

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)		<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	
<h1>Mock Set 4 – Autumn 2018</h1>			
Time: 1 hour 30 minutes		Paper Reference 1MA1/3H	
Mathematics Paper 3 (Calculator) Higher Tier		<u>Solutions</u>	
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.
- 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 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.



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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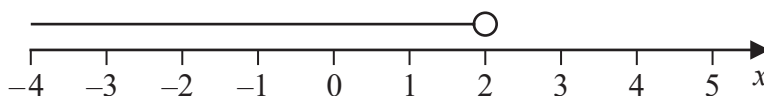

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Write down the inequality shown in the diagram.



$$x < 2$$

(Total for Question 1 is 2 marks)

- 2 The n th term of a sequence is $n^2 + 5$

- (a) (i) Find the first two terms of this sequence.

$$1^2 + 5 = 6$$

$$2^2 + 5 = 9$$

$$6 \quad 9$$

(1)

- (ii) Is 126 a term of this sequence?

You must show how you get your answer.

$$11^2 + 5 = 121 + 5 = 126$$

Yes

(1)

Here are the first five terms of an arithmetic sequence.

26 19 12 5 -2

- (b) Find an expression, in terms of n , for the n th term of this sequence.

$$33 - 7n$$

$$33 - 7n$$

(2)

(Total for Question 2 is 4 marks)



- 3 The table gives information about the times that 100 people took to travel to work.

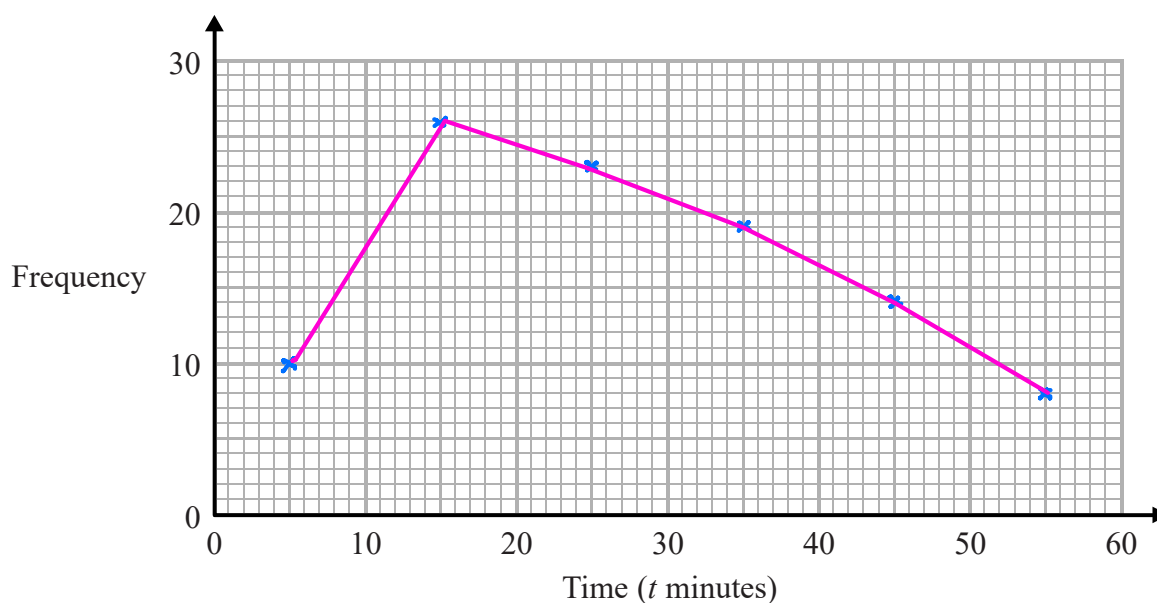
Time (t minutes)	Frequency	c. f.
$0 < t \leq 10$	10	10
$10 < t \leq 20$	26	36
$20 < t \leq 30$	23	59
$30 < t \leq 40$	19	78
$40 < t \leq 50$	14	92
$50 < t \leq 60$	8	100

- (a) Find the class interval that contains the median.

$$20 < t \leq 30$$

(1)

- (b) Draw a frequency polygon for the information in the table.



(2)

(Total for Question 3 is 3 marks)



- 4 In London, 1 pint of milk costs 58p.
In Paris, 1 litre of milk costs 1.05 euros.

1 litre = 1.76 pints

£1 = 1.17 euros

In which city is the milk better value for money, London or Paris?
You must show your working.

