Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | Candidate Number

Tuesday 19 May 2020

Morning (Time: 2 hours) | Paper Reference **4MA1/1H**

Mathematics A
Paper 1H
Higher Tier

You must have:
Ruler graduated in centimetres and millimetres, protractor, pair of 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.

Turn over

P62652A

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Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

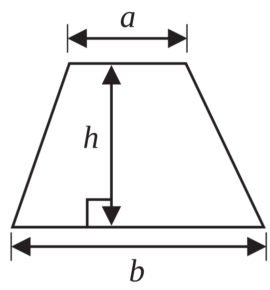
Sum to n terms, $S_n = \frac{n}{2}\,[2a + (n - 1)d]$

The quadratic equation

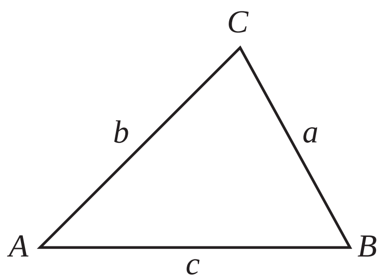
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

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

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



Trigonometry



In any triangle *ABC*

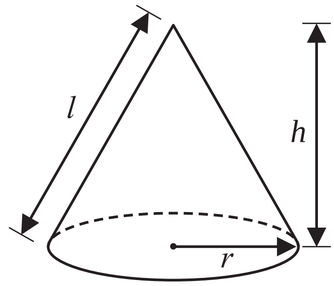
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

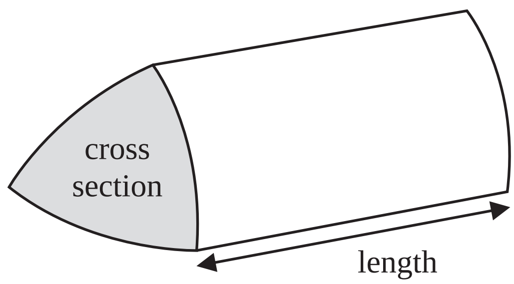
Area of triangle $= \frac{1}{2}ab\sin C$

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

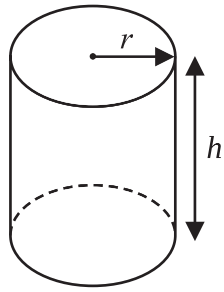
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

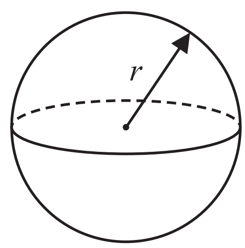


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

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

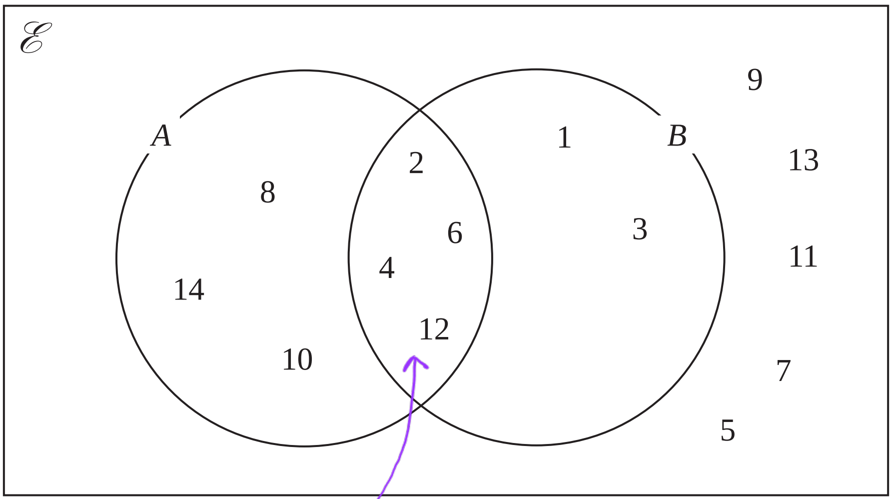


Answer ALL TWENTY FIVE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The numbers from 1 to 14 are shown in the Venn diagram.



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

2, 4, 6, 12 1

(1)

(b) List the members of the set B' everything but B

5, 7, 8, 9, 10, 11, 13, 14 1

(1)

A number is picked at random from the numbers in the Venn diagram.

(c) Find the probability that this number is in set A but is **not** in set B.

$\frac{3}{14}$ 2

(2)

(Total for Question 1 is 4 marks)

2 Toy cars are made in a factory.
The toy cars are made for 15 hours each day.
5 toy cars are made every 12 seconds.

For the toy cars made each day, the probability of a toy car being faulty is 0.002

Work out an estimate of the number of faulty toy cars that are made each day.

