

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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I declare this is my own work.

# GCSE MATHEMATICS

# H

Higher Tier

Paper 2 Calculator

Thursday 4 June 2020

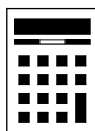
Morning

Time allowed: 1 hour 30 minutes

### Materials

For this paper you must have:

- a calculator
- mathematical instruments.



### Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- 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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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	
26–27	
28–29	
<b>TOTAL</b>	



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](mailto:curtis@cgmaths.co.uk)

Answer **all** questions in the spaces provided.

- 1 Which of these is a correct identity?  
Circle your answer.

[1 mark]

$x + 4x \equiv 5x$

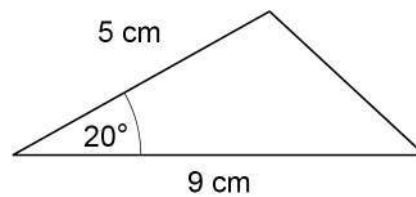
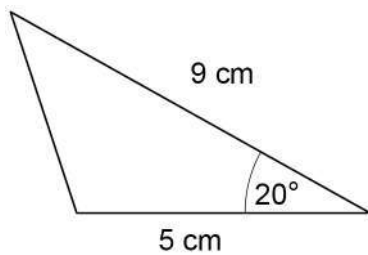
$6x \equiv 18$

$2x + 1 \equiv 7$

$7x + 9 \equiv x$

The identity is true for any value of  $x$ . The others are only true for some values of  $x$

2



Not drawn  
accurately

Circle the reason why these triangles are congruent.

[1 mark]

RHS

ASA

SSS

SAS

R: right angle. H: hypotenuse. S: side. A: angle. Tick what is the same in both triangles. The reason is the one with three ticks



3 Circle the number that is written in standard form.

[1 mark]

$0.9 \times 10^{-3}$

$6 \times 10^{0.5}$

$5.2 \times 10^{-4}$

$12 \times 10^7$

Standard form:  $a \times 10^n$ , where  $1 \leq a < 10$  and  $n$  is an integer

4 Circle the expression that has the **largest** value when  $a < -1$

[1 mark]

$\frac{1}{2}a$

$a$

$a^2$

$a^3$

Pick a number less than -1 and substitute it into each expression to work out which would be the largest

Put negative numbers in brackets when raising to a power

Turn over for the next question

Turn over ►



5

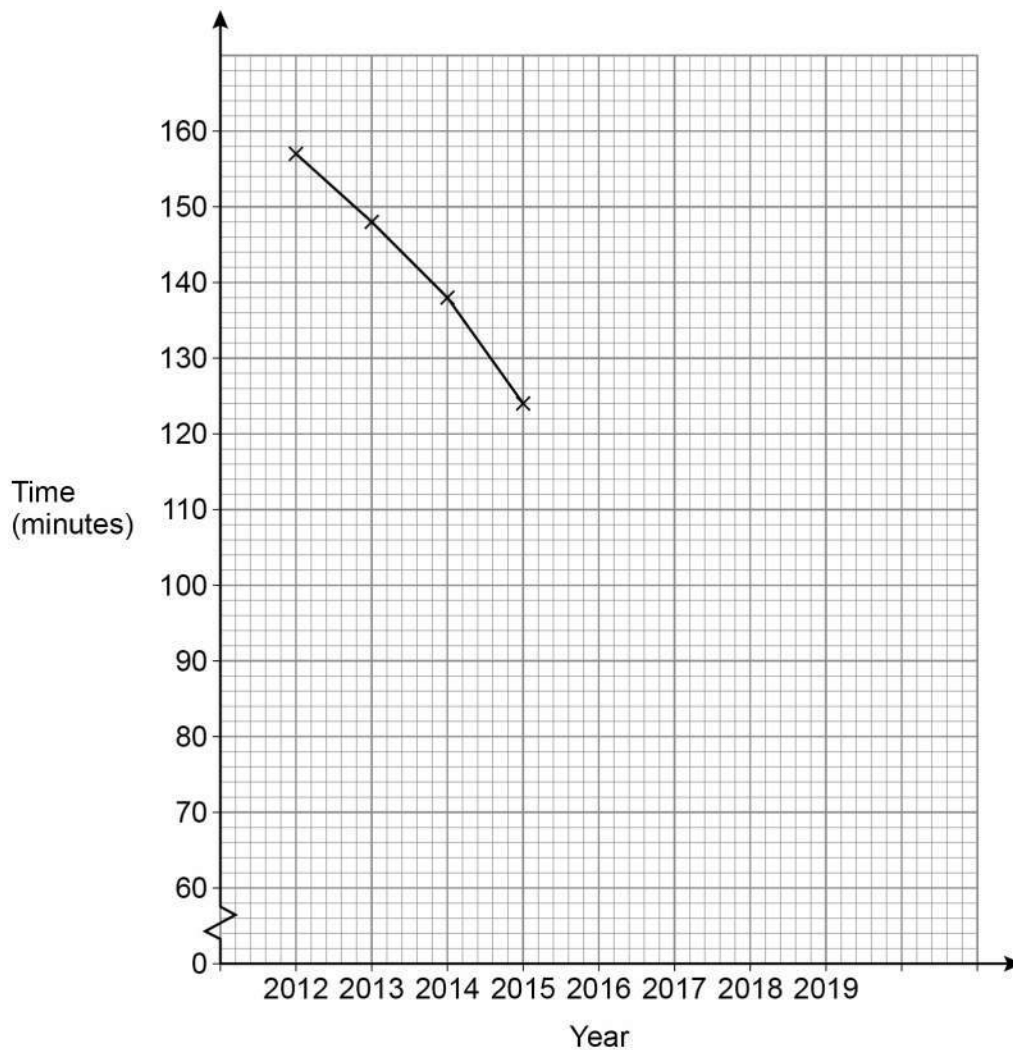
The time students spent watching TV was recorded.

