

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

Pearson Edexcel**Level 1/Level 2 GCSE (9–1)****Tuesday 5 November 2019**

Morning (Time: 1 hour 30 minutes)

Paper Reference **1MA1/1H****Mathematics****Paper 1 (Non-Calculator)****Higher Tier**

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. 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.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**

**Information**

- The total mark for this paper is 80
- 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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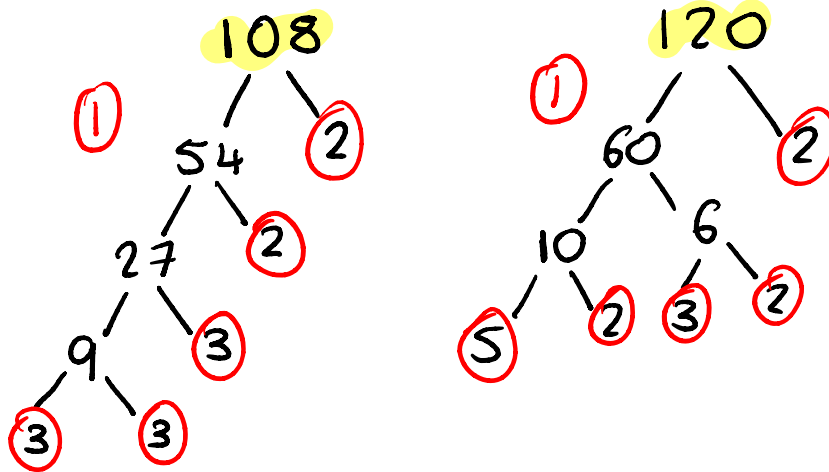
Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Find the Lowest Common Multiple (LCM) of 108 and 120



$$120 = 2 \times 2 \times 3 \times 2 \times 5$$

$$108 = 2 \times 2 \times 3 \times 3 \times 3$$

$$\text{HCF}(120, 108) = 2 \times 2 \times 3 = 12$$

$$\text{LCM}(120, 108) = 12 \times 2 \times 5 \times 3 \times 3 = 1080$$

1080

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- 2 There are 60 people in a choir. ✓
 Half of the people in the choir are women. ✓
 The number of women in the choir is 3 times the number of men in the choir. ✓
 The rest of the people in the choir are children. ✓

the number of children in the choir : the number of men in the choir = $n : 1$

Work out the value of n .
 You must show how you get your answer.

w = Number of women
 c = Number of children
 m = Number of men

$$w + c + m = 60$$

$$w = 60 \div 2 = 30$$

$$w = 3m \rightsquigarrow 3m = 30$$

$$m = \frac{30}{3}$$

$$m = 10$$

$$30 + c + 10 = 60$$

$$c = 60 - 10 - 30$$

$$= 20$$

$$m = 10$$

$$w = 30$$

$$c = 20$$

① $c : m$
 $20 : 10$
 $\div 10 \rightarrow 2 : 1$
 $\therefore n = 2$

work this out using info from the question

①

①

$n = 2$ ①

(Total for Question 2 is 4 marks)

- 3 Work out $1\frac{3}{4} \times 1\frac{1}{3}$

Give your answer as a mixed number.

$$1\frac{3}{4} = \frac{(1 \times 4) + 3}{4} = \frac{7}{4}$$

$$1\frac{1}{3} = \frac{(1 \times 3) + 1}{3} = \frac{4}{3}$$

convert to top-heavy fractions ①

$$\frac{7}{4} \times \frac{4}{3} = \frac{7 \times 4}{4 \times 3} = \frac{28}{12}$$

calculate the product ①

$$\frac{28}{12} = 2\frac{4}{12} = 2\frac{1}{3}$$

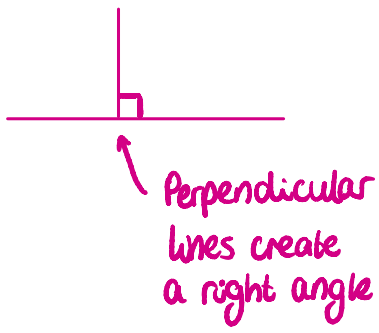
convert back to mixed number and simplify ①

$2\frac{1}{3}$

(Total for Question 3 is 3 marks)

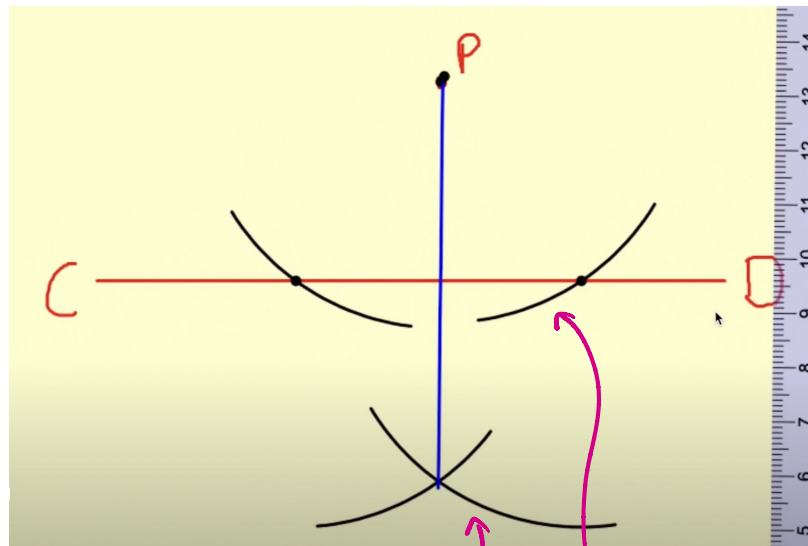


- 4 Use a ruler and **compasses** to construct the line from the point P perpendicular to the line CD . You must show **all** construction lines.



