Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

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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P 5 8 8 6 6 A 0 1 2 4

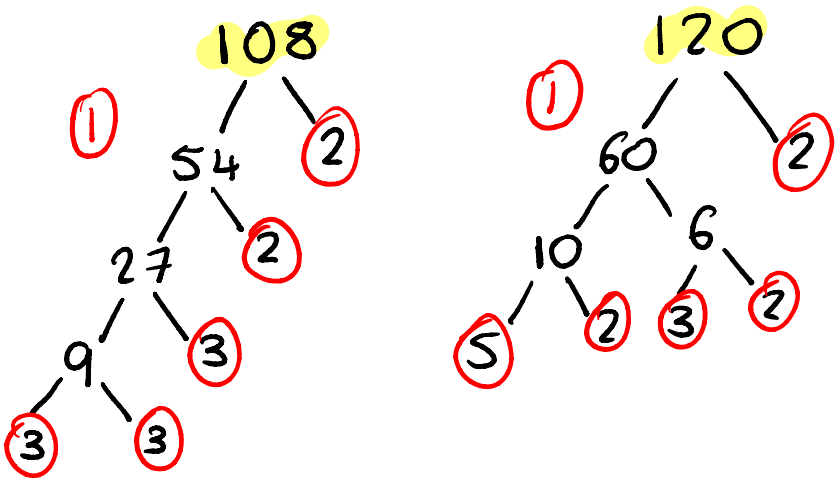
Pearson

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



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

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

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

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

1080 (1)

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

work this out using info from the question

$w + c + m = 60$

$w = 60 \div 2 = 30$

$w = 3m \rightsquigarrow 3m = 30$
$m = \frac{30}{3}$
$m = 10$ (1)

$30 + c + 10 = 60$
$c = 60 - 10 - 30$
$= 20$ (1)

$m = 10$
$w = 30$
$c = 20$

(1) c : m
20 : 10 ÷10
2 : 1 ÷10

$\therefore n = 2$

$n =$ 2 (1)

(Total for Question is 4 marks)

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

Give your answer as a mixed number.

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

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

(1) convert to top-heavy fractions

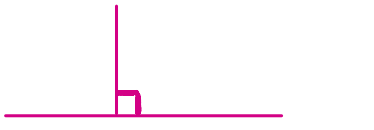
$\frac{7}{4} \times \frac{4}{3} = \frac{7 \times 4}{4 \times 3} = \frac{28}{12}$ (1) calculate the product

$\frac{28}{12} = 2\frac{4}{12} = 2\frac{1}{3}$ (1) convert back to mixed number and simplify

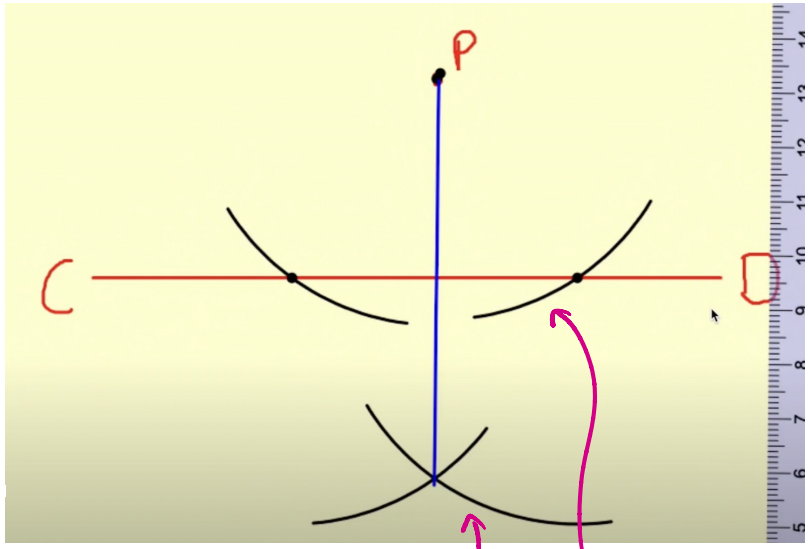
$2\frac{1}{3}$

(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.



