

Please write clearly in block capitals.

Centre number

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Forename(s) _____

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GCSE MATHEMATICS

H

Higher Tier Paper 1 Non-Calculator

Thursday 25 May 2017

Morning

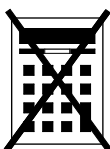
Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments.

You must **not** use a calculator.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
TOTAL	

Advice

- In all calculations, show clearly how you work out your answer.



Answer **all** questions in the spaces provided

- 1 Simplify $2^5 \times 2^3 = 2^{5+3}$
Circle your answer.

[1 mark]

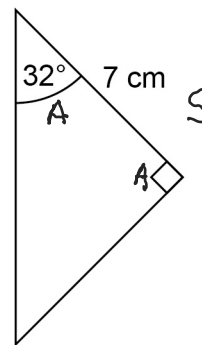
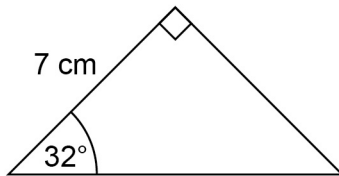
4^8

2^8

2^{15}

4^{15}

2



Not drawn
accurately

Circle the reason why these triangles are congruent.

[1 mark]

SSS

SAS

ASA

RHS

- 3 Which of these is a geometric progression?

Circle your answer.

multiply for the next term

[1 mark]

2, 4, 6, 8, 10

2, 3, 5, 8, 12

2, 6, 18, 54, 162

2, 6, 10, 14, 18

x3 x3



4

$a : b = 4 : 3$

Circle the correct statement.

For every 4a, there is 3b

[1 mark]

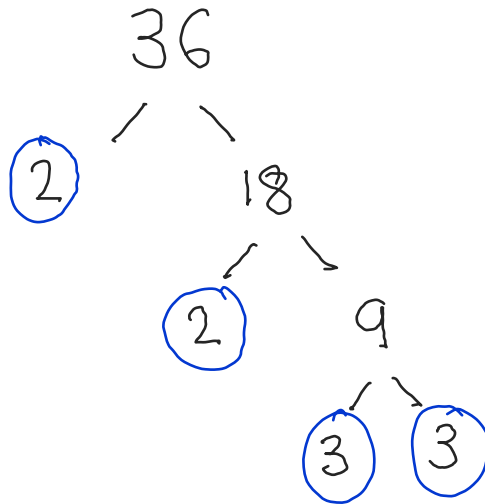
 b is $\frac{4}{7}$ of a b is $\frac{3}{7}$ of a b is $\frac{4}{3}$ of a b is $\frac{3}{4}$ of a

5

Write 36 as a product of prime factors.

Give your answer in index form.

[3 marks]



$2 \times 2 \times 3 \times 3$

Answer $2^2 \times 3^2$

Turn over for the next question

Turn over ►



- 6 The table shows information about the times for 10 people to complete a task.

Time, t (minutes)	Frequency
$0 < t \leq 20$	1
$20 < t \leq 40$	6
$40 < t \leq 60$	3

These statements are about the mean and range of the actual times.

Tick the correct box for each statement.

[4 marks]

	True	False
<p><i>Average time would be more than 20</i></p> <p>The mean could be less than 20 minutes</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<p>The mean could be more than 40 minutes</p> <p><i>'If the 3 values ($40 < t \leq 60$) are large enough</i></p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<p>The mean could be less than 40 minutes</p> <p><i>'If the 6 values are small enough</i></p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<p><i>largest - smallest</i></p> <p>The range could be more than 40 minutes</p> <p>$60 - 1 = 59$</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<p>The range could be less than 40 minutes</p> <p>$40 - 20 = 20$</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<p>The range could be more than 60 minutes</p> <p><i>Not possible as largest value could be $60 - 1 = 59$</i></p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>



- 7 $\frac{3}{5}$ of a number is 162

Work out the number.

[2 marks]

$$\begin{array}{l} \frac{3}{5} = 162 \\ \div 3 \quad \left(\frac{1}{5} = 54 \right) \quad \div 3 \\ \times 5 \quad \left(\frac{5}{5} = 270 \right) \quad \times 5 \end{array}$$

Answer 270

- 8 x km/h = y mph

Use 8 km/h = 5 mph to write a formula for y in terms of x .

[2 marks]

$$5x = 8y$$

Answer $y = \frac{5x}{8}$

Turn over for the next question



9 (a) Density = $\frac{\text{mass}}{\text{volume}}$

The mass of solid A is 6 times the mass of solid B.