① Construction arcs

① Perpendicular line



construction arcs created with compass

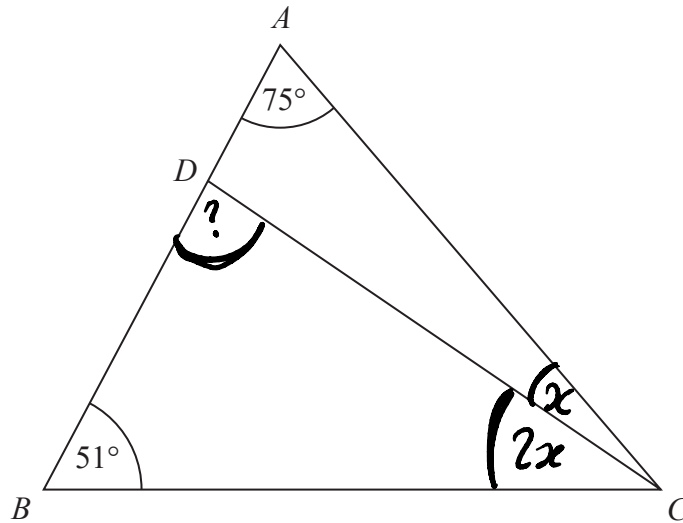
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- 5 The diagram shows triangle ABC .

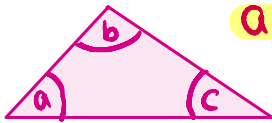


ADB is a straight line.

the size of angle DCB : the size of angle $ACD = 2 : 1$ ✓

Work out the size of angle BDC .

All interior angles of a triangle add to 180°



$$a + b + c = 180$$

$$75 + 51 + 2x + x = 180$$

$$3x = 180 - 75 - 51$$

$$3x = 54 \quad (1)$$

$$x = \frac{54}{3}$$

$$x = 18 \quad (1)$$

For Triangle
ABC

For Triangle
BCD

$$51 + 2x + ? = 180$$

$$\text{Since } x = 18 \quad (1)$$

$$51 + 2(18) + ? = 180$$

$$? = 180 - 51 - 2(18)$$

$$= 180 - 51 - 36$$

$$= 93$$

(1) 93

(Total for Question 5 is 4 marks)



- 6 4 red bricks have a mean weight of 5 kg.
5 blue bricks have a mean weight of 9 kg.
1 green brick has a weight of 6 kg.

Donna says,

“The mean weight of the 10 bricks is less than 7 kg.”

Is Donna correct?

You must show how you get your answer.

$$\text{mean} = \frac{\text{total}}{\text{number of values}} \Rightarrow \text{total} = \text{mean} \times \text{number of values} \quad (1)$$

$$\begin{aligned} \text{Red bricks: Total} &= 5 \times 4 = 20 \text{ kg} \\ \text{Blue bricks: Total} &= 9 \times 5 = 45 \text{ kg} \\ \text{Green bricks: Total} &= 6 \times 1 = 6 \text{ kg} \end{aligned}$$

Total weight for 10 bricks

$$\downarrow 20 + 45 + 6 = 71 \text{ kg} \quad (1)$$

$$\begin{aligned} \therefore \text{mean weight of 10 bricks} \\ &= \frac{71}{10} = 7.1 \text{ kg} \quad (1) \end{aligned}$$

So No Donna is incorrect since $7.1 > 7$

(Total for Question 6 is 3 marks)

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7 (a) Simplify $(p^2)^5$

$$(a^x)^y = a^{xy} \quad (p^2)^5 = p^{2 \times 5} = p^{10} \quad p^{10} \text{ (1)}$$

(b) Simplify $12x^7y^3 \div 6x^3y$

$$\frac{a^x}{a^y} = a^{x-y} \quad \frac{12x^7y^3}{6x^3y} = \frac{2x^7y^3}{x^3y} = 2x^{7-3}y^{3-1} = 2x^4y^2 \quad 2x^4y^2 \text{ (2)}$$

(Total for Question 7 is 3 marks)

