Centre No.						Paper Reference								Surname	Initial(s)
Candidate No.						5	5	4	0	H	/	4	H	Signature	

Paper Reference(s)

5540H/4H

Edexcel GCSE

Mathematics A (Linear) – 2540

Paper 4 (Calculator)

Higher Tier

Monday 2 June 2008 – Afternoon

Time: 1 hour 45 minutes

Examiner's use only

Team Leader's use only

Materials required for examination

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Items included with question papers

Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
You must NOT write on the formulae page.
Anything you write on the formulae page will gain NO credit.
If you need more space to complete your answer to any question, use additional answer sheets.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 25 questions in this question paper. The total mark for this paper is 100.
There are 28 pages in this question paper. Any blank pages are indicated.
Calculators may be used.
If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Advice to Candidates

Show all stages in any calculations.
Work steadily through the paper. Do not spend too long on one question.
If you cannot answer a question, leave it and attempt the next one.
Return at the end to those you have left out.

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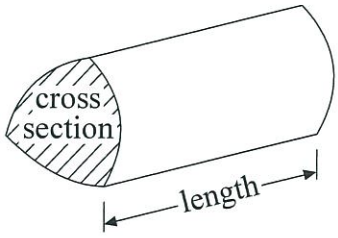
GCSE Mathematics (Linear) 2540

Formulae: Higher Tier

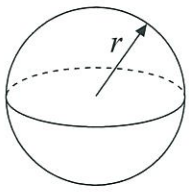
You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

Volume of a prism = area of cross section × length



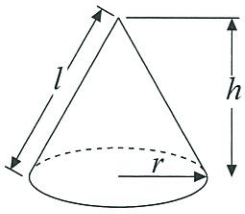
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

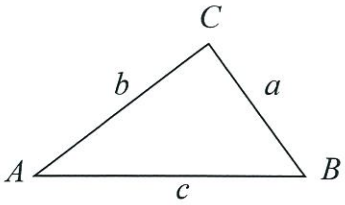


Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



In any triangle ABC



Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2}ab \sin C$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Leave blank

Answer ALL TWENTY FIVE questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1. There are 3 red pens, 4 blue pens and 5 black pens in a box.
Sameena takes a pen, at random, from the box.

(a) Write down the probability that she takes a black pen.

$P(\text{Black}) = \frac{5}{3+4+5} = \frac{5}{12}$

$\frac{5}{12}$

(2)

(b) Write down the probability that Sameena takes a pen that is **not** black.

$P(\text{not black}) = P(\text{Red or Blue})$

$= \frac{3+4}{12} = \frac{7}{12}$

$\frac{7}{12}$

Alternatively, $P(\text{not black}) = 1 - P(\text{black}) = 1 - \frac{5}{12} = \frac{7}{12}$

(1)

(Total 3 marks)

Q1

2. Use your calculator to work out

$$\frac{22.4 \times 14.5}{8.5 \times 3.2}$$

Write down all the figures on your calculator display.