The table shows the average daily time per student each year from 2012 to 2019

Year	2012	2013	2014	2015	2016	2017	2018	2019
Time (minutes)	157	148	138	124	113	100	90	82

A time series graph is drawn to represent the data.

The first four points have been plotted.



The scale increases by 10 over 5 boxes.  $10/5 = 2$   
so each box is worth 2. Half a box is worth 1



5 (a) Complete the graph.

[2 marks]

5 (b) Use the graph to estimate the average daily time per student in 2020

[1 mark]

Extend the line with a similar gradient to the rest of the line to make an estimate for 2020

Answer \_\_\_\_\_ minutes

6 Work out the highest common factor (HCF) of 75 and 105

[2 marks]

Express both numbers as a product of prime factors. The highest common factor is the lowest power of each prime factor multiplied together. If there are none of a prime in one of the expressions, the power is 0 and it doesn't need to be included

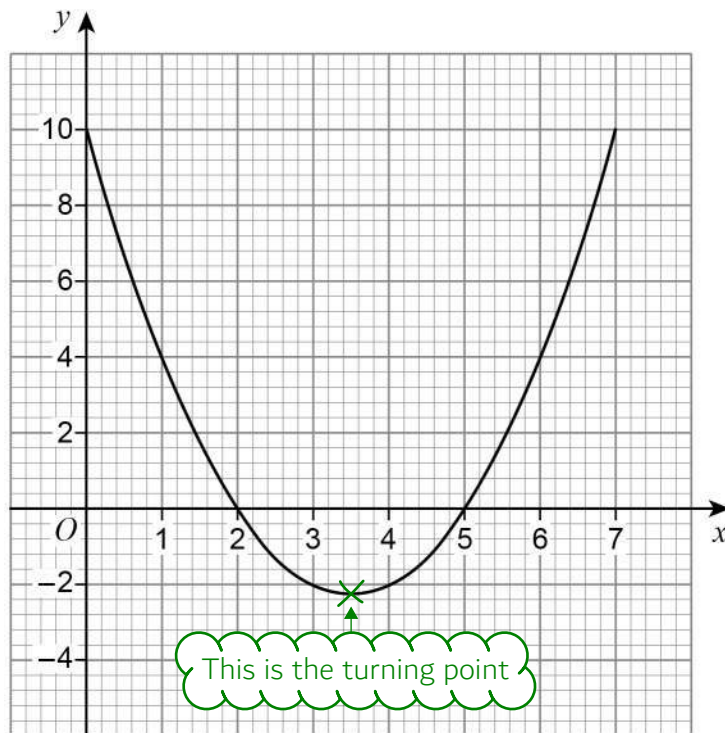
To get a number as a product of prime factors, enter the number, press = then SHIFT then FACT, which is the button on the right



Answer \_\_\_\_\_



- 7 Here is the graph of  $y = x^2 - 7x + 10$  for values of  $x$  from 0 to 7



- 7 (a) Write down the roots of  $x^2 - 7x + 10 = 0$

[2 marks]

Answer \_\_\_\_\_

The roots are the values of  $x$  where  $y = 0$

- 7 (b) Write down the  $x$ -coordinate of the turning point of the curve.

[1 mark]

\_\_\_\_\_

Answer \_\_\_\_\_



8

At a party there are 90 people.

48 are women and 42 are men.

Some women leave.

Some men arrive.

The ratio of women to men is now 10 : 11

Are there now more than 90 people at the party?

Tick **one** box.

Yes

No

Cannot tell

Show working to support your answer.

**[2 marks]**

Adding together the greatest possible number of women and greatest possible number of men gives the greatest possible total number of people now at the party. The number of women must be a multiple of 10 as the ratio is in its simplest form and there are 10 parts for women. Work out how many men there must be by using the ratio when there are the greatest number of women

Turn over for the next question

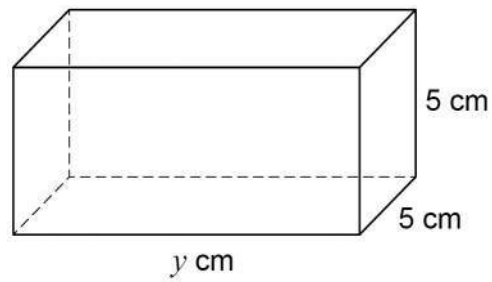
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Turn over ►





9 Here is a cuboid.



9 (a) Assume that the total surface area of the cuboid is  $200 \text{ cm}^2$

Work out the volume of the cuboid.