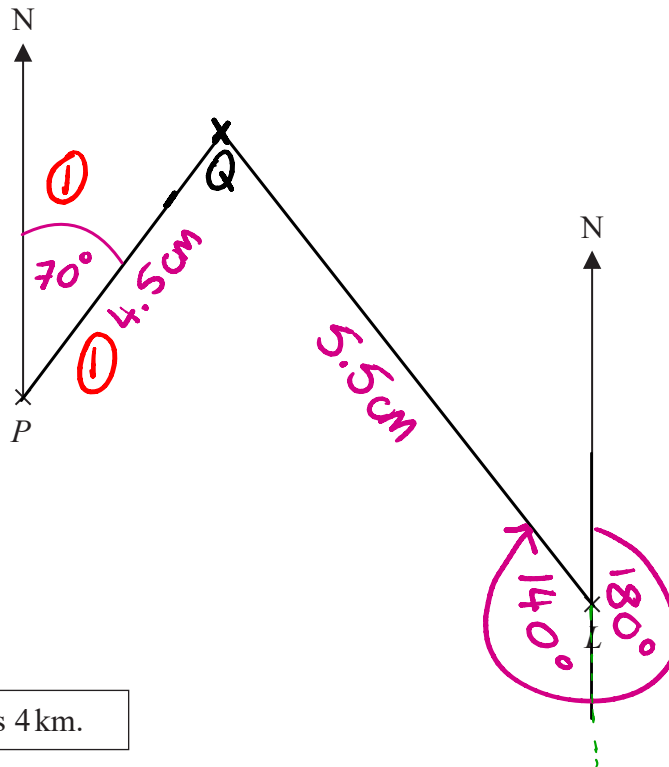
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8 The accurate scale drawing shows the positions of port P and a lighthouse L .



Scale: 1 cm represents 4 km.

Aleena sails her boat from port P on a bearing of 070°

She sails for $1\frac{1}{2}$ hours at an average speed of 12 km/h to a port Q .

Find

- (i) the distance, in km, of port Q from lighthouse L ,
- (ii) the bearing of port Q from lighthouse L .

i) distance = speed \times time
 distance = $12 \times 1.5 = 18\text{ km}$

1 cm : 4 km
 $\times 4.5$ $\times 4.5$
 4.5 cm : 18 km

1 cm : 4 km
 $\times 5.5$ $\times 5.5$
 5.5 cm : 22 km

ii) Bearing of port Q from lighthouse L is

$180^\circ + 140^\circ = 320^\circ$

distance $QL = 22$ km

bearing of Q from $L = 320^\circ$

(Total for Question 8 is 5 marks)



9 A car travels for 18 minutes at an average speed of 72 km/h.

(a) How far will the car travel in these 18 minutes?

distance = speed x time ①

$$\begin{array}{l}
 \div 60 \downarrow \text{60 minutes} = 1 \text{ hour} \\
 \downarrow \text{1 minute} = \frac{1}{60} \text{ hours} \div 60 \\
 \times 18 \downarrow \text{18 minutes} = \frac{18}{60} \text{ hours} \times 18
 \end{array}$$

Need to be working in same units so converting 18 minutes to hours

$$\begin{aligned}
 \text{distance} &= 72 \times \frac{18}{60} \\
 &= 72 \times \frac{9}{30} \\
 &= 72 \times \frac{3}{10} \quad \begin{array}{r} 72 \\ \times 3 \\ \hline 216 \end{array} \\
 &= \frac{72 \times 3}{10} = \frac{216}{10} = 21.6 \text{ km} \\
 & \quad \quad \quad \underline{\quad 21.6 \quad} \text{ km} \quad \textcircled{1} \\
 & \quad \quad \quad \quad \quad \quad \quad (2)
 \end{aligned}$$

David says,

“72 kilometres per hour is faster than 20 metres per second.”

(b) Is David correct?

You must show how you get your answer.

Convert 72 km/h to m/s

$$\begin{array}{l}
 \frac{\text{km}}{\text{h}} \rightarrow \frac{\text{m}}{\text{s}} \quad \left\{ \begin{array}{l} \times \frac{1000}{60 \times 60} = \frac{10}{6 \times 6} = \frac{10}{36} = \frac{5}{18} \end{array} \right. \\
 \begin{array}{l} \nwarrow \text{ } \times 1000 \text{ gets from m to km} \\ \nearrow \text{ } \times 60 \times 60 \text{ gets from s to h} \end{array} \\
 \text{To convert from km/h to m/s need to } \times \frac{5}{18}
 \end{array}$$

$$72 \times \frac{5}{18} = \frac{72 \times 5}{18} = \frac{360}{18} = 20 \text{ m/s} \quad (2)$$

(Total for Question 9 is 4 marks)

