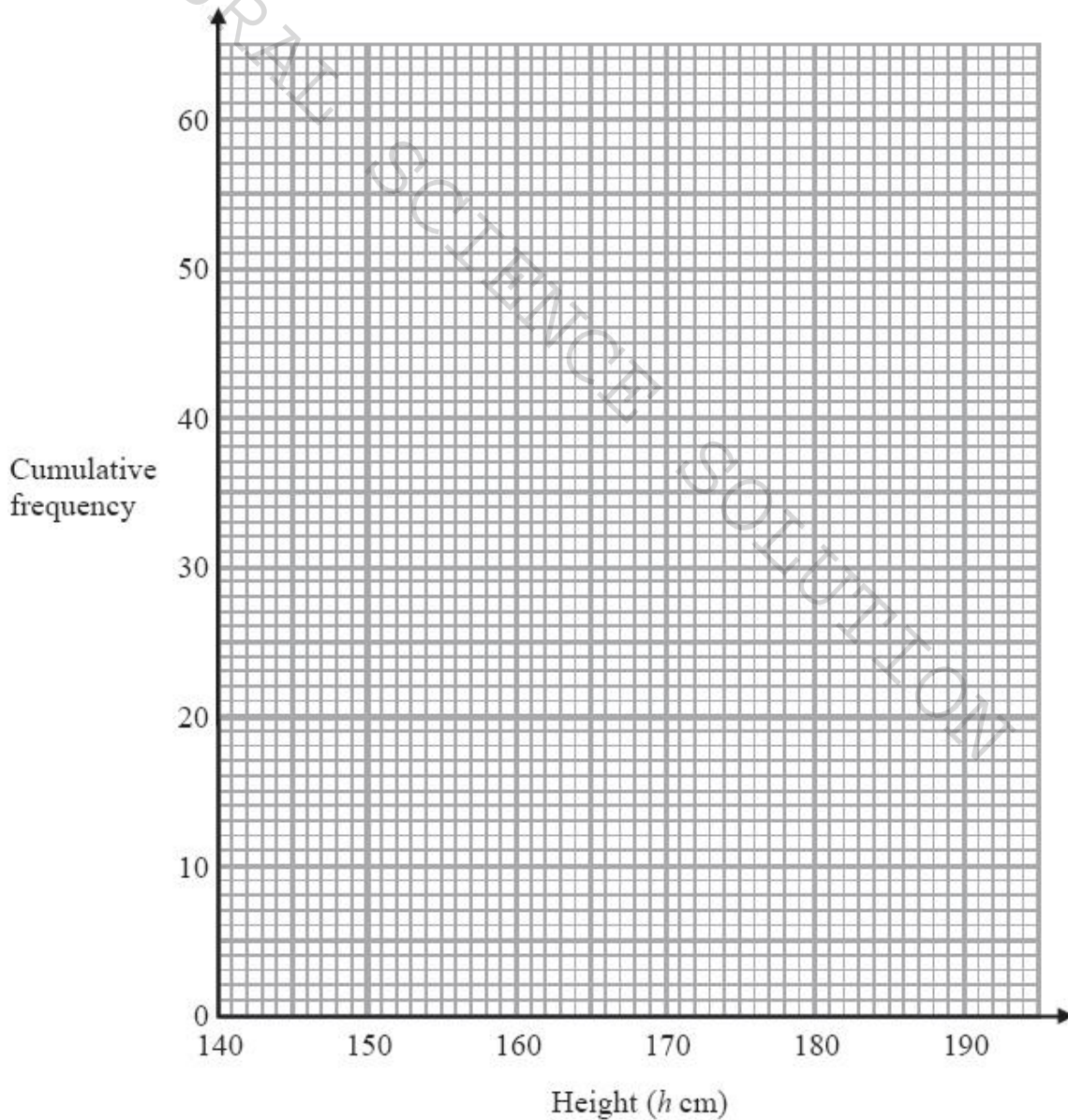
(Q10 4MA0/4HR, June 2013)

Q3.

The cumulative frequency table shows information about the heights of 60 men.

Height (h cm)	Cumulative frequency
$140 < h \leq 150$	10
$140 < h \leq 160$	35
$140 < h \leq 170$	52
$140 < h \leq 180$	58
$140 < h \leq 190$	60

(a) On the grid, draw a cumulative frequency graph for the table.



(2)

(b) Use your graph to find an estimate for the median height of the 60 men.

..... cm
(2)

(c) Use your graph to find an estimate for the number of the men who are taller than 174cm.

.....
(2)
(Total for question = 6 marks)
(Q15 4MA0/4H, Jan 2016)

Q4.

The table gives some information about the incomes, £ I , of 100 people in the UK.

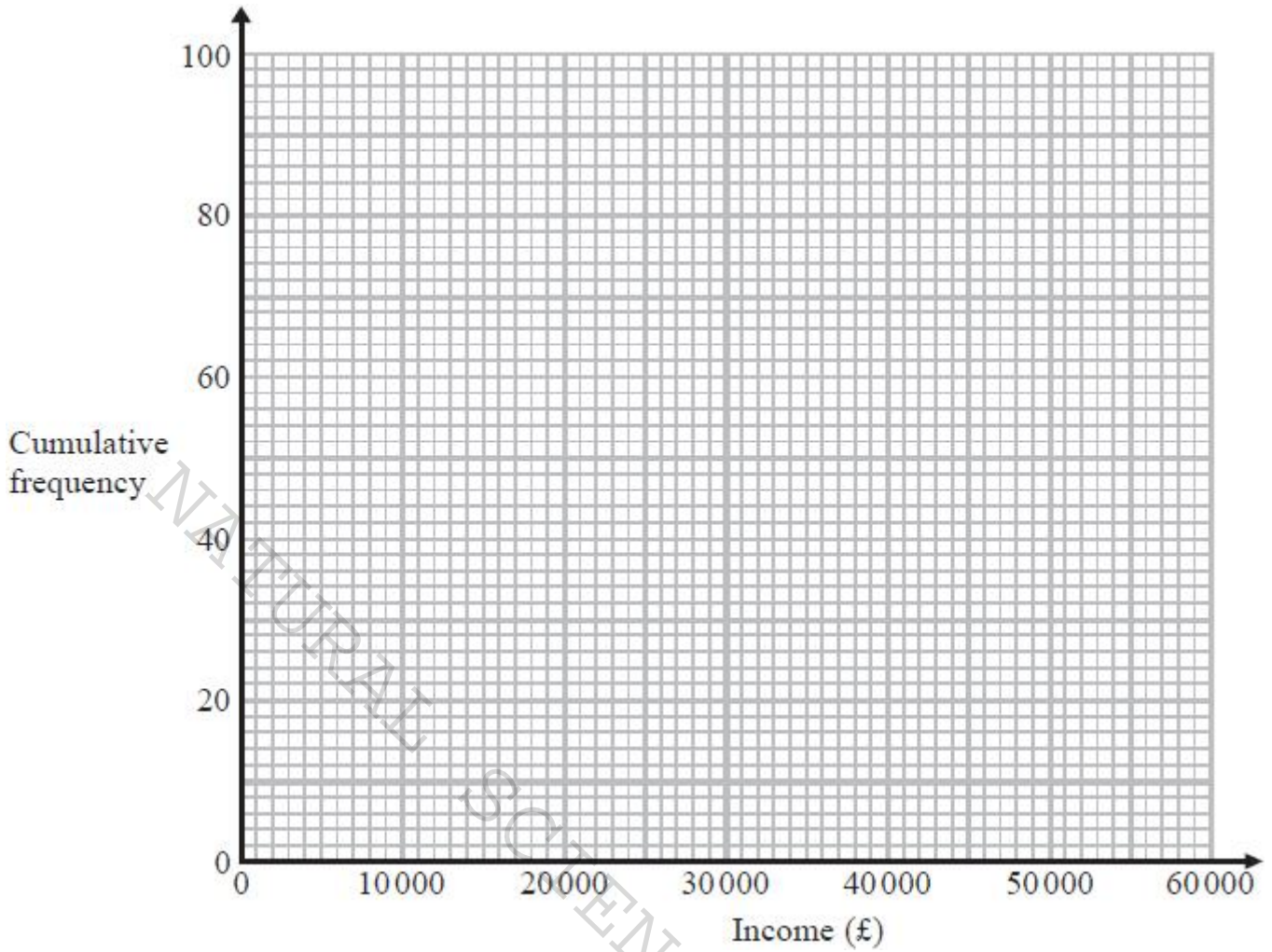
Income (£ I)	Frequency
$0 < I \leq 10\,000$	12
$10\,000 < I \leq 20\,000$	41
$20\,000 < I \leq 30\,000$	25
$30\,000 < I \leq 40\,000$	12
$40\,000 < I \leq 50\,000$	6
$50\,000 < I \leq 60\,000$	4

(a) Complete the cumulative frequency table.

Income (£ I)	Cumulative frequency
$0 < I \leq 10\,000$	12
$0 < I \leq 20\,000$	
$0 < I \leq 30\,000$	
$0 < I \leq 40\,000$	
$0 < I \leq 50\,000$	
$0 < I \leq 60\,000$	

(1)

(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for

(i) the median,

£

(ii) the interquartile range.

£

(3)

(Total for question = 6 marks)

(Q12 4MA0/4HR, June 2016)

Q5.

The grouped frequency table gives information about the lengths of 160 pythons.

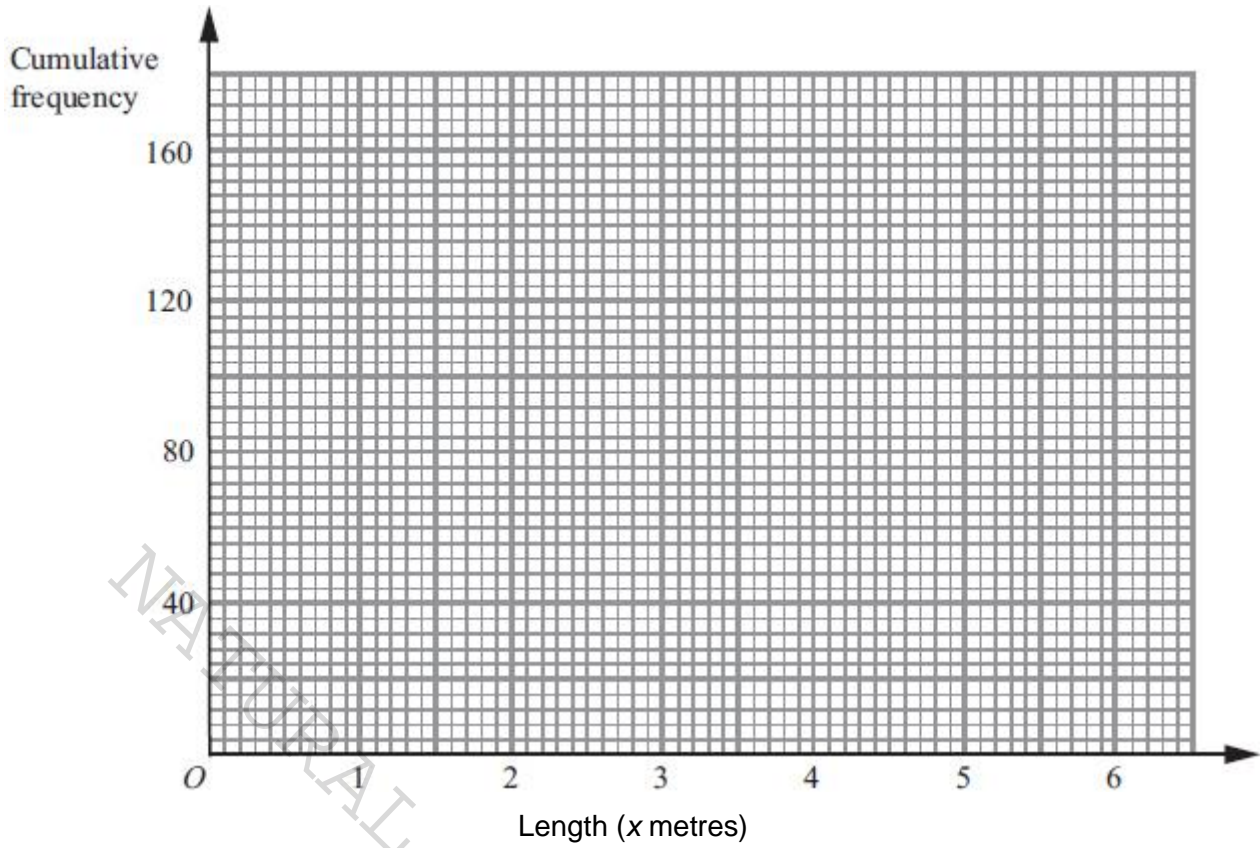
Length (x metres)	Frequency
$0 < x \leq 1$	4
$1 < x \leq 2$	8
$2 < x \leq 3$	16
$3 < x \leq 4$	32
$4 < x \leq 5$	72
$5 < x \leq 6$	28

(a) Complete the cumulative frequency table.