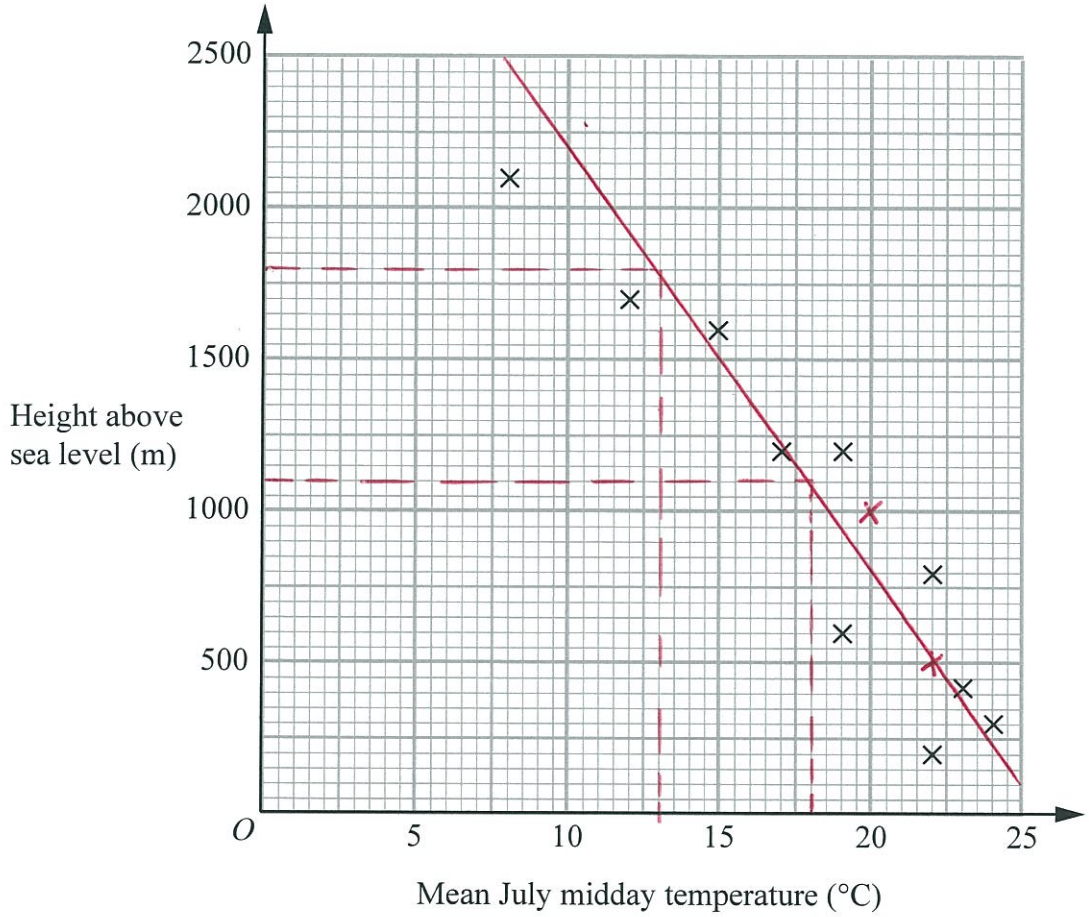
11.94117647

(Total 2 marks)

Q2

Leave blank

3. The scatter graph shows information for some weather stations.
It shows the height of each weather station above sea level (m) and the mean July midday temperature (°C) for that weather station.



The table shows this information for two more weather stations.

Height of weather station above sea level (m)	1000	500
Mean July midday temperature (°C)	20	22

(a) Plot this information on the scatter graph.

(1)

(b) What type of correlation does this scatter graph show?

Negative correlation

(1)

(c) Draw a line of best fit on the scatter graph.

(1)

H 3 1 0 2 2 A 0 4 2 8

Leave blank

A weather station is 1800 metres above sea level.

(d) Estimate the mean July midday temperature for this weather station.

13 °C

(1)

At another weather station the mean July midday temperature is 18°C.

(e) Estimate the height above sea level of this weather station.

1100 m

(1)

Q3

(Total 5 marks)

4.

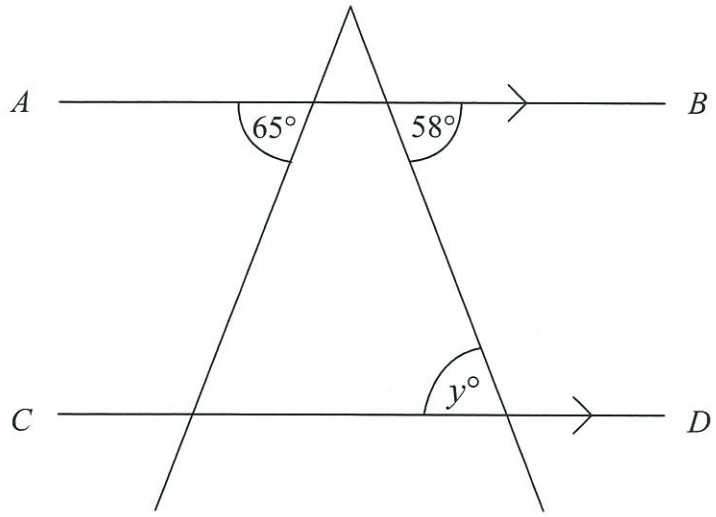


Diagram **NOT** accurately drawn

AB is parallel to *CD*.

(i) Write down the value of y.

58°

(ii) Give a reason for your answer.

Alternate angles (in a Z shape) are equal.

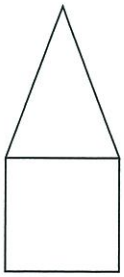
Q4

(Total 2 marks)

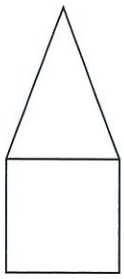
Leave blank

5. Here are the front elevation, side elevation and the plan of a 3-D shape.

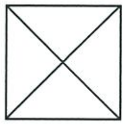
Front elevation



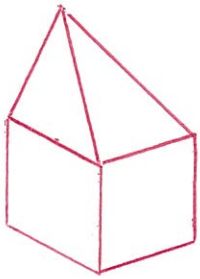
Side elevation



Plan



In the space below, draw a sketch of the 3-D shape.



Q5

(Total 2 marks)

H 3 1 0 2 2 A 0 6 2 8

Leave blank

6. Here are the first four terms of an arithmetic sequence.

5 8 11 14

Find an expression, in terms of n, for the nth term of the sequence.