No because 72 km/h = 20 m/s

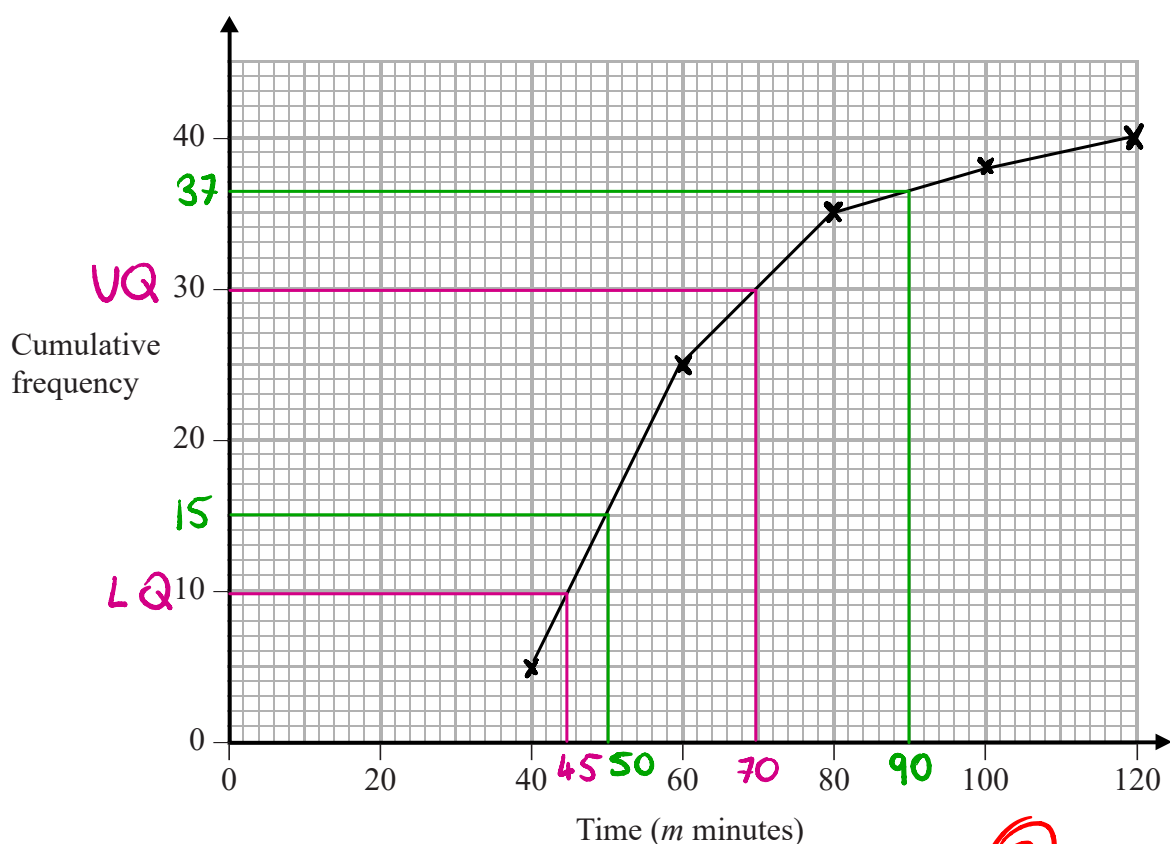


10 The cumulative frequency table shows information about the times, in minutes, taken by 40 people to complete a puzzle.

Time (m minutes)	Cumulative frequency
$20 < m \leq 40$	5
$20 < m \leq 60$	25
$20 < m \leq 80$	35
$20 < m \leq 100$	38
$20 < m \leq 120$	40

$(40, 5)$
 $(60, 25)$
 $(80, 35)$
 $(100, 38)$
 $(120, 40)$

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



②

(2)



(b) Use your graph to find an estimate for the **interquartile range**.

get these values from graph

$$IQR = UQ - LQ$$

\downarrow $\times \frac{3}{4}$ \downarrow $\times \frac{1}{4}$

For UQ: $40 \times \frac{3}{4} = 30 \rightarrow 70$ mins

For LQ: $40 \times \frac{1}{4} = 10 \rightarrow 45$ mins

$\therefore IQR = 70 - 45 = 25$ (1) 25 minutes (2)

One of the 40 people is chosen at random.

(c) Use your graph to find an estimate for the **probability** that this person took between 50 minutes and 90 minutes to complete the puzzle.

get these values from graph

$$37 - 15 = 22$$

(1)

Over 40 since 40 people in total

$$\frac{22}{40}$$

(2)

(Total for Question 10 is 6 marks)

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- 11 There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p .

$$\frac{12}{p} \text{ are yellow}$$

$$\text{On one random trial} \\ \frac{5}{30} \text{ were yellow}$$

$$\frac{5}{30} \xrightarrow{\times \frac{12}{5}} \frac{12}{72}$$

Since $\frac{12}{p}$ are yellow
we can estimate
 $p = 72$

$$\frac{30}{1} \times \frac{12}{5} = \frac{30 \times 12}{5} = \frac{\cancel{3} \times 6 \times 12}{\cancel{5}} = 6 \times 12 = 72$$

$$72 \text{ (1)}$$

$$T = \frac{q}{2} + 5$$

Here is Spencer's method to make q the subject of the formula.

$$2 \times T = q + 5$$

$$q = 2T - 5$$

What mistake did Spencer make in the first line of his method?

$$T = \frac{q}{2} + 5 \Rightarrow 2T = 2\left(\frac{q}{2} + 5\right) \Rightarrow 2T = \frac{2q}{2} + 10$$

$$\Rightarrow 2T = q + 10 \quad \left\{ \text{Spencer forgot to multiply the '+5' by 2} \right.$$

(1)



13 (a) Write $\frac{5}{x+1} + \frac{2}{3x}$ as a single fraction in its simplest form.

$$\frac{5}{x+1} + \frac{2}{3x} = \frac{3x \times 5}{3x(x+1)} + \frac{2(x+1)}{3x(x+1)}$$

$$= \frac{15x}{3x(x+1)} + \frac{2x+2}{3x(x+1)} = \frac{15x+2x+2}{3x(x+1)} = \frac{17x+2}{3x(x+1)}$$