[3 marks]

Volume of cuboid = length  $\times$  width  $\times$  height

Area of rectangle = length  $\times$  width

Opposite faces on a cuboid are the same. Adding together the area of all of the faces on the cuboid gives the surface area. This creates an equation in terms of  $y$  which can be rearranged and solved to find  $y$

Answer \_\_\_\_\_  $\text{cm}^3$



9 (b) In fact, the total surface area of the cuboid is smaller than  $200 \text{ cm}^2$

What does this mean about the volume of the cuboid?

Tick **one** box.

[1 mark]

It is smaller than the answer to part (a)

It is bigger than the answer to part (a)

It is the same as the answer to part (a)

It could be any of the above

Both the width and height are still 5cm so y must be smaller

Turn over for the next question

Turn over ►



10

Alex and Bev sat six tests, each with 50 marks.

The table shows their mean percentages after five tests.

Alex	60%
Bev	52%

After all six tests, their mean percentages were equal.

In the sixth test, Alex scored 24 out of 50

Work out Bev's score, out of 50, in the sixth test.

**[4 marks]**

The mean percentages were equal therefore they must have had the same total scores.

Subtracting Bev's total score after the first five tests from Alex's total score after all six tests leaves Bev's score in the sixth test. The mean percentage of the 50 marks works out the mean score per test. Mean = total/number, so total = mean x number.

Multiplying the mean score by the number of tests will give the total score

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Answer \_\_\_\_\_ out of 50



11

A solid piece of silver has  
mass 2.625 kilograms  
volume 250 cm<sup>3</sup>

Work out the density of the piece of silver.

Give your answer in grams per cubic centimetre.

[2 marks]

The units tell us that the mass in grams needs to be divided  
by the volume in cm<sup>3</sup>. There are 1000 grams in a kilogram

Answer \_\_\_\_\_ g/cm<sup>3</sup>

12

Work out the gradient of the straight line through (-2, 3) and (1, 9)

[2 marks]

Gradient = (change in y)/(change in x)

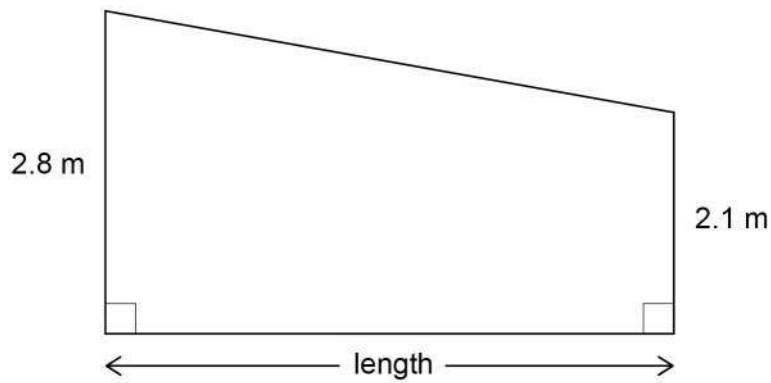
Answer \_\_\_\_\_

Turn over for the next question

Turn over ►



- 13 The diagram shows a wall.



Not drawn  
accurately

The area of the wall is  $39.2 \text{ m}^2$

Work out the length of the wall.

[3 marks]

Area of trapezium =  $\frac{1}{2}(a + b)h$ , where  $a$  and  $b$  are the parallel sides and  $h$  is the distance between them

Answer \_\_\_\_\_ m



- 14 A marathon takes place each year.  
In 2020 there were 6500 runners.

**Prediction**

For each of the next 3 years the number of runners will increase by 5%

Does this predict that in 2023 there will be more than 7500 runners?

You **must** show your working.

**[3 marks]**

Use the compound interest formula. Express an increase of 5% as a decimal then multiply the original amount by this to the power of how many times it needs to be increased by 5% to work out how many runners it predicts. Compare the figure calculated to 7500

Turn over for the next question

Turn over ►



15 Rearrange  $a = \frac{b}{c} + 5$  to make  $c$  the subject.

[3 marks]

Subtracting 5 from both sides gets the terms involving  $c$  on their own. Doing the reciprocal of both sides makes  $c$  a numerator rather than denominator. Multiplying both sides by  $b$  makes  $c$  the subject

Answer \_\_\_\_\_



16

On a restaurant menu there are

22 main dishes, of which  $\frac{4}{11}$  are gluten-free

7 rice dishes, which are all gluten-free

5 naan breads, of which 40% are gluten-free.

This Meal Deal is on the menu.

Choose one main dish, one rice dish and one naan bread

How many of the possible Meal Deals are totally gluten-free?

[3 marks]

Use the product rule for counting. Multiplying the number of outcomes for each individual event gives the total number of outcomes for all of them

