Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | Candidate Number

Time 2 hours

Paper reference **4MA1/2H**

Mathematics A

PAPER 2H

Higher Tier

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

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
- Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ▶

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P 6 5 9 1 8 A 0 1 2 8

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

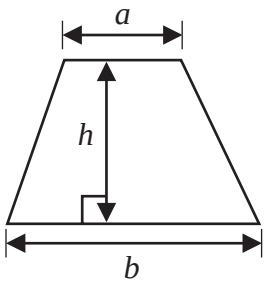
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

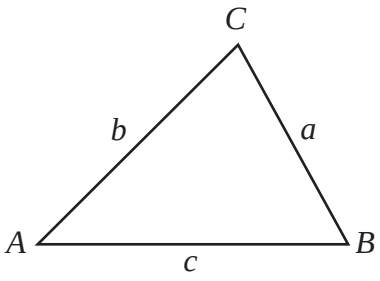
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

Area of trapezium $= \frac{1}{2}(a + b)h$



Trigonometry



In any triangle *ABC*

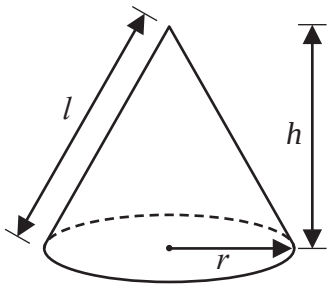
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

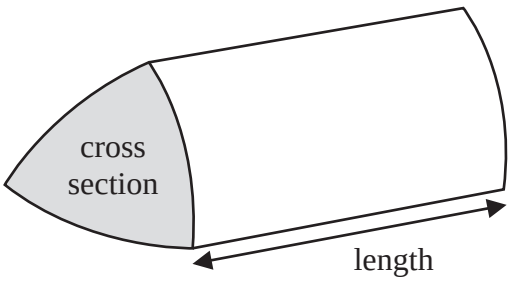
Area of triangle $= \frac{1}{2}ab\sin C$

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

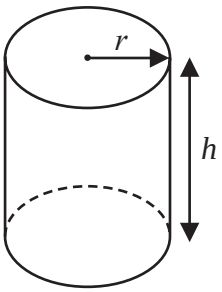
Curved surface area of cone $= \pi r l$



Volume of prism
= area of cross section × length

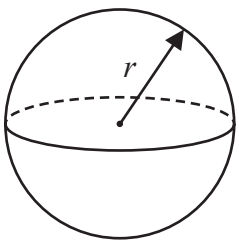


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi r h$



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

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

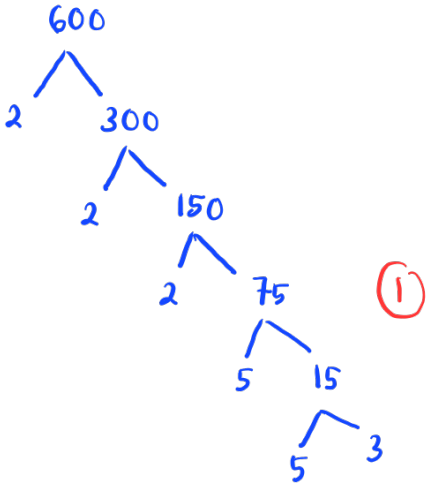


Answer ALL TWENTY THREE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

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



(1)

$2 \times 2 \times 2 \times 3 \times 5 \times 5$ (1) $= 600$

$2^3 \times 3 \times 5^2 = 600$

$2^3 \times 3 \times 5^2$ (1)

(Total for Question 1 is 3 marks)

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

LHS : $\frac{18}{7} \div \frac{9}{8}$ (1)

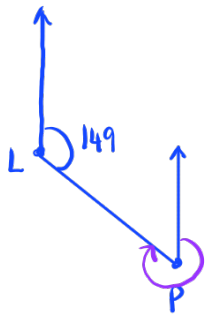
$= \frac{18^{2}}{7} \times \frac{8}{9_{1}}$ (1)

$= \frac{16}{7} = 2\frac{2}{7}$ (1)

(Total for Question 2 is 3 marks)

3 The bearing of Paris from London is 149°

Work out the bearing of London from Paris.