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

(2)

(b) Factorise $(x+y)^2 + 3(x+y)$

$$(x+y)^2 + 3(x+y) = (x+y)[(x+y) + 3]$$

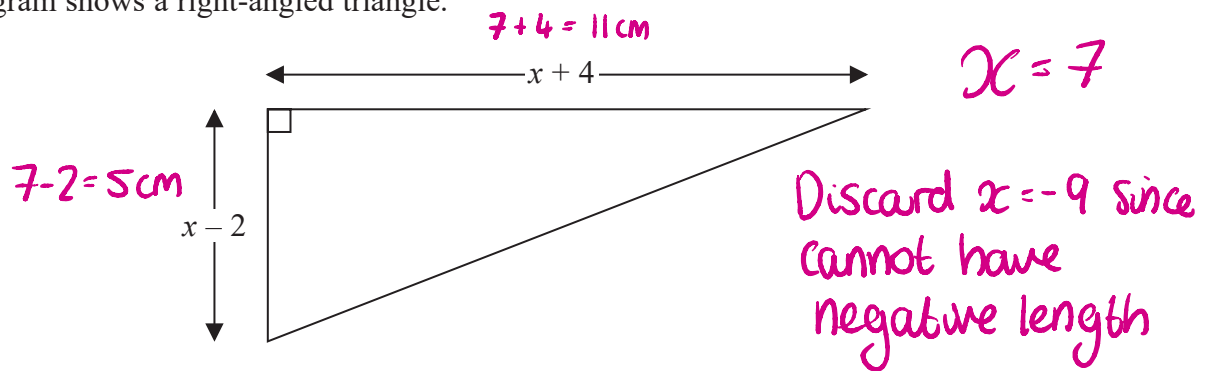
$$(x+y)(x+y+3)$$

(1)

(Total for Question 13 is 3 marks)



14 The diagram shows a right-angled triangle.



All the measurements are in centimetres.

The area of the triangle is 27.5cm^2

Work out the length of the shortest side of the triangle.
You must show all your working.

$$\text{Area of Triangle} = \frac{\text{Base} \times \text{Height}}{2}$$

$$\text{Area} = \frac{1}{2} \times (x-2) \times (x+4) \quad \textcircled{1}$$

$$\frac{1}{2} \times (x-2)(x+4) = 27.5 \times 2$$

$$(x-2)(x+4) = 55$$

$$x^2 + 4x - 2x - 8 = 55$$

$$x^2 + 2x - 8 = 55$$

$$x^2 + 2x - 63 = 0 \quad \textcircled{1}$$

$$-7 \times 9 = -63$$

$$-7 + 9 = 2$$

$$(x-7)(x+9) = 0$$

$$\downarrow$$

$$x-7=0$$

$$x=7$$

$$\downarrow$$

$$x+9=0$$

$$x=-9 \quad \textcircled{1}$$

$\textcircled{1}$

5

..... cm

(Total for Question 14 is 4 marks)

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- 15 Express $0.4\dot{1}\dot{8}$ as a fraction.
You must show all your working.

$x = 0.418181818\dots$ (1)
 $10x = 4.181818\dots$
 $100x = 41.818181\dots$
 $1000x = 418.181818\dots$

$1000x - 10x = 418.1818\dots - 4.1818\dots$
 $990x = 414.0$ (1)
 $x = \frac{414}{990}$

$0.4\dot{1}\dot{8} = \frac{414}{990}$

$\frac{414}{990}$ (1)

(Total for Question 15 is 3 marks)

- 16 (a) Rationalise the denominator of $\frac{22}{\sqrt{11}}$

Give your answer in its simplest form. (1)

$\frac{22}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}} = \frac{22\sqrt{11}}{\sqrt{11} \times \sqrt{11}} = \frac{22\sqrt{11}}{11} \div 11 = \frac{2\sqrt{11}}{1} = 2\sqrt{11}$

$2\sqrt{11}$ (1)
 (2)

- (b) Show that $\frac{\sqrt{3}}{2\sqrt{3}-1}$ can be written in the form $\frac{a+\sqrt{3}}{b}$ where a and b are integers.

$\frac{\sqrt{3}}{2\sqrt{3}-1} \times \frac{(2\sqrt{3}+1)}{(2\sqrt{3}+1)} = \frac{\sqrt{3}(2\sqrt{3}+1)}{(2\sqrt{3}-1)(2\sqrt{3}+1)} = \frac{6+\sqrt{3}}{12+2\sqrt{3}-2\sqrt{3}-1} = \frac{6+\sqrt{3}}{11}$

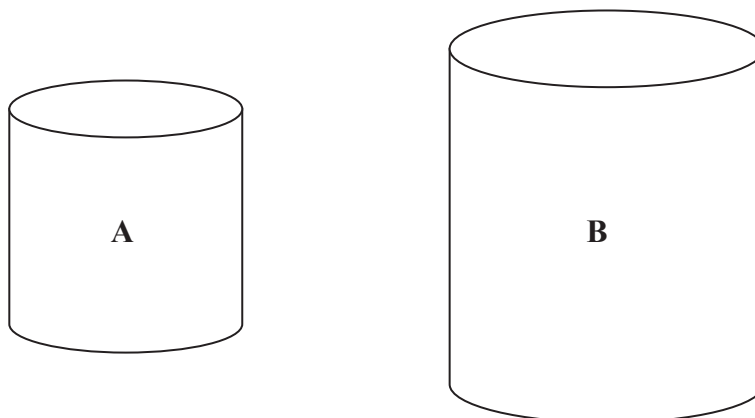
$a = 6$ $b = 11$

(3)

(Total for Question 16 is 5 marks)



17 A and B are two similar cylindrical containers.



the surface area of container A : the surface area of container B = 4 : 9

Tyler fills container A with water.