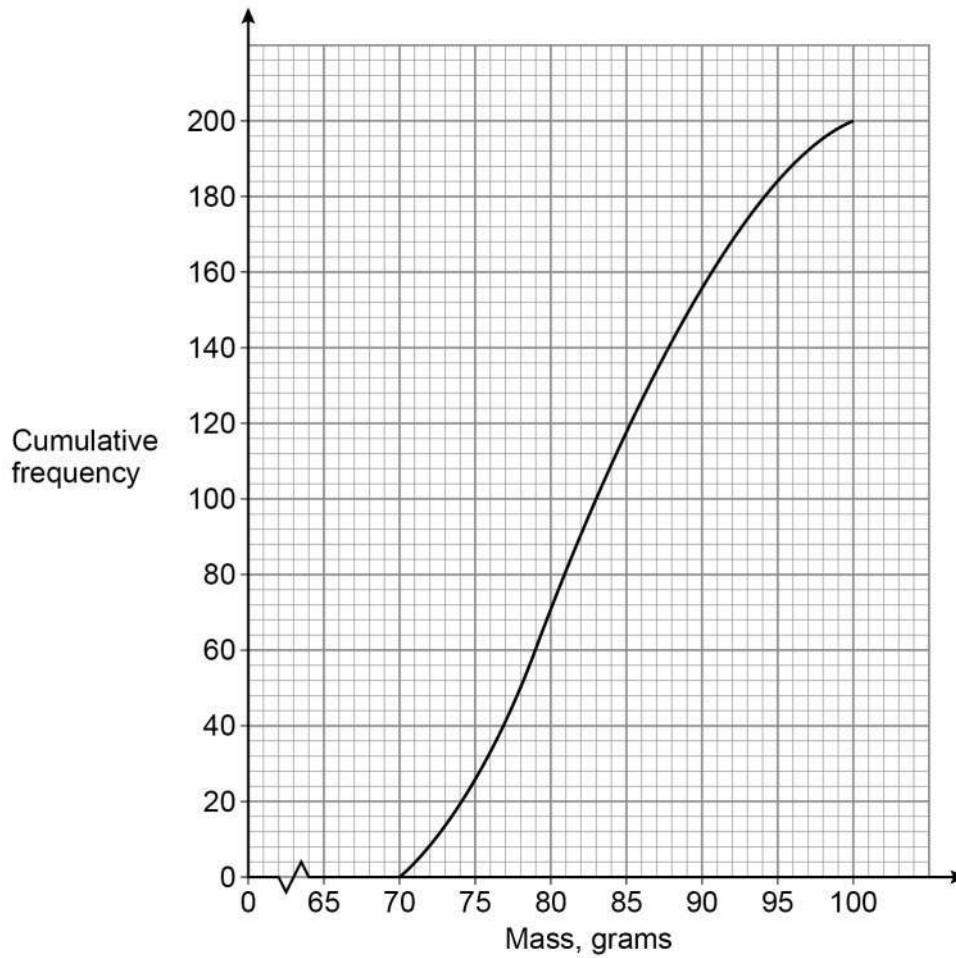
Answer \_\_\_\_\_

Turn over for the next question





- 17 The cumulative frequency graph shows information about the masses of 200 apples.



- 17 (a) Estimate the median mass.

[1 mark]

Answer \_\_\_\_\_ grams

The median is roughly half way through the 200 apples. The 100th apple can be estimated by going across from 100 to the line then down



- 17 (b) Apples with mass 90 grams or less cost 32p each.  
Apples with mass more than 90 grams cost 39p each.

Estimate the **total** cost of the 200 apples.

[3 marks]

Adding the cost of the apples with mass 90 grams or less and the cost of the apples with mass more than 90 grams gives the total cost of the 200 apples. To work out an estimate of how many apples have a mass of 90g or less, go up from 90 on the x axis to the line then across to the y axis. Subtracting this number from 200 leaves the apples which have a mass greater than 90g

Answer £ \_\_\_\_\_

Turn over for the next question

Turn over ►

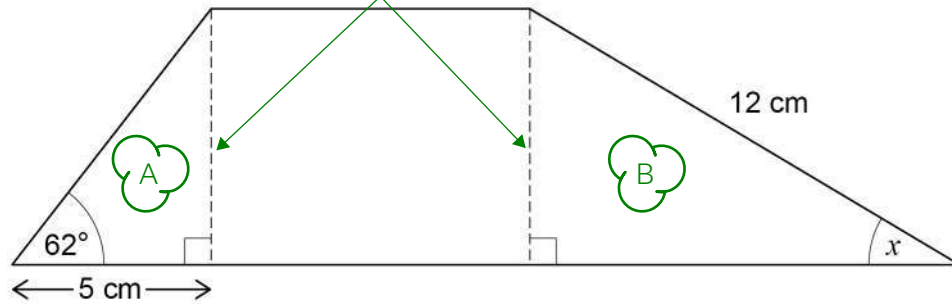


18

This shape is made from two right-angled triangles and a rectangle.

Opposite sides on a rectangle are equal so these two sides are equal

Not drawn accurately



Work out the size of angle  $x$ .

[4 marks]

SOHCAHTOA

Right angled trigonometry can be used in triangles A and B. Finding the dashed line in triangle A helps as this is the same as the dashed line in triangle B. Writing SOH CAH TOA as formula triangles then ticking what we have and are trying to find in triangle A. Underlining what we have and are trying to find in triangle B. If two letters are ticked or underlined that formula triangle can be used. S: sin of the angle. C: cos of the angle. T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent

Answer \_\_\_\_\_ degrees



19

 $a$  and  $b$  are positive values.

Show that  $\frac{7a + 2b - 3a}{8a + 6b + 2a - b}$  always simplifies to the same value.

