



Please write clearly in block capitals.

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I declare this is my own work.

GCSE MATHEMATICS



Higher Tier Paper 2 Calculator

Thursday 4 June 2020

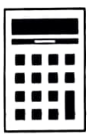
Morning

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.

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	
TOTAL	

Advice

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



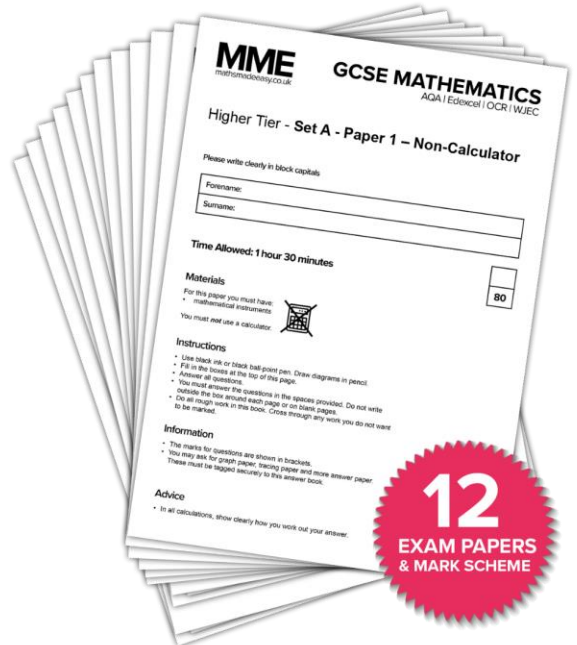
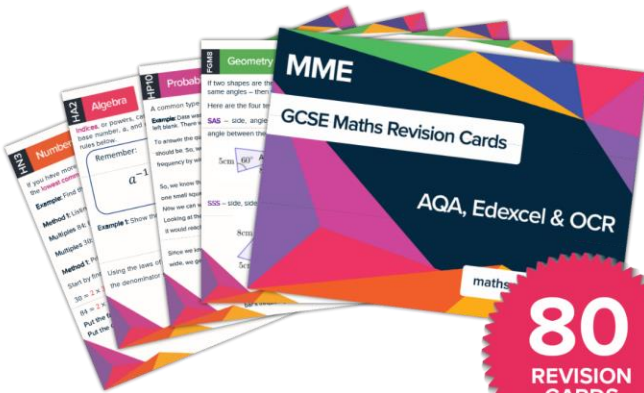
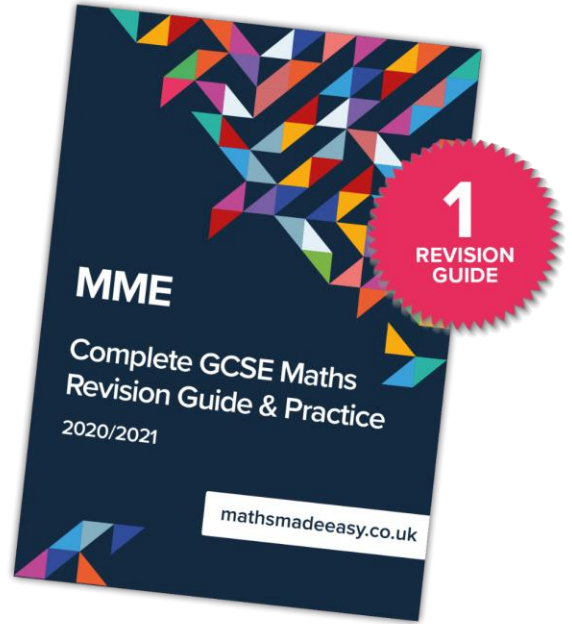
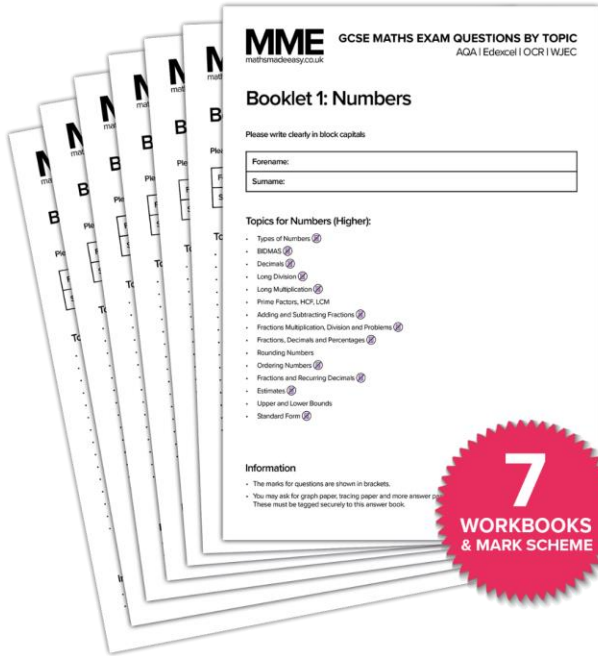
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MME.