She then pours all the water into container B.

Tyler repeats this and stops when container B is full of water.

Work out the number of times that Tyler fills container A with water.

You must show all your working.

	<u>A : B</u>	
Surface area:	4 : 9	units ²
Length:	$\begin{matrix} \swarrow \sqrt{4} & \swarrow \sqrt{9} \\ 2 & 3 \end{matrix}$	units ①
Volume:	$\begin{matrix} \swarrow 2^3 & \swarrow 3^3 \\ 8 & 27 \end{matrix}$	units ³ ①

① 8, 16, 24, 32 ∴ Tyler had to
 ① ② ③ ④ fill container A
 with water
 4 times

①
4

(Total for Question 17 is 4 marks)

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18 The function f is given by

$$f(x) = 2x^3 - 4$$

(a) Show that $f^{-1}(50) = 3$

$$\begin{aligned}
 x &= 2y^3 - 4 \\
 x + 4 &= 2y^3 \\
 y^3 &= \frac{x+4}{2} \\
 y &= \sqrt[3]{\frac{x+4}{2}}
 \end{aligned}
 \quad
 \begin{aligned}
 f^{-1}(x) &= \sqrt[3]{\frac{x+4}{2}} \quad \textcircled{1} \\
 \therefore f^{-1}(50) &= \sqrt[3]{\frac{50+4}{2}} = \sqrt[3]{\frac{54}{2}} = \sqrt[3]{27} = 3 \quad \textcircled{1}
 \end{aligned}$$

(2)

The functions g and h are given by

$$g(x) = x + 2 \quad \text{and} \quad h(x) = x^2$$

(b) Find the values of x for which

$$hg(x) = 3x^2 + x - 1$$

$$h(g(x)) = h(x+2) = (x+2)^2$$

$$\therefore hg(x) = (x+2)^2 \quad \textcircled{1}$$

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

$$\downarrow (x+2)(x+2) \quad \textcircled{1}$$

$$x^2 + 4x + 4 = 3x^2 + x - 1$$

$$4x + 4 = 2x^2 + x - 1$$

$$4 = 2x^2 - 3x - 1$$

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

$$2x^2 - 3x - 5 = 0 \quad \textcircled{1}$$

$$(2x - 5)(x + 1) = 0 \quad \textcircled{1}$$

$$\downarrow$$

$$2x - 5 = 0$$

$$x = 5/2$$

$$\downarrow$$

$$x + 1 = 0$$

$$x = -1$$

$$x = 5/2 \quad \text{and} \quad x = -1$$

(4)

(Total for Question 18 is 6 marks)



- 19 Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$
find the exact value of x .

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

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

$$\frac{3^{-1}}{3^{x+1}} = \frac{3^{\frac{3}{4}}}{3^{x+1}} \quad \textcircled{1}$$

$$3^{x+1} \times 3^{-1} = 3^{\frac{3}{4}}$$

$a^x \times a^y = a^{x+y}$
$(a^x)^y = a^{xy}$
$\frac{a^x}{a^y} = a^{x-y}$

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

$$\frac{3^x}{3^{x+1}} = \frac{3^{\frac{3}{4}}}{3^{x+1}}$$

$$\therefore x = \frac{3}{4} \quad \textcircled{1}$$

$$x = \frac{3}{4}$$

(Total for Question 19 is 3 marks)