Find cost of litre of milk in euros in London

$$0.58 \times 1.76 \times 1.17 = 1.19 \text{ euros}$$

$$1.05 \text{ euros} < 1.19 \text{ euros}$$

so better value in Paris

(Total for Question 4 is 3 marks)



- 5 Simon can see two lights, light A and light B.

Light A flashes every 15 seconds.

Light B flashes every 18 seconds.

At 10 pm, both lights flash at the same time.

How many **more** times will both lights flash at the same time in the next 4 minutes?

$$15 = 3 \times 5$$

$$18 = 2 \times 3 \times 3$$

$$LCM = 2 \times 3 \times 3 \times 5 = 90$$

$$4 \text{ min} = 240 \text{ seconds}$$

flash together at 90, 180

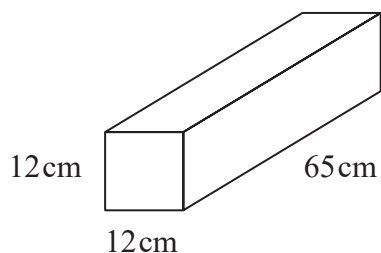
so 2 more times

2

(Total for Question 5 is 3 marks)



- 6 The diagram shows a concrete block on horizontal ground.



$$p = \frac{F}{A}$$

p = pressure

F = force

A = area

The block is a cuboid, 12 cm by 12 cm by 65 cm.
The block exerts a force of 220 newtons on the ground.

Calculate the pressure that the block exerts on the ground.

Give your answer in newtons/cm²

$$\text{Area on ground} = 12 \times 65 = 780 \text{ cm}^2$$

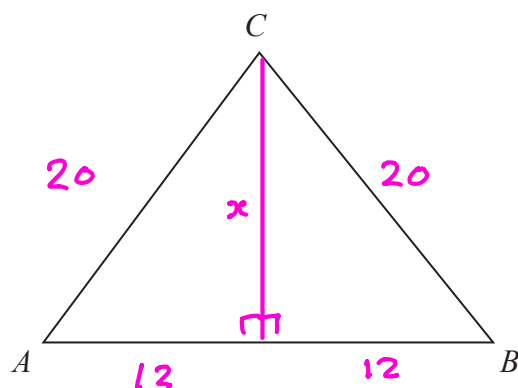
$$\text{pressure} = \frac{220}{780} = 0.282 \text{ N/cm}^2$$

0.282 newtons / cm²

(Total for Question 6 is 2 marks)



7 The diagram shows triangle ABC .



The perimeter of the triangle is 64 cm.

$$AB : BC : CA = 6 : 5 : 5$$

$$6 + 5 + 5 = 16$$

$$16 \text{ parts} = 64 \text{ cm}$$

$$1 \text{ part} = 4 \text{ cm}$$

Work out the area of the triangle.

$$AB = 6 \times 4 = 24 \text{ cm}$$

$$BC = 5 \times 4 = 20 \text{ cm}$$

$$CA = 5 \times 4 = 20 \text{ cm}$$

$$x^2 + 12^2 = 20^2$$

$$x^2 = 20^2 - 12^2$$

$$x^2 = 256$$

$$x = 16$$

$$\begin{aligned} \text{Area of } \triangle ABC &= \frac{1}{2} \text{ base} \times \text{height} \\ &= \frac{24 \times 16}{2} \\ &= 192 \text{ cm}^2 \end{aligned}$$

192 cm²

(Total for Question 7 is 5 marks)



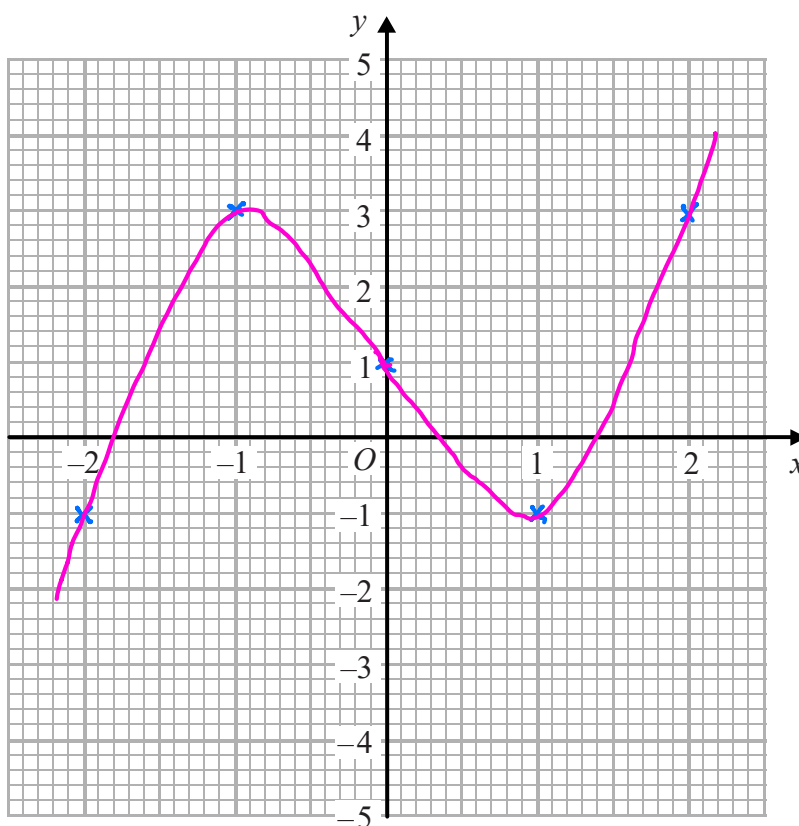
8 (a) Complete the table of values for $y = x^3 - 3x + 1$