**[3 marks]**

Collect like terms on the numerator and denominator. Factorise the numerator and denominator. Cancel out any common factors to simplify it. All  $a$  and  $b$  should be eliminated leaving a constant

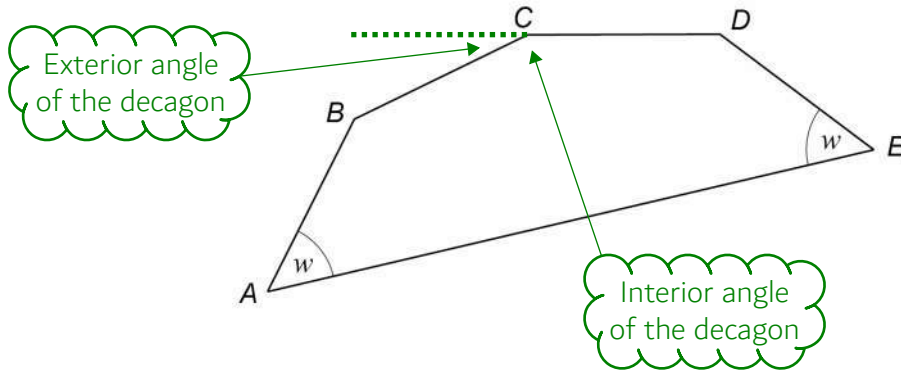
**Turn over for the next question**

7

**Turn over ►**

20

$AB$ ,  $BC$ ,  $CD$  and  $DE$  are four of the sides of a regular decagon.



Not drawn  
accurately

Work out the size of angle  $w$ .

[3 marks]

$(n - 2) \times 180$ , where  $n$  is the number of sides, works out the sum of the interior angles of a polygon. The exterior angles of any polygon add up to 360. The decagon has 10 sides so therefore also has 10 exterior angles and 10 interior angles. It is regular meaning that all of its interior and exterior angles are equal. The exterior angle lies on a straight line with the interior angle

Answer \_\_\_\_\_ degrees



- 21 (a) Circle the point that is on the graph of  $y = \frac{1}{x}$

[1 mark]

(-1, 1)

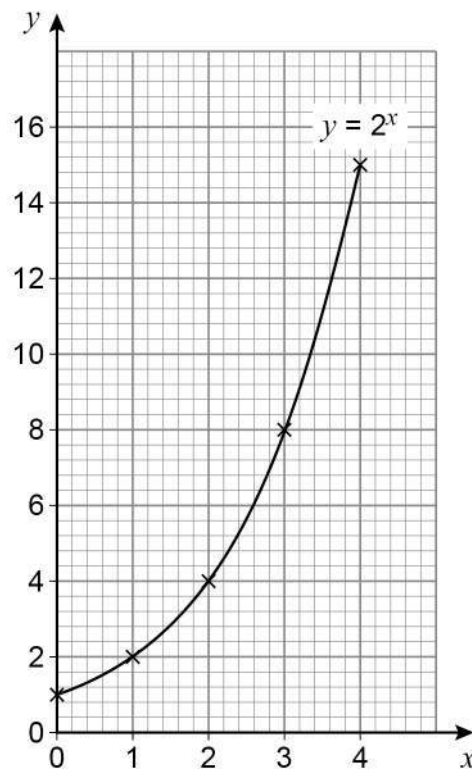
(0.3, 3)

(0.8, 0.2)

(2.5, 0.4)

Substitute in the x coordinate for each point into the equation of the graph to work out the y coordinate. Only one of the points has the correct y coordinate for the x coordinate

- 21 (b) Leo wants to draw the graph of  $y = 2^x$  for values of  $x$  from 0 to 4  
Here is his graph.



Make one criticism of his graph.

[1 mark]

Use table mode by pressing MENU then 3.  $f(x) = 2^x$ .  
Start: 0. End: 4. Step: 1. This works out what points  
should be on the graph by giving a table of values

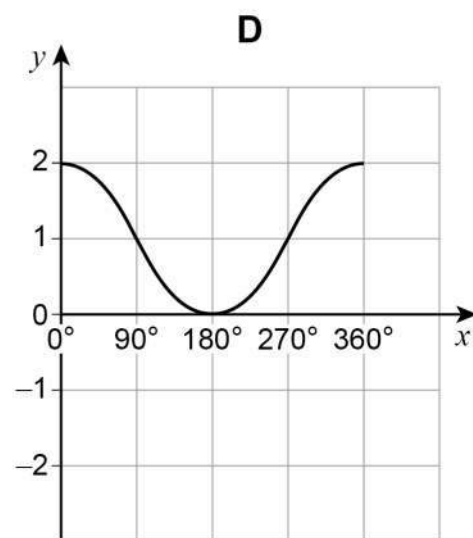
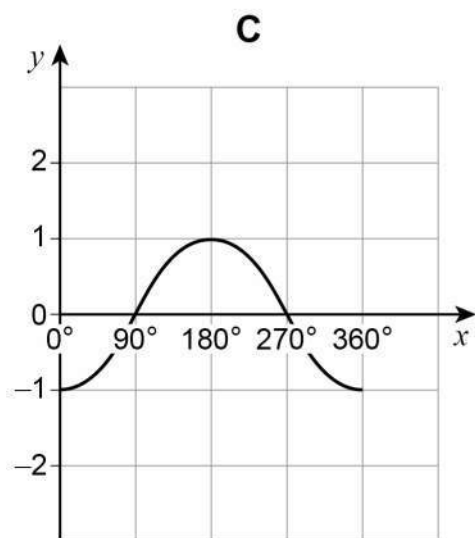
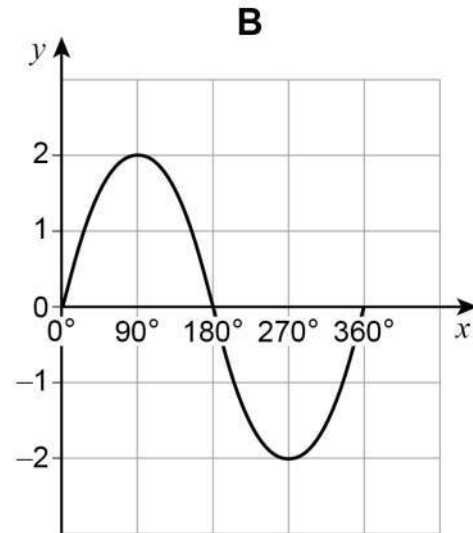
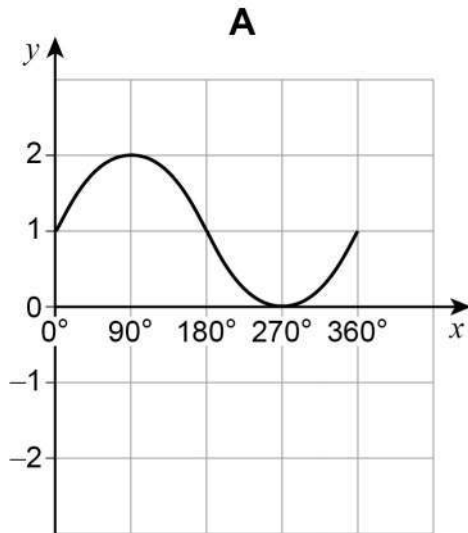