Perpendicular lines create a right angle

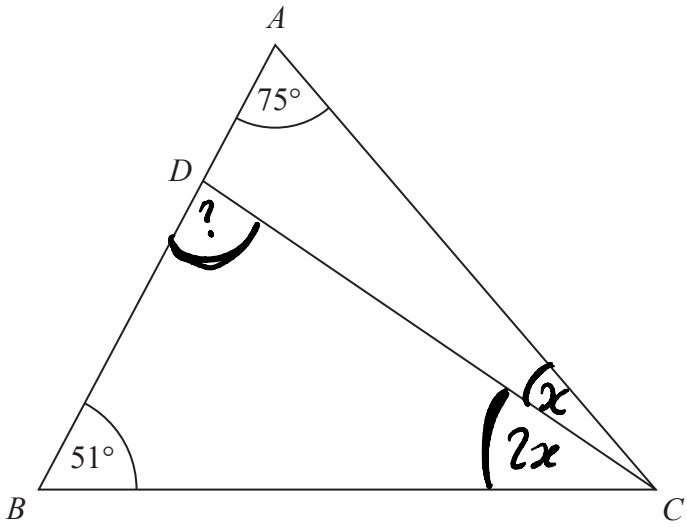


construction arcs created with compass

① Construction arcs

① Perpendicular line

5 The diagram shows triangle *ABC*.



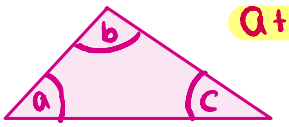
ADB is a straight line.

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



For Triangle ABC

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

$3x = 180 - 75 - 51$

$3x = 54$ (1)

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

$x = 18$ (1)

For Triangle BCD

$51 + 2x + ? = 180$

Since $x = 18$ (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.

mean = $\frac{\text{total}}{\text{number of values}}$ $\Rightarrow$ total = mean x number of values

(1)

Red bricks : Total = 5x4 = 20kg
Blue bricks : Total = 9x5 = 45kg
Green bricks : Total = 6x1 = 6kg

Total weight for 10 bricks
↳ 20+45+6 = 71 kg (1)

∴ mean weight of 10 bricks
= $\frac{71}{10}$ = 7.1 kg (1)

So No Donna is incorrect since 7.1 > 7

(Total for Question 6 is 3 marks)

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

$(a^x)^y = a^{xy}$ $(p^2)^5 = p^{2\times5} = p^{10}$

p^{10} (1)

(1)

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

$\frac{a^x}{a^y} = a^{x-y}$

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

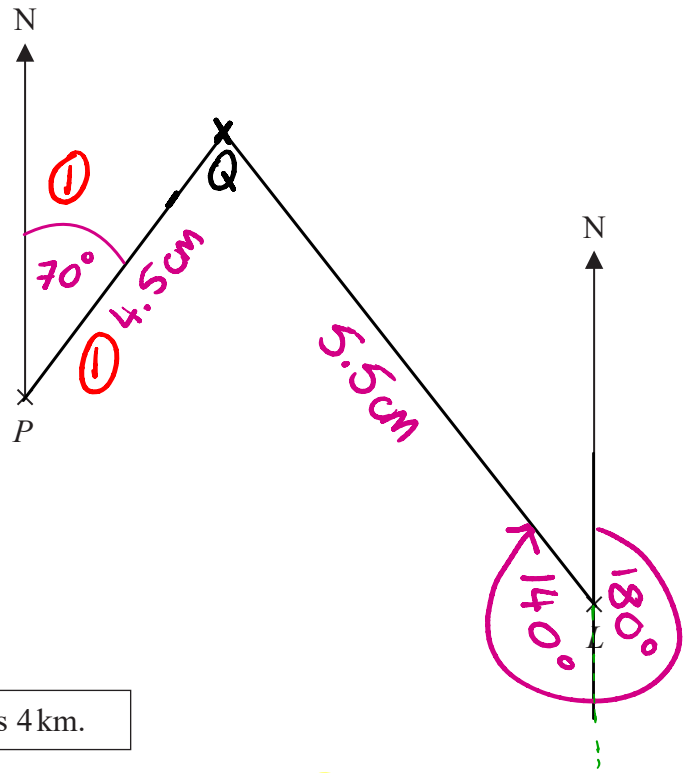
÷6 ÷6

$2x^4y^2$ (1)