$$\begin{aligned}
 x = -2 & \quad y = (-2)^3 - 3(-2) + 1 = -1 & x = 1 & \quad y = 1^3 - 3(1) + 1 = -1 \\
 x = -1 & \quad y = (-1)^3 - 3(-1) + 1 = 3 & x = 2 & \quad y = 2^3 - 3(2) + 1 = 3 \\
 x = 0 & \quad y = 1
 \end{aligned}$$

x	-2	-1	0	1	2
y	-1	3	1	-1	3

(2)

(b) On the grid below, draw the graph of $y = x^3 - 3x + 1$ for values of x from -2 to 2



(2)

(Total for Question 8 is 4 marks)



- 9 Find the value of $\frac{(6.67 \times 10^{-11}) \times (7.35 \times 10^{22})}{(1.74 \times 10^6)^2}$

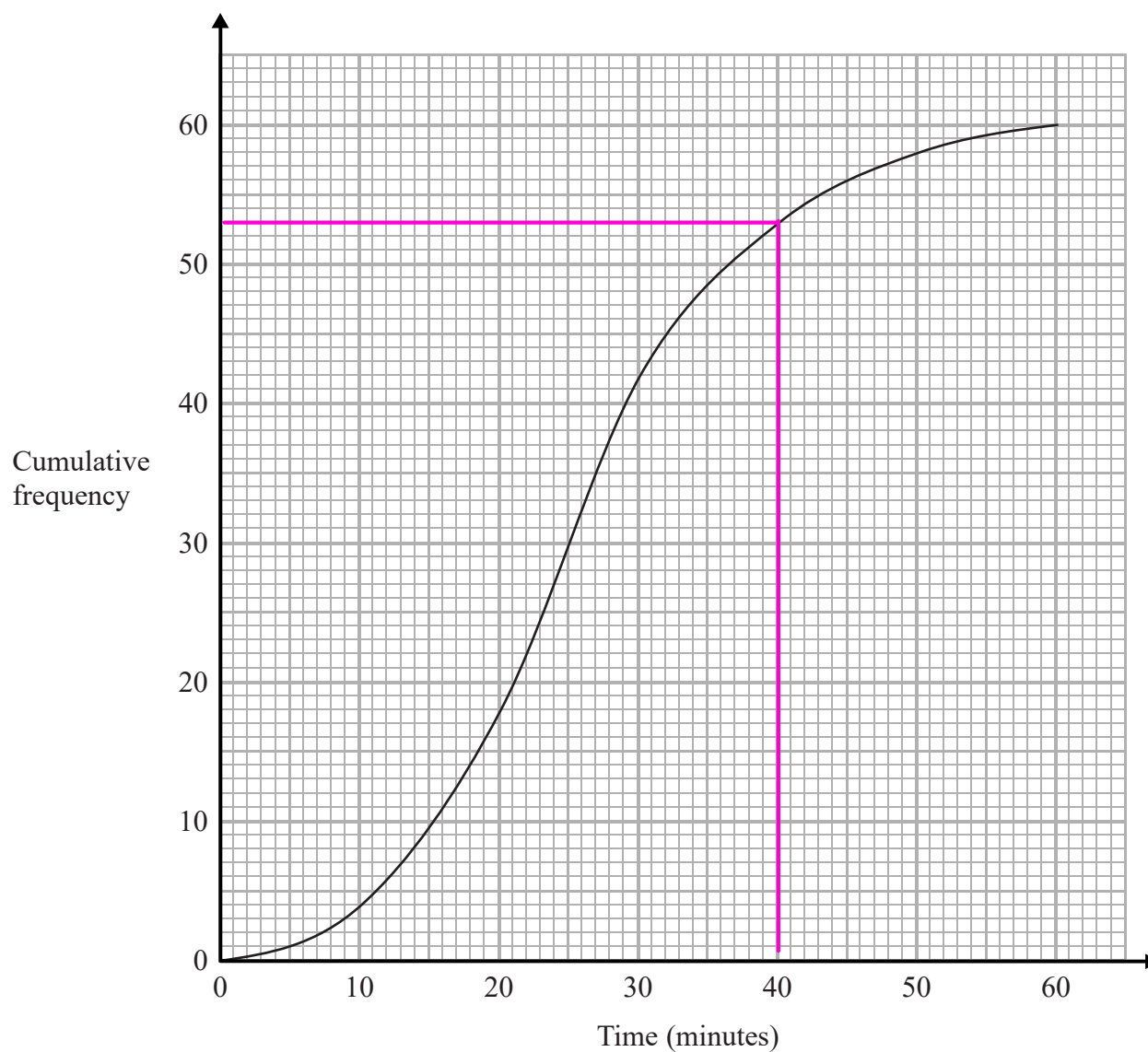
Give your answer correct to 1 decimal place.