$= 360^{\circ} - (180^{\circ} - 149^{\circ})$ (1)

$= 360^{\circ} - 31^{\circ}$

$= 329^{\circ}$ (1)

329 °

(Total for Question 3 is 2 marks)

4 $\mathscr{E}$ = {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) $B \cup I$ - in set B or in set I

b, r, a, z, i, l, e, n, d (1)

(ii) $B \cap I'$ - in set B and not in set I

b, z (1)

(2)

K = {k, e, n, y, a}

Cody writes down the statement $B \cap K = \varnothing$
Cody's statement is wrong.

(b) Explain why.

There is letter 'a' in both sets. (1)

(1)

(Total for Question 4 is 3 marks)

5

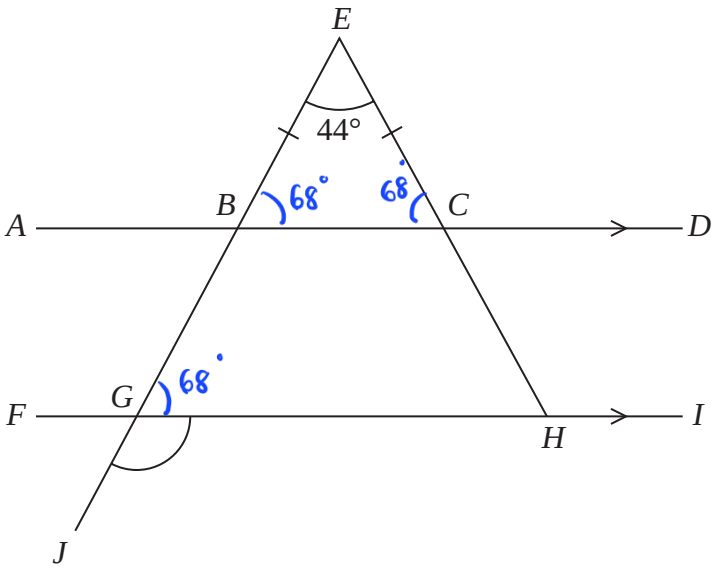


Diagram **NOT** accurately drawn

ABCD and *FGHI* are parallel straight lines.
EBGJ and *ECH* are straight lines.

BE = *CE*
Angle *BEC* = 44°

Work out the size of angle *JGH*.
Give a reason for each stage of your working.

angle EBC = $\frac{180^\circ - 44^\circ}{2}$ = 68° (1)

(angles at the base of isosceles triangle are the same)

angle BGH = angle EBC = 68° (1)

(corresponding angles are the same) (1)

angle JGH = 180° - 68° = 112° (1)

(angles on a straight line sum up to 180°) (1)

112 °

(Total for Question 5 is 5 marks)

6 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

weight of nuts : weight of seeds = 4 : 5

→ Total proportion = 9

seeds = $\frac{5}{9}$ of bag

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.

Weight of seeds in next week's bag :

$\frac{5}{9} \times 19.35 = 10.75$ kg (2)

Decrease in percentage : $\frac{10.75 - 12}{12} \times 100\%$ (1)

$= -10.4\%$ (1)

∴ decrease of 10.4 % from last week

10.4 ..... %

(Total for Question 6 is 4 marks)

7 Here is a right-angled triangle.

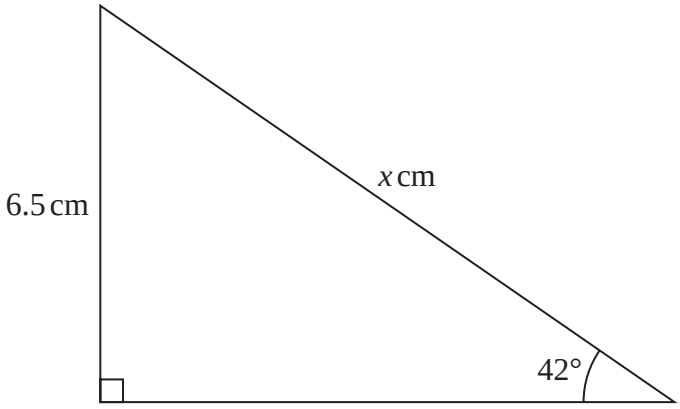


Diagram **NOT** accurately drawn

Work out the value of x.
Give your answer correct to one decimal place.