The volume of solid A is 3 times the volume of solid B.

$$\frac{6}{3} =$$

Complete the sentence.

[1 mark]

The density of solid A is 2 times the density of solid B.

9 (b) Average speed = $\frac{\text{distance}}{\text{time}}$

$$\frac{1/2}{\times 2} = \frac{1}{4}$$

If the distance is halved and the time is doubled, what happens to the average speed?

Circle your answer.

[1 mark]

$\times 2$

$\times 4$

no change

$\div 2$

$\div 4$



10

Solve the simultaneous equations.

$$\begin{array}{r} 2x + y = 18 \quad 1 \\ x - y = 6 \quad 2 \\ \hline \end{array}$$

[3 marks]

$$3x = 24$$

$$\div 3 \quad x = 8 \quad \div 3$$

$$\text{sub in } \textcircled{2} = 8 - y = 6$$

$$y = 2$$

Answer $x = 8, y = 2$

Turn over for the next question

Turn over ►



11 Billy wants to buy these tickets for a show.

4 adult tickets at £15 each

2 child tickets at £10 each

A 10% booking fee is added to the ticket price.

3% is then added for paying by credit card.

Work out the **total** charge for these tickets when paying by credit card.

[5 marks]

$$\text{Adult : } 4 \times 15 = \text{£}60$$

$$\text{Child : } 2 \times 10 = \text{£}20^+$$

$$\text{Total} = \text{£}80$$

$$\text{Booking Fee : } \text{£}80 + 10\%$$

$$10\% = 8 : \text{£}80 + 8 = \text{£}88$$

$$\text{Credit Card : } \text{£}88 + 3\%$$

$$3\% = 0.88 \times 3 = 2.64 : \text{£}88 + 2.64$$

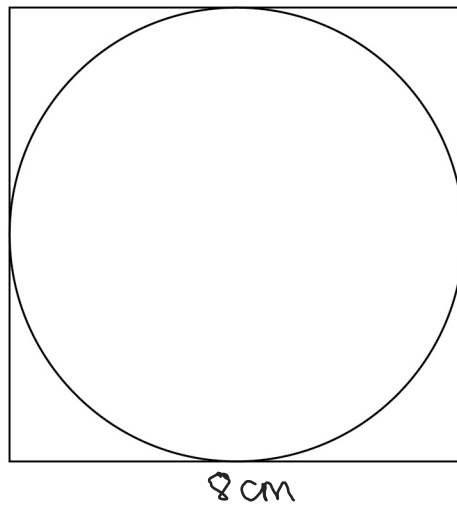
$$= \text{£}90.64$$

Answer £ 90.64



12

Here is a circle touching a square.

Not drawn
accuratelyThe area of the square is 64 cm^2 Work out the area of the circle. $-\pi r^2$ Give your answer in terms of π .**[3 marks]**

$$\text{Area of the square: } 64 \text{ cm}^2$$

$$\text{length of side: } \sqrt{64} = 8 \text{ cm}$$

$$8 \text{ cm} = \text{Diameter}$$

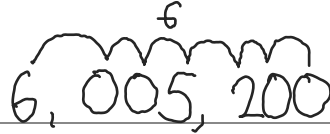
$$4 \text{ cm} = \text{Radius} \quad : \quad \pi \times 4^2 = 16\pi$$

$$\text{Answer } \underline{16\pi} \text{ cm}^2$$

Turn over for the next question**Turn over ►**

- 13 Write the number six million five thousand two hundred in standard form.

[2 marks]

6


Answer = 6.0052×10^6

- 14 Solve $-3x > 6$

[1 mark]

$\div -3$
 $x < -2$
J

sign flips when negative

Answer $x < -2$

- 15 $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$ and $\frac{1}{9}$ are four fractions.

How many of these fractions convert to a recurring decimal?

Circle your answer.