22

One of these is the graph of  $y = 1 + \sin x$  for  $0^\circ \leq x \leq 360^\circ$

Circle the letter above the correct graph.

[1 mark]



Use table mode by pressing MENU then 3.  $f(x) = 1 + \sin(x)$ . Start: 0. End: 360. Step: 90. Use the table of values to check which graph goes through the right points



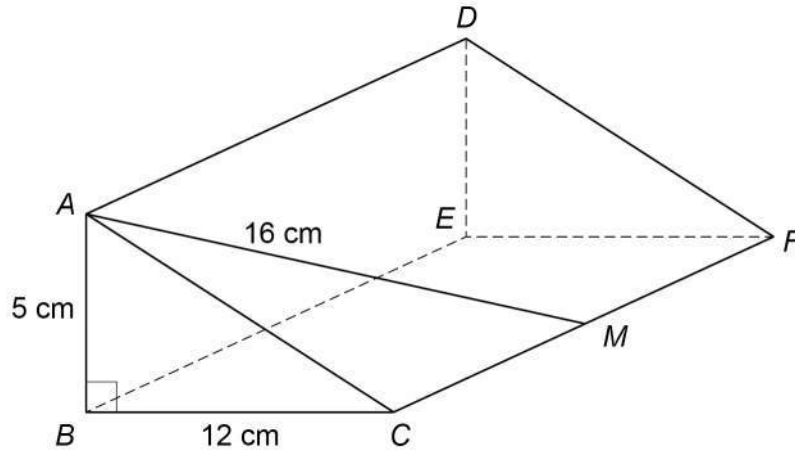
23

Right-angled triangle  $ABC$  is the cross section of a prism.

$$AB = 5 \text{ cm} \quad BC = 12 \text{ cm}$$

$M$  is the midpoint of  $CF$ .

$$AM = 16 \text{ cm}$$



Work out the volume of the prism.

[4 marks]

$$a^2 + b^2 = c^2$$

Pythagoras' Theorem, where  $c$  is the longest side and  $a$  and  $b$  are the shorter sides, can be used to work out side  $AC$  and then side  $CM$

Volume of prism = cross sectional area  $\times$  length. Triangle  $ABC$  is the cross section and  $CF$  is the length. Area of triangle =  $\frac{1}{2} \times$  base  $\times$  height.  
Length  $CF$  is double  $CM$  as  $M$  is the midpoint of  $CF$