By using sine rule :

$$\frac{x}{\sin 90^\circ} = \frac{6.5}{\sin 42^\circ} \quad (1)$$

$$x = \frac{6.5}{0.669} \quad (1)$$

$$= 9.7 \quad (1)$$

$x =$ 9.7

(Total for Question 7 is 3 marks)

8 Solve the simultaneous equations

$$5a + 2c = 10 \quad -(1)$$
$$2a - 4c = 7$$

$\div 2$ → $a - 2c = \frac{7}{2} \quad -(2)$

Show clear algebraic working.

substitute (2) into (1):

$5\left(\frac{7}{2} + 2c\right) + 2c = 10$ (1)

$\frac{35}{2} + 10c + 2c = 10$

$\frac{35}{2} + 12c = 10$

$12c = 10 - \frac{35}{2}$ (1)

$c = \frac{-7.5}{12}$

$= -0.625$

$a = \frac{7}{2} + 2(-0.625)$

$= 2.25$ (1)

$a =$ 2.25

$c =$ -0.625

(Total for Question 8 is 3 marks)

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

$(x-4)(x+6)$

$(x-4)(x+6)$ (2)

(2)

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

$x = 4, -6$ (1)

(1)

(Total for Question 9 is 3 marks)

10 Here is a triangular prism.

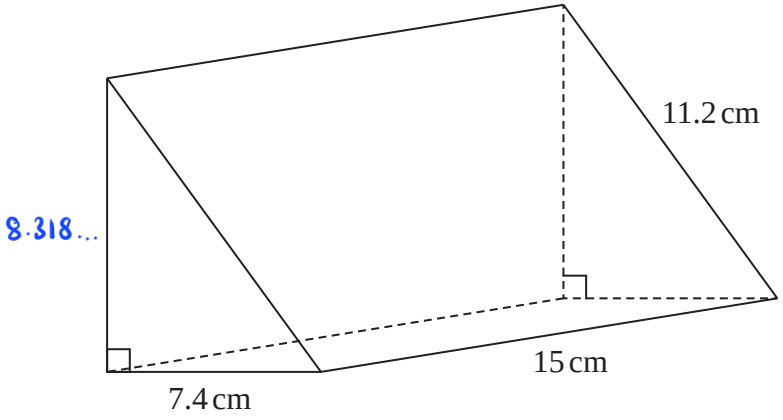


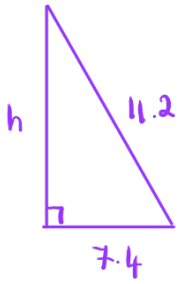
Diagram **NOT** accurately drawn

Work out the volume of the prism.
Give your answer correct to 3 significant figures.

Cross section of the prism :

$h = \sqrt{11.2^2 - 7.4^2}$ (1)

$= 8.407...$ (1)



Area of cross section :

$\frac{1}{2} \times 7.4 \times 8.407...$

$= 31.106...$ (1)

Volume of prism = Area of cross section × length

$= 31.106... \times 15$ (1)

$= 467$ (1)

467 ..... cm^3

(Total for Question 10 is 5 marks)

11 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.

100% + 24% = 124% (1)

124% = 180 000

100% = x

$x = \frac{180\,000}{124} \times 100$ (1)

= 145 161

= 145 000 (3 s.f.) (1)

145 000 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.

2017 to 2020 = 3 years

Value of house each year = 100% + 1.8%

= 101.8% (1)

$120\,000 \times (101.8\%)^3$ (1) = 126597.34

= 127 000 (3 s.f.) (1)