[1 mark]

0

1

2

3

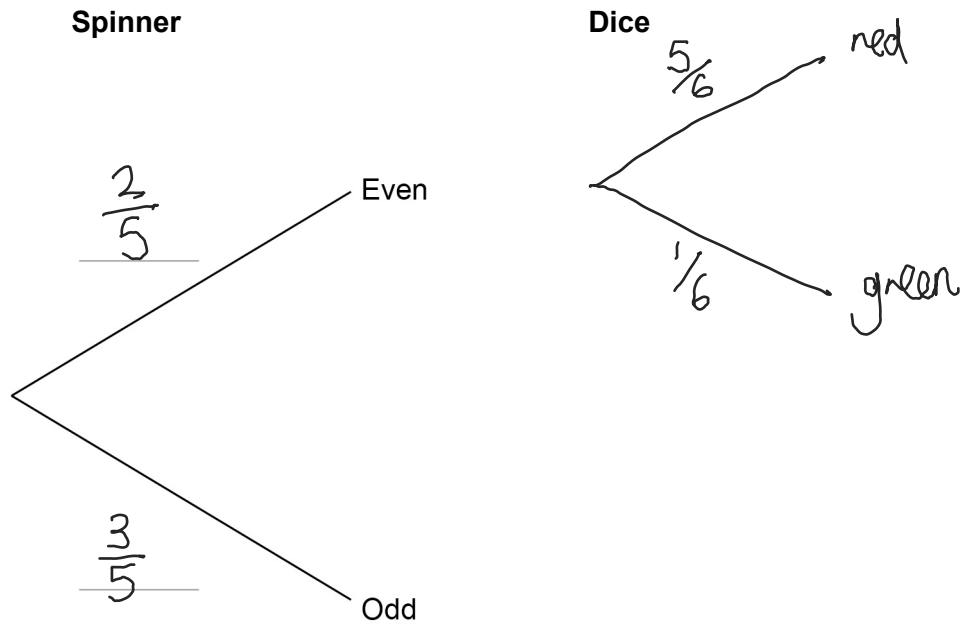
4



- 16** A fair spinner has five equal sections numbered 1, 2, 3, 4 and 5
A fair six-sided dice has five red faces and one green face.
The spinner is spun.
If the spinner shows an even number, the dice is thrown.

- 16 (a)** Complete the tree diagram for the spinner and the dice.

[2 marks]



- 16 (b)** Work out the probability of getting an even number and the colour green.

[2 marks]

$$P(\text{even}) = \frac{2}{5} \qquad \frac{2}{5} \times \frac{1}{6}$$

$$P(\text{green}) = \frac{1}{6}$$

$$\text{Answer} = \frac{2}{30} = \frac{1}{15}$$



- 17 A is the point (2, -5)
B is the point (4, -9)

17 (a) Show that the gradient of the straight line passing through A and B is -2

[2 marks]

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

$$m = \frac{-5 - (-9)}{2 - 4} = \frac{4}{-2} = -2$$

- 17 (b) C is the point (-301, 601)

Does C lie on the straight line passing through A and B?

You **must** show your working.

[2 marks]

Line A and B: $m = -2$

$$y = -2x + c$$

(2, -5)

$$-5 = -2 \times 2 + c$$

$$-1 = c$$

$$AB: y = -2x - 1$$

$$C: x = -301$$

$$y = -2 \times -301 - 1$$

$$y = 602 - 1$$

$$= 601$$

Answer

Yes



18

Bottles of drink are for sale at three shops.

The normal price of a bottle is the same at each shop.

Shop A
Buy 1 bottle
Get 2 more bottles at half price

Shop B
Buy 2 bottles
Get 3 more bottles at half price

Shop C
30% off a bottle

What is the cheapest way to buy **exactly** 8 bottles?

You can buy from more than one shop.