1.6

(Total for Question 9 is 2 marks)



- 10 The cumulative frequency graph gives information about the number of minutes each of 60 people was in a shop.



- (a) Find an estimate for the number of people who were in the shop for more than 40 minutes.

$$60 - 53 = 7$$

7

(2)



Stan has to use the graph to find an estimate for the lower quartile of the times.

Stan writes,

60 people were in the shop.

$25\% \text{ of } 60 = 15$

So the lower quartile of the times is 15 minutes.

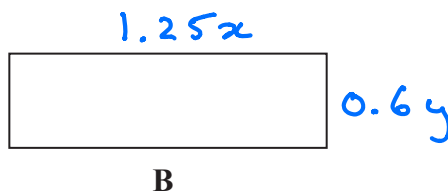
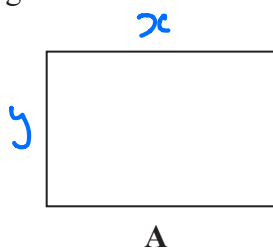
(b) What mistake has Stan made?

15 is the number of people not the lower quartile time. He needs to read the time on the horizontal axis corresponding to a cumulative frequency of 15 on the vertical axis. (1)

(Total for Question 10 is 3 marks)



11 Here are two rectangles.



The length of rectangle **B** is 25% greater than the length of rectangle **A**.

The width of rectangle **B** is $\frac{3}{5} \times$ the width of rectangle **A**.

Find the fraction $\frac{\text{area of rectangle B}}{\text{area of rectangle A}}$

Give your answer in its simplest form.

$$\frac{\text{Area of B}}{\text{Area of A}} = \frac{1.25x \times 0.6y}{xy} = 1.25 \times 0.6 = \frac{3}{4}$$

$$\frac{3}{4}$$

(Total for Question 11 is 3 marks)



- 12 In a class there are 11 boys and 19 girls.
The mean weight of all 30 children is 32.85 kg.
The mean weight of the 11 boys is 31.9 kg.

Work out the mean weight of the 19 girls.

$$\text{Total Weight of all students} = 30 \times 32.85 = 985.5 \text{ kg}$$

$$\text{Total weight of boys} = 11 \times 31.9 = \underline{350.9 \text{ kg}}$$

$$\text{Total weight of girls} = 634.6 \text{ kg}$$

$$\text{Mean weight of girls} = \frac{634.6}{19} = 33.4 \text{ kg}$$

33.4 kg

(Total for Question 12 is 3 marks)