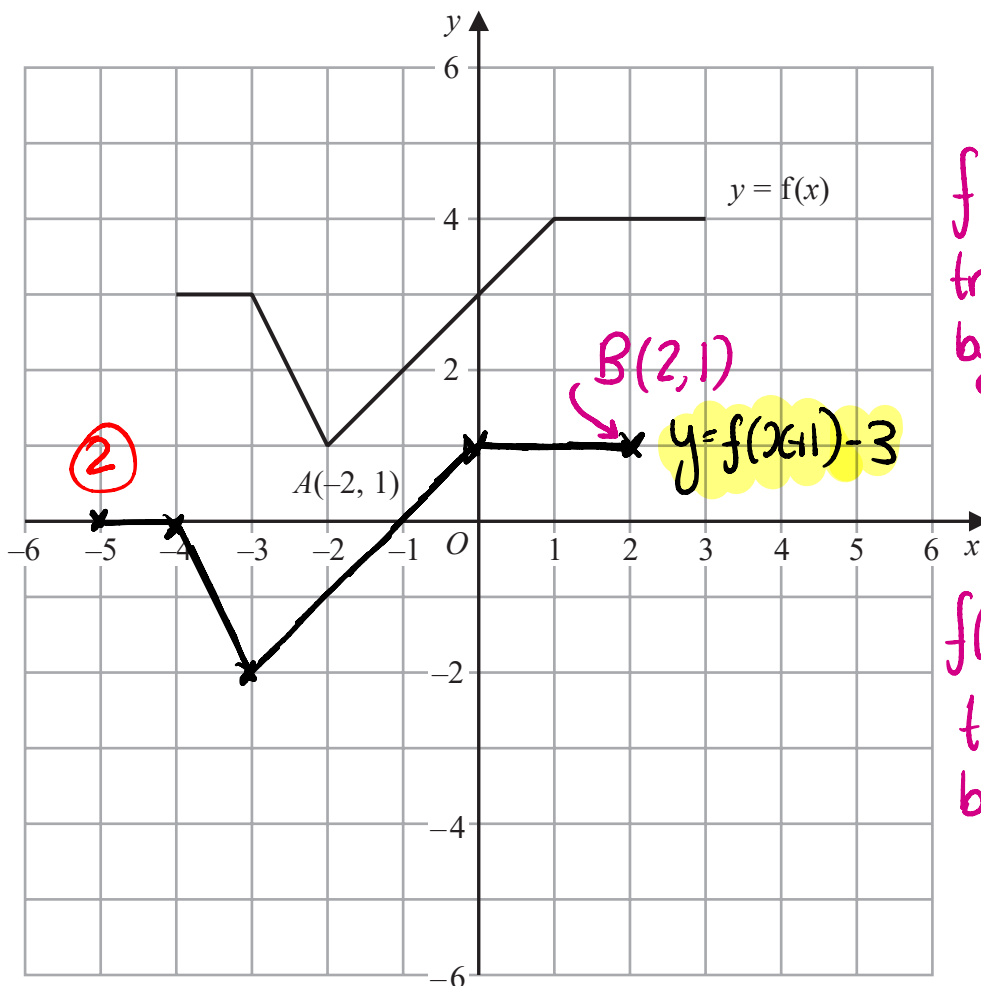
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20 The graph of $y = f(x)$ is shown on the grid.



$f(x+k)$ is translation by $\begin{pmatrix} -k \\ 0 \end{pmatrix}$

$f(x)+k$ is translation by $\begin{pmatrix} 0 \\ k \end{pmatrix}$

- (a) On the grid, draw the graph with equation $y = f(x+1) - 3$ translation by vector $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$ (2)

Point $A(-2, 1)$ lies on the graph of $y = f(x)$.

When the graph of $y = f(x)$ is transformed to the graph with equation $y = f(-x)$, point A is mapped to point B .

- (b) Write down the coordinates of point B .

$f(-x)$ is a reflection in the y axis

(2, 1)
(1)

(Total for Question 20 is 3 marks)



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21 Sketch the graph of

$$y = 2x^2 - 8x - 5$$

showing the coordinates of the turning point and the exact coordinates of any intercepts with the coordinate axes.

Find y -intercept:

$$y = ax^2 + bx + c$$

c is always the y -intercept.

$$y = 2x^2 - 8x - 5$$

$$c = -5$$

$$\therefore y\text{-intercept} = -5$$

Find turning point: (complete the square)

$$2x^2 - 8x - 5 = 0$$

$$2[x^2 - 4x] - 5 = 0$$

$$2[(x-2)^2 - 4] - 5 = 0$$

$$2(x-2)^2 - 8 - 5 = 0$$

$$2(x-2)^2 - 13 = 0$$

$$a(x+d)^2 + e = 0$$

Turning point = $(-d, e)$

$$\text{Turning point} = (2, -13)$$

Find x -intercepts:

$$2(x-2)^2 - 13 = 0$$

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

$$(x-2)^2 = \frac{13}{2}$$

$$x-2 = \pm \sqrt{\frac{13}{2}}$$

$$x = 2 \pm \sqrt{\frac{13}{2}}$$

P.T.O.

(Total for Question 21 is 5 marks)