Length (x metres)	Cumulative frequency
$0 < x \leq 1$	
$0 < x \leq 2$	
$0 < x \leq 3$	
$0 < x \leq 4$	
$0 < x \leq 5$	
$0 < x \leq 6$	

(b) On the grid, draw a cumulative frequency graph for your table.

(1)



(c) Use your graph to find an estimate for the median length of the pythons. (2)

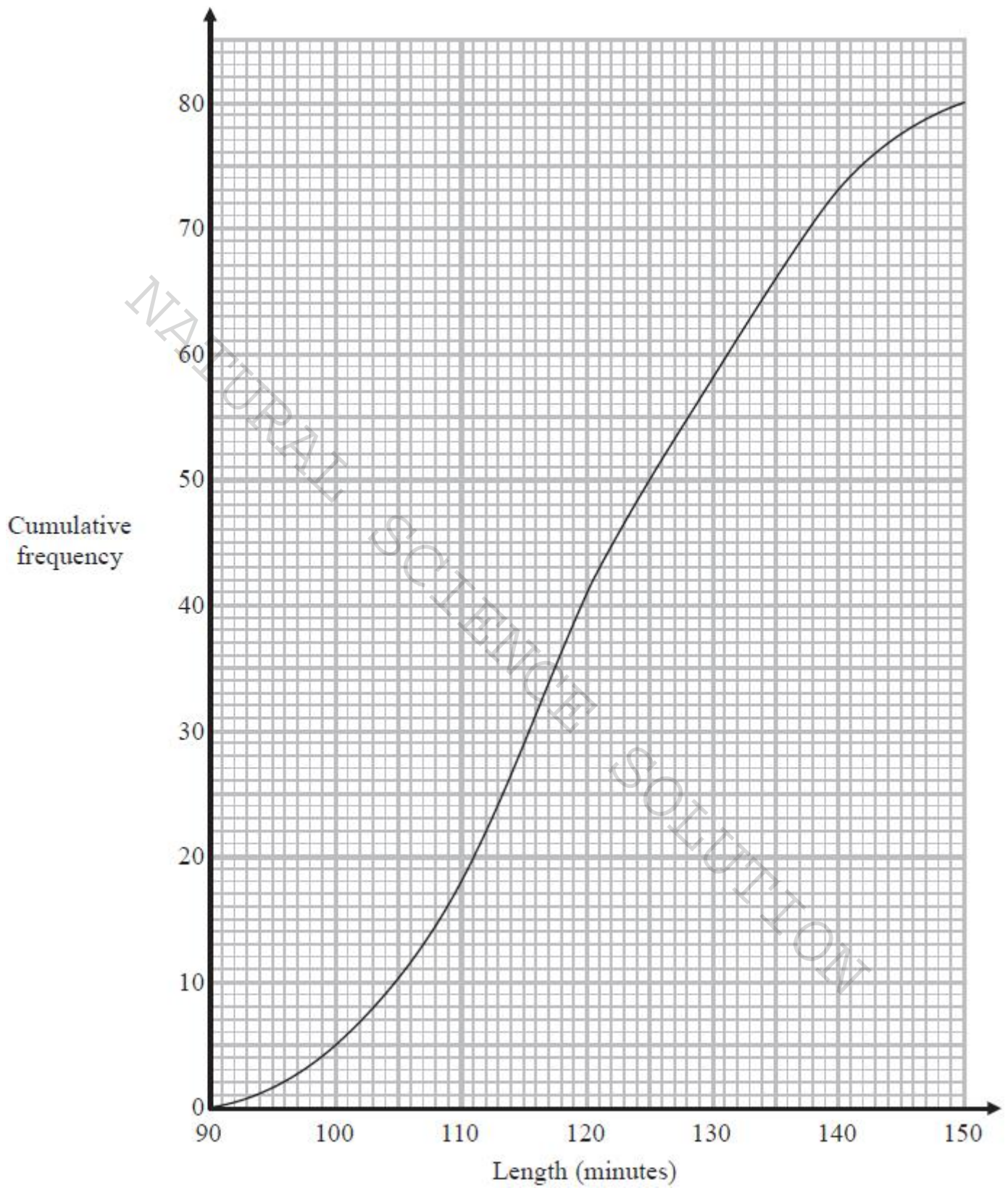
.....metres
(2)

(Total for question = 5 marks)

(Q16 4MA0/4H, Jan 2013)

Q6.

The cumulative frequency graph shows information about the length, in minutes, of each of 80 films.



(a) Find an estimate for the interquartile range.

..... minutes

(2)

(b) Find an estimate for the percentage of the 80 films that lasted more than 125 minutes.

..... %

(3)

(Total for question = 5 marks)

(Q10 4MA0/4H, June 2015)

NATURAL SCIENCE SOLUTION

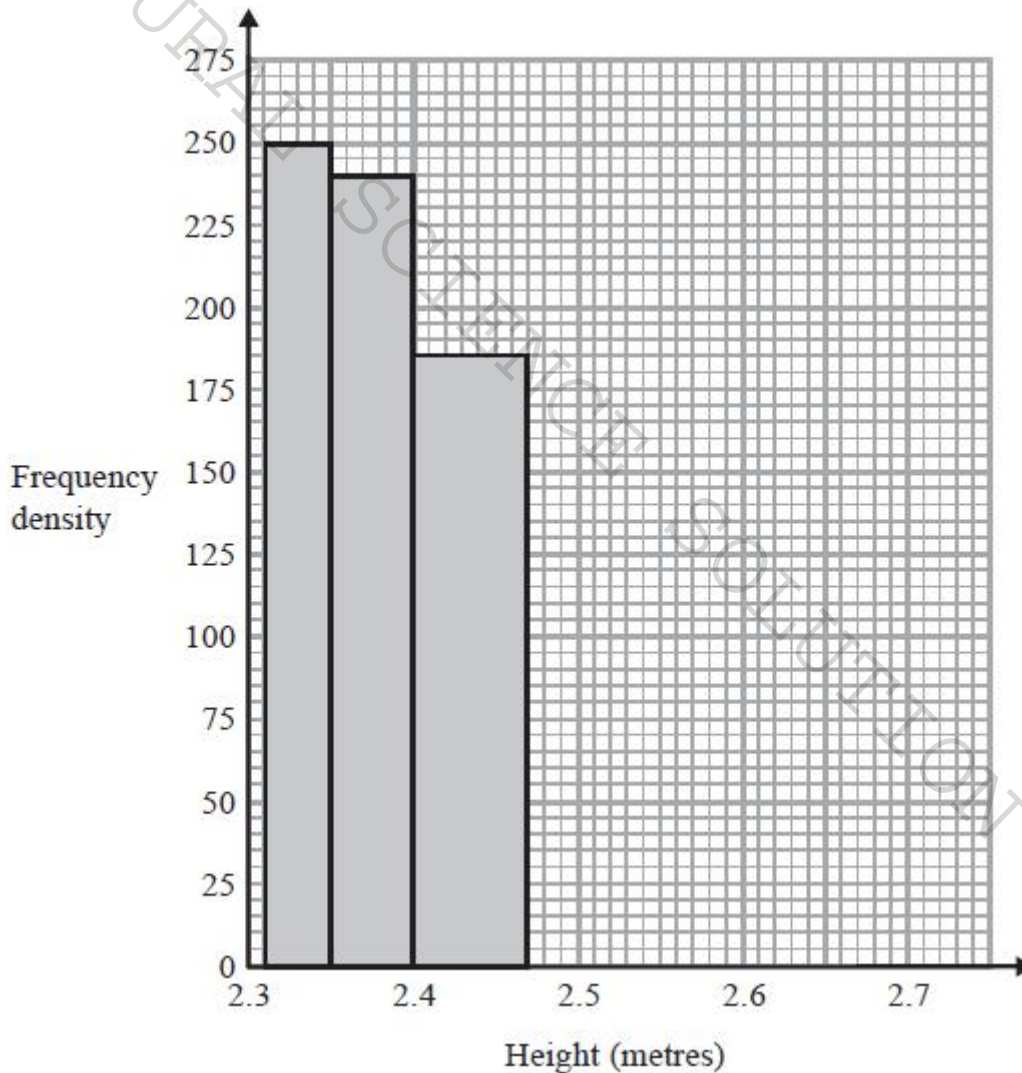
Topic-62: Histogram

Q1.

The table shows information about the heights, in metres, of 45 of the world's tallest men.

Height (h metres)	Number of men
$2.31 < h \leq 2.35$	10
$2.35 < h \leq 2.40$	12
$2.40 < h \leq 2.47$	13
$2.47 < h \leq 2.72$	10

(a) Use the information in the table to complete the histogram.



(2)

(b) Find an estimate for the number of these men with height between 2.32 metres and 2.34 metres.

.....

(1)

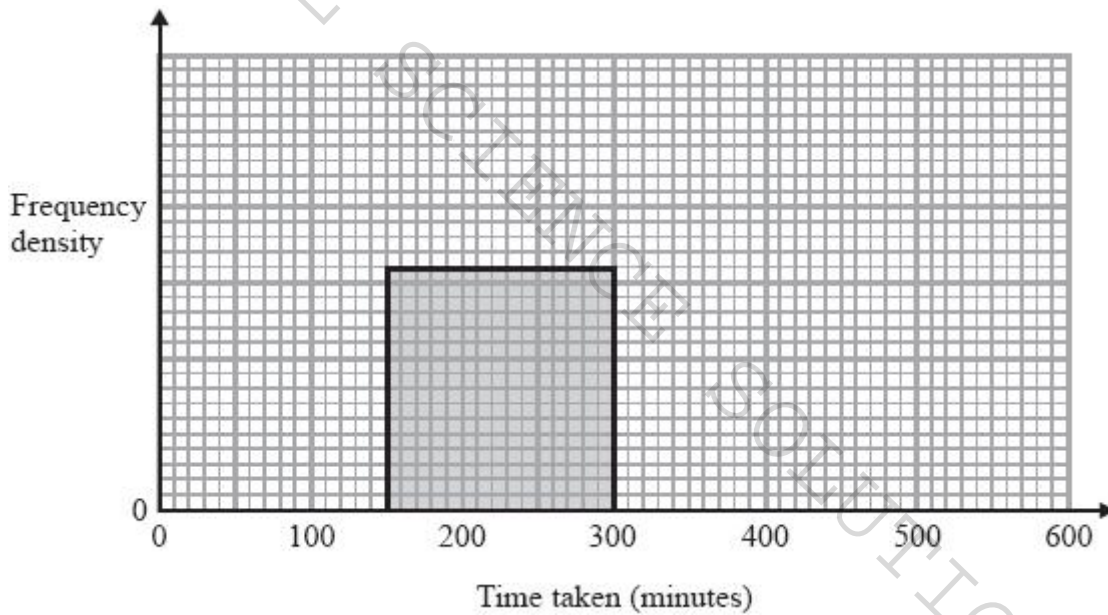
(Total for question = 3 marks)
(Q16 4MA0/4HR, Jan 2017)

Q2.

The table gives information about the time taken by each of 600 people to reach their holiday destination.

Time taken (t minutes)	Frequency
$0 < t \leq 100$	120
$100 < t \leq 150$	140
$150 < t \leq 300$	240
$300 < t \leq 500$	80
$500 < t \leq 600$	20

(a) Use the information in the table to complete the histogram.



(3)

(b) Work out an estimate for the number of people who took more than 200 minutes to reach their holiday destination.

.....