(2)

(Total for Question 7 is 3 marks)

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 x time

distance = 12 x 1.5 = 18km (1)

1cm : 4km (x4.5) → 4.5cm : 18km

1cm : 4km (x5.5) → 5.5cm : 22km

ii) Bearing of port Q from lighthouse L is

180° + 140° = 320°

distance QL = 22 (1) km

bearing of Q from L = 320° (1) °

(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)

60 minutes = 1 hour (÷60)

1 minute = $\frac{1}{60}$ hours (÷60)

18 minutes = $\frac{18}{60}$ hours (x18)

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

distance = $72 \times \frac{18}{60}$

$= 72 \times \frac{9}{30}$

$= 72 \times \frac{3}{10}$

$72 \times 3 = 216$

$= \frac{72 \times 3}{10} = \frac{216}{10} = 21.6$ km

21.6 (1) km

(2)

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

$\frac{km}{h} \rightarrow \frac{m}{s}$ $\times \frac{1000}{60 \times 60} = \frac{10}{6 \times 6} = \frac{10}{36} = \frac{5}{18}$

x1000 gets from m to km

x60x60 gets from s to h

To convert from km/h to m/s need to $\times \frac{5}{18}$

$72 \times \frac{5}{18} = \frac{72 \times 5}{18} = \frac{360}{18} = 20$ m/s

(2)

(Total for Question 9 is 4 marks)