15 hours × 60 × 60 = 54 000 seconds 1

$$\begin{tikzcd} \text{hour} \arrow[r, bend left, "\times 60"] & \text{minutes} \arrow[l, bend left, "\div 60"] \arrow[r, bend left, "\times 60"] & \text{seconds} \arrow[l, bend left, "\div 60"] \end{tikzcd}$$

∴ 12 seconds = 5 cars

∴ 54000 seconds = $\frac{54000}{12} \times 5$ = 22500 cars 1

∴ Faulty car each day = 0.002 × 22500 cars 1

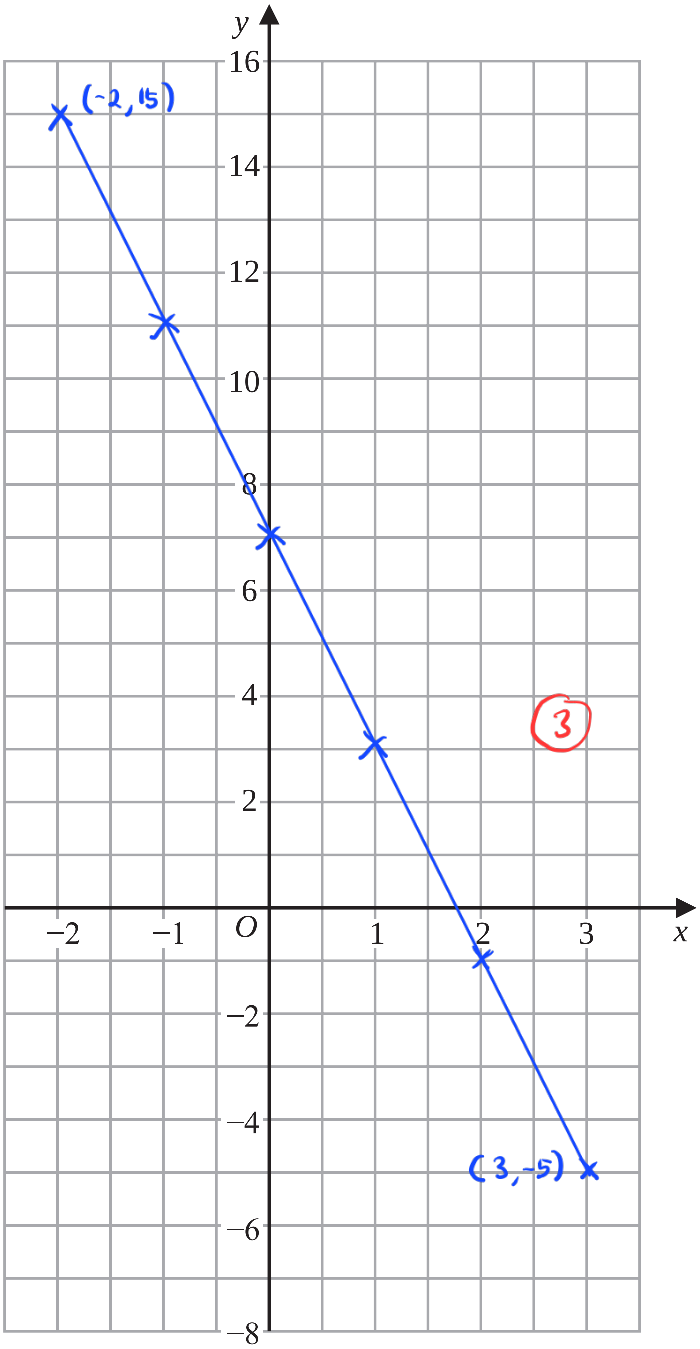
= 45 faulty cars 1

45

(Total for Question 2 is 4 marks)

3 On the grid, draw the graph of $y = 7 - 4x$ for values of x from −2 to 3

x	-2	-1	0	1	2	3
y	15	11	7	3	-1	-5



(Total for Question 3 is 3 marks)

4 Here is a list of six numbers written in order of size.

4 7 x 10 y y

8

The numbers have

a median of 9
a mean of 11

Find the value of x and the value of y.

$$\text{median} = \frac{10 + x}{2} = 9 \quad (1)$$

$$10 + x = 18 \quad -10$$

$$\therefore x = 8$$

$$\text{mean} = 11 = \frac{4 + 7 + 8 + 10 + 2y}{6} \quad (1)$$

$$\times 6$$

$$66 = 29 + 2y$$

$$-2y$$

$$66 - 29 = 2y \quad (1)$$

$$2y = 37 \quad \div 2$$

$$\therefore y = 18.5$$

$x =$ 8 (1)

$y =$ 18.5

(Total for Question 4 is 4 marks)

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5 (a) Write 5.7×10^{-3} as an ordinary number.

0 . 0 0 5 . 7

0.0057 (1)

(1)

(b) Write 800 000 in standard form.

800,000

5 times

8.0×10^5 (1)

(1)

(c) Work out $\dfrac{3 \times 10^5 - 2.7 \times 10^4}{6 \times 10^{-2}}$

$3 \times 10^5 \rightarrow 30 \times 10^4$

$\dfrac{30 \times 10^4 - 2.7 \times 10^4}{6 \times 10^{-2}} = \dfrac{(30 - 2.7) \times 10^4}{6 \times 10^{-2}}$

$= \dfrac{273\,000}{0.06}$ (1)

$= 4550\,000$ (1)

4550 000

(2)

(Total for Question 5 is 4 marks)

6 A rocket travelled 100 km at an average speed of 28 440 km/h.

Work out how long it took the rocket to travel the 100 km.
Give your answer in seconds, correct to the nearest second.