$n \rightarrow$ 1 2 3 4 5

$f(n) \rightarrow$ 5 8 11 14 17

Difference $\rightarrow$ 3 3 3 3

$f(n) = 3n + 2$

$3n + 2$

(Total 2 marks)

Q6

7. The equation

$$x^3 + 2x = 26$$

has a solution between 2 and 3

Use a trial and improvement method to find this solution.
Give your answer correct to one decimal place.
You must show **all** your working.

x	$x^3 + 2x$	
2.5	20.625	$\rightarrow < 26$
2.8	27.552	$\rightarrow > 26$
2.7	25.083	$\rightarrow < 26$
2.75	26.296875	$\rightarrow > 26$

$\therefore 2.7 < x < 2.75$

$\Rightarrow x = 2.7$ (1 d.p.).

$x =$ 2.7

(Total 4 marks)

Q7

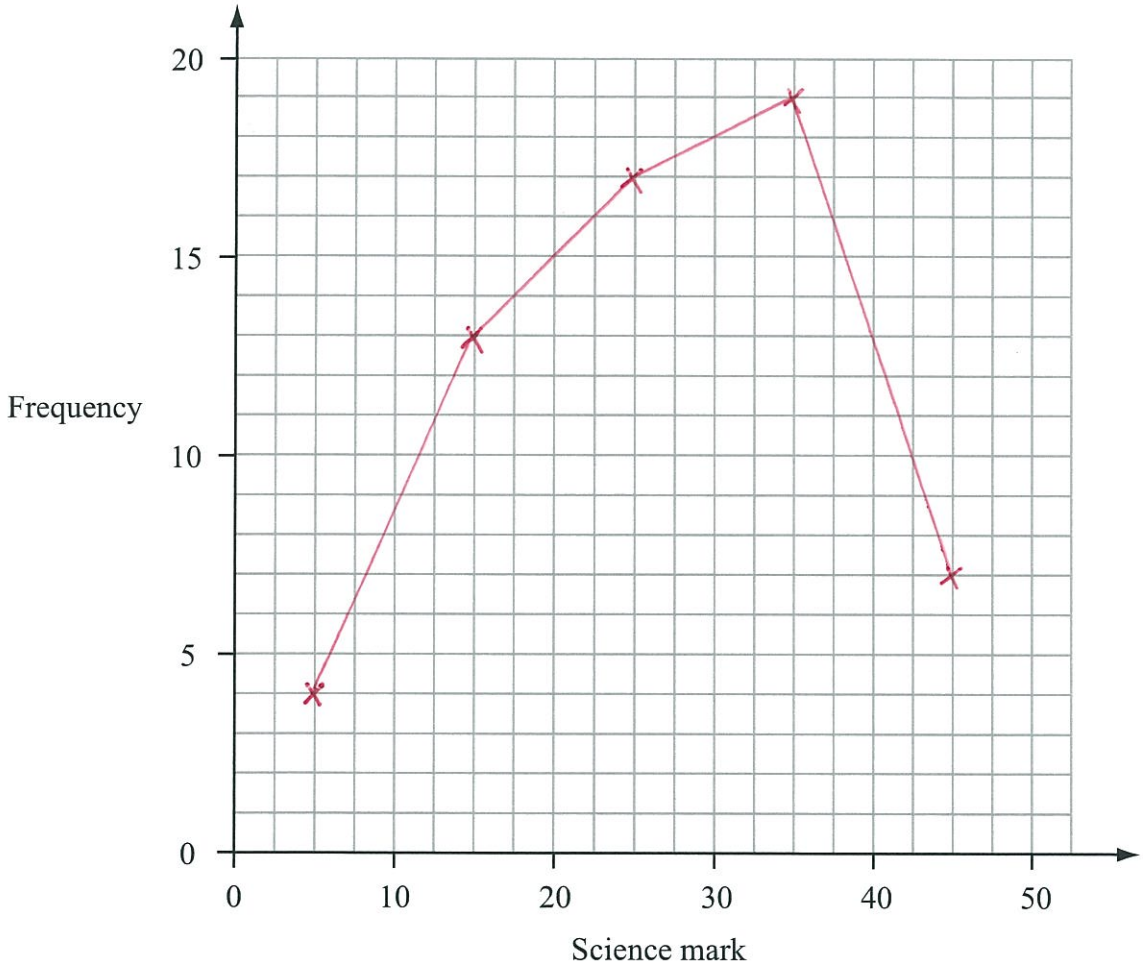
Leave blank

8. 60 students take a science test.
The test is marked out of 50.

This table shows information about the students' marks.

Science mark	0–10	11–20	21–30	31–40	41–50
Frequency	4	13	17	19	7

On the grid, draw a frequency polygon to show this information.



Q8

(Total 2 marks)

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9.