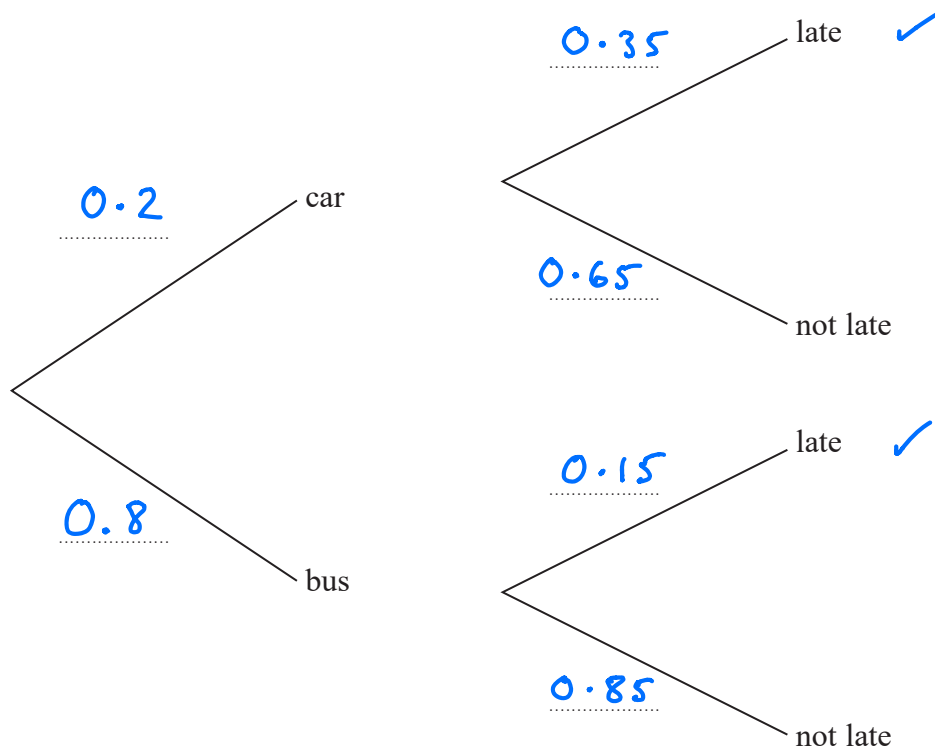
13 When Lee goes to work, he either travels by car or by bus.

The probability that on any day Lee goes to work he travels by car is 0.2

When Lee travels to work by car, the probability that he is late is 0.35

When Lee travels to work by bus, the probability that he is late is 0.15

(a) Complete the probability tree diagram for this information.



(2)

(b) Work out the probability that on any day Lee goes to work he is late.

$$\begin{aligned}
 P(\text{Late}) &= 0.2 \times 0.35 + 0.8 \times 0.15 \\
 &= 0.07 + 0.12 \\
 &= 0.19
 \end{aligned}$$

0.19

(3)

(Total for Question 13 is 5 marks)



14 $g = \frac{Gm}{r^2}$

The value of r is decreased by 20%

The value of G and the value of m are not changed.

Calculate the percentage increase in the value of g .

$$g' = \frac{Gm}{(0.8r)^2} = \frac{Gm}{0.64r^2}$$

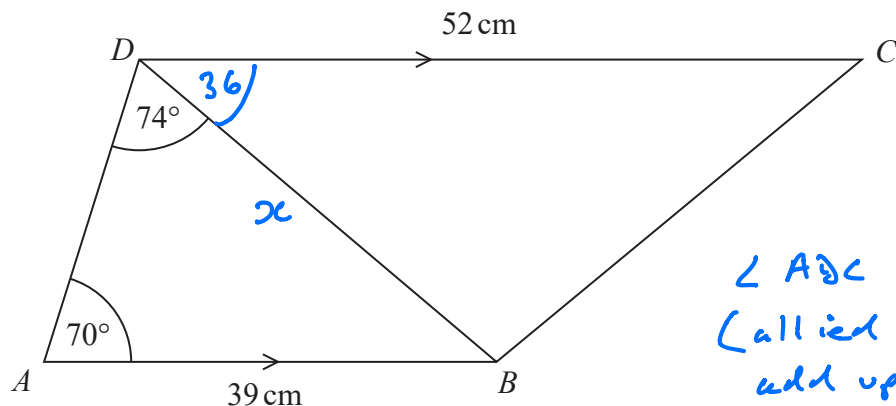
$$\frac{g'}{g} = \frac{\frac{Gm}{0.64r^2}}{\frac{Gm}{r^2}} = \frac{Gm}{0.64r^2} \times \frac{r^2}{Gm} = \frac{1}{0.64} = 1.5625$$

56.25%

(Total for Question 14 is 3 marks)



15 Here is trapezium $ABCD$.



$\angle ABC = 110^\circ$
(allied angles add up to 180°)
 $\therefore \angle BDC = 36^\circ$

AB and DC are parallel.

Work out the area of triangle BCD .

Give your answer correct to 3 significant figures.

$$\frac{x}{\sin 70^\circ} = \frac{39}{\sin 74^\circ}$$

$$x = \frac{39}{\sin 74^\circ} \times \sin 70^\circ$$

$$x = 38.125 \text{ cm}$$

Area of $\triangle BCD$

$$= \frac{1}{2} \times 38.125 \times 52 \sin 36^\circ$$

$$= 582.64 \text{ cm}^2$$

$$= 583 \text{ cm}^2$$

.....cm²

(Total for Question 15 is 5 marks)



16 Shape **A** and shape **B** are two similar solid shapes.

The ratio of the volume of shape **A** to the volume of shape **B** is 1 : 10

Aisha says that the height of shape **B** is 10 times the height of shape **A**.