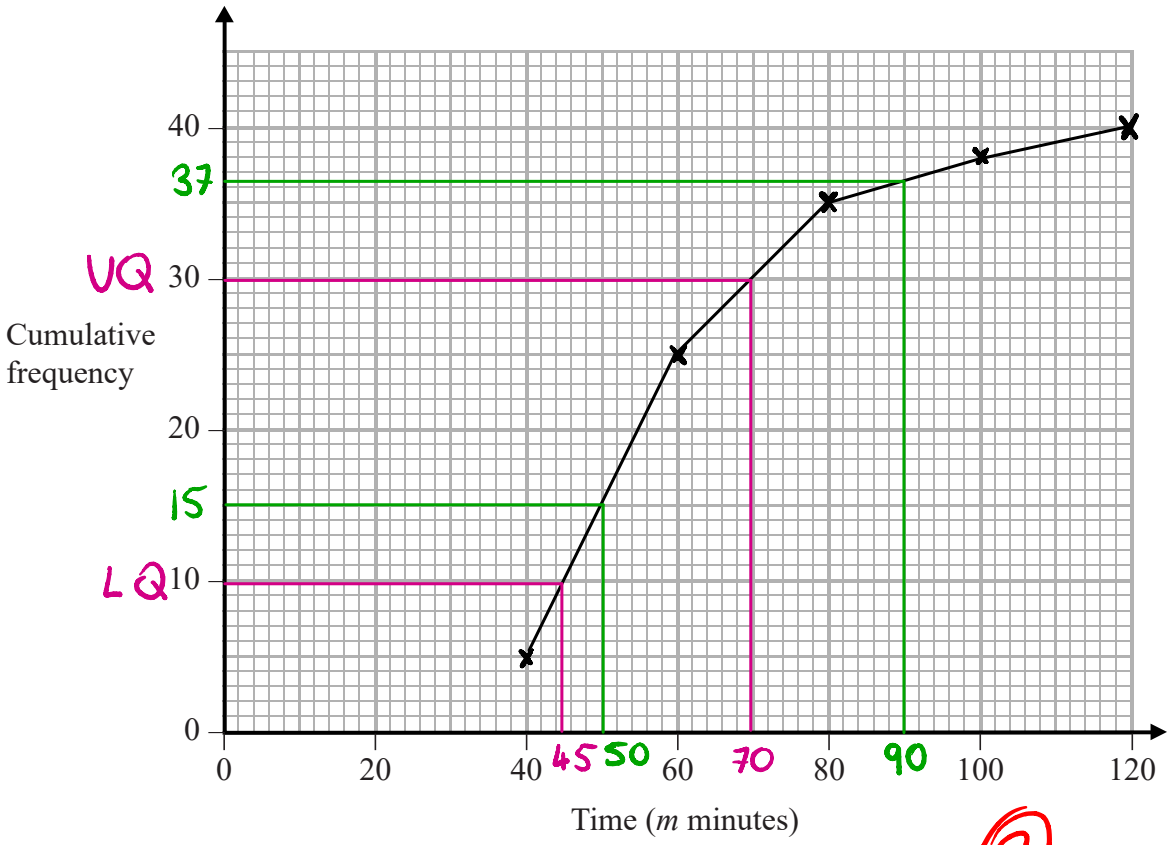
No because 72 km/h = 20 m/s

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
$20 < m \leqslant 40$	5
$20 < m \leqslant 60$	25
$20 < m \leqslant 80$	35
$20 < m \leqslant 100$	38
$20 < m \leqslant 120$	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)

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get these values from graph

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

IQR = UQ − LQ
(UQ: ×3/4, LQ: ×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

$\frac{22}{40}$ (1)

.....

(2)

(Total for Question 10 is 6 marks)

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.

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

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

$\frac{5}{30} \xrightarrow{\times \frac{12}{5}} \frac{12}{72}$ (1)

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

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

72 (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?

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

$\Rightarrow 2T = q + 10$ {Spencer forgot to multiply the '+5' by 2 (1)

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

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

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

(1)

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

(2)

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

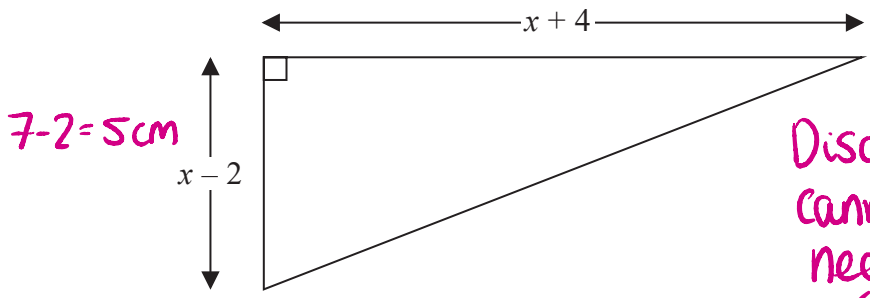
$$(x+y)^2 + 3(x+y) = (x+y)[(x+y)+3]$$

$$(x+y)(x+y+3) \quad (1)$$

(1)

(Total for Question 13 is 3 marks)

14 The diagram shows a right-angled triangle.



7+4 = 11 cm

x = 7

7-2 = 5 cm

Discard x = -9 since cannot have negative length

All the measurements are in centimetres.

The area of the triangle is 27.5 cm^2

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

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

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

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

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

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

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

$x^2 + 2x - 63 = 0$ (1)

$-7 \times 9 = -63$

$-7 + 9 = 2$

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

$x - 7 = 0$ $\quad x + 9 = 0$ (1)

$x = 7$ or $x = -9$

(1) 5 ..... cm

(Total for Question 14 is 4 marks)

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

$x = 0.418181818...$ (1)

$10x = 4.181818...$

$100x = 41.818181...$

$1000x = 418.181818...$

$1000x - 10x = 418.1818... - 4.1818...$

(1) $990x = 414.0$

$x = \frac{414}{990}$

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

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

(Total for Question 15 is 3 marks)

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

$\sqrt{a} \times \sqrt{a} = a$

Give your answer in its simplest form. (1)

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

(1) $2\sqrt{11}$

(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.