Answer \_\_\_\_\_  $\text{cm}^3$

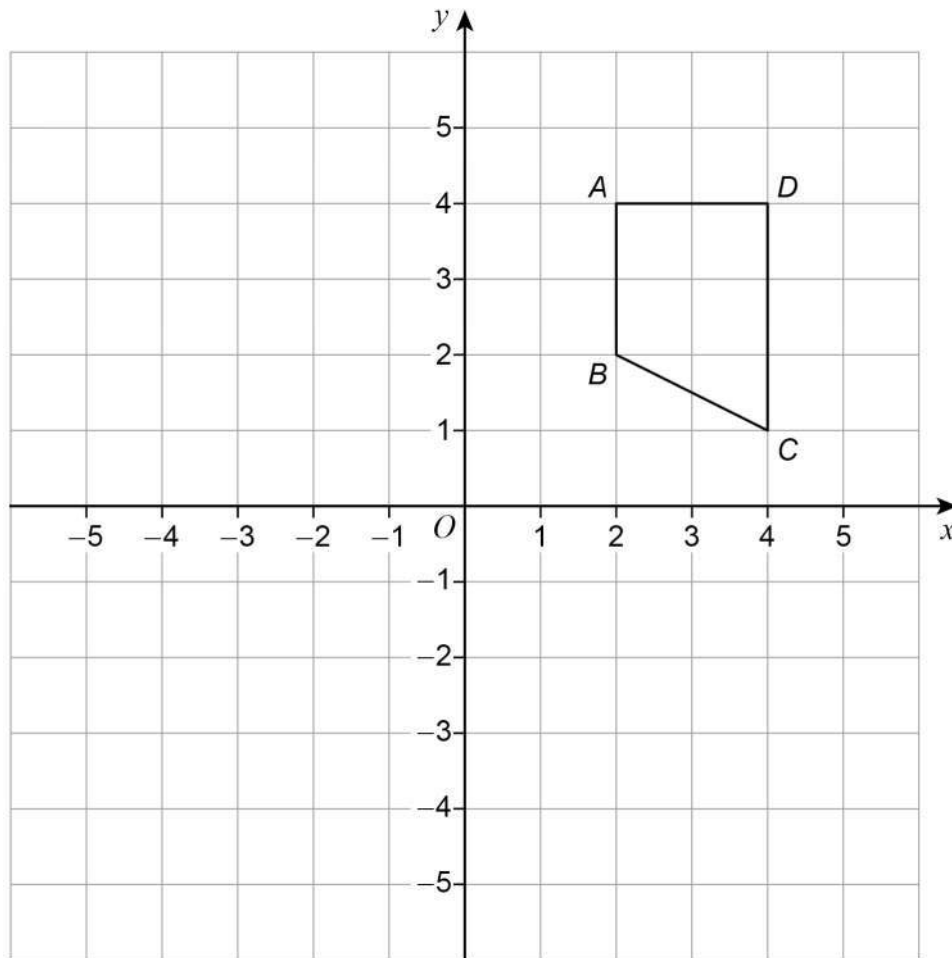
5

Turn over ►





24

Quadrilateral  $ABCD$  is shown.

24 (a) Work out the coordinates of  $C$  when  $ABCD$  is rotated  $90^\circ$  clockwise about  $O$

then

translated by  $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$

The column vector is in the form  $\begin{pmatrix} x \\ y \end{pmatrix}$ .  
The positive  $x$  direction is to the right  
and the positive  $y$  direction is up

[2 marks]

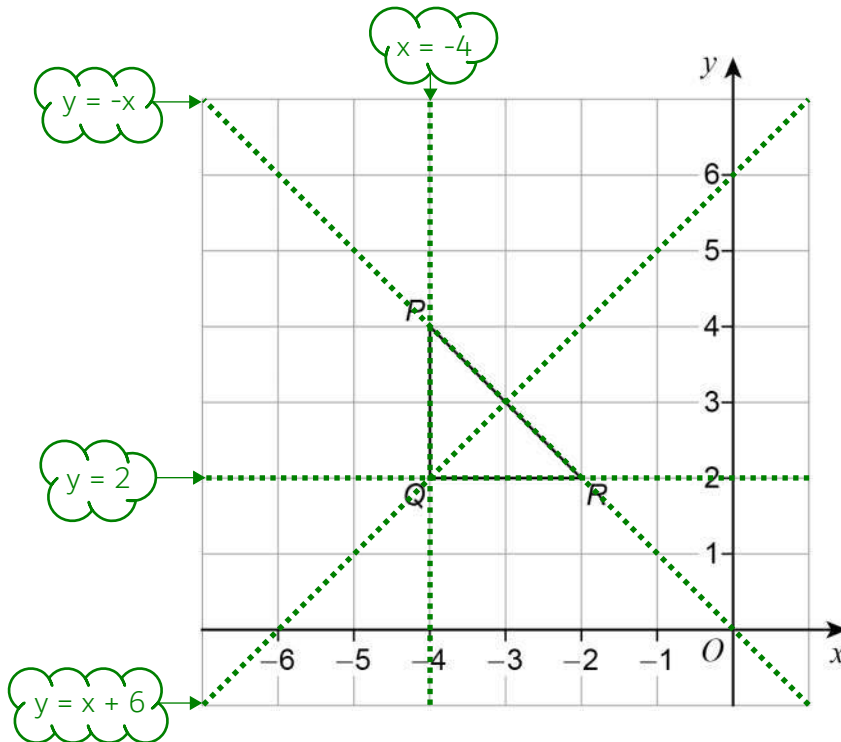
To rotate use tracing paper: draw on top of point  $C$ , put something sharp in the point  $(0, 0)$  then rotate the paper around that point

Answer ( \_\_\_\_\_ , \_\_\_\_\_ )

We only need to rotate and translate point  $C$



24 (b) Triangle  $PQR$  is shown.



When  $PQR$  is reflected in a line,  $P$  and  $R$  are invariant points.

Circle the equation of the line.

[1 mark]

$y = x + 6$

$y = -x$

$y = 2$

$x = -4$

Invariant means that the points do not move

25 Factorise  $3x^2 + 11x - 20$

[2 marks]

It is in the form  $ax^2 + bx + c$ . Multiplying  $a$  by  $c$  gives  $-60$ . Find two numbers which multiply to this and add to  $b$ . Split the middle term into these numbers of  $x$ . Factorise the left two terms and right two terms separately. Then bring into the factorised form

Answer \_\_\_\_\_



26

Edith's van can safely carry a maximum load of 920 kilograms.

She wants to use her van to carry

30 sacks of potatoes, each of mass 25 kilograms to the nearest kilogram

and

20 sacks of carrots, each of mass 7.5 kilograms to 1 decimal place.

Can she definitely use her van safely in one journey?

You **must** show your working.

[4 marks]

To be safe, the upper bound of the total mass needs to be less than 920kg. Add the upper bound of the mass of the potatoes to the upper bound of the mass of the carrots to work this out. Multiply the upper bound of one sack by the number of sacks to get the upper bound for all sacks of either the potatoes or carrots. To work out the upper bound of one sack, add half of the resolution of the measurement. The resolution of the potatoes is 1kg as it is to the nearest 1kg

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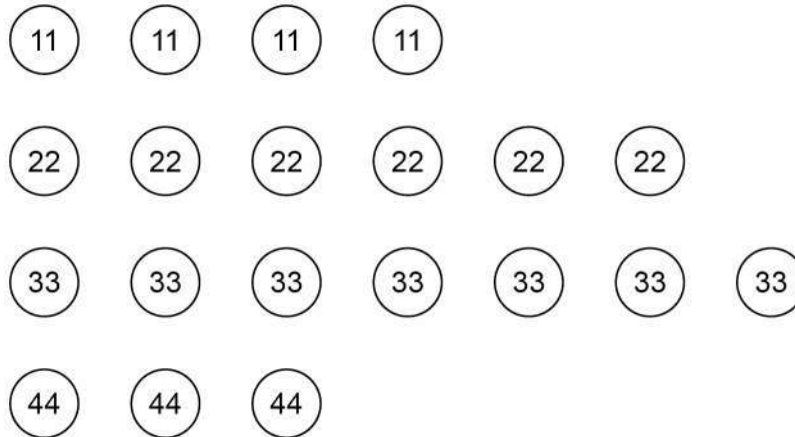
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27

These 20 discs are in a bag.



Two of the discs are taken at random from the bag.

Work out the probability that the first disc has a **smaller** number than the second disc.**[4 marks]**

Taking 11 as the first disc AND taking 22, 33, 44 as the second disc OR taking 22 as the first disc AND taking 33, 44 as the second disc OR taking 33 as the first disc AND taking 44 as the second disc. AND means to multiply the probabilities, OR means to add the probabilities. There are 20 disks on the first pick and there are 19 on the second pick as there is one fewer disk once one is taken

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Answer \_\_\_\_\_

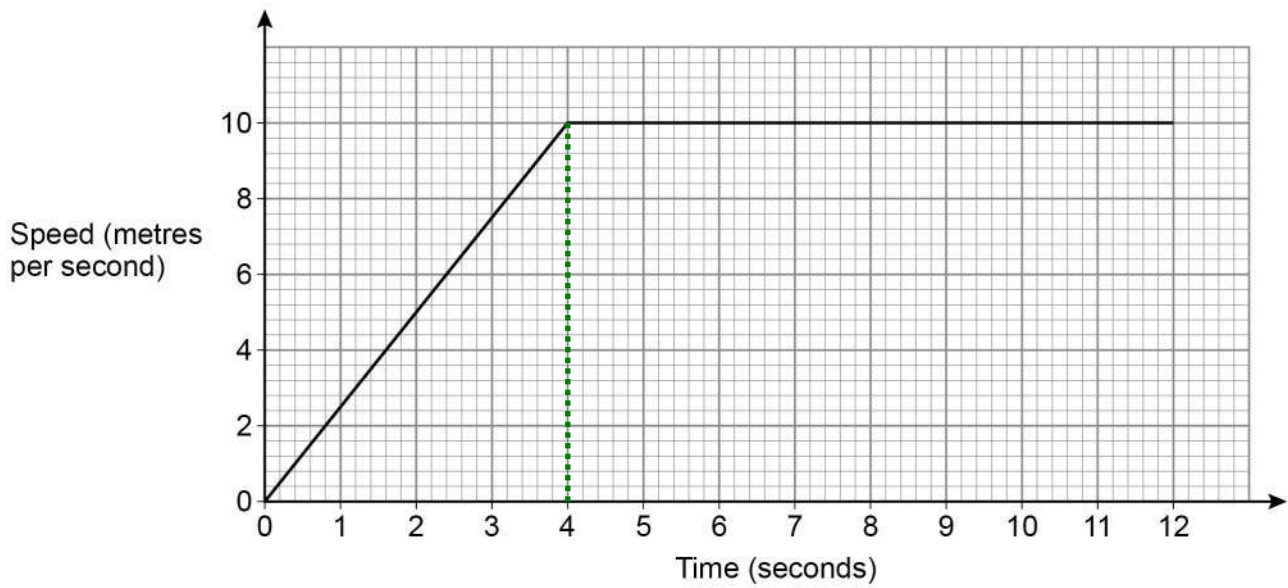
Turn over ►



28

A horse runs in a field.

The speed-time graph represents the first 12 seconds of the run.



After how many seconds had the horse run a distance of 75 metres?

**[3 marks]**

Distance on a speed-time graph is the area under the line.

Area of triangle =  $\frac{1}{2} \times \text{base} \times \text{height}$ Area of rectangle = length  $\times$  width

Answer \_\_\_\_\_ seconds