(2)

(Total for question = 5 marks)

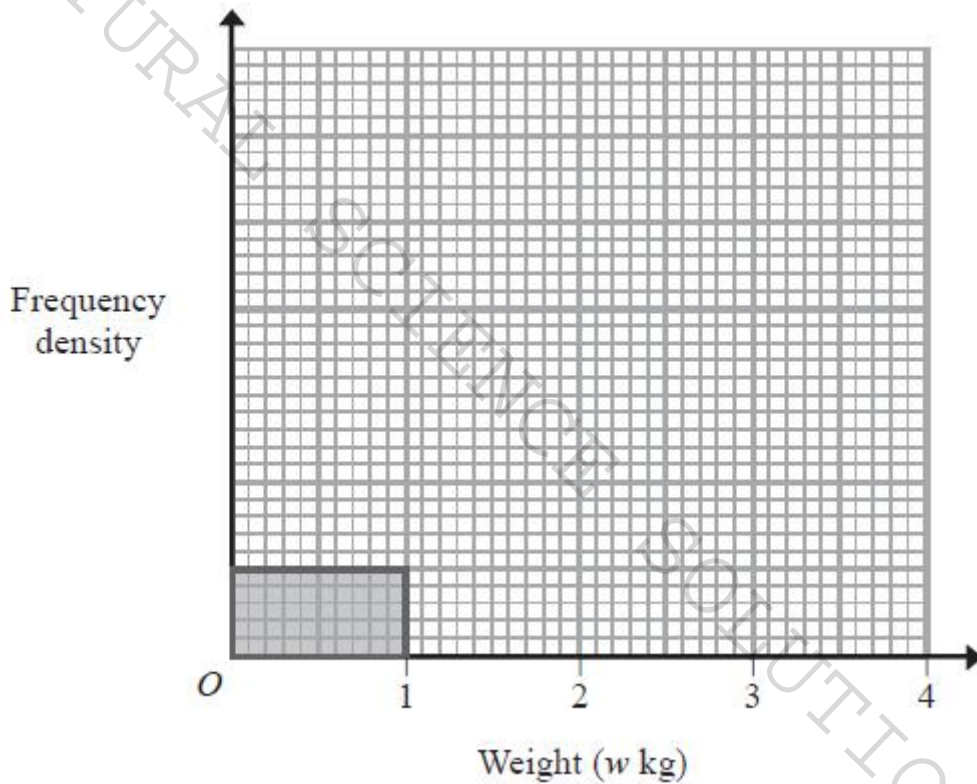
(Q19 4MA0/4HR, June 2017)

Q3.

400 people are asked to guess the weight of a large cake.
The table shows information about the weights they guess.

Weight (w kg)	Number of guesses
$0 < w \leq 1$	50
$1 < w \leq 1.6$	90
$1.6 < w \leq 2$	120
$2 < w \leq 2.5$	95
$2.5 < w \leq 4$	45

Use the information in the table to complete the histogram.



(Total for question = 3 marks)

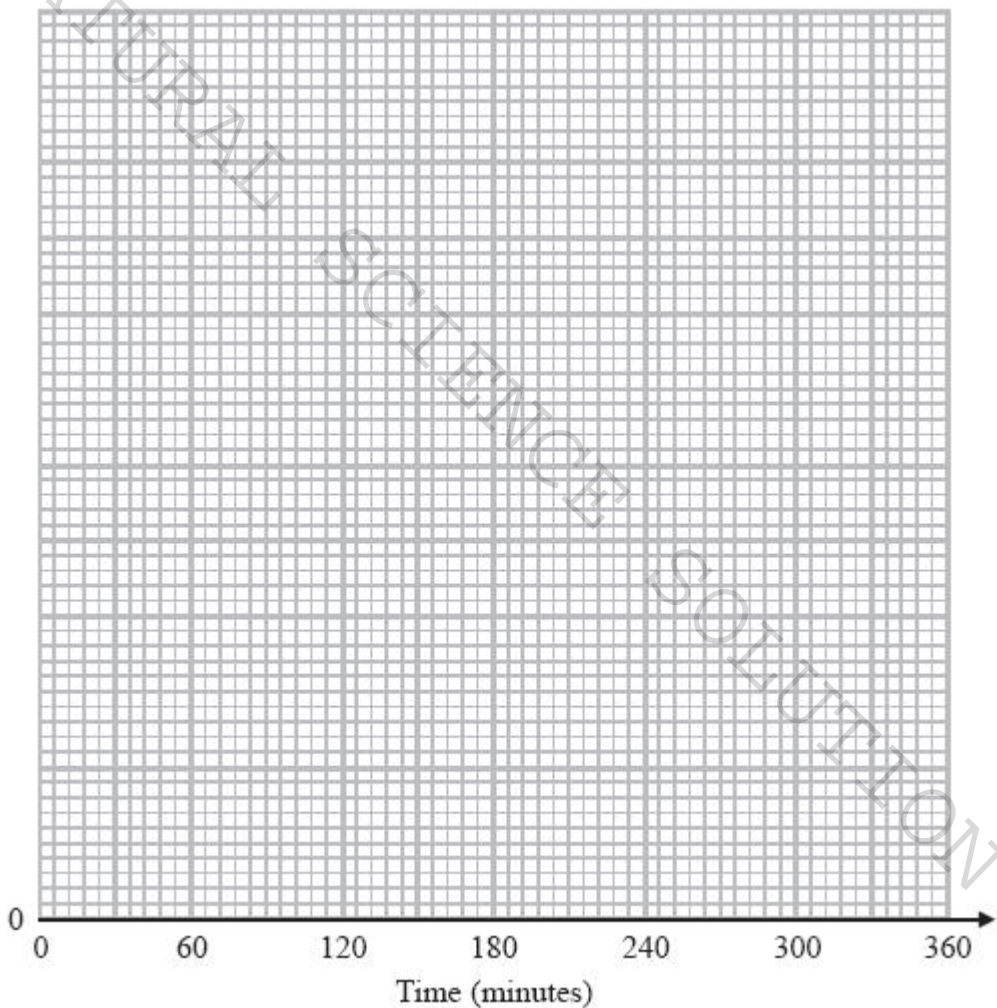
(Q18 4MA0/4HR, June 2015)

Q4.

The table gives information about the times, in minutes, some people waited in the accident and emergency department at a hospital.

Time (t minutes)	Frequency
$0 < t \leq 30$	60
$30 < t \leq 90$	270
$90 < t \leq 120$	150
$120 < t \leq 240$	156
$240 < t \leq 300$	24

On the grid, draw a histogram for this information.



(Total for question = 3 marks)

(Q18 4MA0/4H, June 2017)

Q5.

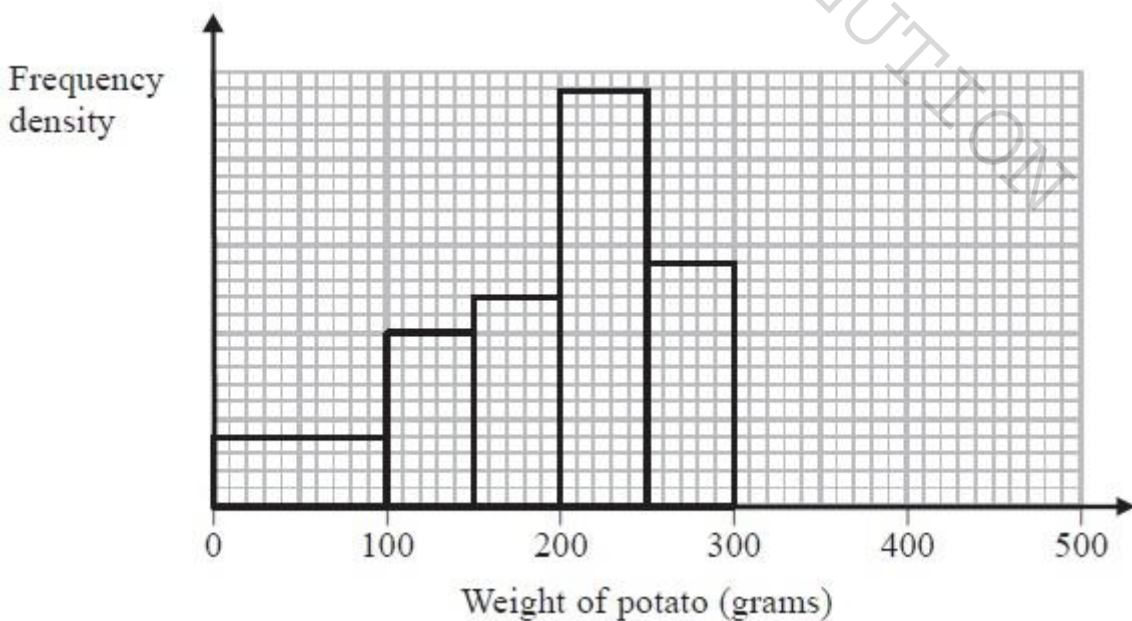
Loma grows tomatoes in her garden.
The table shows information about the weights, in grams, of some of her tomatoes.

Weight of tomato (w grams)	Number of tomatoes
$0 < w \leq 10$	2
$10 < w \leq 20$	8
$20 < w \leq 30$	16
$30 < w \leq 40$	10
$40 < w \leq 50$	4

(a) Work out an estimate for the total weight of these tomatoes.

..... grams
(3)

Loma also grows potatoes.
The incomplete histogram shows information about the weights, in grams, of some of her potatoes.



There were 10 potatoes with weights between 100 grams and 150 grams.

(b) How many potatoes had weights less than 100 grams?

.....
(2)

There were 12 potatoes with weights between 300 grams and 450 grams.

(c) Show this information on the histogram.

(2)

(Total for Question is 7 marks)

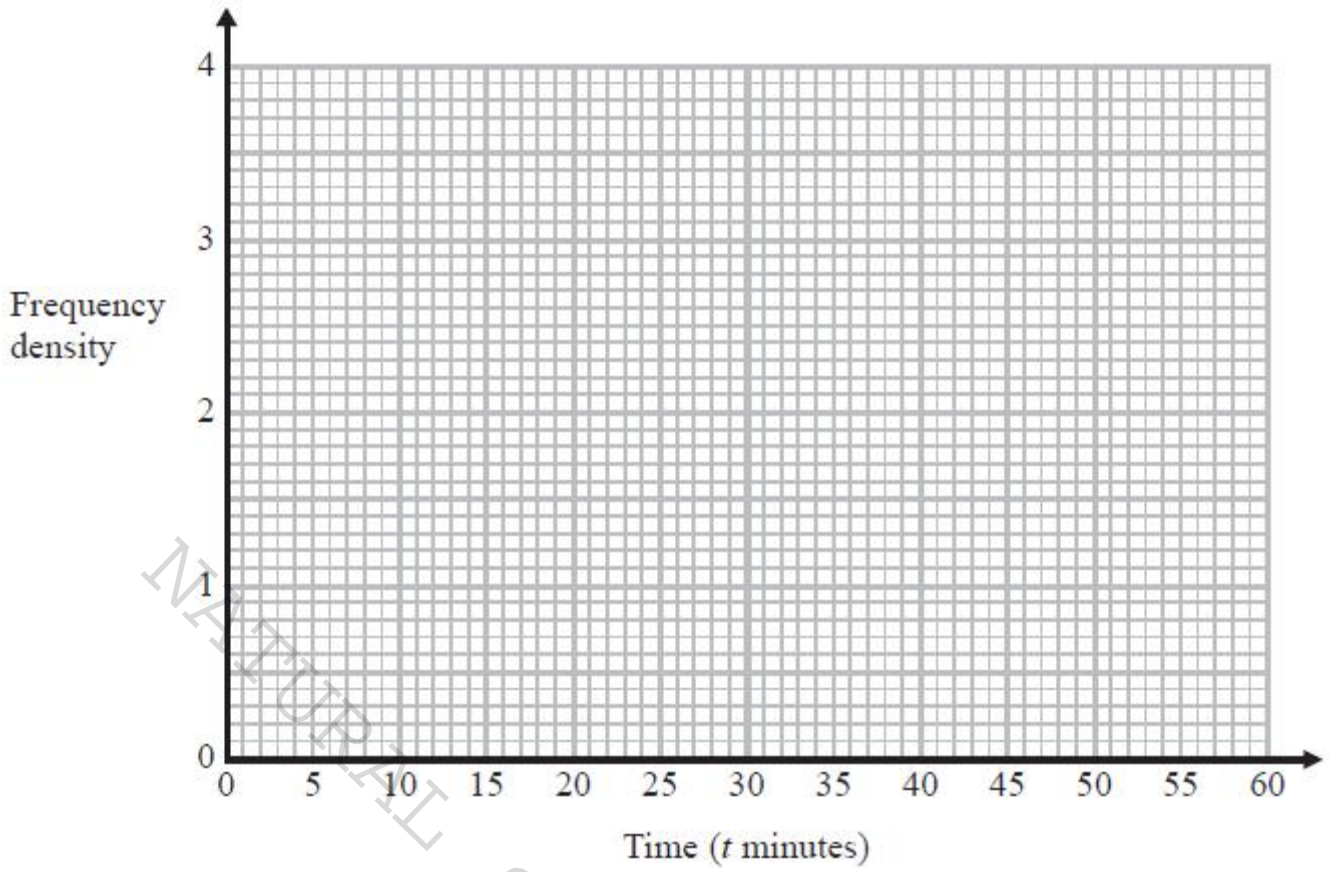
(Q12 4MA0/4HR, Jan 2014)

Q6.