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

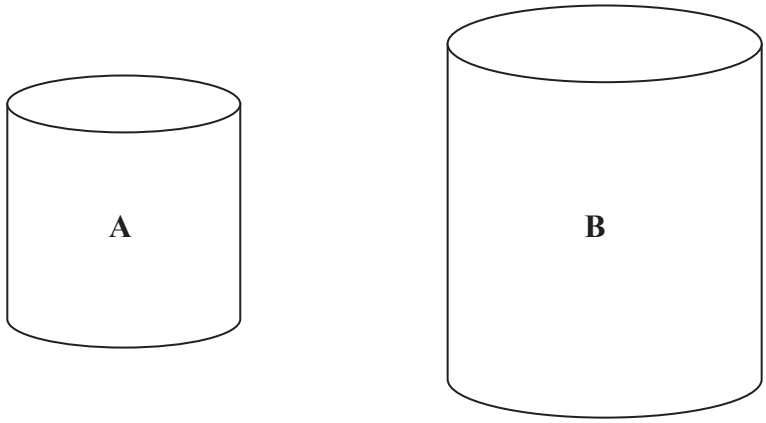
(1) (1) (1)

$a = 6 \quad b = 11$

(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.

	A : B	
Surface area:	4 : 9	units^2
Length:	2 : 3	units (1)
Volume:	8 : 27	units^3 (1)

(1) 8, 16, 24, 32
① ② ③ ④

∴ Tyler had to fill container A with water 4 times

(1)

4

(Total for Question 17 is 4 marks)

18 The function f is given by

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

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

$x = 2y^3 - 4$

$x + 4 = 2y^3$

$y^3 = \frac{x+4}{2}$

$y = \sqrt[3]{\frac{x+4}{2}}$

$f^{-1}(x) = \sqrt[3]{\frac{x+4}{2}}$ (1)

$\therefore f^{-1}(50) = \sqrt[3]{\frac{50+4}{2}} = \sqrt[3]{\frac{54}{2}} = \sqrt[3]{27} = 3$ (1)

(2)

The functions g and h are given by

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

(b) Find the values of x for which

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

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

$\therefore hg(x) = (x+2)^2$ (1)

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

$\downarrow (x+2)(x+2)$ (1)

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

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

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

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

$2x^2 - 3x - 5 = 0$ (1)

$(2x - 5)(x + 1) = 0$

$2x - 5 = 0$ $\quad x + 1 = 0$

$x = 5/2$ $\quad x = -1$

(1)

$x = 5/2$ and $x = -1$

(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.

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

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

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

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

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

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

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

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

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

(Total for Question 19 is 3 marks)

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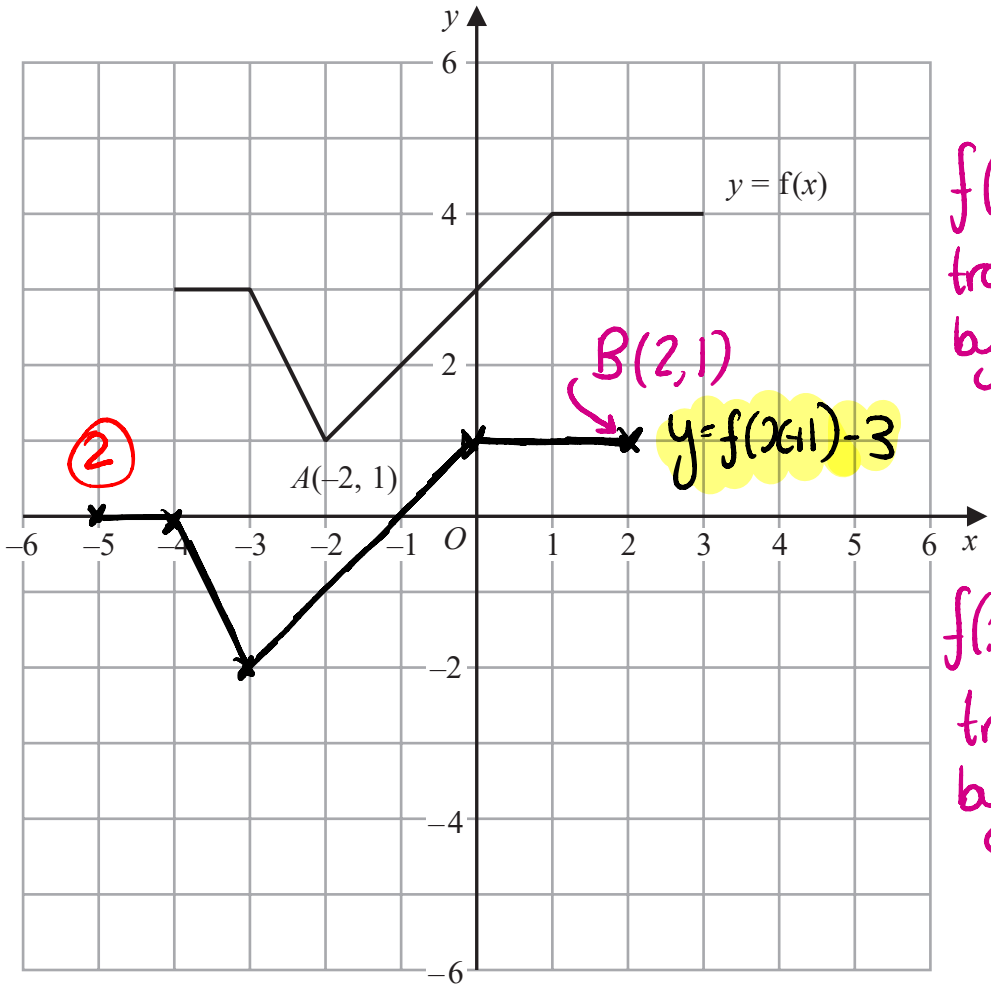
20 The graph of $y = f(x)$ is shown on the grid.