127 000 yuan

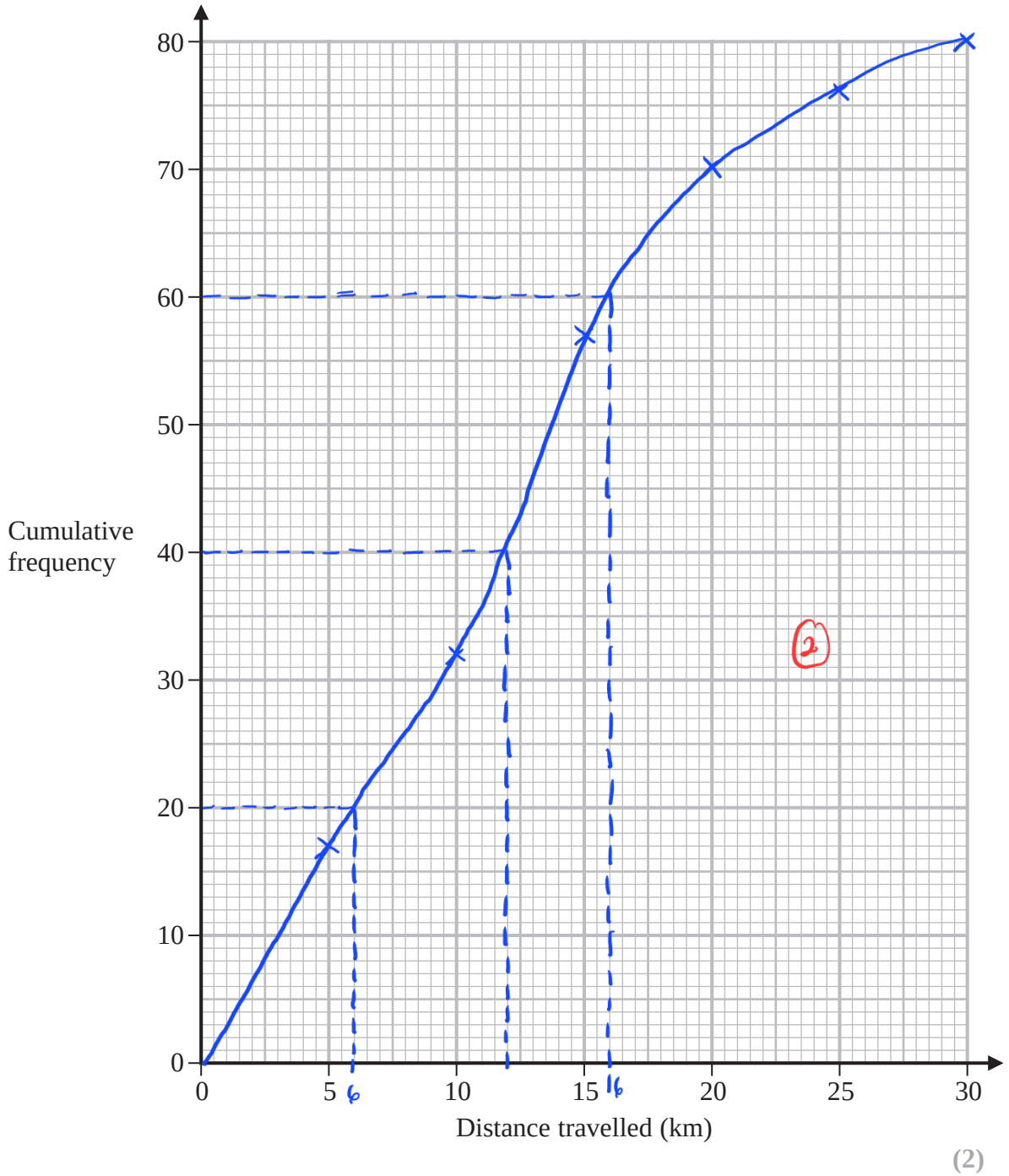
(3)

(Total for Question 11 is 6 marks)

12 The cumulative frequency table gives information about the distance, in kilometres, that each of 80 workers travel from home to work at Office *A*.

Distance travelled (d km)	Cumulative frequency
$0 < d \leqslant 5$	17
$0 < d \leqslant 10$	32
$0 < d \leqslant 15$	57
$0 < d \leqslant 20$	70
$0 < d \leqslant 25$	76
$0 < d \leqslant 30$	80

(a) On the grid below, draw a cumulative frequency graph for the information in the table.



(2)

(b) Use your graph to find an estimate for the median distance travelled.

Median = $\frac{80}{2}$ = 40 - from graph

12 (1) km

(1)

(c) Use your graph to find an estimate for the interquartile range of the distances travelled.

$Q_1 = \frac{1}{4} \times 80 = 20$ $Q_3 = \frac{3}{4} \times 80 = 60$

Interquartile range = 16 - 6 (1)

= 10 (1)

10 km

(2)

For Office *B*, the median distance workers travel from home to work is 15 km and the interquartile range is 5 km.