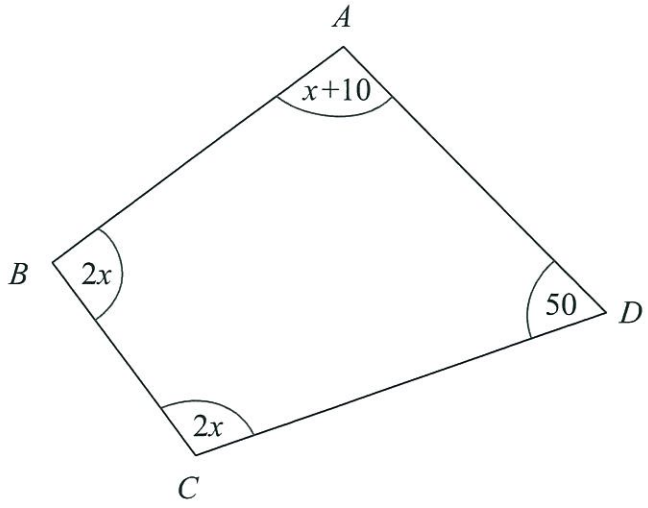

Diagram **NOT** accurately drawn

In this quadrilateral, the sizes of the angles, in degrees, are

$x + 10$
$2x$
$2x$
50

(a) Use this information to write down an equation in terms of x.

$x+10+2x+2x+50=360$

$\Rightarrow 5x+60=360$

$5x+60=360$

(2)

(b) Work out the value of x.

$x=\frac{360-60}{5}=\frac{300}{5}=60°$

$x =$ $60°$

(3)

(Total 5 marks)

Q9

Turn over

Leave blank

10. A garage sells British cars and foreign cars.
The ratio of the number of British cars sold to the number of foreign cars sold is 2 : 7

The garage sells 45 cars in one week.

(a) Work out the number of British cars the garage sold that week.

$\frac{45}{2+7} \times 2 = \frac{45}{9} \times 2 = 5 \times 2 = 10$

10
.....
(2)

A car tyre costs £80 plus VAT at $17\frac{1}{2}$ %.

(b) Work out the total cost of the tyre.

$80 + \left(\frac{17.5}{100} \times 80\right)$

or, when factorised to its shorthand form,

$80 \times 1.175 = £94.00$

£ 94.00
.....
(3)

The value of a new car is £12 000
The value of the car depreciates by 20% per year.

(c) Work out the value of the car after 2 years.

$12{,}000 \times 0.8^2 = £7{,}680$

£ 7,680
.....
(3)

Q10

(Total 8 marks)

H 3 1 0 2 2 A 0 1 0 2 8

Leave blank

11. (a) Simplify $4a + 3c - 2a + c$

$2a + 4c$

(1)

(b) $S = \frac{1}{2}at^2$

Find the value of S when $t = 3$ and $a = \frac{1}{4}$

$S = \frac{1}{2}\left(\frac{1}{4}\right)(3^2) = \frac{1}{8}(9) = \frac{9}{8} = 1\frac{1}{8}$ or 1.125

$S =$ 1.125

(2)

(c) Factorise $x^2 - 5x$

$x(x - 5)$

(2)

(d) Expand and simplify $(x + 3)(x + 4)$ $= x^2 + 4x + 3x + 12$

$x^2 + 7x + 12$

$x^2 + 7x + 12$

(2)

(e) Factorise $y^2 + 8y + 15$

$(y + 5)(y + 3)$

$(y + 5)(y + 3)$

(2)

Q11

(Total 9 marks)

Leave blank

12. A shop sells mobile phones.
The table shows the number of mobile phones sold each month from January to May.

Jan	Feb	Mar	Apr	May
70	64	73	85	91

(a) Work out the percentage increase in the number of mobile phones sold from April to May.
Give your answer correct to 3 significant figures.

$\frac{91-85}{85} \times 100 = 7.06\%$ (3 s.f.).

7.06 %
(3)

(b) Work out the 3-month moving averages for the information in the table.
The first one has been worked out for you.

69 74 83
(2)

(Total 5 marks)

Q12

Leave blank

13.

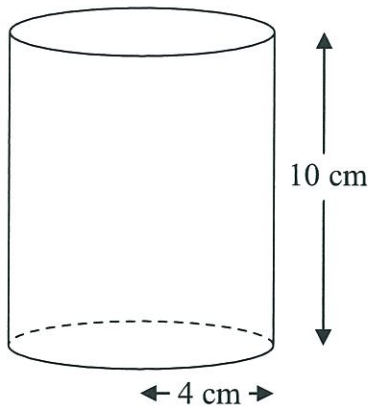

Diagram **NOT** accurately drawn

A solid cylinder has a radius of 4 cm and a height of 10 cm.

(a) Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

Volume of cylinder $= \pi r^2 h$

$= \pi(4^2)(10)$

$= 160\pi = 503 \text{ cm}^3$ (3 s.f.).

503 ..... cm^3
(2)

The cylinder is made from wood.
The density of the wood is 0.6 grams per cm^3.

(b) Work out the mass of the cylinder.
Give your answer correct to 3 significant figures.