You **must** show your working.**[3 marks]**

$$\text{shop A: } 3 \text{ full, } 5 \text{ half price}$$

$$3 \times 1 + 5 \times 0.5 = 5.5$$

$$\text{Shop B: } 4 \text{ full, } 4 \text{ half price}$$

$$4 \times 1 + 4 \times 0.5 = 6$$

$$\text{Shop C: } 0.7 \times 8 = 5.6$$

$$\text{Cheapest: } A + C : 6 \text{ bottle from A:}$$

$$2 \times 1 + 4 \times 0.5 = \underline{\underline{4}}$$

$$2 \times 0.7 = \underline{\underline{1.40}}$$

Answer £5.40 is cheapest
6 bottles from A and
2 from C

7

Turn over ►

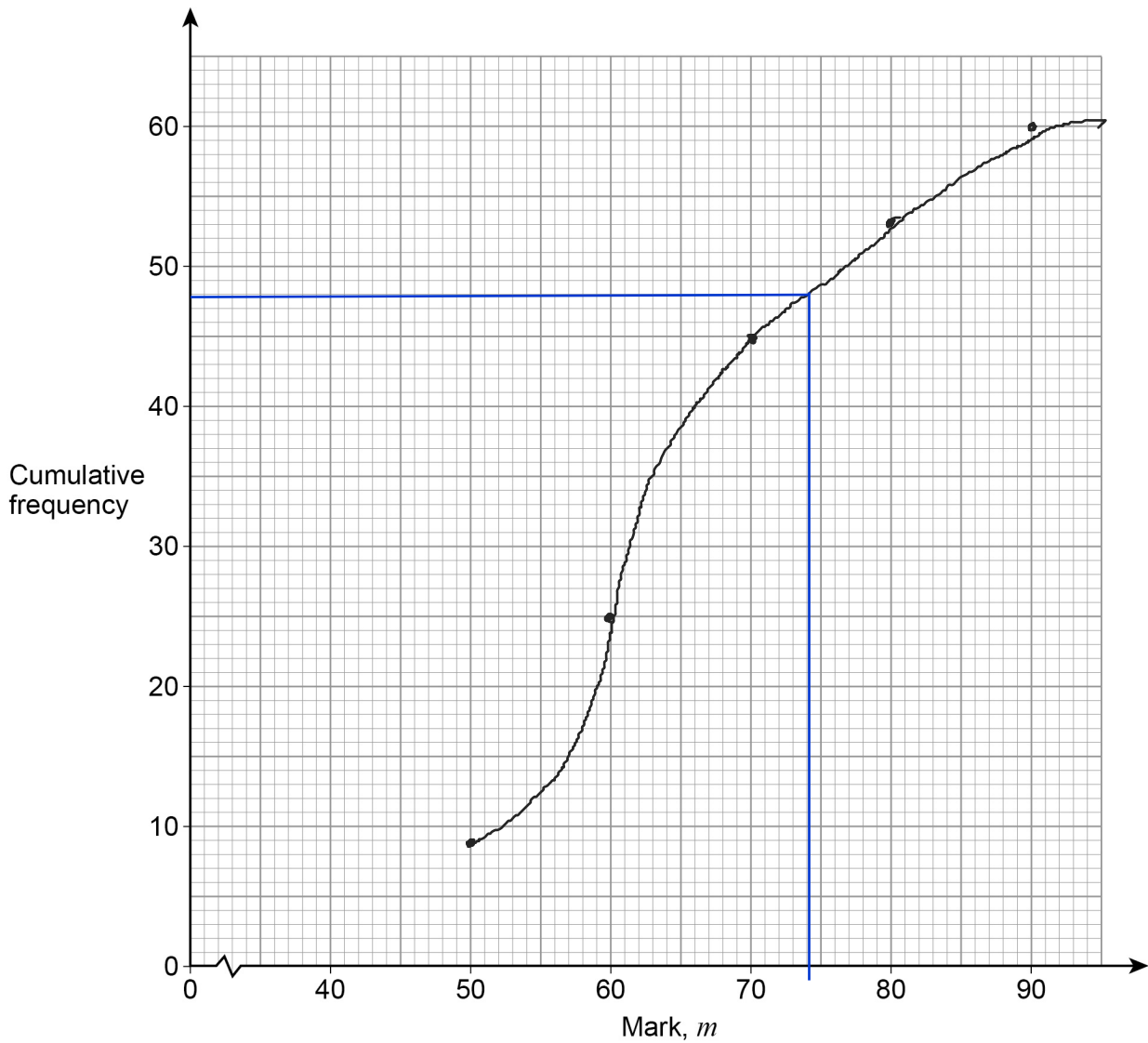


- 19 Here is some information about the marks of 60 students in a test.

Mark, m	Frequency	Cumulative	
$40 < m \leq 50$	9	9	
$50 < m \leq 60$	16	25	
$60 < m \leq 70$	20	45	
$70 < m \leq 80$	8	53	
$80 < m \leq 90$	7	60	

- 19 (a) On the grid, draw a cumulative frequency graph.

[3 marks]



19 (b) Use your graph to estimate the lowest mark of the top 20% of students.

[2 marks]

$$20\% \text{ of } 60 = 12$$

$$60 - 12 = 48$$

When $cf = 48$, mark is 74

Answer 74

20

Work out the diameter of the circle
Circle your answer.