$\text{speed} = \dfrac{\text{distance}}{\text{time}}$

$\text{time} = \dfrac{\text{distance}}{\text{speed}}$

$= \dfrac{100 \text{ km}}{28\,440 \text{ km/h}}$ (1)

$= 0.0035 \text{ h} \times \dfrac{3600 \text{ s}}{1 \text{ h}}$ (1)

convert h to s

$\text{hour} \xrightarrow{\times 60} \text{minute} \xrightarrow{\times 60} \text{second}$

$\text{second} \xrightarrow{\div 60} \text{minute} \xrightarrow{\div 60} \text{hour}$

$= 12.6 \text{ s}$

$= 13 \text{ s}$ (nearest second) (1)

13 seconds

(Total for Question 6 is 3 marks)

7 (a) Solve $5(4 - x) = 7 - 3x$
Show clear algebraic working.

$5(4 - x) = 7 - 3x$

$20 - 5x = 7 - 3x$ (1)

$20 - 7 = -3x + 5x$ (1)

$13 = 2x$

$x = \frac{13}{2} = 6.5$ (1)

$x =$ 6.5

(3)

(b) Factorise fully $16m^3g^3 + 24m^2g^5$

$8(2m^3g^3 + 3m^2g^5)$ – factorise integers

$= 8m^2(2mg^3 + 3g^5)$ (1) – factorise m terms

$= 8m^2g^3(2m + 3g^2)$ (1) – factorise g terms

$8m^2g^3(2m + 3g^2)$

(2)

(c) (i) Factorise $y^2 - 2y - 48$

$y = \frac{2 \pm \sqrt{(-2)^2 - 4(-48)}}{2}$

$= \frac{2 \pm 14}{2}$

$y = 8$ or -6 (1). Hence, $(y+6)(y-8)$ (1)

$(y+6)(y-8)$

(2)

(ii) Hence, solve $y^2 - 2y - 48 = 0$

8, −6 (1)

(1)

(Total for Question 7 is 8 marks)

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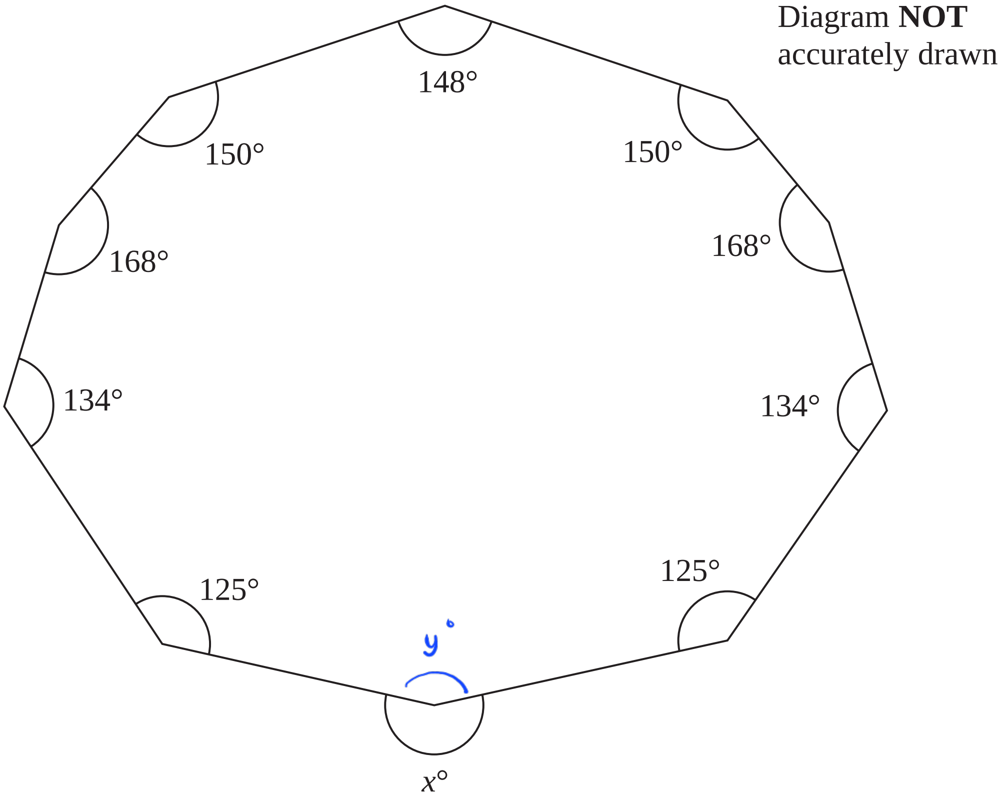
8 Here is a 10-sided polygon.



Work out the value of *x*.

angle inside polygon : $(n-2) \times 180°$

$= (10-2) \times 180° = 1440°$ (1)

$125° + 134° + 168° + 150° + 148° + 150° + 168° + 134° + 125° + y° = 1440°$

$y° = 1440° - 1302°$

$= 138°$ (1)

$\therefore x° = 360° - y°$

$= 360° - 138°$ (1)

$= 222°$ (1)

$x =$ 222°

(Total for Question 8 is 4 marks)

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

A bag costs 1080 rupees in the sale.

Work out the normal price of the bag.

Normal price $- \frac{20}{100} \times$ normal price $= 1080$

1

$0.8 \times$ normal price $= 1080$

normal price $= \frac{1080}{0.8}$ 1

$= 1350$ 1

1350 .... rupees

(Total for Question 9 is 3 marks)

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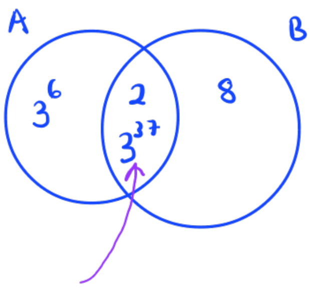
10 $A = \ \ 2 \times 3^{43}$
$B = 16 \times 3^{37}$

(a) Find the highest common factor (HCF) of A and B.



HCF of A and B is 2×3^{37}

2×3^{37} (1)

....
(1)

(b) Express the number $A \times B$ as a product of powers of its prime factors.
Give your answer in its simplest form.

$A = 2 \times 3^{43}$

$B = 16 \times 3^{37}$

$= 2^4 \times 3^{37}$

$A \times B = (2 \times 3^{43}) \times (2^4 \times 3^{37})$ (1)

$= 2 \times 2^4 \times 3^{43} \times 3^{37}$

$= 2^{1+4} \times 3^{43+37}$

$= 2^5 \times 3^{80}$ (1)

$2^5 \times 3^{80}$

....
(2)

(Total for Question 10 is 3 marks)

11 The diagram shows trapezium *ABCD* in which *BC* and *AD* are parallel.

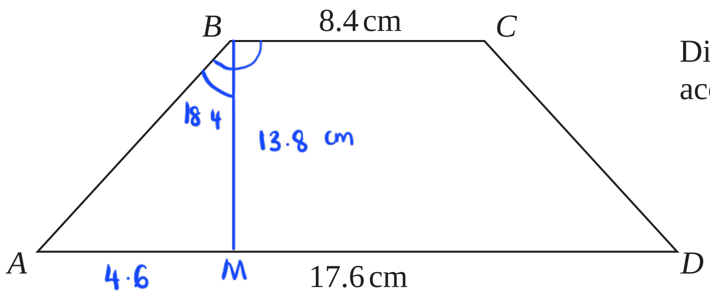


Diagram **NOT** accurately drawn

The trapezium has exactly one line of symmetry.

$BC = 8.4\,\text{cm}$
$AD = 17.6\,\text{cm}$

The trapezium has area $179.4\,\text{cm}^2$

Work out the size of angle *ABC*.
Give your answer correct to 1 decimal place.

Area of trapezium ABCD : $\frac{1}{2} \times (BC + AD) \times BM = 179.4$

$\frac{1}{2} \times (8.4 + 17.6) \times BM = 179.4$ (1)

$BM = \frac{179.4}{13} = 13.8$ cm (1)

$AM = \frac{17.6 - 8.4}{2} = 4.6$ cm (1)

Finding angle ABM :

$\tan \angle ABM = \frac{4.6}{13.8}$ (1)

$\angle ABM = \tan^{-1} \frac{1}{3}$

$= 18.43°$ (1)

$\therefore$ Angle ABC $= 18.43° + 90°$

$= 108.4°$ (1)

108.4 °

(Total for Question 11 is 6 marks)

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12 Solve the simultaneous equations

$$7x - 2y = 34$$
$$3x + 5y = -3$$

Show clear algebraic working.

$7x - 2y = 34$

$3x + 5y = -3$ — ②

$2y = 7x - 34$

$y = \frac{7x - 34}{2}$ — ①

substitute ① into ②

$3x + 5\left(\frac{7x - 34}{2}\right) = -3$ (1)

$6x + 35x - 170 = -6$

$41x = -6 + 170$ (1)

$x = \frac{164}{41}$

$= 4$

$y = \frac{7(4) - 34}{2}$ (1)

$= \frac{28 - 34}{2}$

$= -3$

$x =$ 4 (1)

$y =$ -3

(Total for Question 12 is 4 marks)

13 Jan invests \$8000 in a savings account.
The account pays compound interest at a rate of x% per year.

At the end of 6 years, there is a total of \$8877.62 in the account.

Work out the value of x.
Give your answer correct to 2 decimal places.

$$8000 \times \left(\frac{100+x}{100}\right)^6 = 8877.62 \quad (1)$$

$$\left(\frac{100+x}{100}\right)^6 = \frac{8877.62}{8000}$$

$$\left(\frac{100+x}{100}\right)^6 = 1.1097025$$

$$\frac{100+x}{100} = \sqrt[6]{1.1097025} \quad (1)$$

$$\frac{100+x}{100} = 1.0175$$

$$100+x = 101.75$$

$$x = 101.75 - 100$$

$$= 1.75 \quad (1)$$

$x =$ 1.75

(Total for Question 13 is 3 marks)

14 F is inversely proportional to the square of v.

Given that $F = 6.5$ when $v = 4$

find a formula for F in terms of v.

$F \propto \frac{1}{v^2}$

$F = \frac{k}{v^2}$ (1)

when $F = 6.5$ and $v = 4$,

$6.5 = \frac{k}{4^2}$

$k = 6.5 \times 16$

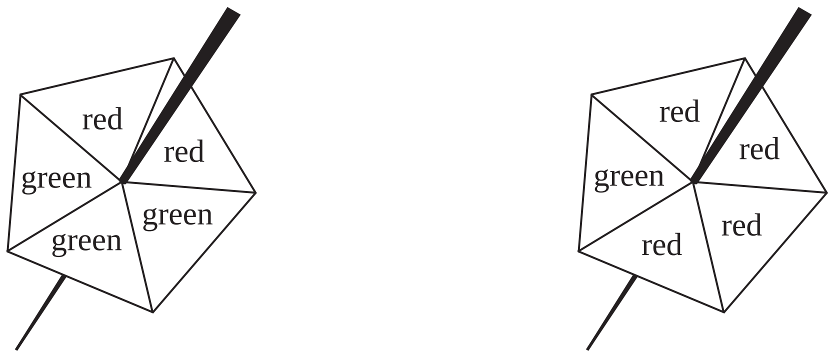
$= 104$ (1)

$\therefore F = \frac{104}{v^2}$ (1)

$F = \frac{104}{v^2}$

(Total for Question 14 is 3 marks)

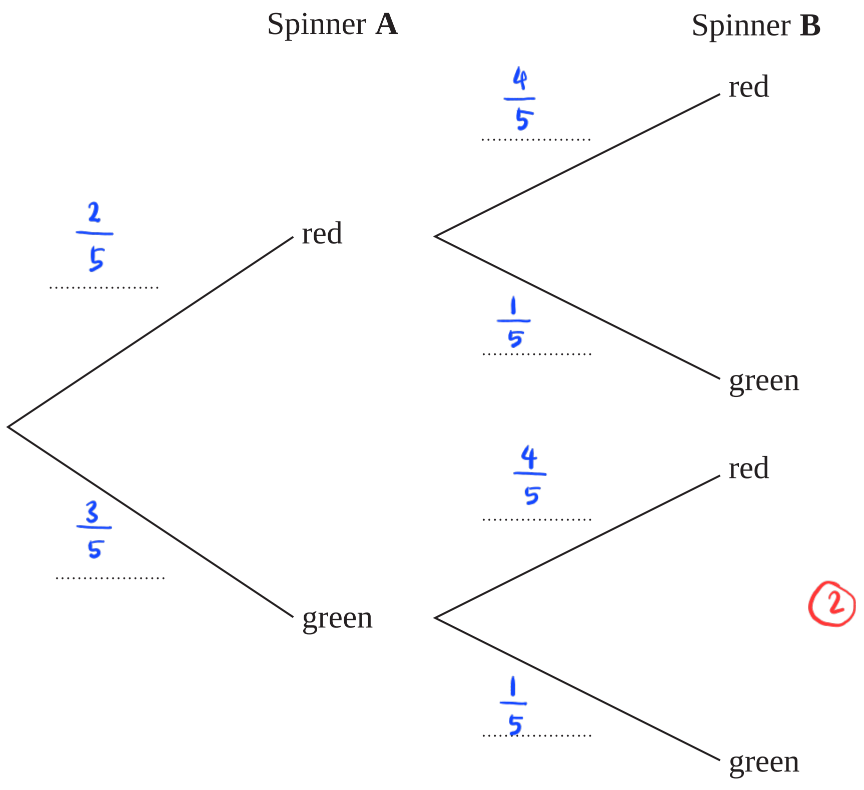
15 Harry has two fair 5-sided spinners.



Spinner **A** Spinner **B**

Harry is going to spin each spinner once.

(a) Complete the probability tree diagram.



(2)

P 6 2 6 5 2 A 0 1 6 2 8

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(b) Work out the probability that at least one of the spinners will land on green.

P(both green) $= \frac{3}{5} \times \frac{1}{5} = \frac{3}{25}$

P(A red, B green) $= \frac{2}{5} \times \frac{1}{5} = \frac{2}{25}$ 1

P(A green, B red) $= \frac{3}{5} \times \frac{4}{5} = \frac{12}{25}$

P(at least one spinner lands on green) $= \frac{3}{25} + \frac{2}{25} + \frac{12}{25}$ 1

$= \frac{17}{25}$ 1

$\frac{17}{25}$

(3)

(Total for Question 15 is 5 marks)

16

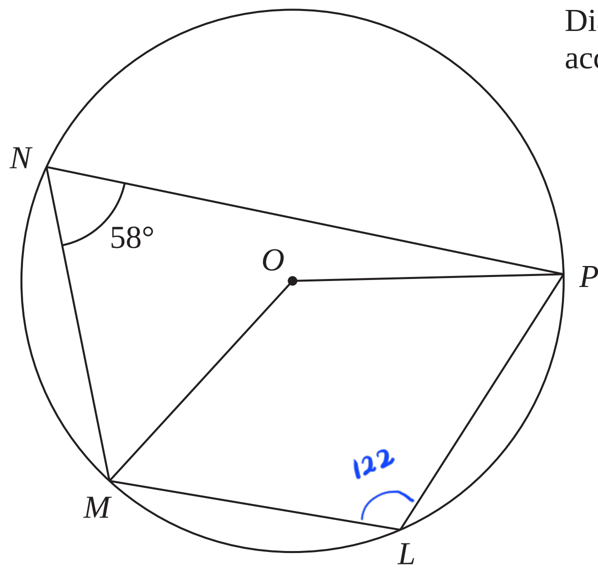


Diagram **NOT** accurately drawn

L, *M*, *N* and *P* are points on a circle, centre *O*

Angle *MNP* = 58°

(a) (i) Find the size of angle *MLP*

$180^\circ - 58^\circ = 122^\circ$

122 (1) °

(ii) Give a reason for your answer.

opposite angles in a cyclic quadrilateral sums up to 180°. (2)

(2)

(b) Find the size of the reflex angle *MOP*

reflex angle = $180^\circ < \theta < 360^\circ$

angle MOP = 2 x angle MLP

= $2 \times 122^\circ$ (1)

= 244° (1)

244 °

(2)

(Total for Question 16 is 4 marks)

17 A metal block has a mass of 5 kg, correct to the nearest 50 grams.
The block has a volume of $(1.84 \times 10^{-3})\,m^3$, correct to 3 significant figures.

Work out the upper bound for the density of the block.
Give your answer in kg/m^3 correct to 1 decimal place.
Show your working clearly.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

mass $= 5\text{ kg} \times 1000$
$= 5000\text{ g}$
lower bound $= 5000 - \left(\frac{50}{2}\right) = 4975\text{ g}$
upper bound $= 5000 + \left(\frac{50}{2}\right) = 5025\text{ g}$ (1)

Volume $= 1.84 \times 10^{-3}\ m^3$
lower bound $= 1.835 \times 10^{-3}\ m^3$
upper bound $= 1.845 \times 10^{-3}\ m^3$ (1)

Since we want the upper bound of density,

$$\text{density}_{UB} = \frac{\text{mass}_{UB}}{\text{volume}_{LB}}$$

$$= \frac{5.025\text{ kg}}{1.835 \times 10^{-3}\ m^3} \ (1) = 2738.4\ kg\,m^{-3} \ (1)$$

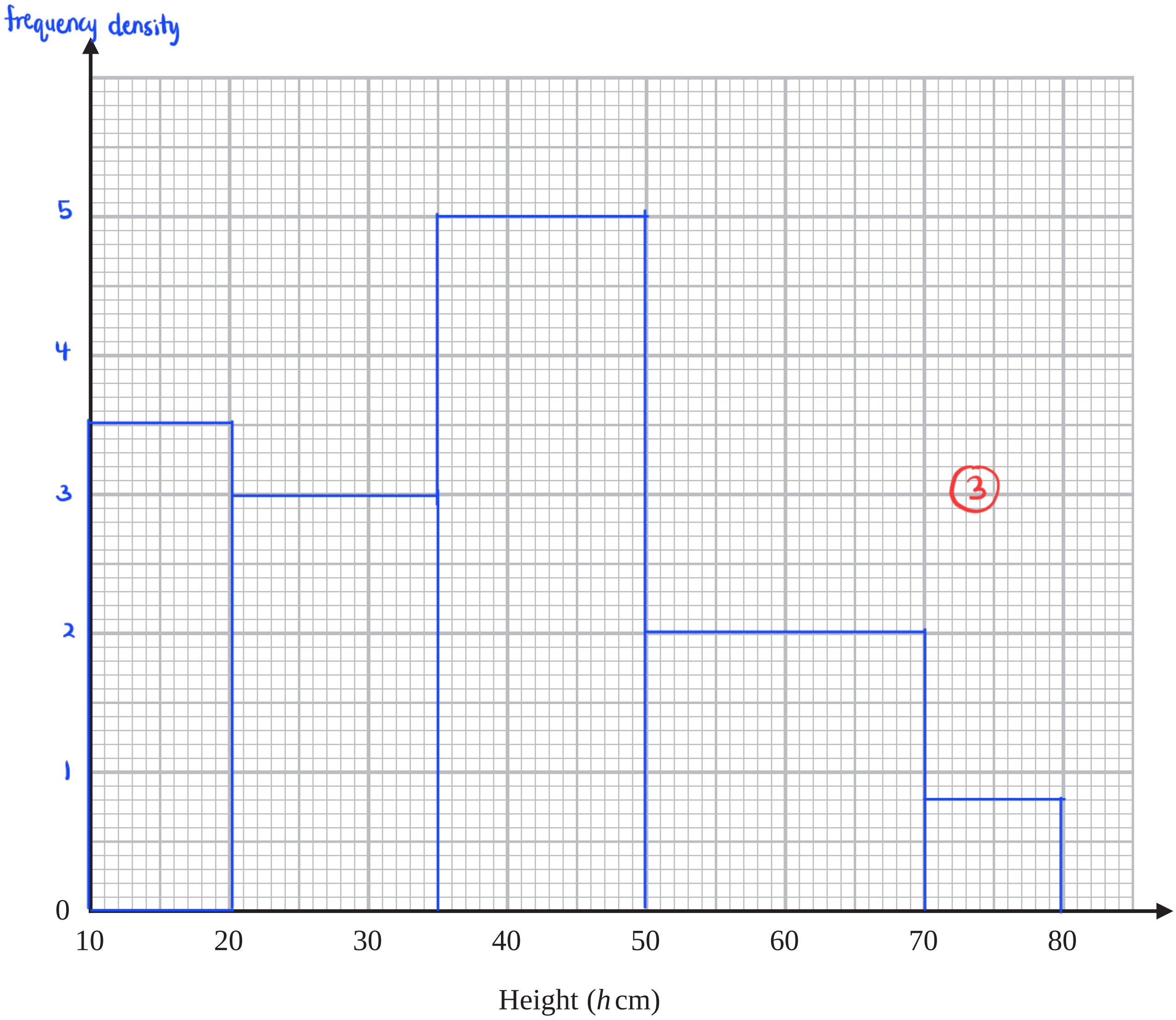
2738.4 .... kg/m^3

(Total for Question 17 is 4 marks)

18 The table gives information about the heights, in centimetres, of some plants.

Height (h cm)	Frequency	frequency density
$10 < h \leqslant 20$	35	$35/10 = 3.5$
$20 < h \leqslant 35$	45	$45/15 = 3$
$35 < h \leqslant 50$	75	$75/15 = 5$
$50 < h \leqslant 70$	40	$40/20 = 2$
$70 < h \leqslant 80$	8	$8/10 = 0.8$

(a) On the grid, draw a histogram for this information.



(3)

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only consider 40 to 50 from $35 < h \leqslant 50$ class.

(b) Work out an estimate for the number of these plants with a height greater than 40 cm.

$\frac{2}{3} \times 75 + 40 + 8$ (1)

$= 50 + 40 + 8$

$= 98$ (1)

98

(2)

(Total for Question 18 is 5 marks)

19 Without using a calculator, rationalise the denominator of $\dfrac{6}{3-\sqrt{7}}$

Simplify your answer.
You must show each stage of your working.

$\dfrac{6}{3-\sqrt{7}} \times \dfrac{3+\sqrt{7}}{3+\sqrt{7}}$ (1)

$= \dfrac{6(3+\sqrt{7})}{9-7}$ (1)

$= \dfrac{18+6\sqrt{7}}{2}$

$= 9+3\sqrt{7}$ (1)

$9+3\sqrt{7}$

(Total for Question 19 is 3 marks)

20 **R** and **S** are two similar solid shapes.

Shape **R** has surface area 108 cm^2 and volume 135 cm^3
Shape **S** has surface area 300 cm^2

Work out the volume of shape **S**.

$$\frac{S}{R} = \sqrt{\frac{300}{108}} = \sqrt[3]{\frac{V_s}{135}} \quad 1$$

$$V_s = \left(\sqrt{\frac{300}{108}}\right)^3 \times 135 \quad 1$$

$$= 625 \quad 1$$

625 cm^3

(Total for Question 20 is 3 marks)

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21 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.

$\therefore \; 9x^2 - 4 \equiv (3x+2)(3x-2)$

$\therefore \; 3x^2 - 13x - 10 \equiv (3x+2)(x-5)$

$$\frac{1}{\cancel{3x-2}} \times \frac{\cancel{(3x+2)}\cancel{(3x-2)}}{\cancel{(3x+2)}(x-5)} \text{ (1)} - \frac{7}{x-1}$$

$$= \frac{1 \; (x-1)}{x-5 \; (x-1)} \text{ (1)} - \frac{7 \; (x-5)}{x-1 \; (x-5)}$$

$$= \frac{x-1-7x+35}{(x-5)(x-1)} \text{ (1)} \text{ (1)}$$

$$= \frac{-6x+34}{(x-5)(x-1)}$$

$$= \frac{2(17-3x)}{(x-5)(x-1)} \text{ (1)}$$

$$\frac{2(17-3x)}{(x-5)(x-1)}$$

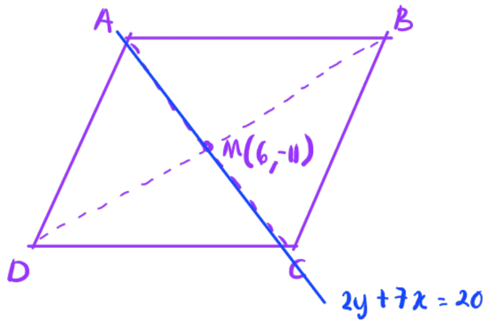
(Total for Question 21 is 5 marks)

22 *ABCD* is a rhombus.

The diagonals, *AC* and *BD*, intersect at the point *M*.
The coordinates of *M* are (6, −11)

The points *A* and *C* both lie on the line with equation $2y + 7x = 20$

Find the exact coordinates of the point where the line through *B* and *D* intersects the *y*-axis.



Equation of straight line AC :

$2y + 7x = 20$

$2y = 20 - 7x$

$y = \dfrac{-7x + 20}{2}$

$\therefore \quad y = -\frac{7}{2}x + 10$ where gradient $= -\frac{7}{2}$ (1)

Gradient of line BD $= \dfrac{-1}{m_{AC}} = \dfrac{2}{7}$ (1)

Equation of line BD :

$y = mx + c$

at $M(6,-11)$: $-11 = \frac{2}{7}(6) + c$

$c = -\frac{89}{7}$ (1)

$\therefore$ Line BD intersect y-axis at $(0, -\frac{89}{7})$ (1)

(0 , $-\frac{89}{7}$)

(Total for Question 22 is 4 marks)

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23 Curve **C** has equation $y = px^3 - mx$ where p and m are positive integers.