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

1

(2 , 1)

(1)

(Total for Question 20 is 3 marks)

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-intercept $= -5$ (1)

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 $= (-d, e)$

Turning point $= (2, -13)$ (1)

Find x-intercepts:

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

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

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

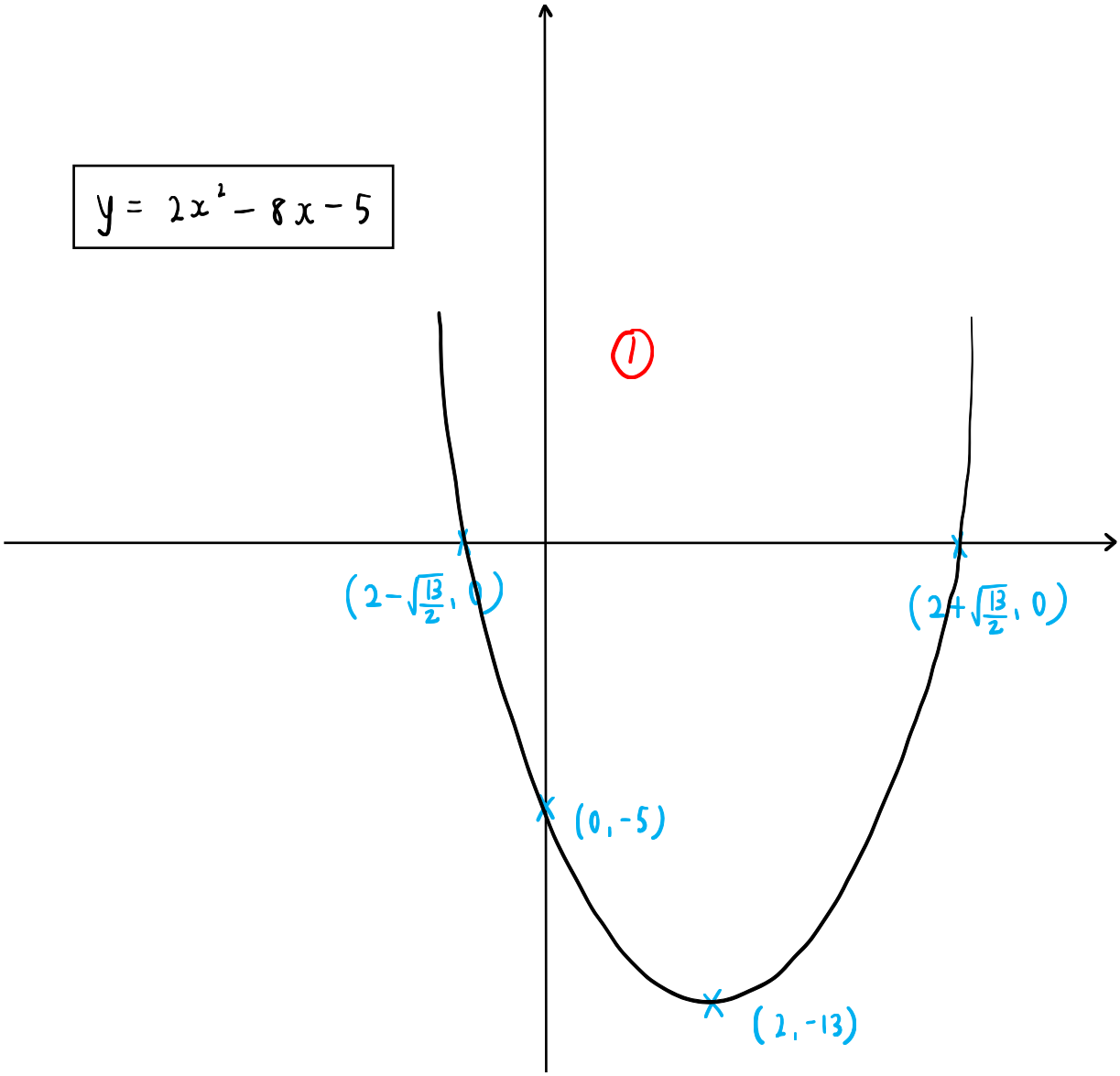
$x - 2 = \pm\sqrt{\frac{13}{2}}$

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