The table shows information about the times, in minutes, that 100 shoppers spent in a supermarket.

Time (t minutes)	Frequency
$10 \leq t < 15$	6
$15 \leq t < 20$	10
$20 \leq t < 30$	20
$30 \leq t < 40$	36
$40 \leq t < 60$	28

Draw a histogram to show this information.

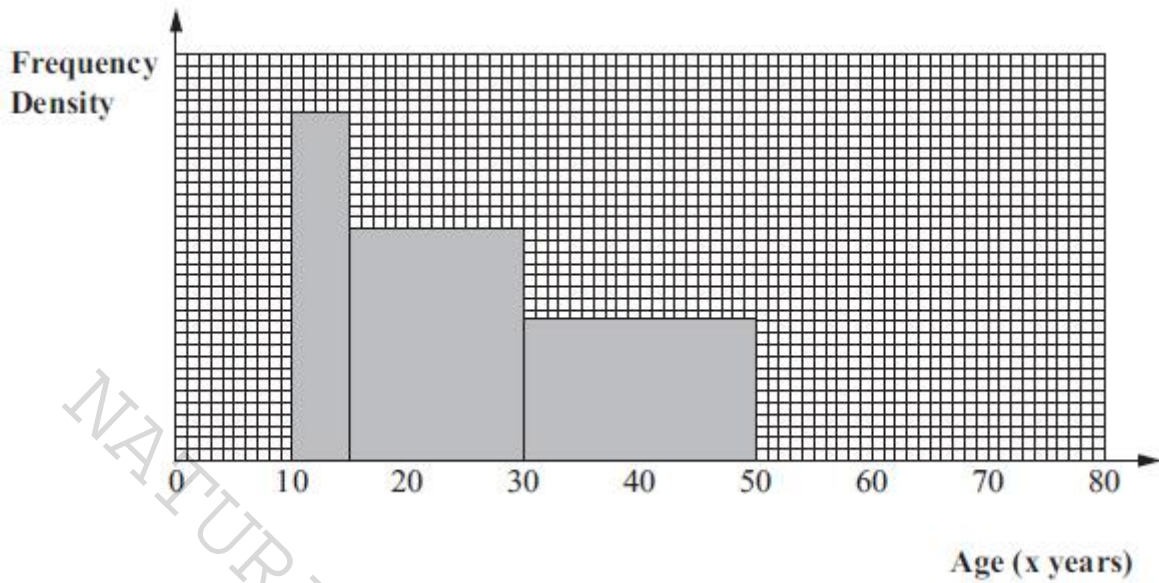


(Total for Question is 3 marks)

(Q22 4MA0/4H, June 2014)

Q7.

The incomplete histogram and table give information about the ages of people living in a village.



Age (x years)	Frequency
$0 \leq x < 10$	100
$10 \leq x < 15$	60
$15 \leq x < 30$	
$30 \leq x < 50$	
$50 \leq x < 75$	50
$75 \leq x < 80$	20

(i) Use the histogram to complete the table.

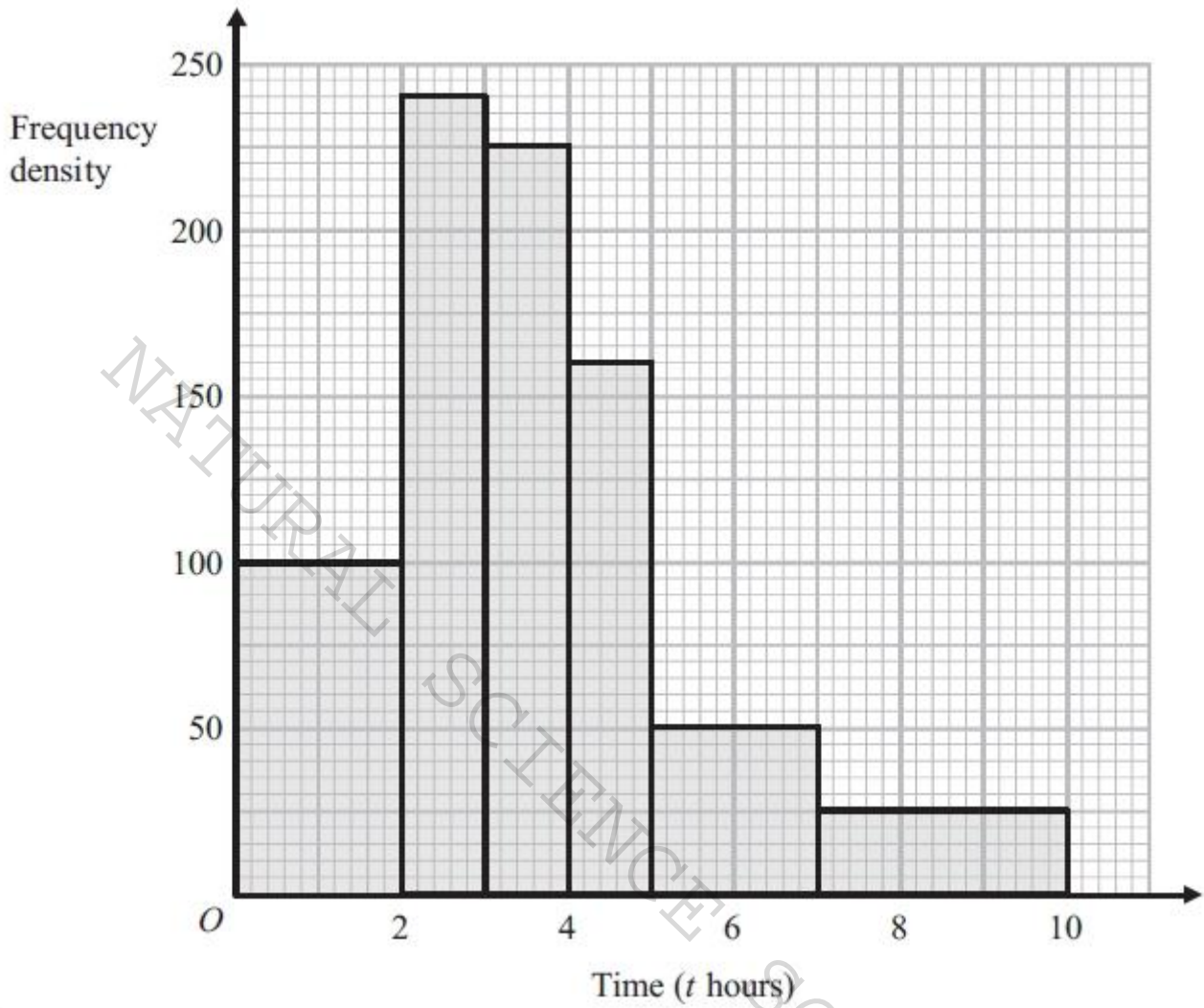
(ii) Use the table to complete the histogram.

(Total for question = 4 marks)

(Q16 4MA0/4H, June 2011)

Q8.

The histogram shows information about the times, t hours, for which some cars were left in a car park.



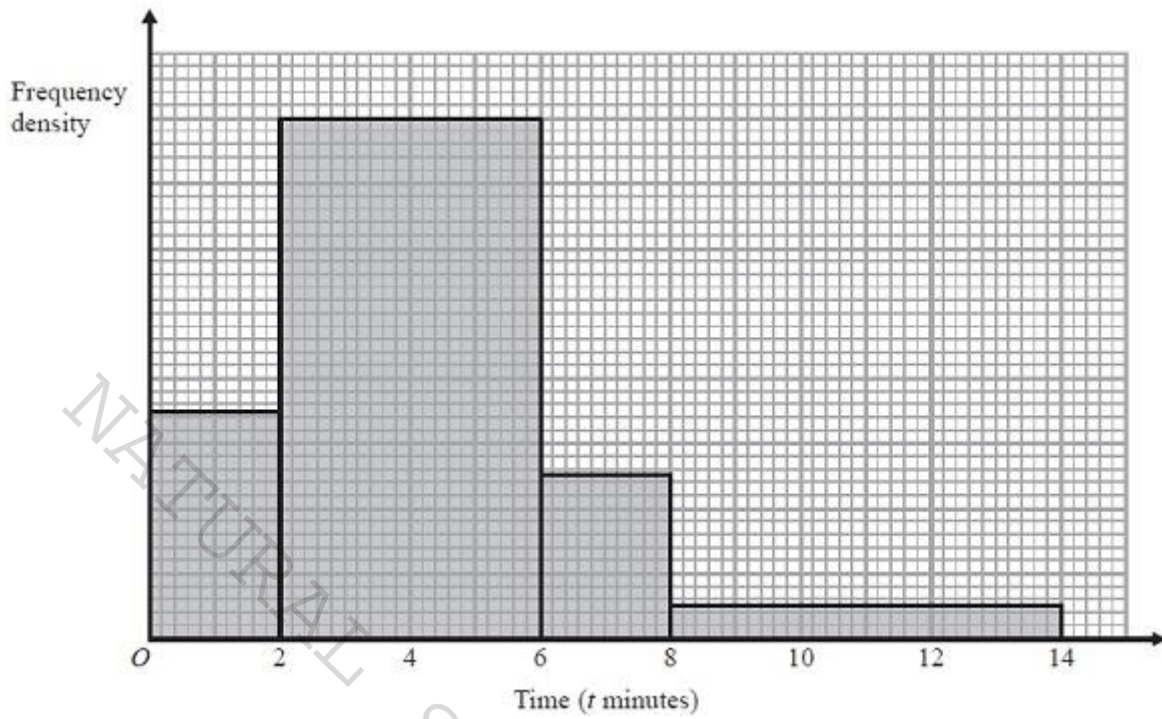
Calculate an estimate for the number of cars which were left in the car park for between 4.5 hours and 8 hours.

.....
(Total for question = 3 marks)

(Q18 4MA0/4H, June 2013)

Q9.

The histogram shows information about the times, t minutes, customers spent in a post office.



28 customers spent 2 minutes or less in the post office.

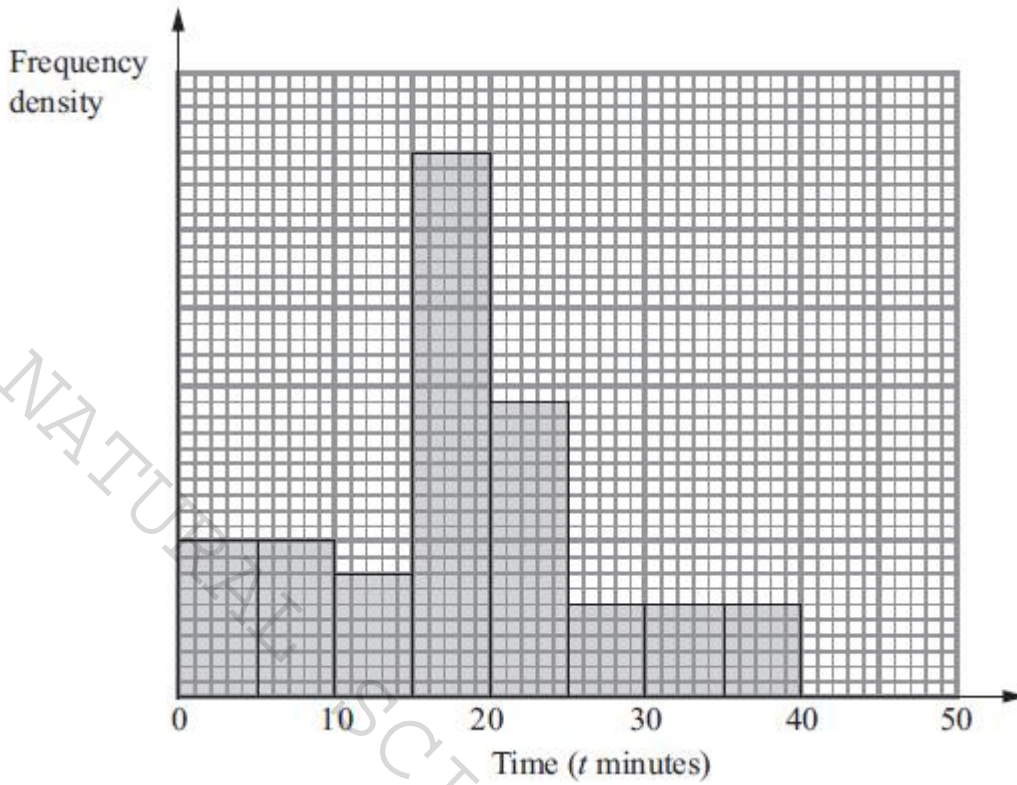
Calculate an estimate for the number of customers who spent between 5 and 14 minutes in the post office.