$\text{Density} = \dfrac{\text{Mass}}{\text{Volume}}$

$0.6 = \dfrac{\text{Mass}}{160\pi}$

$\Rightarrow \text{Mass} = 0.6(160\pi)$

$= 302\text{g}$ (3 s.f.).

302 ..... grams
(2)

(Total 4 marks)

Q13

H 3 1 0 2 2 A 0 1 3 2 8

Turn over

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14.

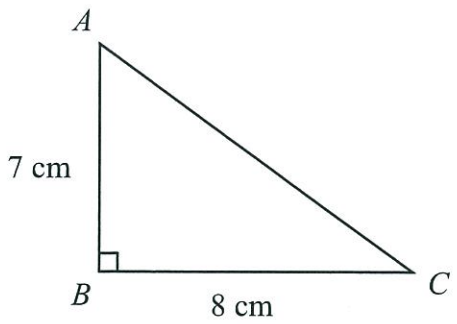

Diagram **NOT** accurately drawn

ABC is a right-angled triangle.
AB = 7 cm,
BC = 8 cm.

(a) Work out the area of the triangle.

Area $= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2}(7)(8) = \frac{56}{2} = 28 \text{ cm}^2$

28 ..... cm^2
(2)

(b) Work out the length of *AC*.
Give your answer correct to 2 decimal places.

$AC^2 = 7^2 + 8^2$

$\Rightarrow AC = \sqrt{7^2 + 8^2}$

$= \sqrt{113}$

$= 10.63 \text{ cm}$ (2d.p.).

10.63 ..... cm
(3)

H 3 1 0 2 2 A 0 1 4 2 8

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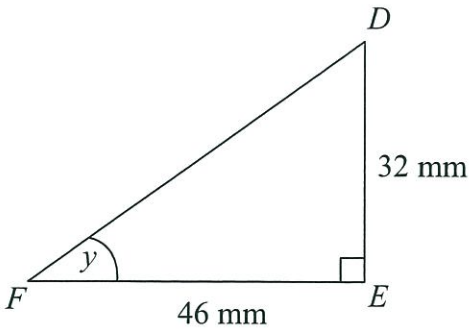


Diagram **NOT** accurately drawn

DEF is another right-angled triangle.
DE = 32 mm,
FE = 46 mm.

(c) Calculate the size of angle *y*.
Give your answer correct to 1 decimal place.

$\tan y = \frac{32}{46}$

$\Rightarrow y = \tan^{-1}\left(\frac{32}{46}\right)$

$= 34.8^\circ$ (1d.p.).

34.8 °

(3)

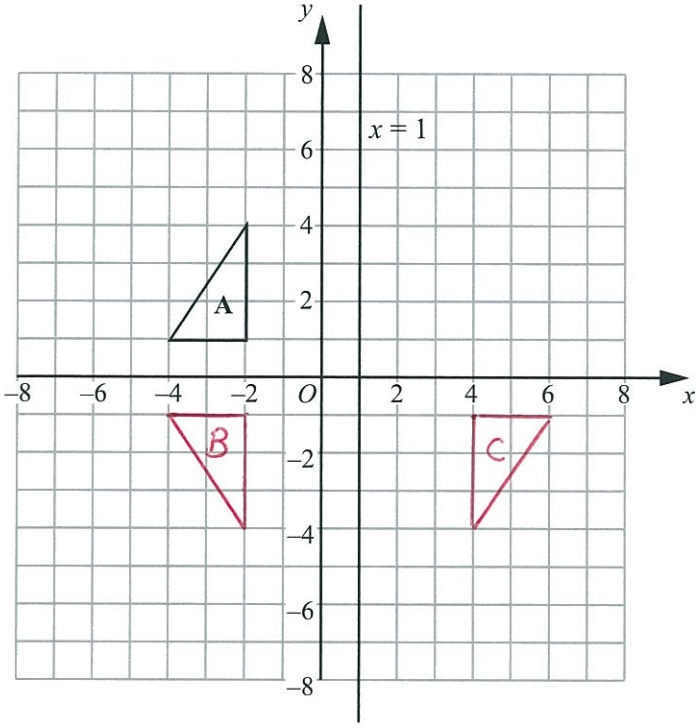
(Total 8 marks)

Q14

Turn over

Leave blank

15.



Triangle **A** is reflected in the x-axis to give triangle **B**.
Triangle **B** is reflected in the line $x = 1$ to give triangle **C**.

Describe the **single** transformation that takes triangle **A** to triangle **C**.

A rotation of 180° about the point (1, 0)

Q15

(Total 3 marks)

H 3 1 0 2 2 A 0 1 6 2 8

Leave blank

16. (a) Express 252 as a product of its prime factors.