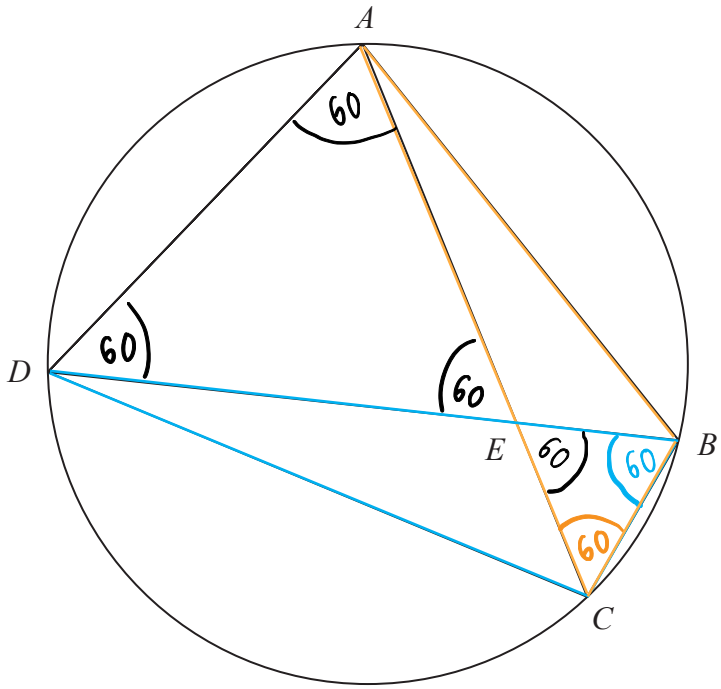
P.T.O.

(Total for Question 21 is 5 marks)

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



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)

AED is equilateral ∴ ∠AED = ∠ADE = ∠DAE = 60°

(1)

∠DAC = ∠DBC because angles in the same segment are equal.

∠ADB = ∠ACB because angles in the same segment are equal.

∴ ∠ACB = ∠DBC (1)

∠CEB = 60 ∴ ΔEBC is equilateral

AC = AE + EC = DE + EB = DB. ∴ AC = DB (1)

ΔABC is congruent to ΔDCB because they meet the SAS criteria.

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS