Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

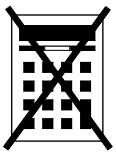
Higher Tier Paper 1 Non-Calculator

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.

Advice

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

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	

Please note that these worked solutions have neither been provided nor approved by AQA and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

.CG Maths.

Answer **all** questions in the spaces provided

1 Simplify $2^5 \times 2^3$

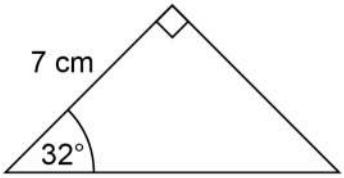
Circle your answer.

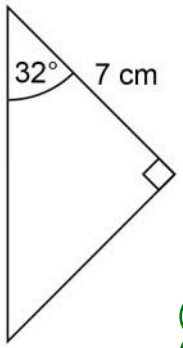
[1 mark]

4^8 2^8 2^{15} 4^{15}

$a^x \times a^y = a^{x+y}$

2





Not drawn accurately

Identical, the same shape and size.

Circle the reason why these triangles are congruent.

[1 mark]

SSS SAS ASA RHS

S: Side. A: Angle. R: Right angle. H: Hypotenuse
'SSS' means that it has three sides which are the same.
'SAS' means that it has two sides and one angle which are the same.

3 Which of these is a geometric progression?

Circle your answer.

[1 mark]

×2
2, 4, 6, 8, 10

×$\frac{3}{2}$
2, 3, 5, 8, 12

×3
2, 6, 18, 54, 162

×3
2, 6, 10, 14, 18

A sequence, or pattern, of numbers where you multiply by the same number between each term.

4 $a : b = 4 : 3$

Circle the correct statement.

[1 mark]

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

a could be 4 and b could be 3

5 Write 36 as a product of prime factors.

Give your answer in index form.

[3 marks]

e.g. $2^3 \times 3^2 \times 5 \times 7^2$

Factor of 36: a whole number which can be multiplied by another whole number to give the number 36.
4 x 9 = 36, therefore 4 and 9 are factors.

Prime number: a whole number which can only be divided by itself and 1 to get another whole number.
7 can only be divided by 7 and 1, therefore 7 is prime.

Factor tree

Answer _____

Turn over for the next question

7

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

Between 0 and 20 minutes

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

The number of times a result occurs

3 people completed the task between 40 and 60 minutes

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

Tick the correct box for each statement.

[4 marks]

A type of average which finds the 'central' value. Add up all the results then divide by the number of results

Assume all the values are as low as possible in their range

Assume all the values are as high as possible in their range

What is the highest possible range?

	True	False
The mean could be less than 20 minutes	☐	☐
The mean could be more than 40 minutes	☐	☐
The mean could be less than 40 minutes	☐	☐
The range could be more than 40 minutes	☐	☐
The range could be less than 40 minutes	☐	☐
The range could be more than 60 minutes	☐	☐

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

Work out the number.

[2 marks]

$\frac{3}{5}x = 162$

Answer _____

8 x km/h = y mph

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

[2 marks]

x needs to be divided by 8 to work out how many lots of 8km/h it is. Then multiplying by 5 as every lot of 8km/h is a lot of 5mph

Answer $y =$ _____

Turn over for the next question

8

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

Consider the changes one at a time. Increasing the mass will increase the density. What would increasing the volume do?

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.

Complete the sentence.

[1 mark]

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

Consider the changes one at a time.

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

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

Circle your answer.

[1 mark]

× 2 × 4 no change ÷ 2 ÷ 4

10 Solve the simultaneous equations.

$2x + y = 18$

$x - y = 6$

[3 marks]

The magnitude of the y terms are the same in both equations so start by adding both of the equations together to eliminate the y terms and leave an equation in terms of x which can be rearranged and solved.

Answer _____

Turn over for the next question

5

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.

1. Calculate the price of the tickets
2. Add 10%
3. Then add 3%

(Adding 13% is not the same)

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

[5 marks]

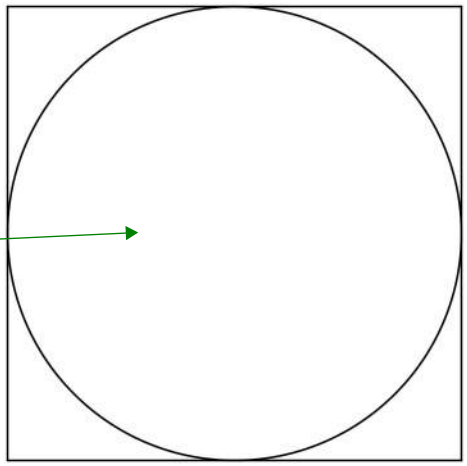
4 x 15 2 X 10

10% = $\frac{1}{10}$ ÷10

3% = 3 X 1% = 3 X $\frac{1}{100}$ ÷100 then X3

Answer £ _____

12 Here is a circle touching a square.



Not drawn accurately

The area of the circle must be less than 64

The area of the square is 64 cm^2

Work out the area of the circle.

Give your answer in terms of π.

Leave π in the answer, don't convert it to a decimal

[3 marks]

πr^2

Start with the formula for the area of a circle. r is the radius. We need to find another length (to do with the square) to find it.

Answer _____ cm^2

Turn over for the next question

8

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

[2 marks]

Start by writing the number in ordinary form if this helps. Starting with the 200 then the 5000 makes this easier. Then convert into standard form.

A number between 1 and 10 (not including 10) multiplied by a power of 10.

Answer _____

14 Solve $-3x > 6$

[1 mark]

Solving inequalities is very similar to solving equations... apart from a couple of exceptions. When multiplying or dividing both sides by a negative number, the inequality symbol must flip.

Answer _____

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

$$8\overline{)1.0^{2}0^{4}0} \quad 0.125$$

1/8 can be worked out by dividing 1 by 8. It is not recurring as it terminates

Divide 1 by each of the denominators to convert them into decimals. If the same remainder appears more than once, the decimal must recur

16 A fair spinner has five equal sections numbered 1, 2, 3, 4 and 5

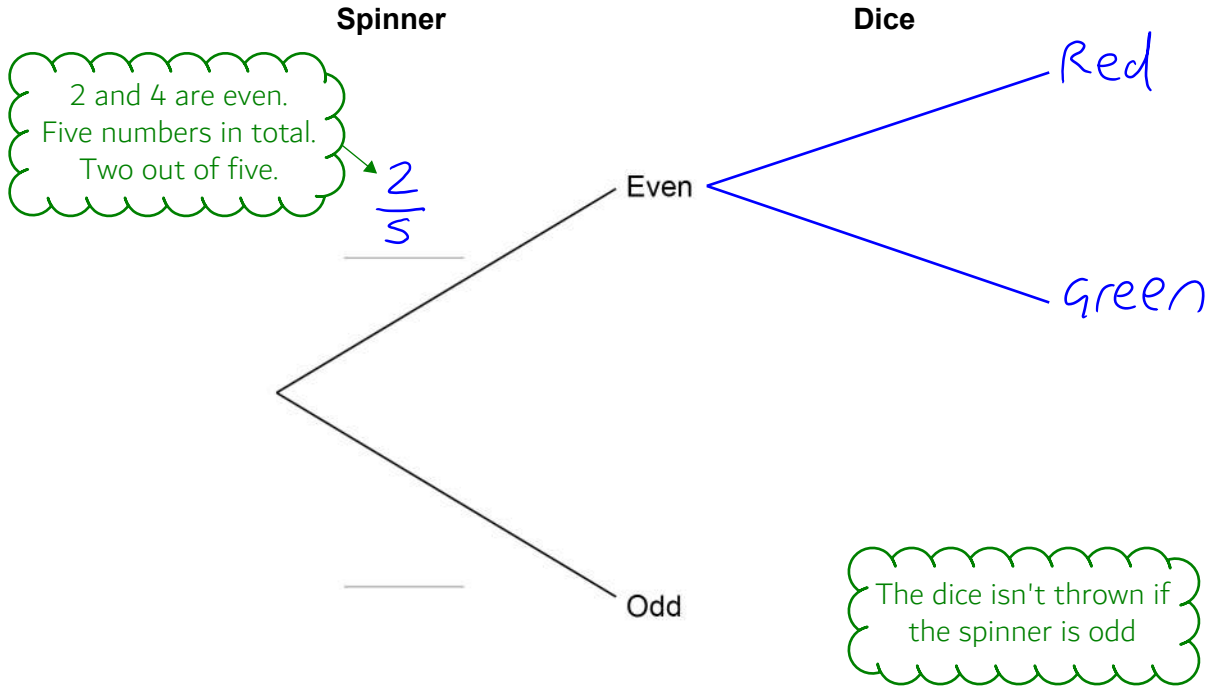
A fair six-sided dice has five red faces and one green face.

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]

'And' means to multiply the probabilities of each event.

Answer _____

8

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]

Gradient = (change in y)/(change in x)
Change in y = (y coordinate of A) - (y coordinate of B)
Change in x = (x coordinate of A) - (x coordinate of B)

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]

... as both AB and AC have the same gradient and both go through point A. Show that the gradient of AC is also -2

Answer _____

18 Bottles of drink are for sale at three shops.

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

Shop A	**Shop B**	**Shop C**
Buy 1 bottle Get 2 more bottles at half price	Buy 2 bottles Get 3 more bottles at half price	30% off a bottle

We need to compare the average cost of a bottle in each deal

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

You can buy from more than one shop.

You **must** show your working.

Let x be the normal cost of a bottle.

[3 marks]

Shop A : $x + \frac{1}{2}x + \frac{1}{2}x = 2x$

$\frac{2x}{3} = 0.6x$

Dividing the total cost by the number of bottles gives the average cost of one bottle

Answer _____

7

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

Mark, m	Frequency
$40 < m \leqslant 50$	9
$50 < m \leqslant 60$	16
$60 < m \leqslant 70$	20
$70 < m \leqslant 80$	8
$80 < m \leqslant 90$	7

Cumulative Frequency

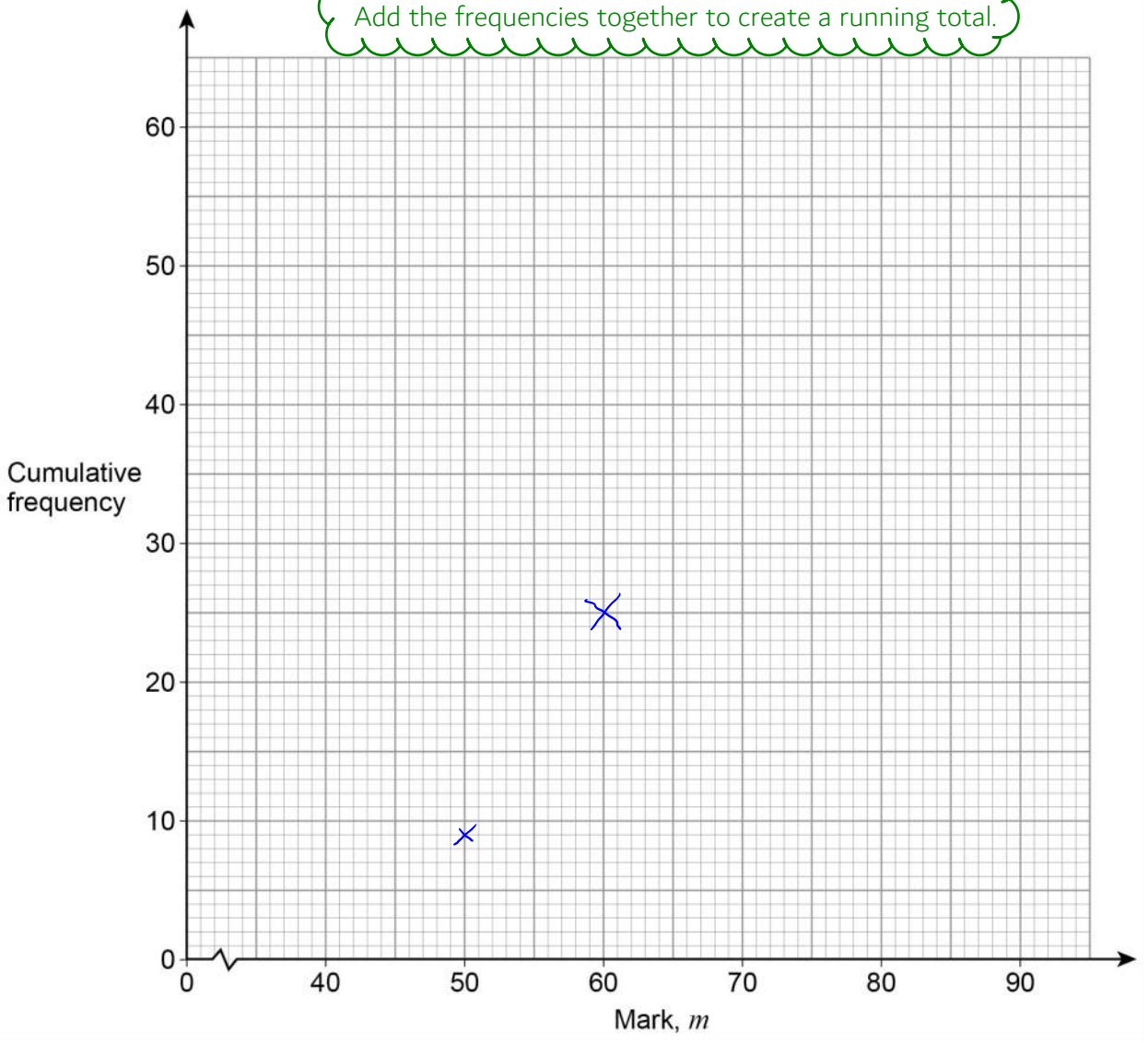
9

25 ← 9 + 16

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

[3 marks]

Cumulate: gather together and combine.
Add the frequencies together to create a running total.



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

[2 marks]

There are 60 students in total. How many students are the top 20%?
We can use the graph to estimate the lowest score of this group.

Answer _____

20 Work out the diameter of the circle $x^2 + y^2 = 64$

Circle your answer.

[1 mark]

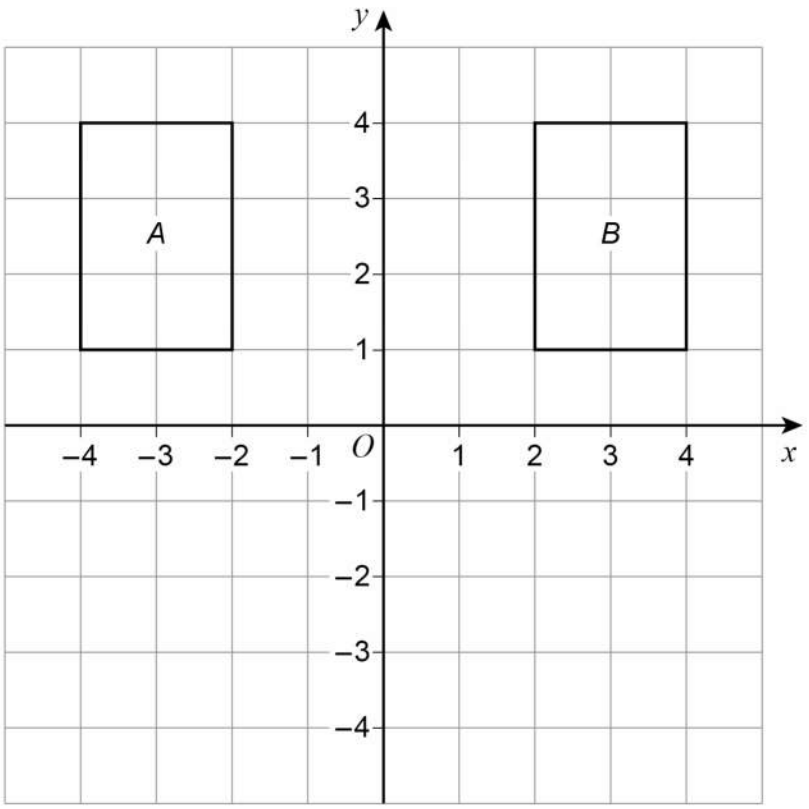
8 16 32 128

Equation of a circle: $x^2 + y^2 = r^2$, where r is the radius. Diameter is double the radius.

Turn over for the next question

6

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.