$252 = 2 \times 126$
$= 2 \times 2 \times 63$
$= 2 \times 2 \times 3 \times 21$
$= 2 \times 2 \times 3 \times 3 \times 7$

$2^2 \times 3^2 \times 7$

(3)

James thinks of two numbers.
He says "The Highest Common Factor (HCF) of my two numbers is 3
The Lowest Common Multiple (LCM) of my two numbers is 45"

(b) Write down two numbers that James could be thinking of.

$45 = 3 \times 3 \times 5$

Factors of 45 are 3, 9, 5, 15

HCF {9, 15} = 3

LCM {9, 15} = 45

9 and 15

(3)

(Total 6 marks)

Q16

17. The number of atoms in one kilogram of helium is 1.51×10^{26}

Calculate the number of atoms in 20 kilograms of helium.
Give your answer in standard form.

$20 \times 1.51 \times 10^{26} = 3.02 \times 10^{27}$

3.02×10^{27}

(Total 2 marks)

Q17

Leave blank

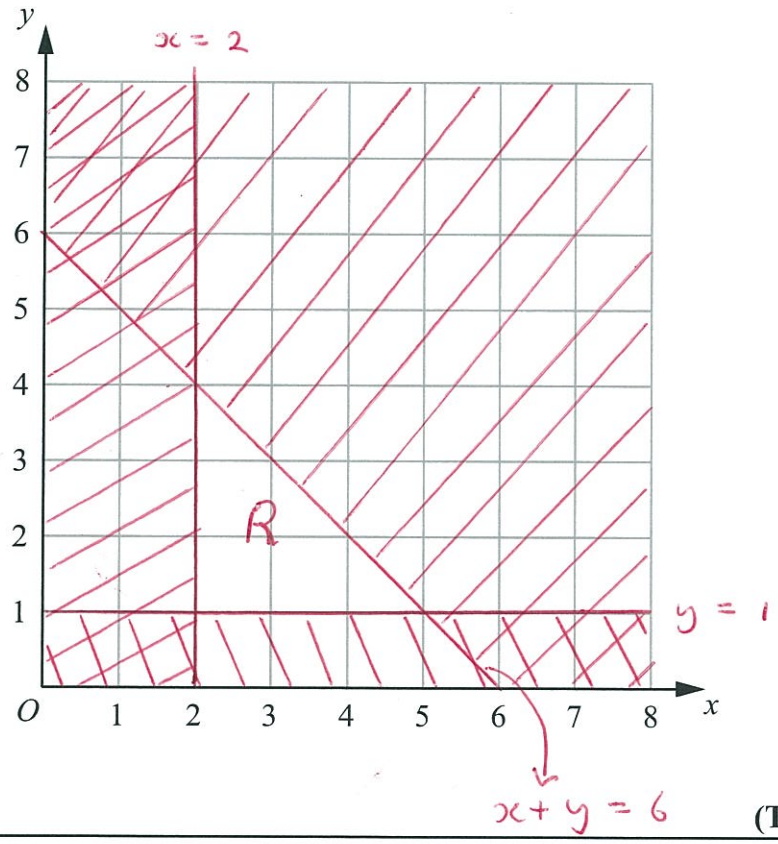
18. The region **R** satisfies the inequalities

$$x \geqslant 2, \quad y \geqslant 1, \quad x + y \leqslant 6$$

On the grid below, draw straight lines and use shading to show the region **R**.

$x + y \leqslant 6$

$\Rightarrow y \leqslant -x + 6$



(Total 3 marks)

Q18

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19.

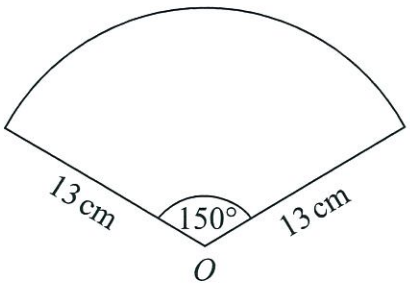

Diagram **NOT** accurately drawn

The diagram shows a sector of a circle, centre O.
The radius of the circle is 13 cm.
The angle of the sector is 150°.

Calculate the area of the sector.
Give your answer correct to 3 significant figures.

$\frac{150}{360} \times \pi r^2$

$= \frac{5}{12}\pi(13^2)$

$= 221\text{ cm}^2$ (3 s.f.).

221 ..... cm^2

(Total 2 marks)

Q19

Turn over

Leave blank

20. q is inversely proportional to the square of t.

When $t = 4$, $q = 8.5$

(a) Find a formula for q in terms of t.

$q \propto \frac{1}{t^2}$

$\Rightarrow q = \frac{k}{t^2}$

$8.5 = \frac{k}{4^2}$

$\Rightarrow k = 8.5(16) = 136. \therefore q = \frac{136}{t^2}$

$q =$ $\frac{136}{t^2}$

(3)

(b) Calculate the value of q when $t = 5$

$q = \frac{136}{5^2} = \frac{136}{25} = 5.44$

5.44

(1)

(Total 4 marks)

Q20

H 3 1 0 2 2 A 0 2 0 2 8

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21. The incomplete histogram and table show information about the weights of some containers.