(a) Is Aisha correct?

Give a reason for your answer.

No - lengths would be in ratio $1 : \sqrt[3]{10}$

(1)

The surface area of shape **B** is 72 cm^2

(b) Work out the surface area of shape **A**.

Give your answer correct to 3 significant figures.

Areas in ratio $1 : (\sqrt[3]{10})^2 = 10^{2/3}$

Surface Area of Shape A = $\frac{72}{10^{2/3}} = 15.5 \text{ cm}^2$

15.5 cm²
(2)

(Total for Question 16 is 3 marks)



17 Kelly grows potatoes.

She has 2500 kg of potatoes, correct to the nearest 10 kg.

Kelly is going to put the potatoes into sacks.

Each sack will contain 12.5 kg of potatoes.

Kelly assumes that 12.5 kg is measured correct to the nearest 0.1 kg.

(a) Does Kelly definitely have enough potatoes to fill 200 sacks?

You must show how you get your answer.

Minimum amount of potatoes = 2495 kg

Max amount in a sack = 12.55 kg

Worst case
$$\frac{2495}{12.55} = 198.8 \text{ sacks}$$

No she may not have enough
for 200 sacks

(3)

Kelly's assumption is wrong.

12.5 kg is measured correct to the nearest 0.5 kg.

(b) Explain how this could affect your decision in part (a).

Decision unaffected
$$\frac{2495}{12.75} = 195.7 \text{ sacks}$$

so may fill even less sacks

(1)

(Total for Question 17 is 4 marks)



18 Write $\frac{3(x-1)}{x^2-4x-5} - \frac{2}{x-5}$ as a single fraction in its simplest form.

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

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

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

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

$$= \frac{1}{x+1}$$

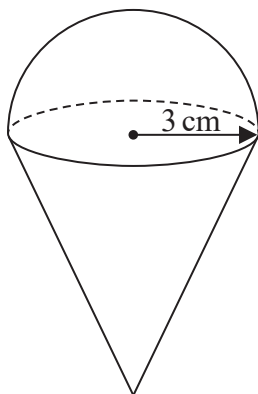
$$\frac{1}{x+1}$$

(Total for Question 18 is 4 marks)



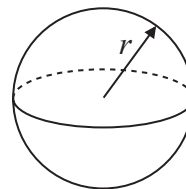
- 19 The diagram shows a solid made by joining a solid hemisphere to a solid circular cone.

The centre of the plane face of the cone coincides with the centre of the plane face of the hemisphere.



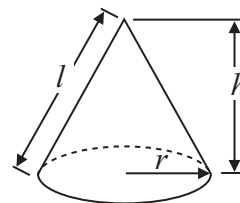
$$\text{Surface area of sphere} = 4\pi r^2$$

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



$$\text{Curved surface area of cone} = \pi r l$$

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



The radius of the hemisphere is 3 cm.

The radius of the base of the cone is 3 cm.

The volume of the solid is $30\pi \text{ cm}^3$

Work out the total surface area of the solid.

Give your answer as a multiple of π .

$$l^2 = r^2 + h^2$$

$$l^2 = 3^2 + 4^2$$

$$l^2 = 25$$

$$l = 5 \text{ cm}$$

$$\text{Vol } 30\pi = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

$$90\pi = 2\pi r^3 + \pi r^2 h$$

$$90\pi = 54\pi + 9\pi h$$

$$90 = 54 + 9h$$

$$36 = 9h$$

$$\frac{36}{9} = h$$

$$\underline{h = 4 \text{ cm}}$$

$$\text{Surface Area} = 2\pi r^2 + \pi r l$$

$$= 2\pi \times 9 + \pi \times 3 \times 5$$

$$= 18\pi + 15\pi$$

$$= \underline{33\pi \text{ cm}^2}$$

$$33\pi \text{ cm}^2$$

(Total for Question 19 is 5 marks)



20 Solve algebraically the simultaneous equations

$$y = 2x^2 - 3x - 10 \quad \textcircled{1}$$

$$2x - y = -2 \quad \textcircled{2}$$

From $\textcircled{2}$ $2x + 2 = y$

Sub for y in $\textcircled{1}$

$$2x + 2 = 2x^2 - 3x - 10$$

$$0 = 2x^2 - 5x - 12$$

$$0 = 2x^2 + 3x - 8x - 12$$

$$0 = x(2x + 3) - 4(2x + 3)$$

$$0 = (x - 4)(2x + 3)$$

$$\Rightarrow x - 4 = 0 \quad \text{or} \quad 2x + 3 = 0$$

$$x = 4$$

$$2(4) + 2 = y$$

$$y = 10$$

$$2x = -3$$

$$x = -\frac{3}{2}$$

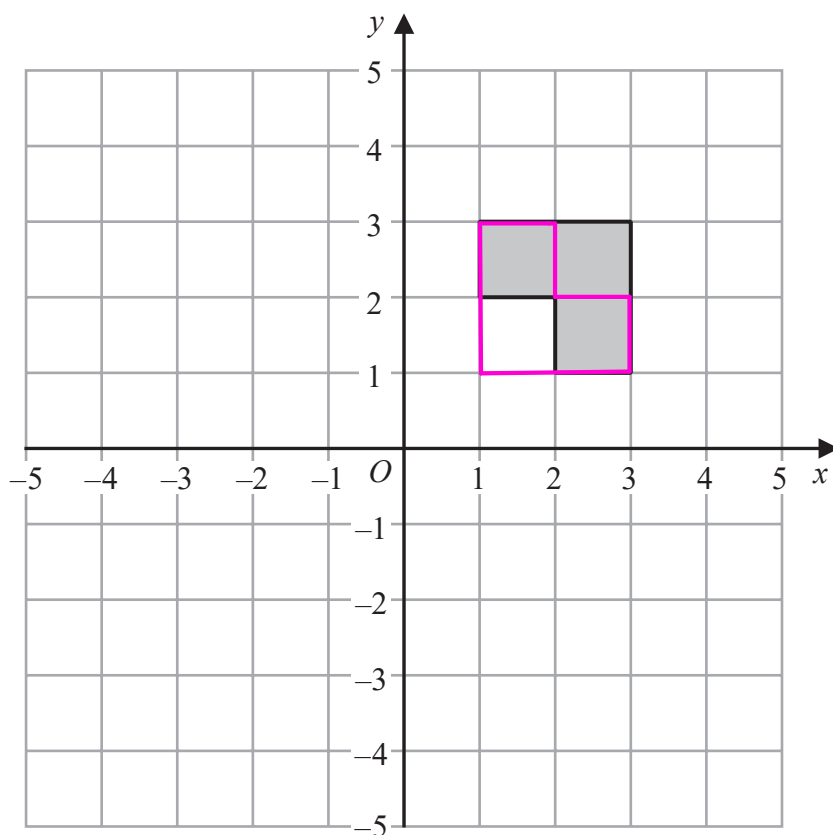
$$2\left(-\frac{3}{2}\right) + 2 = y$$

$$y = -1$$

$$\begin{cases} x = 4 \\ y = 10 \end{cases} \quad \text{or} \quad \begin{cases} x = -\frac{3}{2} \\ y = -1 \end{cases}$$

(Total for Question 20 is 5 marks)





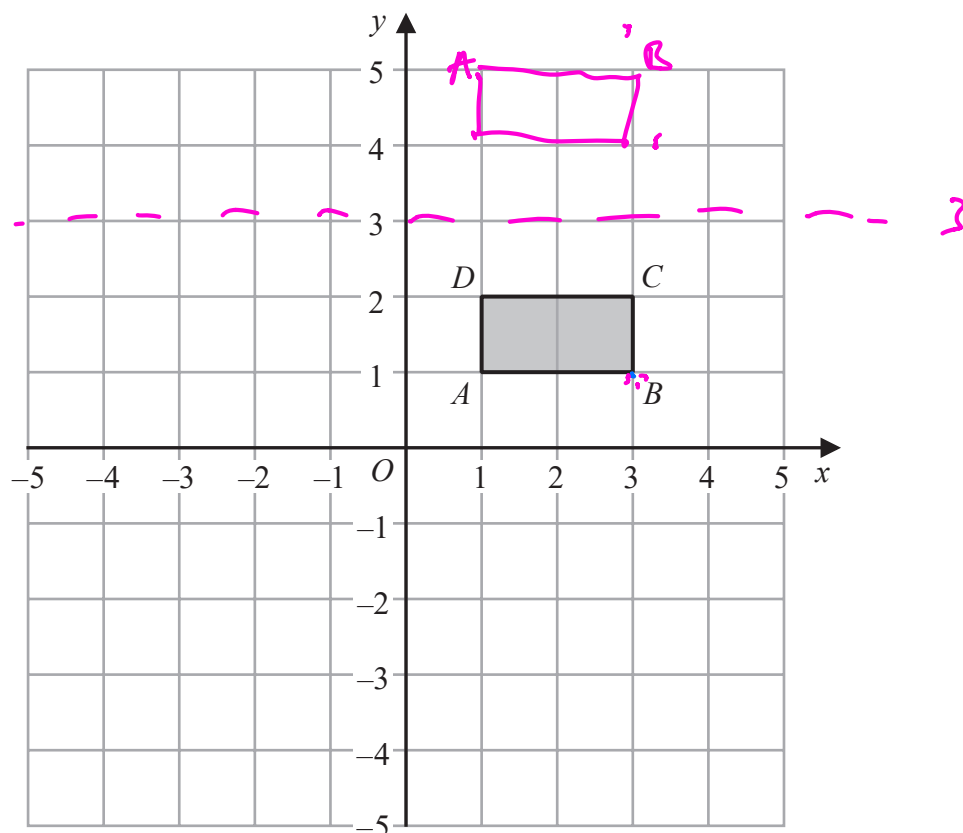
The shaded shape is rotated 180° about the point $(2, 2)$