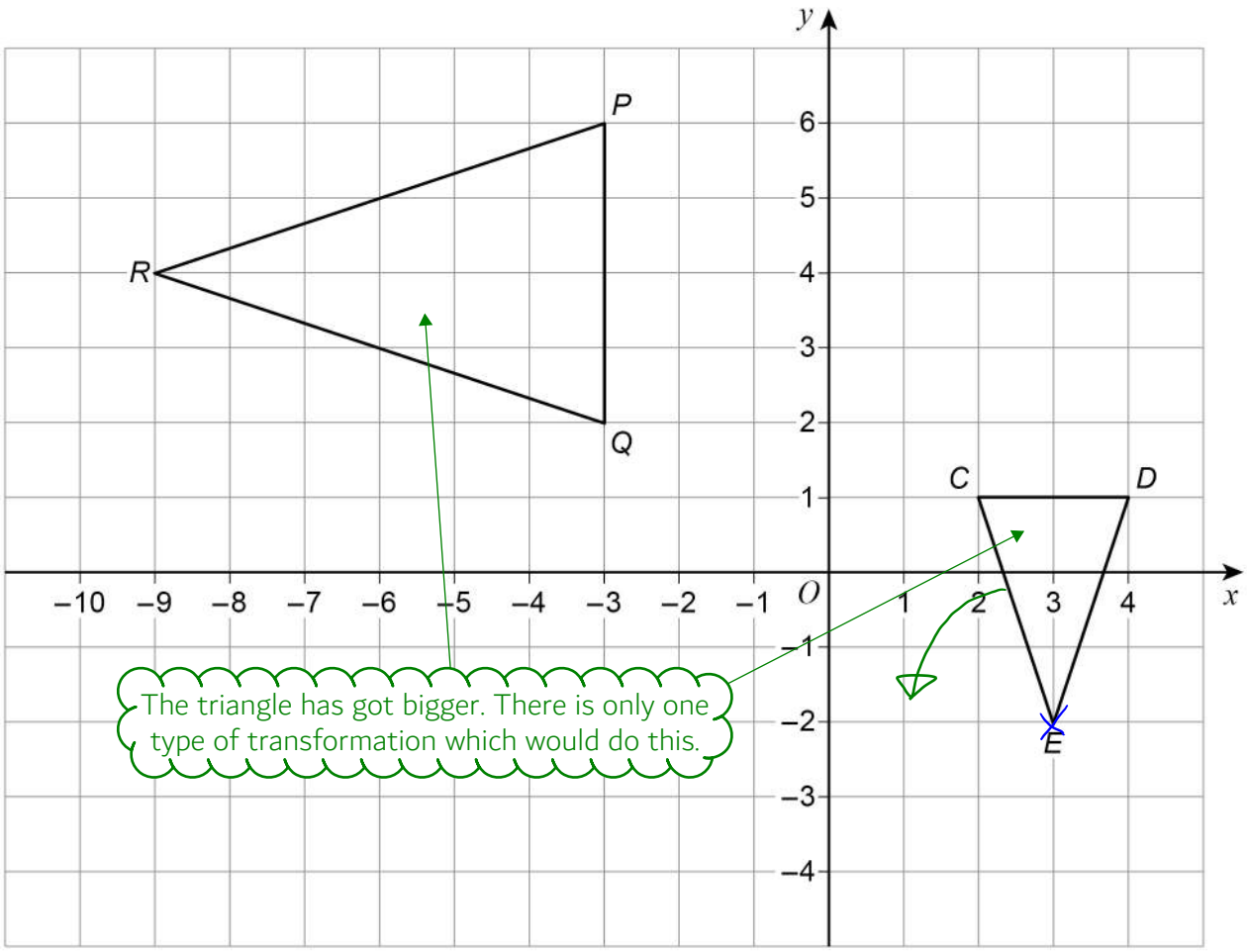
Yes ☐ No ☐

Give a reason for your answer.

[1 mark]

Is there any other single transformation which could map rectangle A to B (rotation, translation, enlargement)?

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.

First sketch the triangle after the rotation.

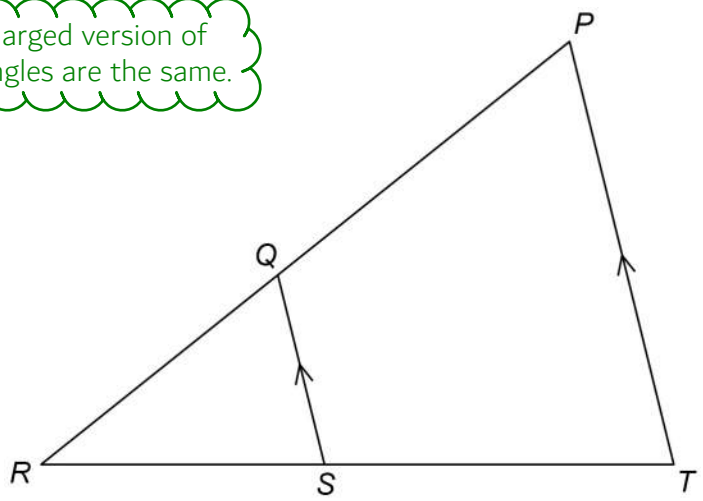
[3 marks]

Turn over for the next question

4

22 *PRT* and *QRS* are similar triangles.

PRT is an enlarged version of QRS. All the angles are the same.



Not drawn accurately

Which of these is equivalent to $\frac{QR}{PR}$?

QR is the shorter side and is being divided by a longer side, PR, which is a scaled version of QR.

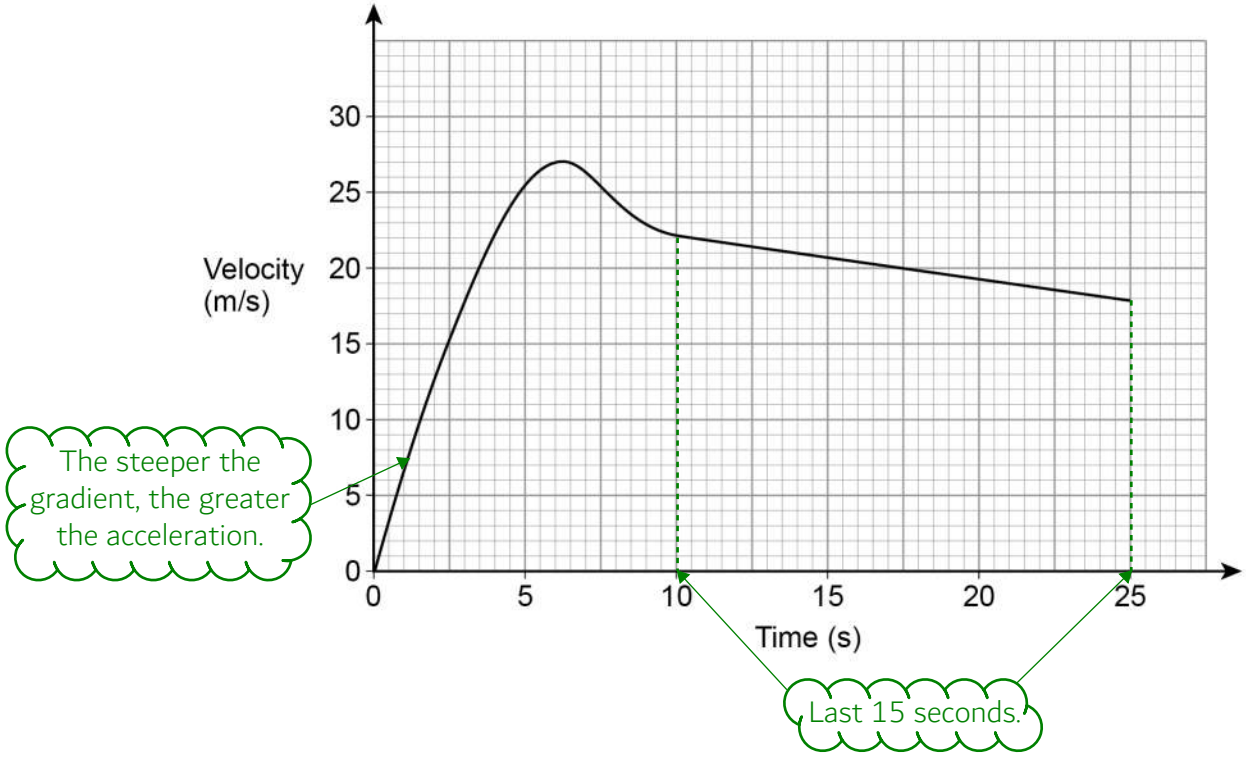
Circle your answer.

[1 mark]

$\frac{RS}{ST}$ $\quad$ $\frac{QS}{PT}$

$\frac{PT}{QS}$ $\quad$ $\frac{RT}{RS}$

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



23 (a) After how many seconds was the acceleration zero?

[1 mark]

Answer _____ seconds

23 (b) Work out the distance travelled in the last 15 seconds.

[2 marks]

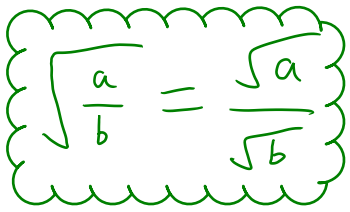
$d = st$ ← distance = speed x time

Answer _____ metres

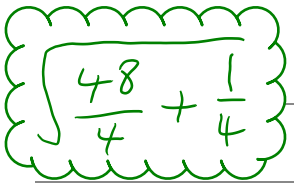
4

Turn over ►

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

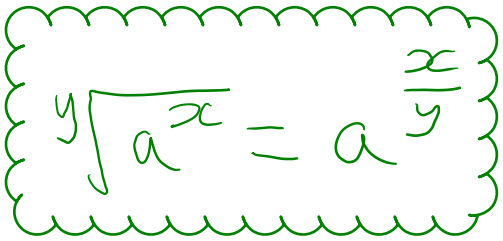


[1 mark]



Answer _____

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



[2 marks]

Answer 2^4

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

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

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

84 people in the office wear glasses.

Let x = total number of people.

Work out the number of people in the office.

[4 marks]

Number of males $= \frac{1}{3}x$, females $= \frac{2}{3}x$

1/4 of the females add 3/8 of the males is 84. Make an equation involving x then rearrange and solve it to find the total number of people in the office

Answer _____

Turn over for the next question

7

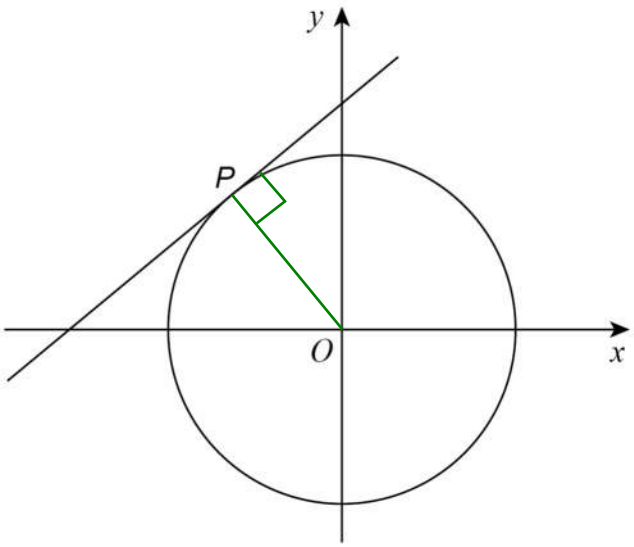
26 Expand and simplify $(x - 4)(2x + 3y)^2$

[4 marks]

Expand out the square bracket first using 'square the first term, double the product of the two terms, square the last term'. Then expand out with the first bracket.

Answer _____

27 P (–1, 4) is a point on a circle, centre O



Not drawn accurately

Work out the equation of the tangent to the circle at P.

Give your answer in the form $y = mx + c$

[4 marks]

The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept. Circle theorem: the angle between a tangent and a radius is always 90°. The tangent is perpendicular to the radius so its gradient, m, is the negative reciprocal of the gradient of the radius. The gradient of the radius can be found using (change in y)/(change in x). c = y - mx and point P lies on the tangent.

Answer _____

8

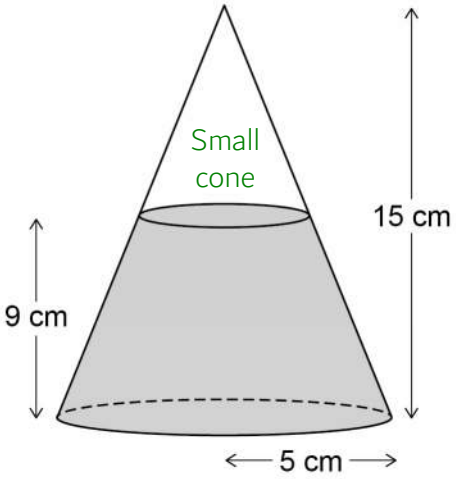
28 Volume of cone = $\frac{1}{3}\pi r^2 h$ where r is the radius and h is the perpendicular height.

A cone has a

horizontal base of radius 5 cm

height of 15 cm

The cone contains water to a depth of 9 cm



The water is 9/15 of the way up the cone, or 6/15 of the way from the top.

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

Give your answer in terms of π.

[4 marks]

Volume of water = volume of large cone - volume of small cone

Answer _____ cm^3

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

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

[4 marks]

$$\frac{2\left(\frac{\sqrt{2}}{2}\right)-(1)}{4(\sqrt{3})}$$

Answer _____

END OF QUESTIONS

8