Weight (w) in kg	Frequency
$0 < w \leqslant 1000$	16
$1000 < w \leqslant 2000$	18
$2000 < w \leqslant 4000$	20
$4000 < w \leqslant 6000$	16
$6000 < w \leqslant 8000$	12
$8000 < w \leqslant 12000$	8

Freq. Density = $\frac{\text{Freq.}}{\text{Class width}}$

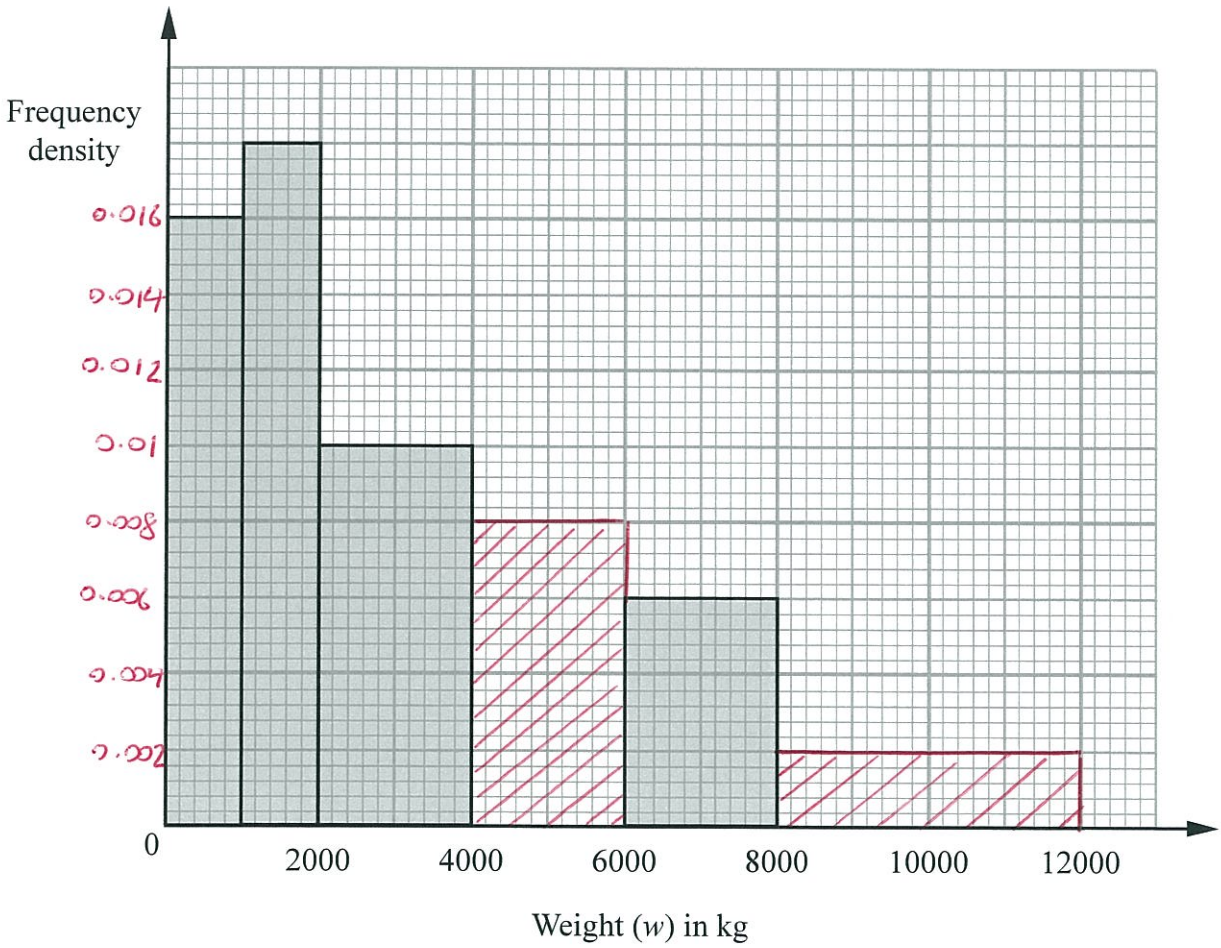
0.016
0.018
0.01
0.008
0.006
0.002

(a) Use the information in the histogram to complete the table.

(2)

(b) Use the information in the table to complete the histogram.

(2)



Q21

(Total 4 marks)

Turn over

Leave blank

22. Katy drove for 238 miles, correct to the nearest mile.
She used 27.3 litres of petrol, to the nearest tenth of a litre.

$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Katy's journey.
Give your answer correct to 2 decimal places.

$\frac{238.5}{27.25}$ = 8.75 miles per litre (2d.p.).