.....
(Total for Question is 3 marks)

(Q16 4MA0/4H, Jan 2014)

Q10.

The histogram shows information about the times, t minutes, patients spent at a doctors' surgery on one day.
 No patient spent more than 40 minutes at the surgery.



(a) Calculate the percentage of the patients who spent between 25 and 40 minutes at the surgery.

.....%
 (3)

(b) 16 patients spent between 10 and 15 minutes at the surgery.
 Calculate the total number of patients at the surgery that day.

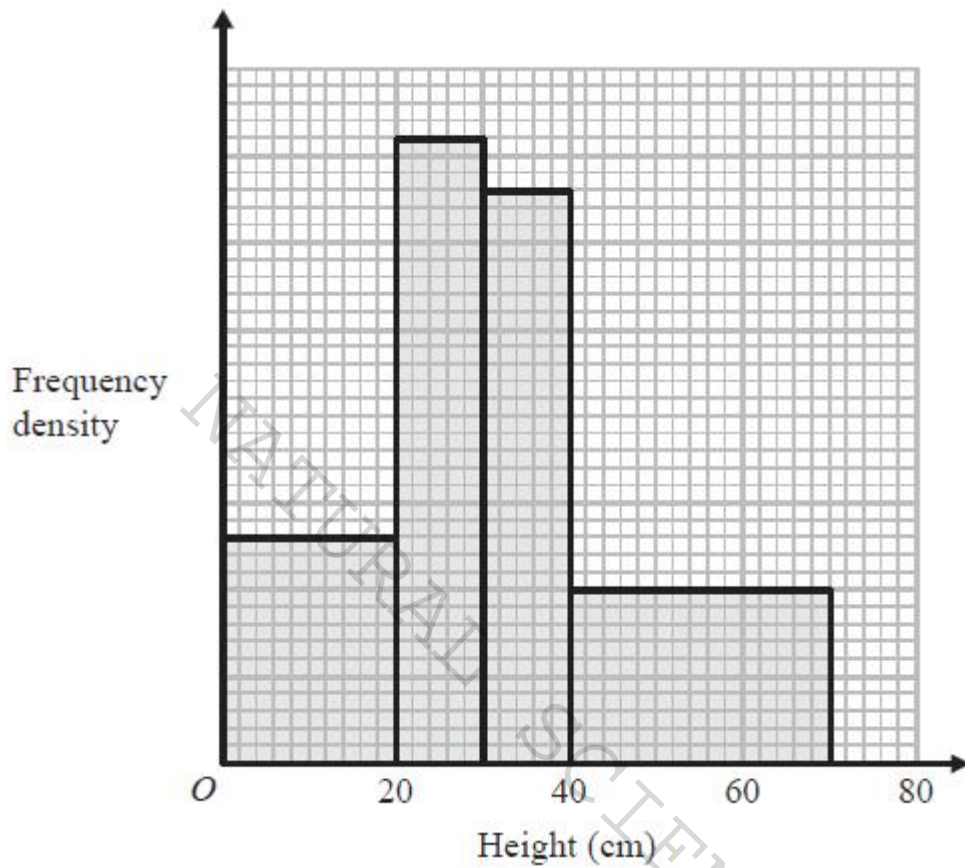
.....
 (2)

(Total for question = 5 marks)

(Q17 4MA0/4H, June 2012)

Q11.

The histogram shows information about the heights of some tomato plants.



26 plants have a height of less than 20 cm.

Work out the total number of tomato plants.

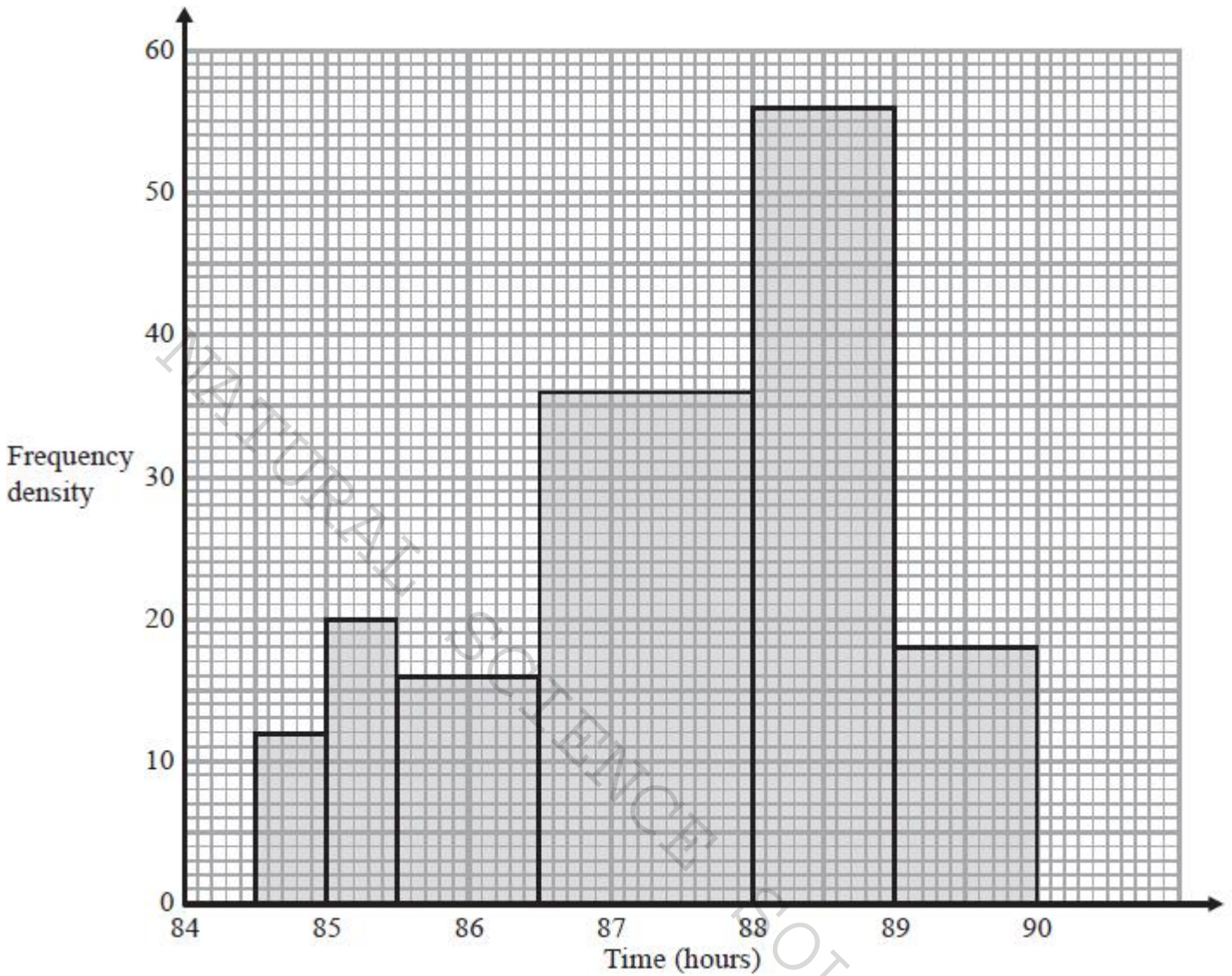
.....

(Total for question = 3 marks)

(Q20 4MA0/4H, Jan 2015)

Q12.

The histogram shows information about the times taken by 160 cyclists to complete the Tour de France cycle race.



6 cyclists took less than 85 hours.

(a) Work out an estimate for the number of the 160 cyclists who took less than 86 hours.

.....

(2)

(b) For these 160 cyclists, work out an estimate for the time taken by the cyclist who finished in 50th position.

..... hours

(2)

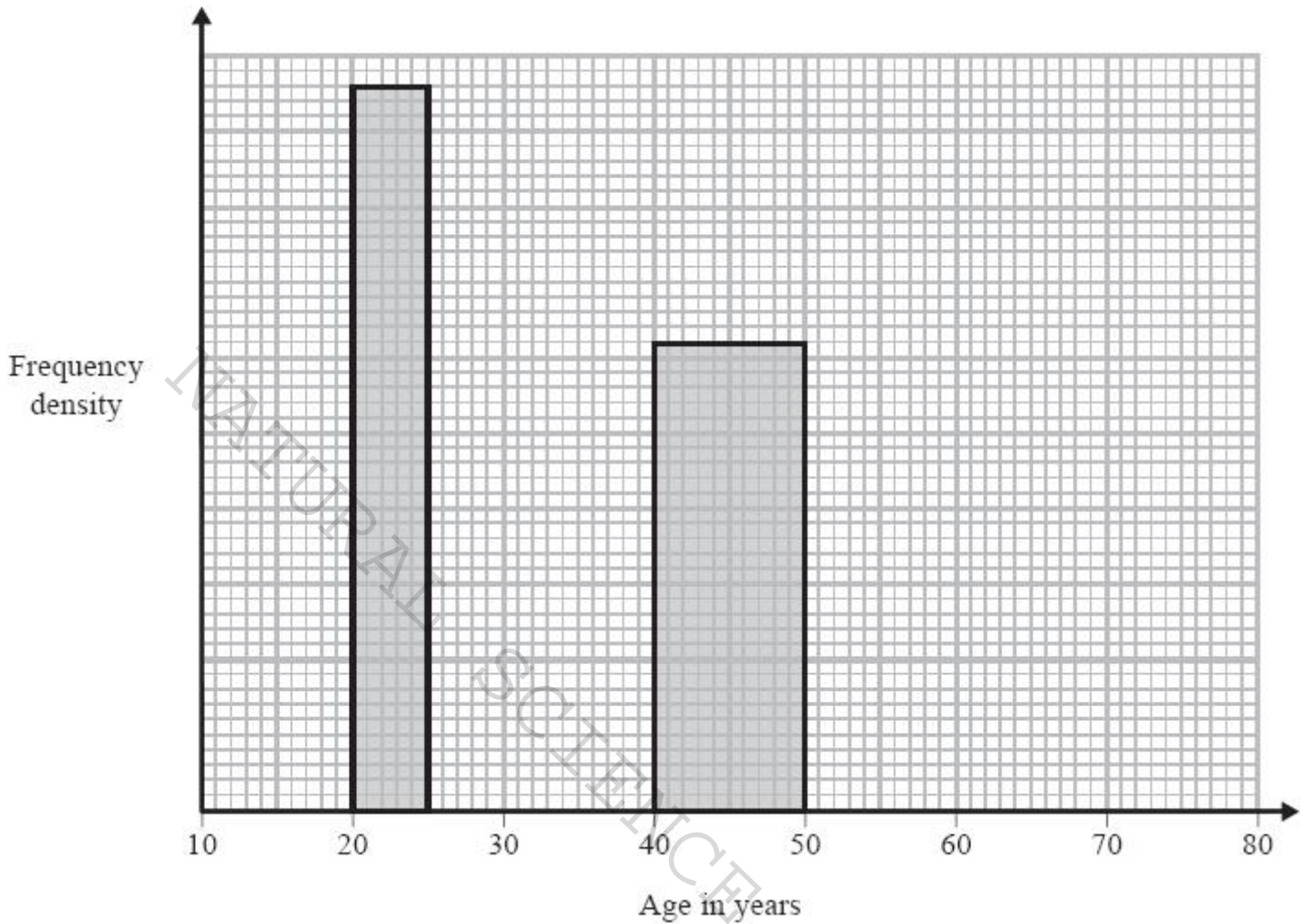
(Total for question = 4 marks)

(Q20 4MA0/4H, Jan 2017)

NATURAL SCIENCE SOLUTION

Q13.

The incomplete histogram and the incomplete table show information about the ages of people watching a film in a cinema.



Age (a years)	Number of people
$10 \leq a < 20$	38
$20 \leq a < 25$	24
$25 \leq a < 40$	63
$40 \leq a < 50$	
$50 \leq a < 80$	24

(a) Use the histogram to complete the table.

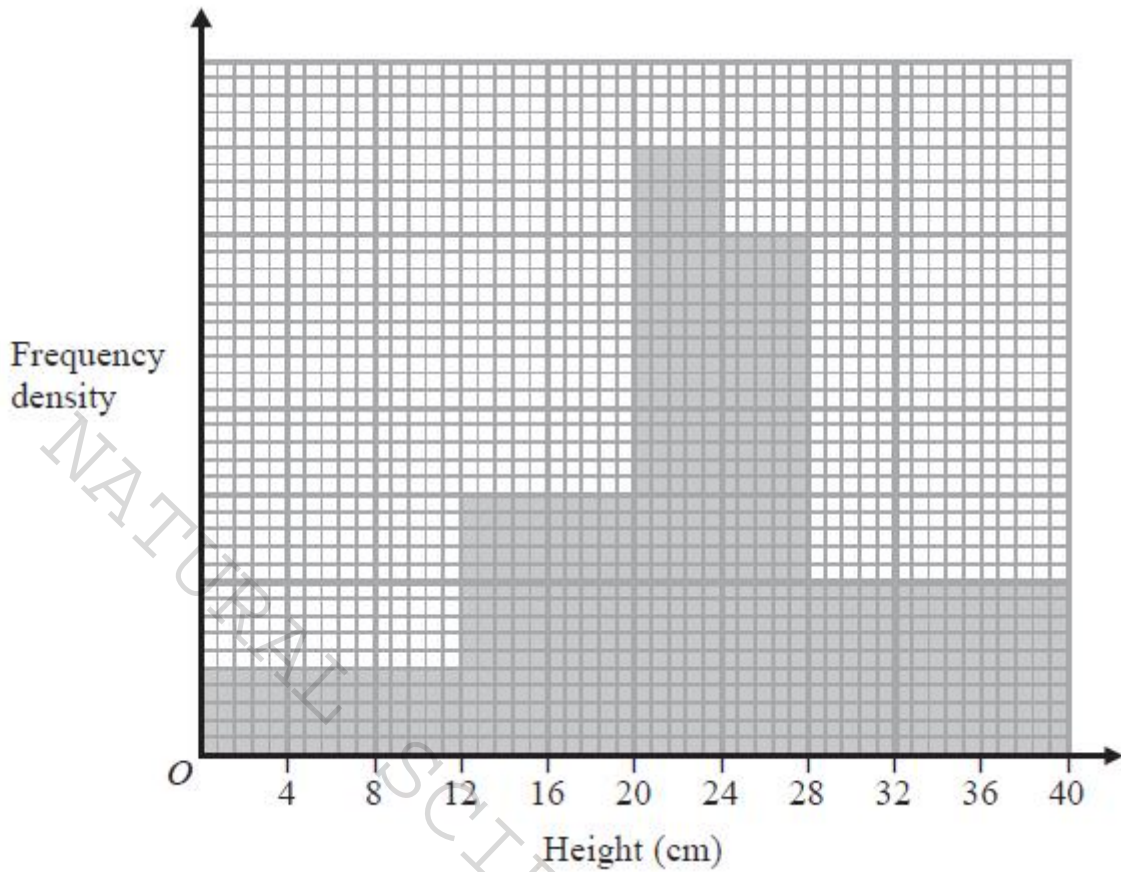
(2)

(b) Use the table to complete the histogram.

(2)

(Total for question = 4 marks)
(Q18 4MA0/4HR, Jan 2016)

Q14.



The histogram gives information about the heights of some plants.
 There are 360 plants with a height of 20 cm or less.
 Work out the number of plants with a height of more than 20 cm.

.....

(Total for question = 3 marks)

(Q18 4MA0/4HR, Jan 2015)

Probability

NATURAL SCIENCE SOLUTION

Topic-63: Probability and relative frequency

Q1.

Sophie takes an examination.

If she fails the examination, she will resit.

The probability that Sophie passes the examination on her first attempt is 0.7

If she fails the examination on any attempt, the probability she passes on the next attempt is 0.9

Work out the probability that Sophie takes at most 2 attempts to pass the examination.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 3 marks)
(Q15 4MA1/2H/EAM, Specimen papers)

Q2.

A box contains 15 counters.

There are 4 red counters, 5 green counters and the rest are yellow counters.

Niklas takes at random a counter from the box and writes down the colour of his counter.

He then puts the counter back into the box.

Sasha then takes at random a counter from the box and writes down the colour of her counter.

Work out the probability that the counters taken by Niklas and Sasha both have the same colour.

.....
(Total for question = 3 marks)
(Q16 4MA1/2H, Nov 2021)

Q3.

A bag contains only pink sweets, white sweets, green sweets and red sweets.

The table gives each of the probabilities that, when a sweet is taken at random from the bag, the sweet will be green or the sweet will be red.

Sweet	pink	white	green	red
Probability			0.2	0.35

The ratio

$$\text{number of pink sweets} : \text{number of white sweets} = 2 : 1$$

There are 28 red sweets in the bag.

Work out the number of white sweets in the bag.

.....
(Total for question = 5 marks)
(Q06 4MA1/2H, Jan 2022)

Q4.

A tin contains tea bags with a choice of four different flavours of tea.

The four flavours of tea are Assam or Darjeeling or Nilgiri or Rize.

Sara takes at random a tea bag from the tin.

The table shows each of the probabilities that the flavour of the tea Sara takes is Assam or Darjeeling or Rize.

Flavour of tea	Assam	Darjeeling	Nilgiri	Rize
Probability	0.38	0.24		0.16

(a) Work out the probability that the flavour of the tea Sara takes is Nilgiri.

.....
(2)

(b) Work out the probability that the flavour of the tea Sara takes is either Darjeeling or Rize.

.....
(2)

(Total for question = 4 marks)

(Q01 4MA1/2HR, Jan 2022)

Q5.

In a bag, there are only red counters, blue counters, green counters and yellow counters.

The total number of counters in the bag is 80

In the bag

the number of red counters is $x + 7$

the number of blue counters is $x - 11$

the number of green counters is $3x$

Jude takes at random a counter from the bag.

The probability that he takes a red counter is $\frac{1}{4}$

Work out the probability that Jude takes a yellow counter.

.....
(Total for question = 4 marks)

(Q06 4MA1/2HR, Jan 2023)

Q6.

A bag contains only red beads, blue beads, green beads and yellow beads.

The table gives the probabilities that, when a bead is taken at random from the bag, the bead will be blue or the bead will be yellow.

Colour	red	blue	green	yellow
Probability		0.24		0.31

The probability that the bead will be green is twice the probability that the bead will be red.

Sofia takes at random a bead from the bag.

She writes down the colour of the bead and puts the bead back into the bag.

She does this 180 times.

Work out an estimate for the number of times she takes a red bead from the bag.

.....
(Total for question = 4 marks)
(Q06 4MA1/2H, Jan 2020)

Q7.

The table shows information about the lengths of time, in minutes, 120 customers spent in a supermarket.

Length of time (L minutes)	Frequency
$20 < L \leq 30$	6
$30 < L \leq 40$	26
$40 < L \leq 50$	31
$50 < L \leq 60$	40
$60 < L \leq 70$	17

(a) Write down the modal class.

.....
(1)

(b) Work out an estimate for the mean length of time spent by the 120 customers in the supermarket.

..... minutes

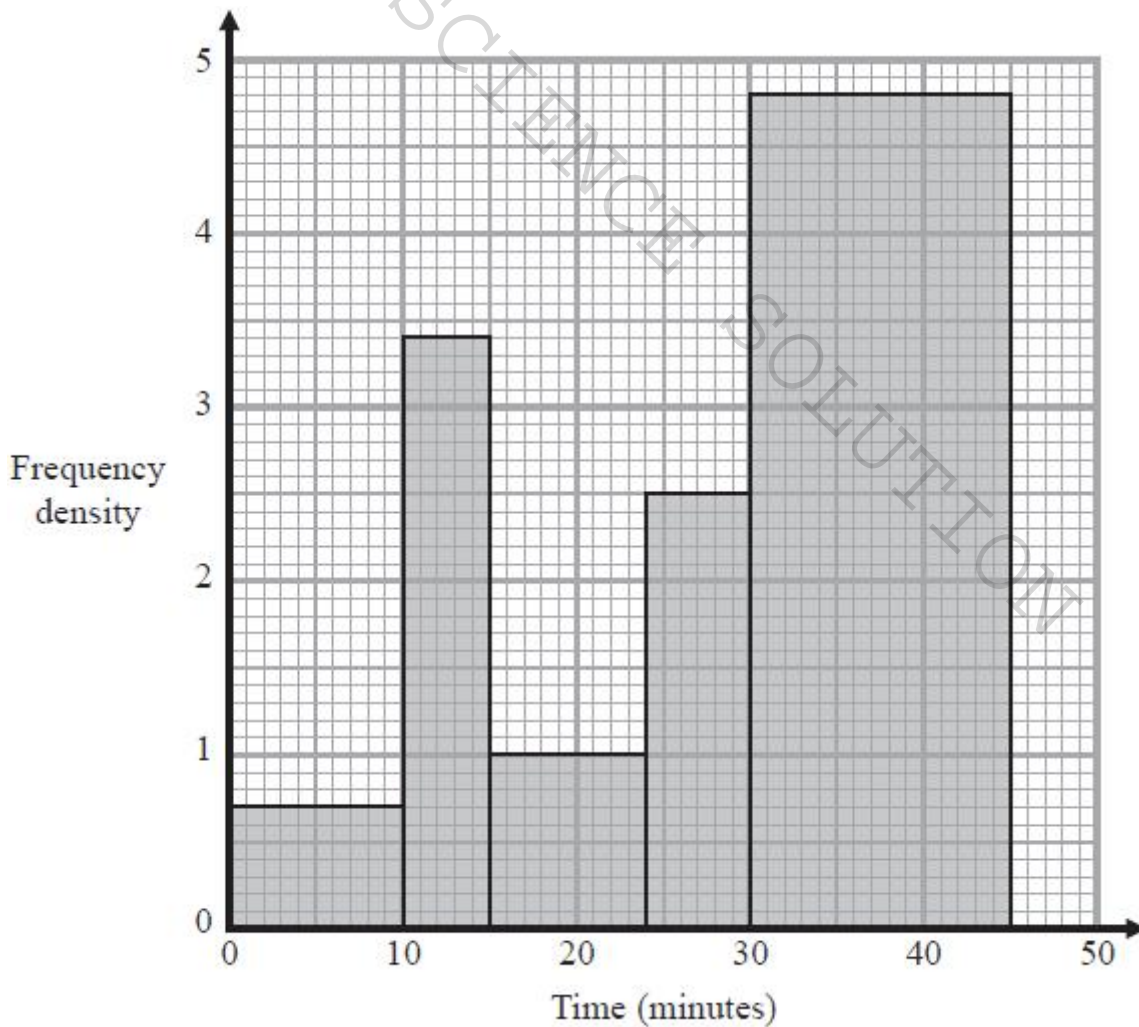
(4)

(Total for question = 5 marks)

(Q02 4MA1/2H, Nov 2020)

Q8.

The histogram gives information about the times, in minutes, that some customers spent in a supermarket.



(a) Work out an estimate for the proportion of these customers who spent between 17 minutes and 35 minutes in the supermarket.

.....

(3)

One of the customers is selected at random.

Given that this customer had spent more than 30 minutes in the supermarket,

(b) find the probability that this customer spent more than 36 minutes in the supermarket.

.....