(d) Use the information above to compare the distances that workers at Office *A* and workers at Office *B* travel from home to work.
Write down **two** comparisons.

1 workers in Office B travels further than workers in Office A since the median is higher. (1)

2 The distance travelled by workers in Office A is more spread out as the interquartile range is bigger. (1)

(2)

(Total for Question 12 is 7 marks)

DO NOT WRITE IN THIS AREA

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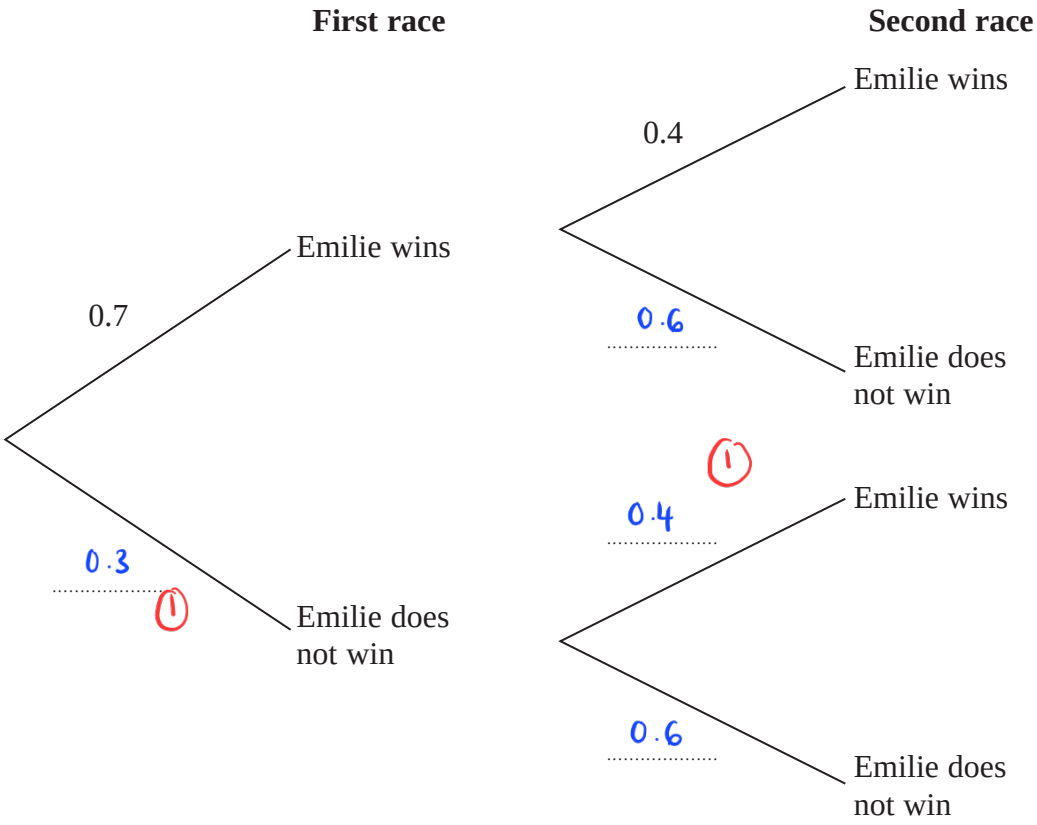
DO NOT WRITE IN THIS AREA

13 Emilie takes part in two races.

The probability that she wins the first race is 0.7
The probability that she wins the second race is 0.4
The outcomes of the two races are independent.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Emilie wins exactly one of the two races.

P(win race 1, lose race 2) = 0.7 × 0.6
= 0.42

P(lose race 1, win race 2) = 0.3 × 0.4 (1)
= 0.12

Total = 0.42 + 0.12 (1)
= 0.54 (1)

0.54

(3)

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.