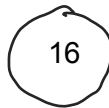
$$x^2 + y^2 = \underline{64} \quad \text{--- } r^2$$

$$r = 8$$

$$d = 8 \times 2 = 16$$

[1 mark]

8



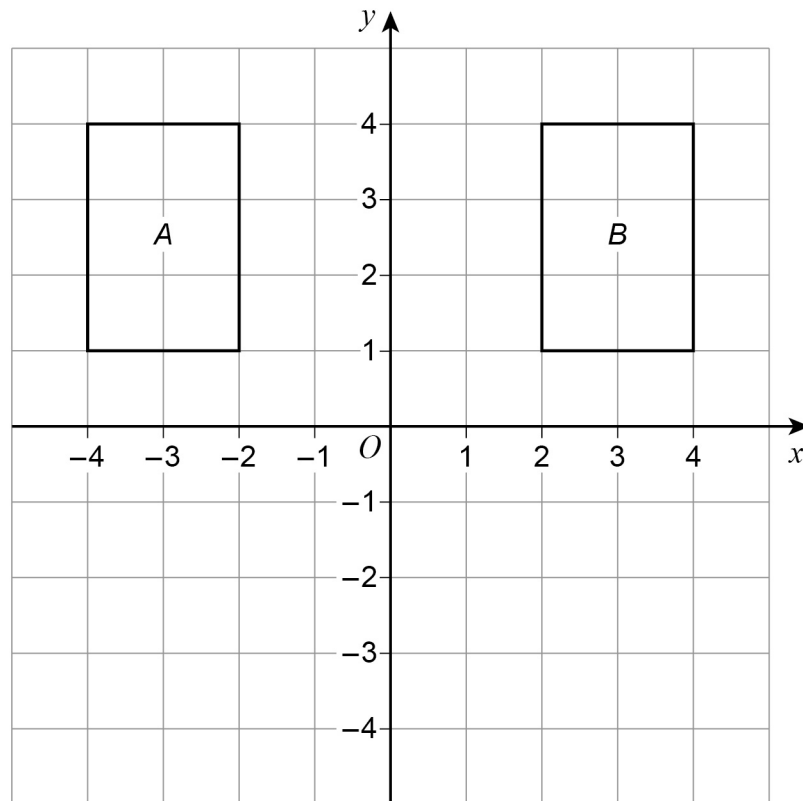
32

128

Turn over for the next question



21 (a) The diagram shows rectangles A and B.



Rectangle A can be mapped to rectangle B by a single transformation.

Javed says,

“The **only** single transformation is a reflection in the y -axis because the rectangles are on opposite sides of the y -axis.”

Is he correct?

Tick a box.