8.75 ..... miles per litre

(Total 3 marks)

Q22

H 3 1 0 2 2 A 0 2 2 2 8

Leave blank

23. (a) Show that the equation

$$\frac{5}{x+2} = \frac{4-3x}{x-1}$$

can be rearranged to give $3x^2 + 7x - 13 = 0$

$5(x-1) = (x+2)(4-3x)$

$5x - 5 = 4x - 3x^2 + 8 - 6x$

$5x - 5 = -3x^2 - 2x + 8$

$\Rightarrow 3x^2 + 7x - 13 = 0$

(3)

(b) Solve $3x^2 + 7x - 13 = 0$
Give your solutions correct to 2 decimal places.

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where $(a, b, c) = (3, 7, -13)$

$\Rightarrow x = \frac{-7 \pm \sqrt{7^2 - 4(3)(-13)}}{2(3)} = \frac{-7 \pm \sqrt{205}}{6}$

$= 1.22$ (2d.p.) or -3.55 (2d.p.)

$x =$ 1.22 or $x =$ −3.55

(3)

(Total 6 marks)

Q23

Turn over

Leave blank

24.

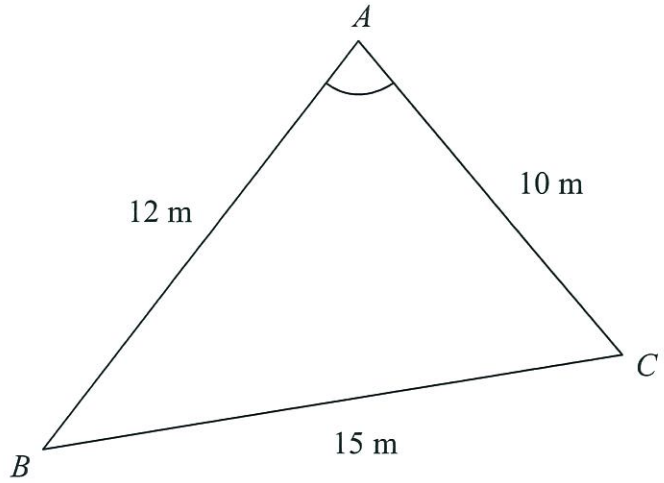


Diagram **NOT** accurately drawn

ABC is a triangle.
AB = 12 m.
AC = 10 m.
BC = 15 m.

Calculate the size of angle *BAC*.
Give your answer correct to one decimal place.

Cosine rule

$a^2 = b^2 + c^2 - 2bc \cos A$

$\Rightarrow 15^2 = 12^2 + 10^2 - 2(12)(10)\cos A$

$\Rightarrow \cos A = \dfrac{12^2 + 10^2 - 15^2}{2(12)(10)} = \dfrac{19}{240}$

$\therefore A = \cos^{-1}\left(\dfrac{19}{240}\right) = 85.5^\circ$ (1 d.p.).

85.5 °

(Total 3 marks)

Q24

Leave blank

25.

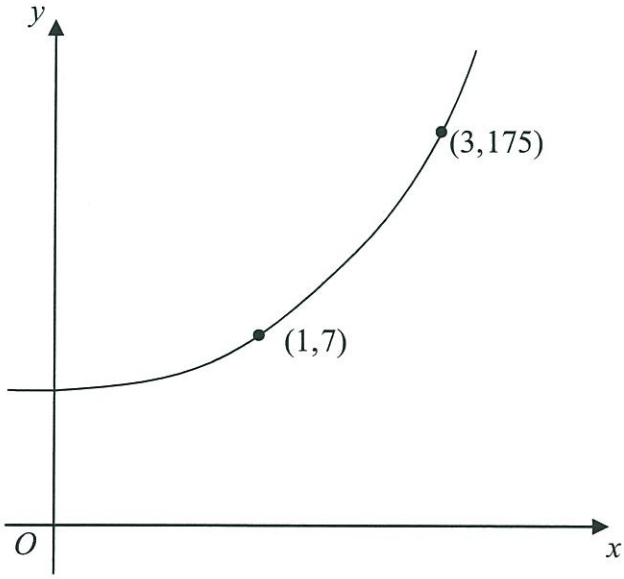


Diagram **NOT** accurately drawn

The sketch shows a curve with equation

$$y = ka^x$$

where k and a are constants, and $a > 0$

The curve passes through the points (1, 7) and (3, 175).

Calculate the value of k and the value of a.

$7 = ka \quad \dots \quad (1)$

$175 = ka^3 \quad \dots \quad (2)$

From (1): $k = \frac{7}{a}$.

In (2): $175 = \frac{7}{a}a^3 = 7a^2 \Rightarrow a = \sqrt{\frac{175}{7}} = 5$

In (1): $7 = 5k$

$\Rightarrow k = \frac{7}{5} = 1\frac{2}{5}$ or 1.4

$k =$ 1.4

$a =$ 5

Q25

(Total 3 marks)

TOTAL FOR PAPER: 100 MARKS

END

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