P(wins first 2 races, lose race 3) = $0.7 \times 0.4 \times (1-0.6)$

$= 0.7 \times 0.4 \times 0.4$

$= 0.112$

P(wins 1 of first 2 races, wins race 3) = 0.54×0.3

$= 0.162$ (1)

Total : $0.112 + 0.162$ (1)

$= 0.274$ (1)

0.274

(3)

(Total for Question 13 is 8 marks)

14 Simplify fully $\left(\frac{9x^4}{16y^{10}}\right)^{-\frac{1}{2}}$

$9x^4 = 3^2x^4$

$16y^{10} = 2^4y^{10}$

$\left(\frac{9x^4}{16y^{10}}\right)^{-\frac{1}{2}} = \left(\frac{3^2x^4}{2^4y^{10}}\right)^{-\frac{1}{2}}$

$= \frac{3^{2(-\frac{1}{2})} \cdot x^{4(-\frac{1}{2})}}{2^{4(-\frac{1}{2})} \cdot y^{10(-\frac{1}{2})}}$ (1)

$= \frac{3^{-1} \cdot x^{-2}}{2^{-2} \cdot y^{-5}}$ (1) $= \frac{2^2 \cdot y^5}{3x^2}$

$= \frac{4y^5}{3x^2}$ (1)

$\frac{4y^5}{3x^2}$

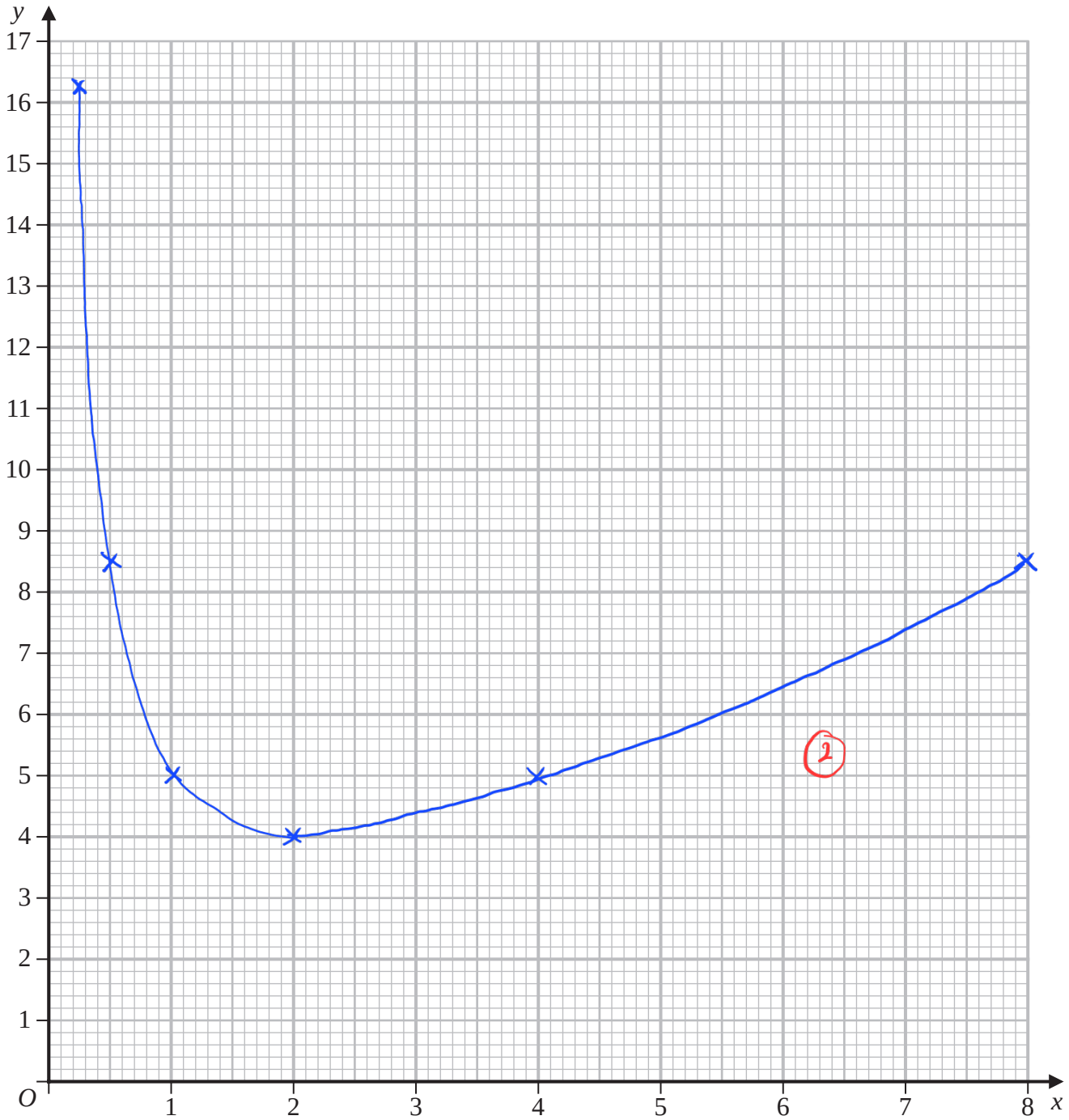
(Total for Question 14 is 3 marks)