(a) How many of the vertices of the shaded shape are invariant?

Only invariant vertex is $(2, 2)$

1





Rectangle $ABCD$ is transformed by a combination of two transformations so that

all points on AB are invariant
and there are no other invariant points.

The first transformation is

a reflection in the line with equation $y = k$, where k is an integer and $k \neq 1$

(b) Describe fully the second transformation.

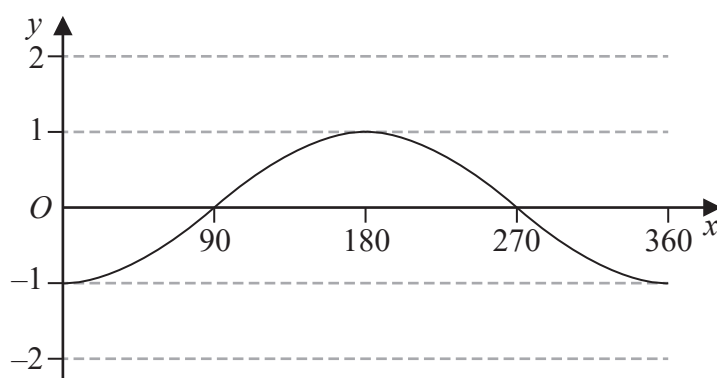
Translation by $\begin{pmatrix} 0 \\ -2(k-1) \end{pmatrix}$ or $\begin{pmatrix} 0 \\ 2-2k \end{pmatrix}$

(2)

(Total for Question 21 is 3 marks)



22 Here is a sketch of the graph of a trigonometric function for $0 \leq x \leq 360$

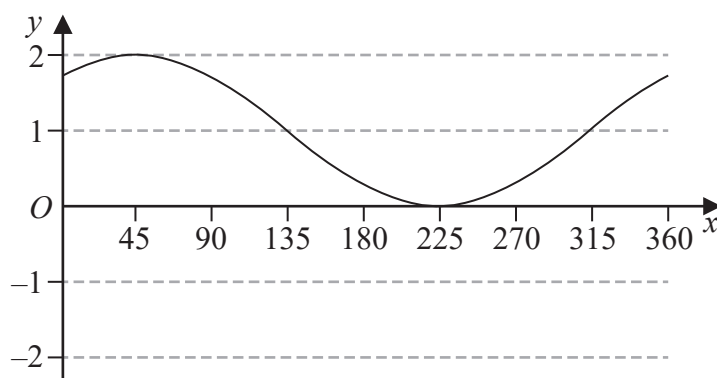


(a) Write down a possible equation of the graph.

$$y = -\cos x$$

(1)

Here is a sketch of the graph of $y = \cos(x - p)^\circ + r$ for $0 \leq x \leq 360$



(b) Find the value of p and the value of r .

$$p = 45$$

$$r = 1$$

(2)

(Total for Question 22 is 3 marks)



23 Prove that $4x^2 - 8x + 7$ is positive for all values of x .

$$= 4 \left(x^2 - 2x + \frac{7}{4} \right)$$

$$= 4 \left((x-1)^2 + \frac{7}{4} - 1 \right)$$

$$= 4(x-1)^2 + 7 - 4$$

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

Since $(x-1)^2 \geq 0$ for all x

$$4x^2 - 8x + 7 \geq 3 \text{ for all } x$$

$\therefore 4x^2 - 8x + 7$ is positive
for all x

(Total for Question 23 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS



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