Yes

No

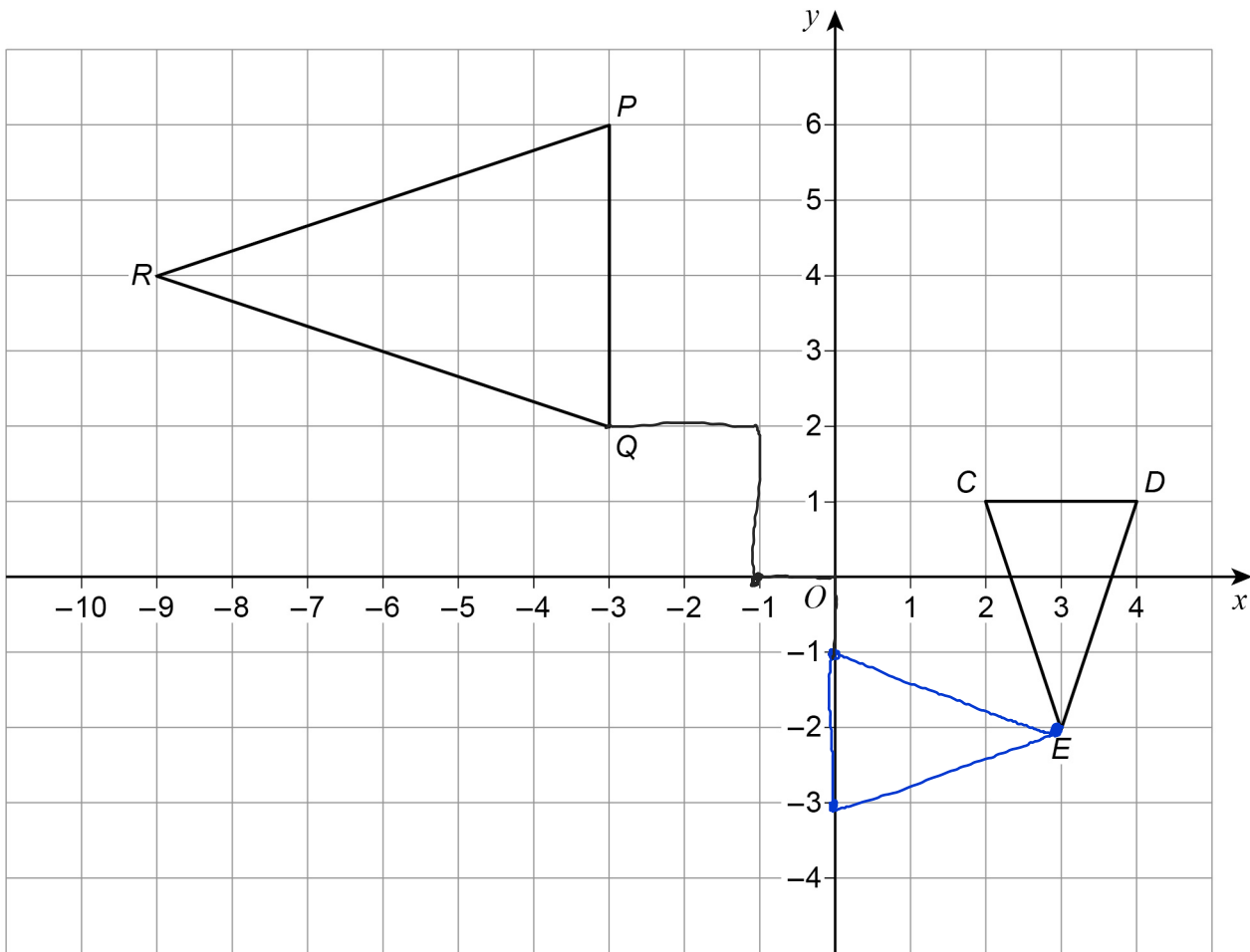
Give a reason for your answer.

[1 mark]

It could be undergone a translation $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ to
rectangle B.



21 (b) This diagram shows triangles CDE and PQR .



CDE is mapped to PQR by combining two single transformations.

The first is a rotation of 90° anticlockwise about E .

Describe fully the second transformation.

[3 marks]

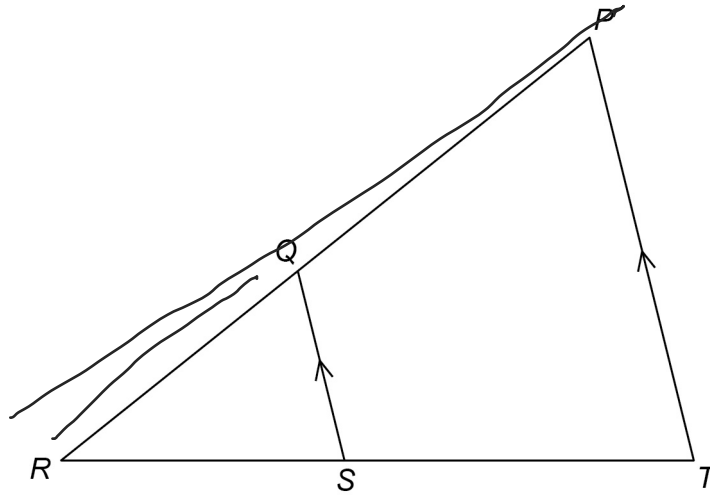
Enlargement, scale factor -2
at centre $(-1, 0)$

Turn over for the next question

Turn over ►



22

 PRT and QRS are similar triangles.Not drawn
accuratelyWhich of these is equivalent to $\frac{QR}{PR}$?

Circle your answer.

[1 mark]

$$\frac{RS}{ST} \quad \times$$

$$\frac{QS}{PT}$$

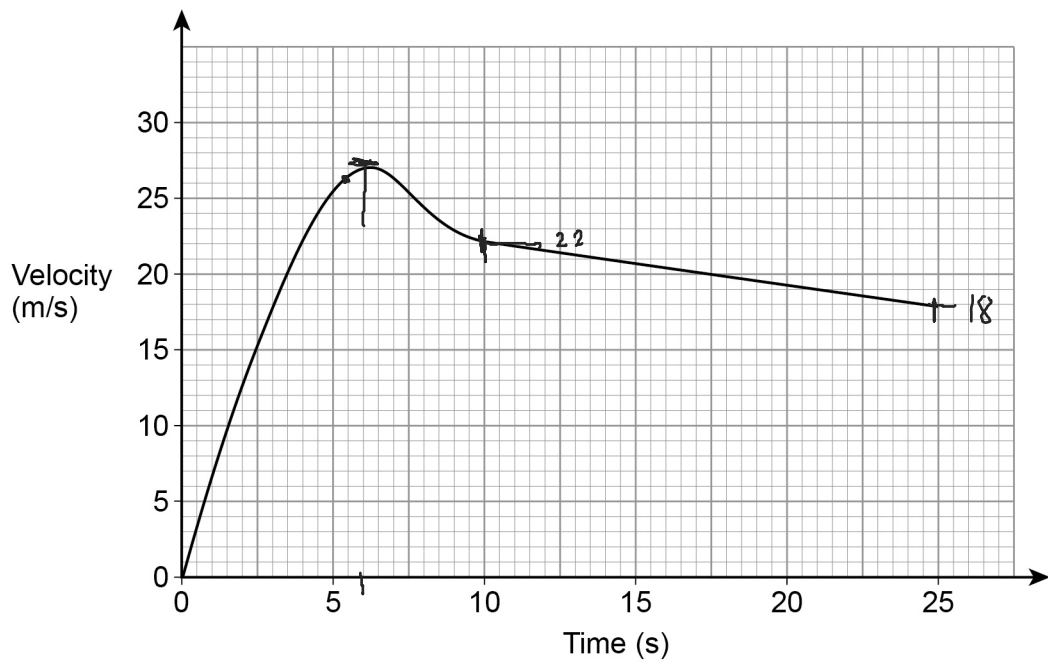
$$\frac{PT}{QS}$$

$$\frac{RT}{RS}$$



23

Here is a velocity-time graph of a motorbike for 25 seconds.



23 (a)

After how many seconds was the acceleration zero? - flat

[1 mark]

Answer 6. seconds

23 (b)

Work out the distance travelled in the last 15 seconds.

[2 marks]

$$\text{Average velocity} = \frac{22 + 18}{2} = 20$$

$$20 \times 15 = 300$$

Answer 300 metres

Turn over ►



24 (a) Work out $\sqrt{12\frac{1}{4}}$ as an improper fraction.

[1 mark]

$$\sqrt{\frac{49}{4}} = \pm \frac{7}{2}$$

Answer $\pm \frac{7}{2}$

24 (b) Work out $\sqrt[3]{16}$ as a power of 2

[2 marks]

$$16 = 2^4 \quad \sqrt[3]{2^4} = 2^{\frac{4}{3}}$$

Answer $2^{\frac{4}{3}}$



25

In an office there are twice as many females as males.

$$\begin{array}{l} f + m \\ m + m + m \end{array}$$

 $\frac{1}{4}$ of the females wear glasses.

 $\frac{3}{8}$ of the males wear glasses.

84 people in the office wear glasses.

Work out the number of people in the office.

[4 marks]

$$\frac{3}{8} + \frac{1}{4} \times 2 = \frac{3}{8} + \frac{4}{8} = \frac{7}{8}$$

$$\begin{array}{l} \frac{7}{8} x = 84 \\ \div 7 \quad \leftarrow \quad \div 7 \\ \frac{1}{8} x = 12 \\ \times 8 \quad \leftarrow \quad \times 8 \\ x = 96 = m \leftarrow 1 \text{ part} \end{array}$$

$$\begin{array}{r} 96 \times \\ \underline{\quad 3} \\ 288 \end{array}$$

Answer 288**Turn over for the next question****Turn over ►**

26

Expand and simplify $(x-4)(2x+3y)^2$

[4 marks]

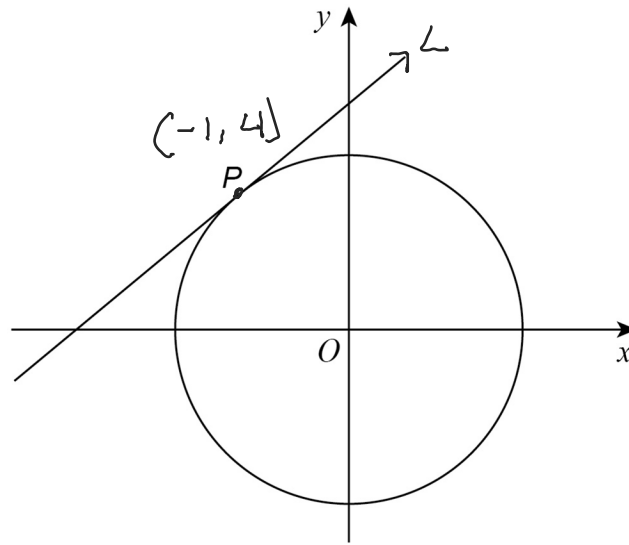
$$\begin{aligned} & (2x+3y)(2x+3y) \\ &= 4x^2 + 6xy + 6xy + 9y^2 \\ &= 4x^2 + 12xy + 9y^2 \end{aligned}$$