Find the range of values of x, in terms of p and m, for which the gradient of **C** is negative.

gradient of curve C = $\frac{dy}{dx}$

$$\frac{dy}{dx} = 3px^2 - m \quad (1)$$

when gradient of C is negative,

$$\frac{dy}{dx} < 0$$

$$3px^2 - m < 0 \quad (1)$$

$$3px^2 < m$$

$$x^2 < \frac{m}{3p}$$

$$x = \pm\sqrt{\frac{m}{3p}} \quad (1)$$

$$-\sqrt{\frac{m}{3p}} < x < \sqrt{\frac{m}{3p}} \quad (1)$$

$-\sqrt{\frac{m}{3p}} < x < \sqrt{\frac{m}{3p}}$

(Total for Question 23 is 4 marks)

PMT

24 Here are the first five terms of an arithmetic sequence.

$$8 \xrightarrow{+7} 15 \xrightarrow{+7} 22 \xrightarrow{+7} 29 \xrightarrow{+7} 36$$

Work out the sum of all the terms from the 50th term to the 100th term inclusive.

$a = 8$ common difference, $d = 7$ (1)

$$S_{100} = \frac{100}{2}\left[2(8) + (100-1)7\right]$$

$$= 50\,(16 + 693)$$

$$= 35\,450$$

$$S_{50} = \frac{50}{2}\left[2(8) + (50-1)7\right] \quad (1)$$

$$= 25\,(16 + 343)$$

$$= 8975$$

$$S_{100} - S_{50} = 35\,450 - 8975$$

$$= 26\,475$$

since we also need to include the 50th term :

$$26\,475 + (T_{50} = 8 + 49(7))$$

$$= 26\,475 + 351 \quad (1)$$

$$= 26\,826 \quad (1)$$

Alternatively, we can just work out $S_{100} - S_{49}$, as this will also include T_{50} in it.

26 826

(Total for Question 24 is 4 marks)

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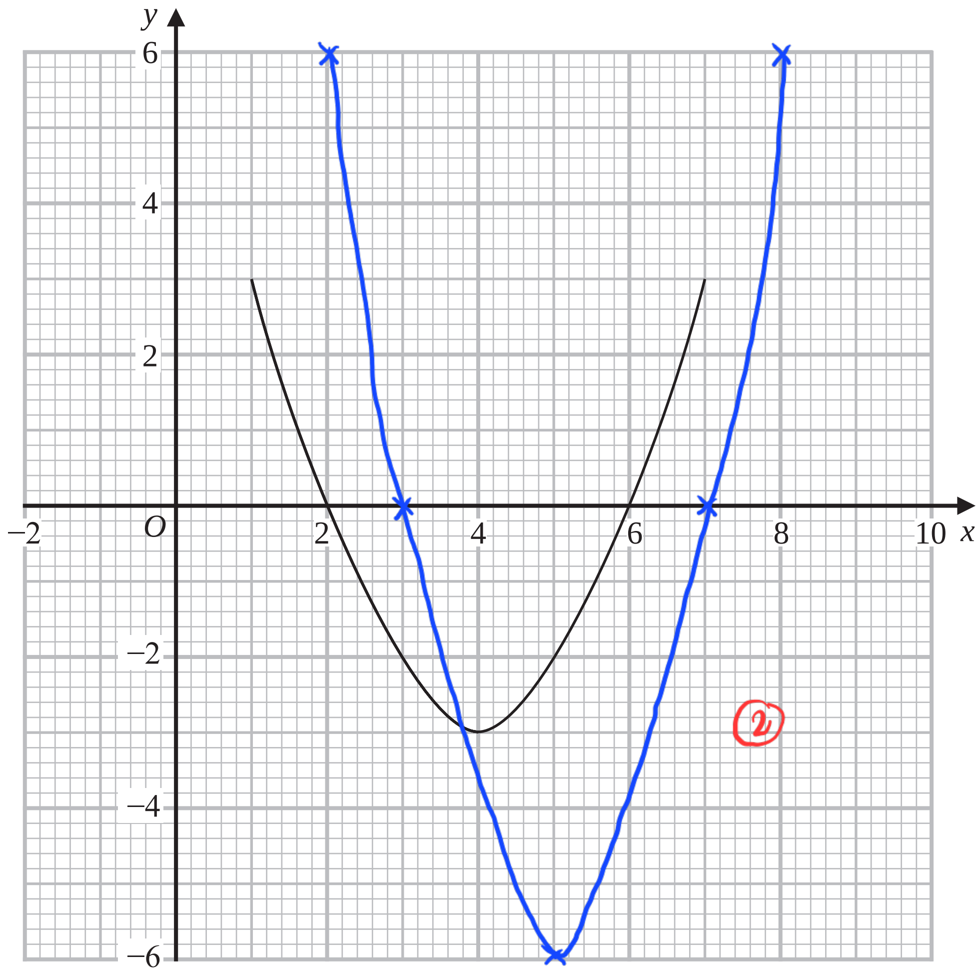
25 The curve with equation $y = \mathrm{g}(x)$ is transformed to the curve with equation $y = -\mathrm{g}(x)$ by the single transformation **T**.

(a) Describe fully the transformation **T**.

Reflection in the x-axis 1

(1)

The diagram shows the graph of $y = \mathrm{f}(x)$



x-coordinate move one position to the right

(b) On the grid, draw the graph of $y = 2\mathrm{f}(x - 1)$

multiply y-coordinate by 2

(2)

(Total for Question 25 is 3 marks)

TOTAL FOR PAPER IS 100 MARKS

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