(2)

(Total for question = 5 marks)

(Q18 4MA1/2H, Jan 2020)

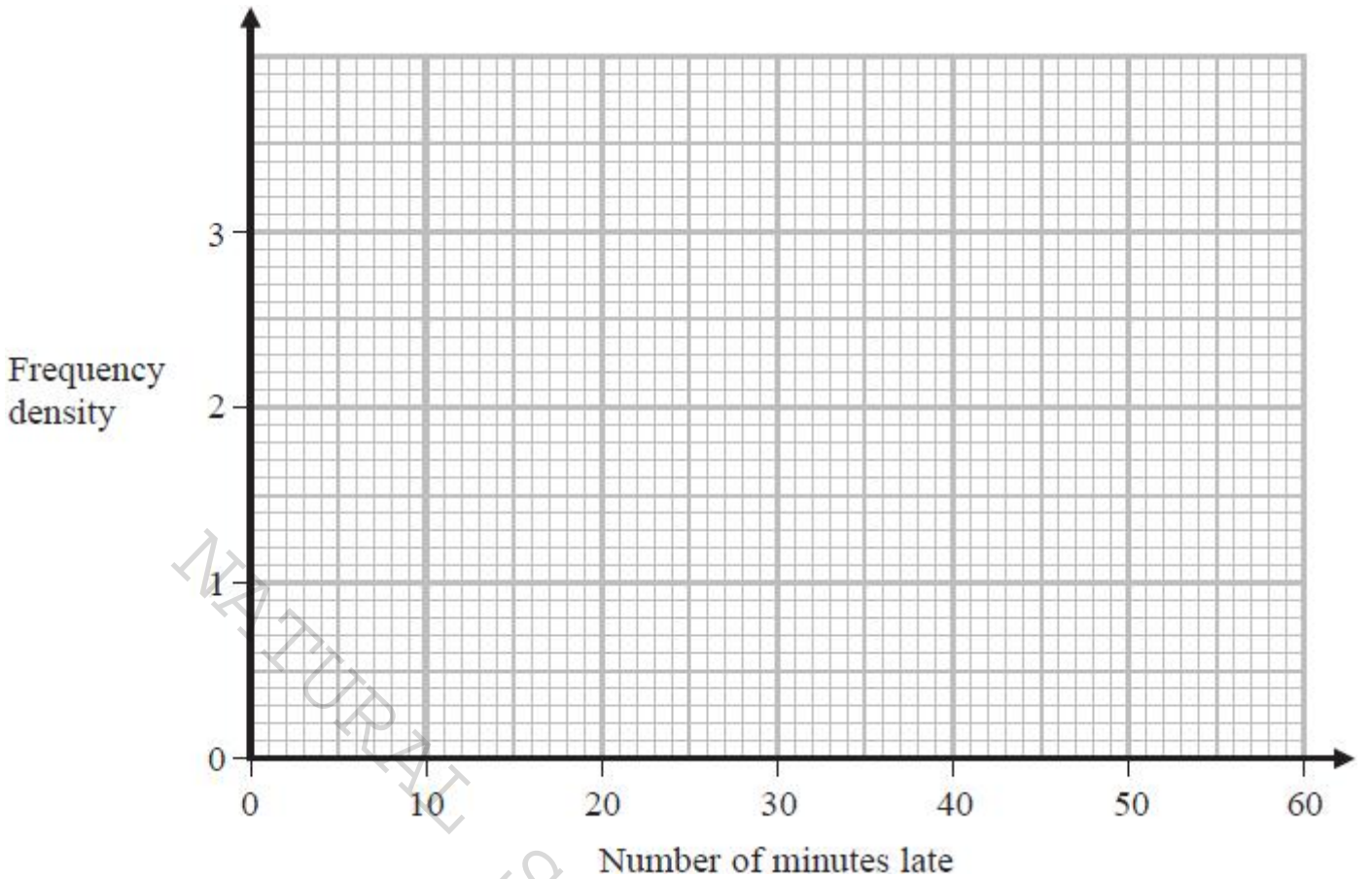
Q9.

Manuel collected information about the flights that arrived late at an airport last month.

The table gives information about the number of minutes that these flights were late.

Minutes late (L minutes)	Frequency
$0 < L \leq 10$	8
$10 < L \leq 15$	13
$15 < L \leq 25$	19
$25 < L \leq 40$	24
$40 < L \leq 60$	6

(a) On the grid, draw a histogram for this information.



(3)

Manuel selected at random a flight that was late by 25 minutes or less from his results.

(b) Work out an estimate for the probability that this flight was late by 5 minutes or less.

(2)

(Total for question = 5 marks)
(Q14 4MA1/2H, Nov 2021)

Q10.

The table gives information about the amounts of money, in euros, that 70 of Anjali's friends spent last Saturday.

Money spent (S euros)	Frequency
$0 < S \leq 8$	6
$8 < S \leq 16$	14
$16 < S \leq 24$	19
$24 < S \leq 32$	25
$32 < S \leq 40$	6

One of Anjali's 70 friends is going to be chosen at random.

(a) Find the probability that this friend spent more than 24 euros last Saturday.

.....
(1)

(b) Work out an estimate for the mean amount of money spent by Anjali's friends last Saturday.

Give your answer correct to 2 decimal places.

..... euros

(4)

(Total for question = 5 marks)
(Q03 4MA1/2H, Nov 2021)

Q11.

There are 90 counters in a bag.

Each counter in the bag is either red or blue so that

the number of red counters : the number of blue counters = 2 : 13

Li is going to put some more red counters in the bag so that

the probability of taking at random a red counter from the bag is $\frac{1}{3}$

Work out the number of red counters that Li is going to put in the bag.

(Total for question = 4 marks)

(Q03 4MA1/2H, Jan 2019)

Q12.

A biased spinner can land on green or on yellow or on brown or on pink.

The table gives the probabilities that, when the spinner is spun, it will land on green or on yellow or on brown.

Colour	green	yellow	brown	pink
Probability	0.32	0.13	0.28	

Timucin spins the spinner 200 times.

Work out an estimate for the number of times the spinner lands on pink.

.....
(Total for question = 3 marks)
(QU02 4MA1/2H, June 2023)

Q13.

In a bag there are only red bricks, blue bricks, green bricks and orange bricks.

The number of green bricks in the bag is the same as the number of orange bricks.

Jiao takes at random a brick from the bag.

The table gives the probability that Jiao takes a red brick and the probability that he takes a blue brick.

Colour	red	blue	green	orange
Probability	0.26	0.3		

(a) Work out the probability that Jiao takes an orange brick.

.....
(3)

Jiao puts the brick back into the bag.
There are 91 red bricks in the bag.

Jiao is going to build a tower using all the red bricks and all the blue bricks but no other bricks.
The tower will be in the shape of a cuboid.
There will be 4 bricks in each layer of the tower.

(b) Work out how many layers the tower will have.

.....
(3)
(Total for question = 6 marks)
(Q03 4MA1/2H/EAM, Specimen papers)

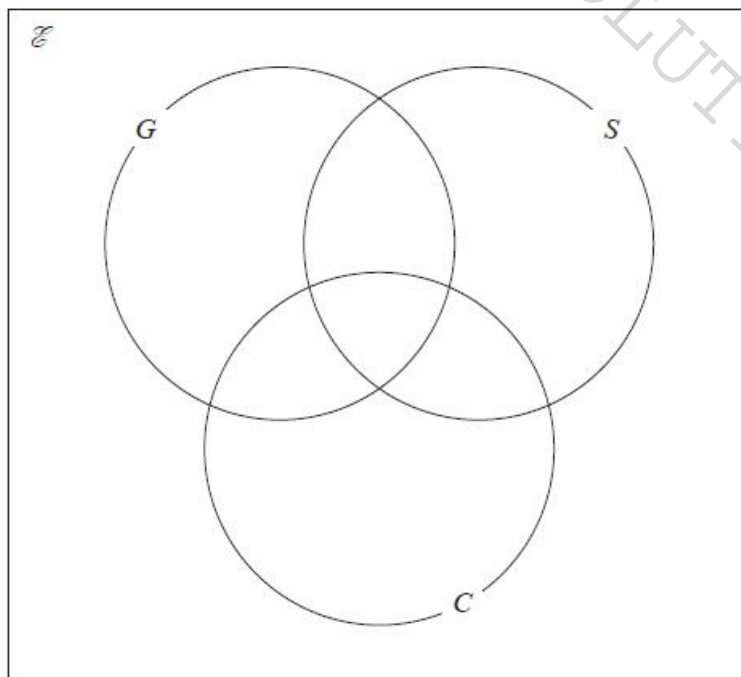
Q14.

100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers

- 31 have sheep
- 53 have chickens
- 6 have goats, sheep and chickens
- 11 have sheep and goats
- 17 have sheep and chickens
- 18 have goats and chickens
- 20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

(b) Find

(i) $n(G)$

.....
(1)

(ii) $n([G \cup S]')$

.....
(1)

(iii) $n(G' \cap C)$

.....
(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

.....
(2)

(Total for question = 8 marks)
(QU16 4MA1/2H, June 2022)

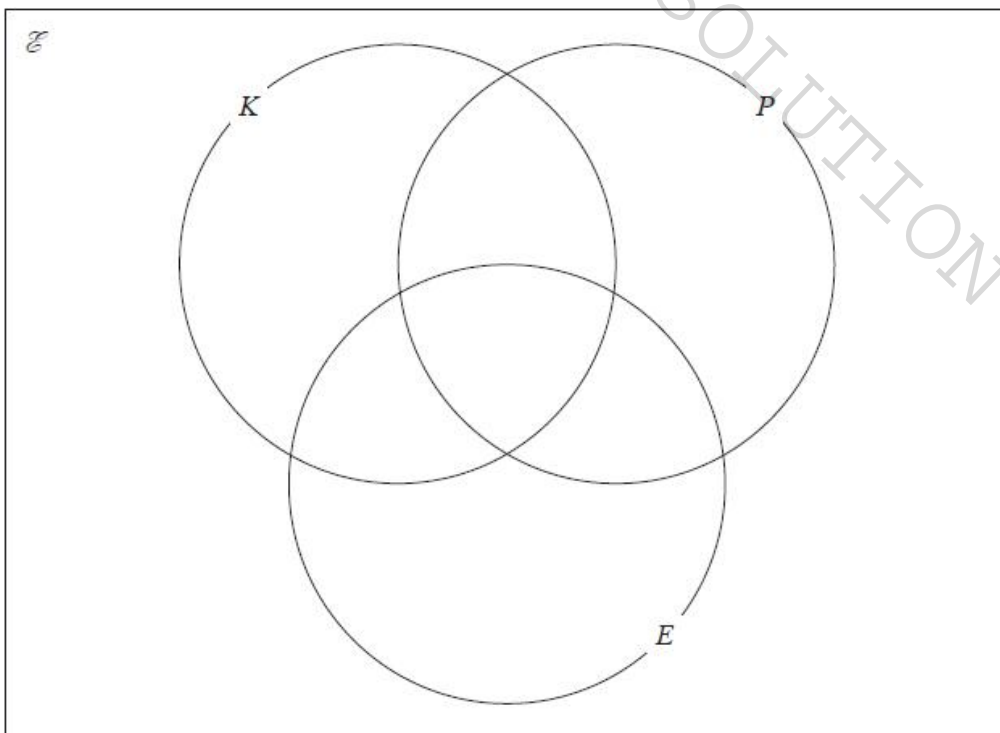
Q15.

60 art students were asked if they would like to attend workshops for knitting (K), for photography (P) or for embroidery (E)

Of these students

- 9 chose knitting, photography and embroidery
- 17 chose knitting and photography
- 16 chose photography and embroidery
- 20 chose knitting and embroidery
- 28 chose photography
- 39 chose embroidery
- 2 chose none of the workshops

(a) Using this information, complete the Venn diagram to show the numbers of students in each subset.



(3)

One of the students is chosen at random.

Given that this student chose photography,

(b) find the probability that this student also chose knitting.

.....
(2)

(c) Find $n(P \cap K)$

.....
(1)

(d) Find $n([P \cup E] \cap K)$

.....
(1)

(Total for question = 7 marks)

(QU16 4MA1/2H, June 2024)

NATURAL SCIENCE SOLUTION

Topic-64: Conditional probability

Q1.

30 adults booked to stay in a hotel.

19 adults booked breakfast

15 adults booked dinner

4 adults did not book breakfast or dinner

Some adults booked breakfast **and** dinner.

Meihui chooses at random two of the 30 adults.

Work out the probability that these two adults each booked breakfast **and** dinner.

.....
(Total for question = 4 marks)
(QU19 4MA1/2HR, June 2023)

Q2.

There are 12 counters in a bag.

3 of the counters are red

9 of the counters are green

Ameya, Jack and Ella each take at random one counter from the bag.

Work out the probability that at least one red counter is still in the bag.

.....
(Total for question = 3 marks)

(QU20 4MA1/2H, June 2023)

Q3.

Boris has a bag that only contains red sweets and green sweets.

Boris takes at random 2 sweets from the bag.

$$\frac{12}{35}$$

The probability that Boris takes exactly 1 red sweet from the bag is

Originally there were 3 red sweets in the bag.

Work out how many green sweets there were originally in the bag.
Show your working clearly.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

(Q23 4MA1/2H, June 2019)

Q4.

A bag contains X counters.

There are only red counters and blue counters in the bag.

There are 4 more blue counters than red counters in the bag.

Finty takes at random 2 counters from the bag.

The probability that Finty takes 2 blue counters from the bag is $\frac{3}{8}$

Work out the value of X .

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

(Q20 4MA1/2H, Nov 2020)

Q5.