$$\begin{aligned} & (x-4)(4x^2 + 12xy + 9y^2) \\ &= 4x^3 + 12x^2y + 9xy^2 - 16x^2 - 48xy - 36y^2 \end{aligned}$$

Answer $4x^3 + 12x^2y + 9xy^2 - 16x^2 - 48xy - 36y^2$



27

 $P(-1, 4)$ is a point on a circle, centre O Not drawn
accuratelyWork out the equation of the tangent to the circle at P .Give your answer in the form $y = mx + c$

[4 marks]

$$OP \text{ gradient} : \frac{4-0}{-1-0} = -4$$

$$\text{Gradient of } L \text{ is negative reciprocal} = \frac{1}{4}$$

$$L: y = \frac{1}{4}x + c$$

$$(-1, 4) \quad 4 = \frac{1}{4}x - 1 + c$$

$$4 + \frac{1}{4} = c = \frac{17}{4}$$

$$\text{Answer } y = \frac{1}{4}x + \frac{17}{4}$$

8

Turn over ►



28

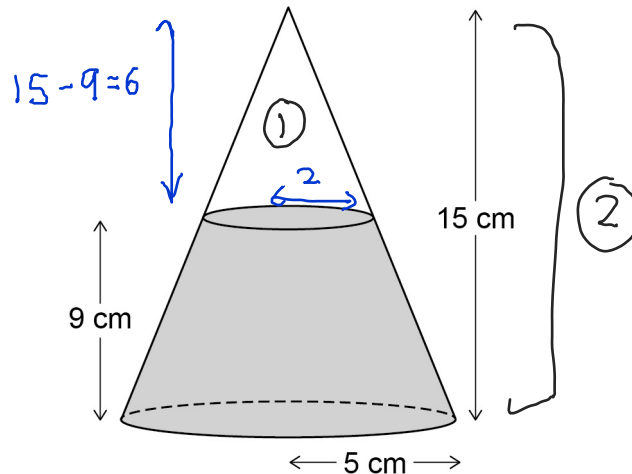
Volume of cone = $\frac{1}{3}\pi r^2 h$ where r is the radius and h is the perpendicular height.

A cone has a

horizontal base of radius 5 cm

height of 15 cm

The cone contains water to a depth of 9 cm



Work out the volume of the water, in cm^3

Give your answer in terms of π .

[4 marks]

$$\text{scale factor: } \frac{6}{15} = \frac{2}{5} \quad \text{radius} = \frac{2}{5} \times 5 = 2$$

$$\begin{aligned} \text{Volume of whole cone: } & \frac{1}{3} \times \pi \times 5^2 \times 15 \\ & = 125\pi \end{aligned}$$

$$\begin{aligned} \text{Volume of cone } h=6: & \frac{1}{3} \times \pi \times 2^2 \times 6 \\ & = 8\pi \end{aligned}$$

$$\text{Volume of frustum: } 125 - 8 = 117$$

Answer 117π cm^3



29 Simplify $\frac{2 \sin 45^\circ - \tan 45^\circ}{4 \tan 60^\circ}$

Give your answer in the form $\frac{\sqrt{a} - \sqrt{b}}{c}$ where a , b and c are integers.

[4 marks]

$$\sin 45 = \frac{\sqrt{2}}{2} \quad \tan 45 = 1 \quad \tan 60 = \sqrt{3}$$

$$= \frac{2 \times \frac{\sqrt{2}}{2} - 1}{4 \times \sqrt{3}} = \frac{\sqrt{2} - 1}{4\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{\sqrt{6} - \sqrt{3}}{4 \times 3} = \frac{\sqrt{6} - \sqrt{3}}{12}$$

Answer $\frac{\sqrt{6} - \sqrt{3}}{12}$

END OF QUESTIONS



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