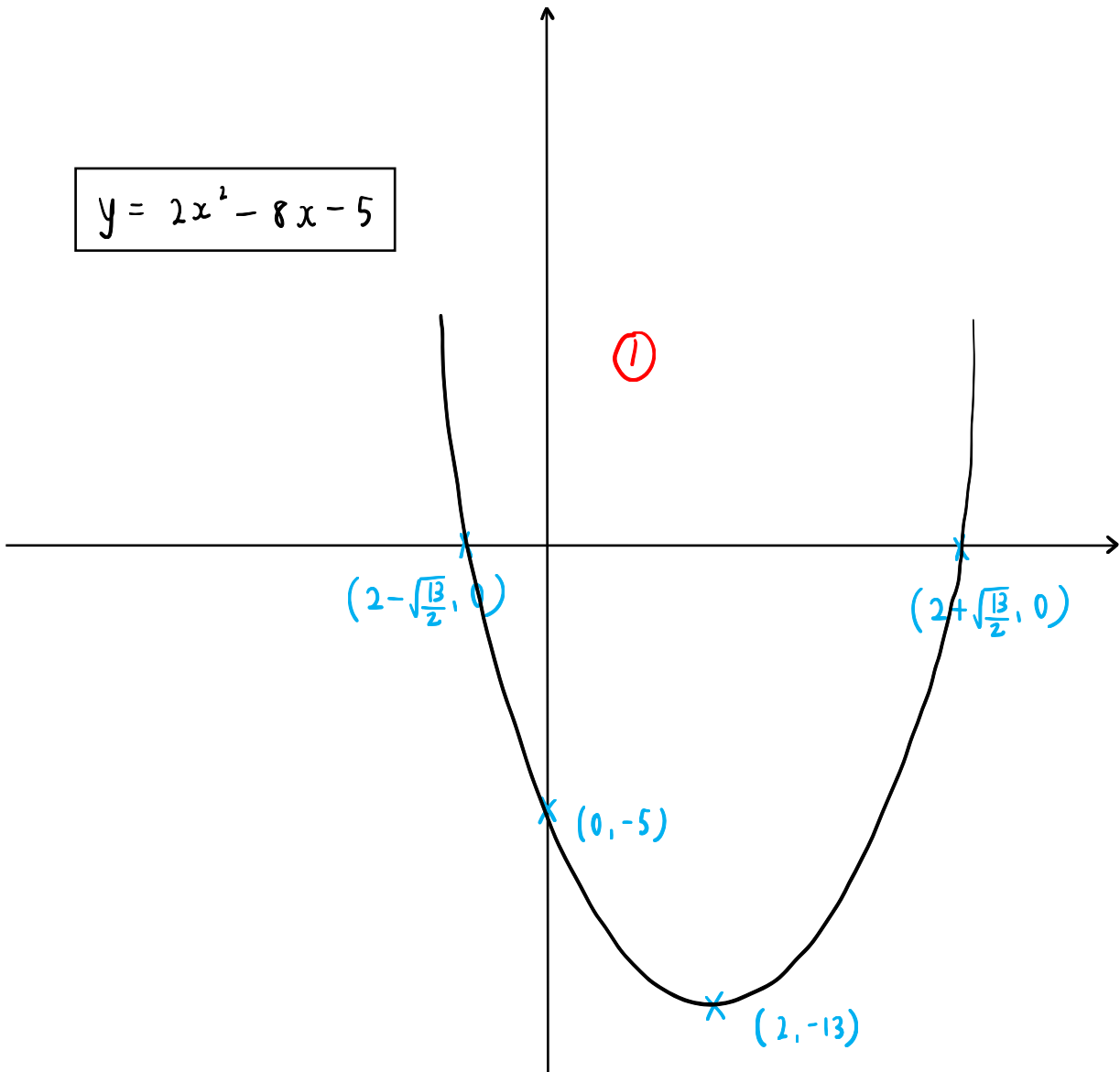
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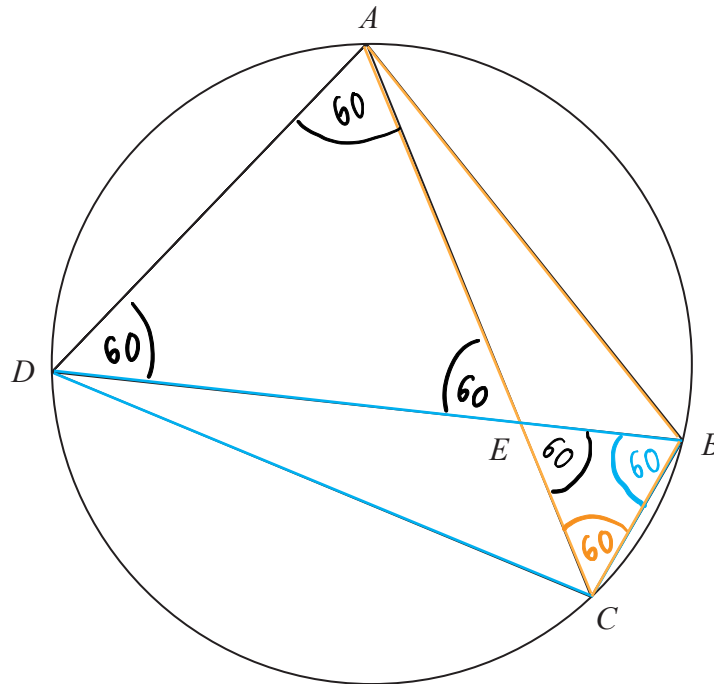
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$$y = 2x^2 - 8x - 5$$



22 A, B, C and D are four points on a circle.



AEC and DEB are straight lines.

Triangle AED is an equilateral triangle.

→ SSS, ASA, SAS, RHS.

Prove that triangle ABC is congruent to triangle DCB .

Line BC is shared by both triangles. ①

$\triangle AED$ is equilateral $\therefore \angle AED = \angle ADE = \angle DAE = 60^\circ$ ①

$\angle DAC = \angle DBC$ because angles in the same segment are equal.

$\angle ADB = \angle ACB$ because angles in the same segment are equal.

$\therefore \angle ACB = \angle DBC$ ①

$\angle CEB = 60^\circ \therefore \triangle EBC$ is equilateral

$AC = AE + EC = DE + EB = DB. \therefore AC = DB$ ①

$\triangle ABC$ is congruent to $\triangle DCB$ because they meet the SAS criteria.

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