Pippa has a box containing N pens.

There are only black pens and red pens in the box.

The number of black pens in the box is 3 more than the number of red pens.

Pippa is going to take at random 2 pens from the box.

The probability that she will take a black pen **followed** by a red pen is $\frac{9}{35}$

Find the possible values of N .

Show clear algebraic working.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 5 marks)

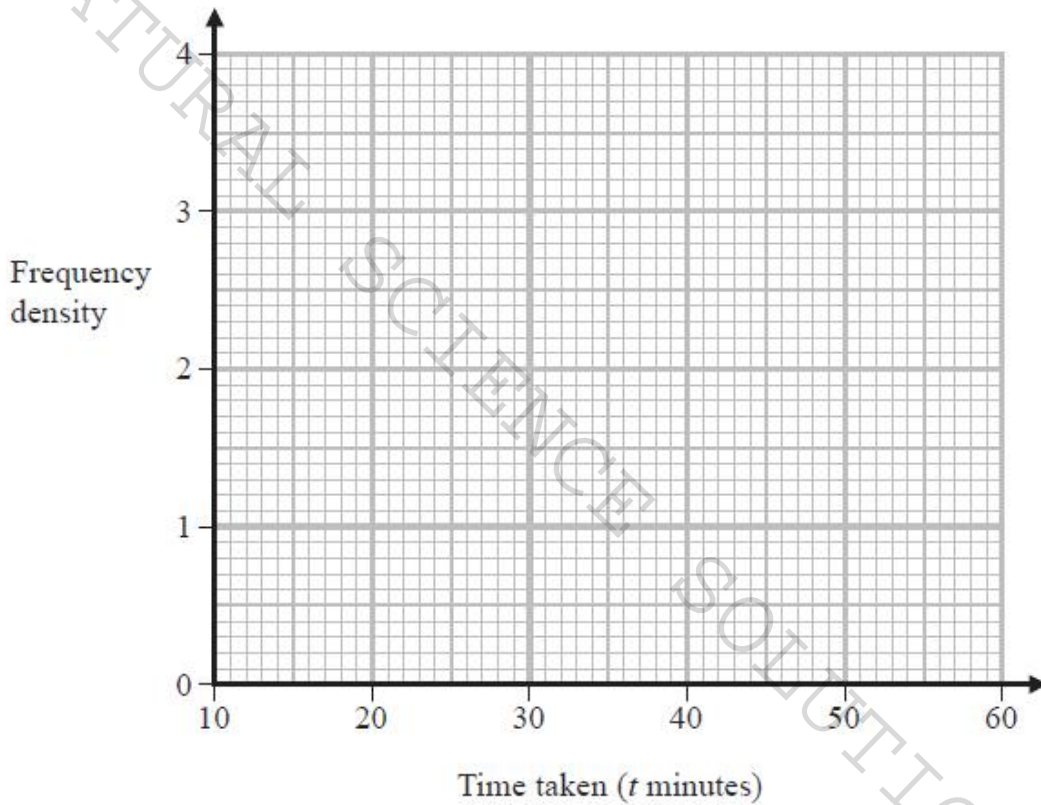
(Q23 4MA1/2H, June 2021)

Q6.

The table gives information about the time taken by each student in Year 11 to complete a homework task.

Time taken (t minutes)	Frequency
$10 < t \leq 25$	15
$25 < t \leq 30$	18
$30 < t \leq 50$	32
$50 < t \leq 60$	4

(a) On the grid, draw a histogram for this information.



(3)

One of these students who took 50 minutes or less and more than 25 minutes to complete this homework task is chosen at random.

(b) Find an estimate for the probability that this student took 45 minutes or less to complete this homework task.

(2)

(Total for question = 5 marks)
(Q17 4MA1/2HR, Jan 2023)

Q7.

Ciara throws **four** fair six-sided dice.

The faces of each dice are labelled with the numbers 1, 2, 3, 4, 5, 6

Work out the probability that at least one of the dice lands on an even number.

NATURAL SCIENCE SOLUTION

.....
(Total for question = 3 marks)

(QU14 4MA1/2HR, June 2022)

Q2.

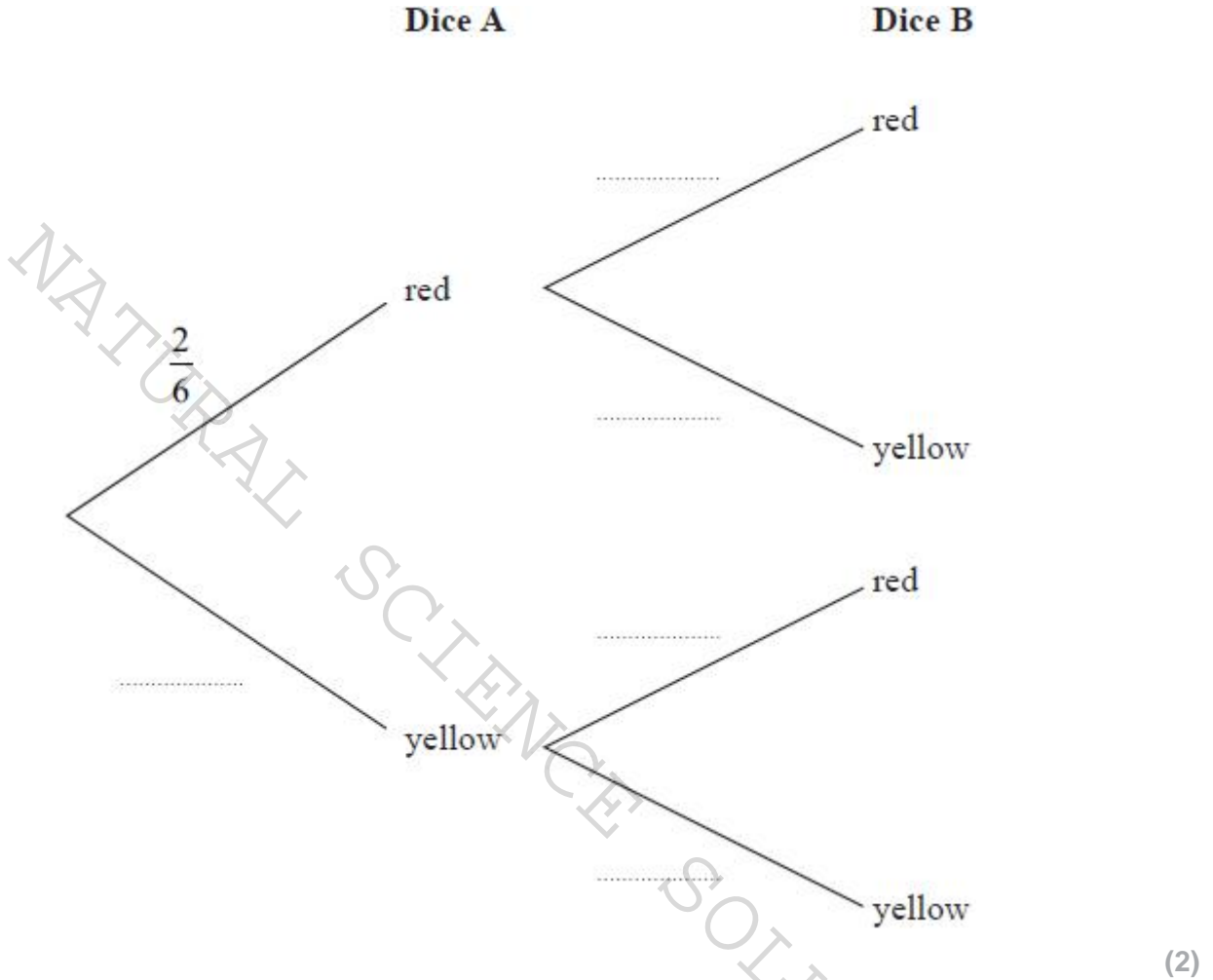
Narin has two fair 6-sided dice.

Dice **A** has 2 red faces and 4 yellow faces.

Dice **B** has 1 red face and 5 yellow faces.

Narin is going to throw each dice once.

(a) Complete the probability tree diagram.



(b) Work out the probability that both dice land on yellow.

.....
(2)

(Total for question = 4 marks)

(QU13 4MA1/2H, June 2023)

Emilie is going to take part in a third race.

If she wins both of the first two races, the probability that she will win the third race is 0.6

If she wins exactly one of the first two races, the probability that she will win the third race is 0.3

(c) Work out the probability that Emilie will win exactly two of the three races.

.....
(3)

(Total for question = 8 marks)

(Q13 4MA1/2H, June 2021)

NATURAL SCIENCE SOLUTION

Q4.

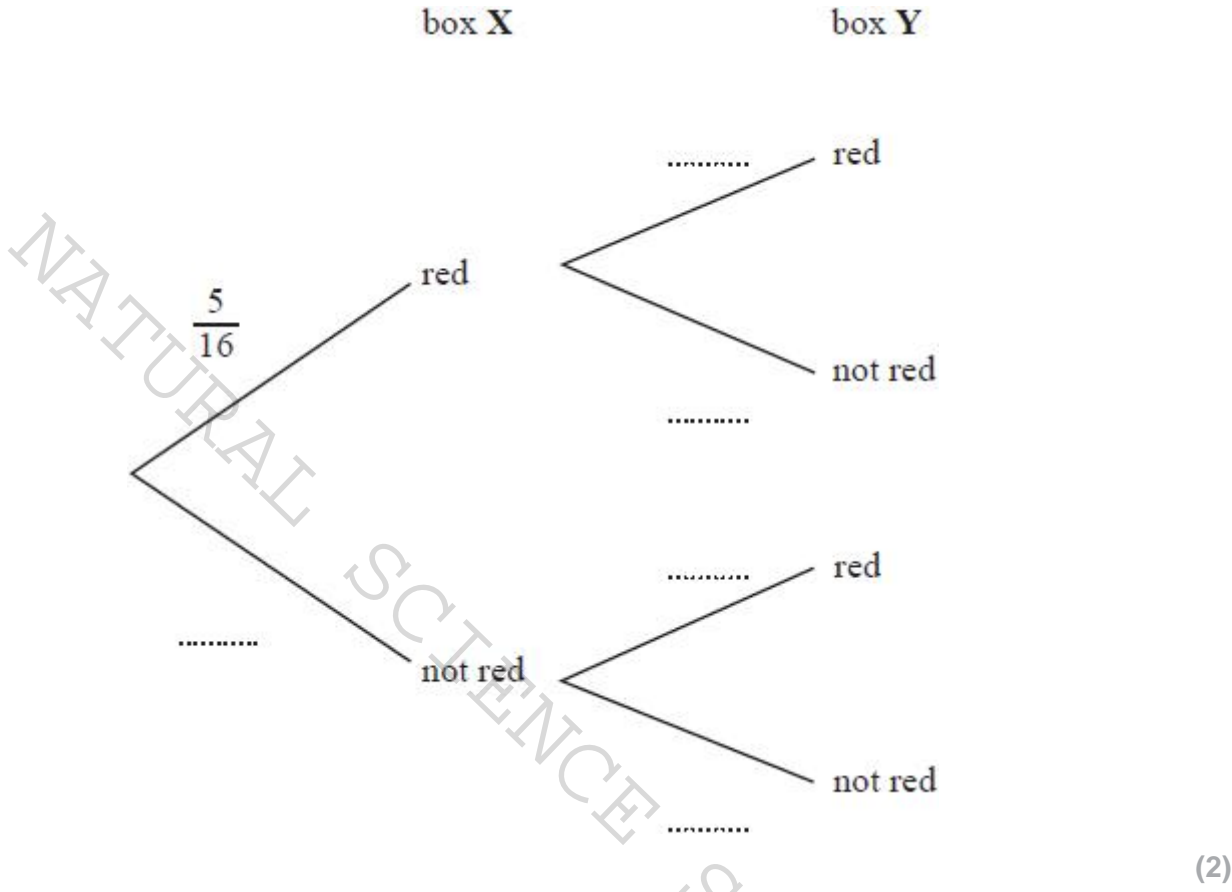
Sid has 2 boxes of crayons, box **X** and box **Y**

5 of the 16 crayons in box **X** are red.

7 of the 20 crayons in box **Y** are red.

Sid takes at random one crayon from box **X** and one crayon from box **Y**

(a) Complete the probability tree diagram.



(b) Work out the probability that Sid takes two crayons that are red or two crayons that are not red.

.....
(3)

(Total for question = 5 marks)

(Q11 4MA1/2H, Nov 2023)