15 (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	5	4	5	8.5

(2) (2)

(b) On the grid, draw the graph of $y = \frac{1}{x}(x^2 + 4)$ for $0.25 \leqslant x \leqslant 8$



(2)

(Total for Question 15 is 4 marks)

16 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

$A \propto \frac{1}{r^2}$

$A = \frac{k}{r^2}$ (1)

when $A = 5$ and $r = 0.3$

$5 = \frac{k}{0.3^2}$

$k = 5 \times 0.3^2$

$= 0.45$ (1)

$A = \frac{0.45}{r^2}$ (1)

$A = \frac{0.45}{r^2}$

(3)

(b) Find the value of A when $r = 7.5A$

$A = \frac{0.45}{(7.5A)^2}$

$A = \frac{0.45}{56.25A^2}$ (1)

$56.25A^3 = 0.45$

$A^3 = \frac{0.45}{56.25}$

$A^3 = \frac{1}{125}$ (1)

$A = \sqrt[3]{\frac{1}{125}}$

$= \frac{1}{5} = 0.2$ (1)

$A =$ 0.2

(3)

(Total for Question 16 is 6 marks)

17 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.

gradient of line L : $\frac{4-(-1)}{6-4}$

$= \frac{5}{2}$ (1)

gradient of line M = $\frac{-1}{m_L}$

$= \frac{-1}{\frac{5}{2}} = -\frac{2}{5}$ (1)

Equation of line M : $y = -\frac{2}{5}x + 8$ ← intersects at y-axis (0,8)

when M intersects x-axis, $y = 0$

$0 = -\frac{2}{5}x + 8$

$\frac{2}{5}x = 8$

$x = \frac{8 \times 5}{2}$

$= 20$ (1)

∴ M intersects x-axis at (20, 0) (1)

(20 , 0)

(Total for Question 17 is 4 marks)

18

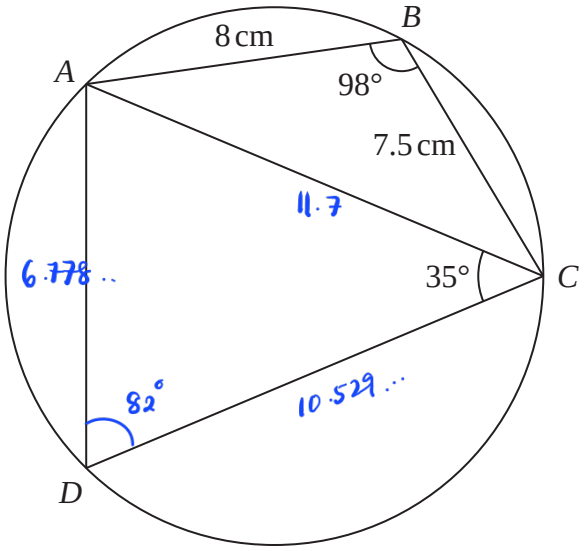


Diagram **NOT** accurately drawn

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°
Angle *ACD* = 35°

Work out the perimeter of quadrilateral *ABCD*.
Give your answer correct to one decimal place.

angle ADC = $180^\circ - 98^\circ$
= 82° (1)

By using cosine rule :

$AC^2 = 8^2 + 7.5^2 - 2(8)(7.5)\cos 98^\circ$
$AC^2 = 136.95\ldots$ (1)
$AC = 11.702\ldots$ (1)

By using sine rule :

$$\frac{AD}{\sin 35^\circ} = \frac{11.702\ldots}{\sin 82^\circ}$$

$$AD = \frac{11.702\ldots}{\sin 82^\circ} \times \sin 35^\circ$$
$= 6.778\ldots$ (1)

angle DAC = $180^\circ - 82^\circ - 35^\circ$

$= 63^\circ$

By using sine rule :

$$\frac{DC}{\sin 63^\circ} = \frac{6.778\ldots}{\sin 35^\circ}$$

$$DC = \frac{6.778\ldots}{\sin 35^\circ} \times \sin 63^\circ$$

$= 10.529\ldots$ (1)

Perimeter of ABCD = $8 + 7.5 + 10.529\ldots + 6.778\ldots$

$= 32.8$ cm (1)

32.8 cm

(Total for Question 18 is 6 marks)

19 Solve the simultaneous equations

$$y = 3 - 2x \quad -①$$
$$x^2 + y^2 = 18 \quad -②$$

Show clear algebraic working.

substitute ① into ②:

$x^2 + (3-2x)^2 = 18$ ①

$x^2 + 9 - 12x + 4x^2 = 18$

$5x^2 - 12x + 9 - 18 = 0$

$5x^2 - 12x - 9 = 0$ ①

$x = \dfrac{12 \pm \sqrt{(-12)^2 - 4(5)(-9)}}{2(5)}$ ①

$= \dfrac{12 \pm \sqrt{324}}{10}$

$= \dfrac{12 \pm 18}{10}$

$x = 3$ or $x = -0.6$

$y = -3$ or $y = 4.2$ ①

$x = 3, y = -3 \quad x = -0.6, y = 4.2$ ①

(Total for Question 19 is 5 marks)

20 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.

Calculating scale factor for length of the block :

Small block : large block = $\sqrt{25} : \sqrt{36}$

$= 5 : 6$ (1)

Finding volume of large block :

$\left(\frac{6}{5}\right)^3 \times 300 = 518.4\ cm^3$ (1) (1)

518.4

..... cm^3

(Total for Question 20 is 3 marks)

21 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.

Stationary point : $\frac{dy}{dx} = 0$

(1)

$\frac{dy}{dx} = 2kx - \frac{16}{x^2}$ (1)

$2kx - \frac{16}{x^2} = 0$ (1)

$2kx^3 - 16 = 0$

$kx^3 = \frac{16}{2}$

$kx^3 = 8$

$x^3 = \frac{8}{k}$

$x = \sqrt[3]{\frac{8}{k}}$

Given $x = \frac{2}{3}$,

$\frac{2}{3} = \sqrt[3]{\frac{8}{k}}$

$k = 27$ (1)

Substitute $k = 27$ and $x = \frac{2}{3}$ into equation of curve:

$y = 27\left(\frac{2}{3}\right)^2 + \frac{16}{\frac{2}{3}}$

$= 36$

$a = 36$ (1)

$a =$ 36

(Total for Question 21 is 5 marks)

22 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**.

$g(x) = 2x^2 - 12x + 13$

$= 2(x^2 - 6x) + 13$

$= 2[(x-3)^2 - 9] + 13$

$= 2(x-3)^2 - 18 + 13$ (1)

$g(x) = 2(x-3)^2 - 5$ (1)

x : translate 3 positions to the right

y : translate 5 position downward

Stretch y-direction with scale factor 2 (1) and followed by translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ (1).

(Total for Question 22 is 4 marks)

23 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.

Let black pens = B
red pens = R

$B = R + 3$

$B + R = N$

$(R+3) + R = N$

$2R + 3 = N$ (1)

$P(B) \times P(R) = \frac{9}{35}$

$\frac{R+3}{N} \times \frac{R}{N-1} = \frac{9}{35}$

$\frac{R+3}{2R+3} \times \frac{R}{2R+2} = \frac{9}{35}$

$\frac{R^2 + 3R}{4R^2 + 10R + 6} = \frac{9}{35}$ (1)

$35R^2 + 105R = 36R^2 + 90R + 54$ (1)

$R^2 - 15R + 54 = 0$ (1)

$R = \frac{15 \pm \sqrt{(-15)^2 - 4(1)(54)}}{2}$

$= \frac{15 \pm \sqrt{9}}{2}$

$= \frac{15 \pm 3}{2}$

$R = 9$ or 6

$N = 2(9) + 3$ or $2(6) + 3$

$= 21$ or 15 (1)

21 , 15

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

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