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or for purchase separately.

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

Do not write outside the box

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

[1 mark]

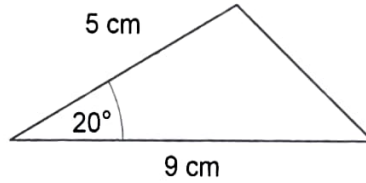
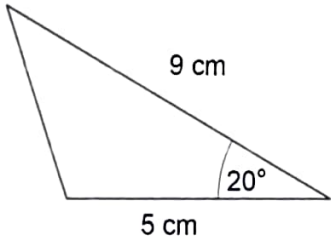
$x + 4x \equiv 5x$

$6x \equiv 18$

$2x + 1 \equiv 7$

$7x + 9 \equiv x$

2



Not drawn accurately

Circle the reason why these triangles are congruent.

[1 mark]

RHS

ASA

SSS

SAS



3 Circle the number that is written in standard form.

[1 mark]

0.9×10^{-3}

$6 \times 10^{0.5}$

5.2×10^{-4}

12×10^7

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

[1 mark]

$\frac{1}{2}a$

a

a^2

a^3

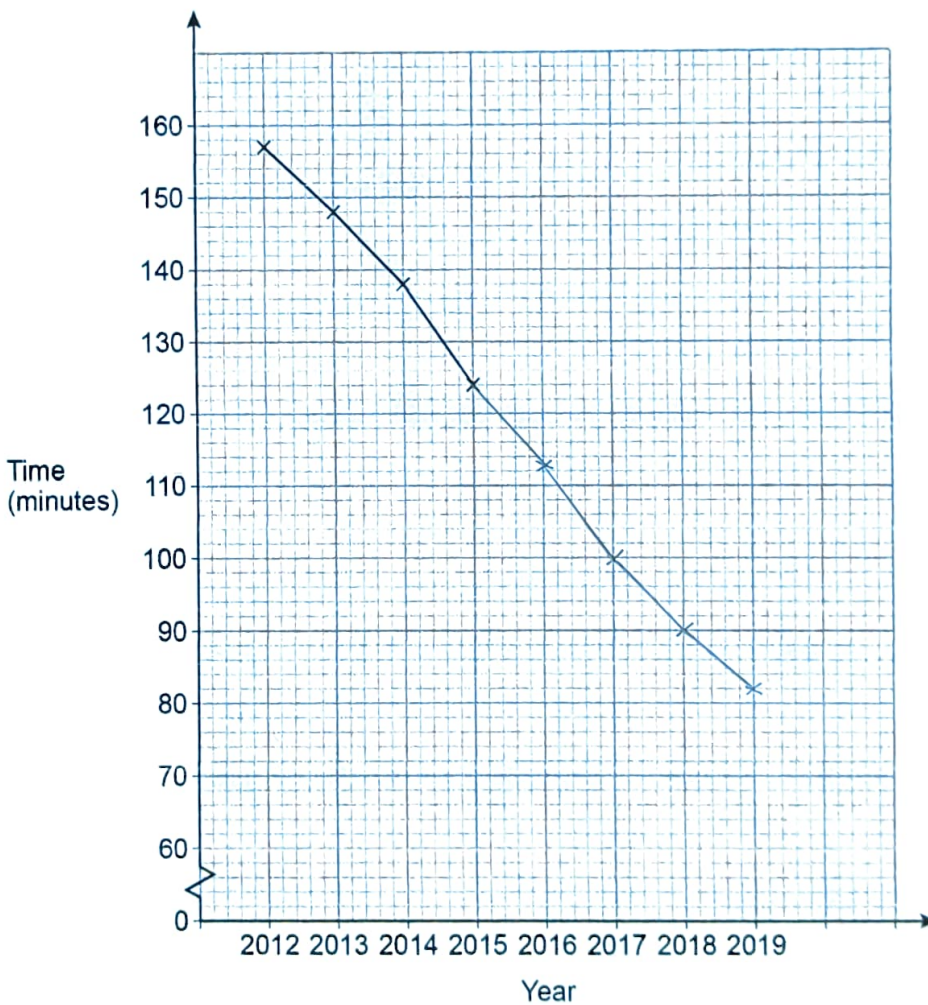
Turn over for the next question



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.



5 (a) Complete the graph.

[2 marks]

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

[1 mark]

Answer 74 minutes

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

[2 marks]

$$75 = 3 \times 5^2$$

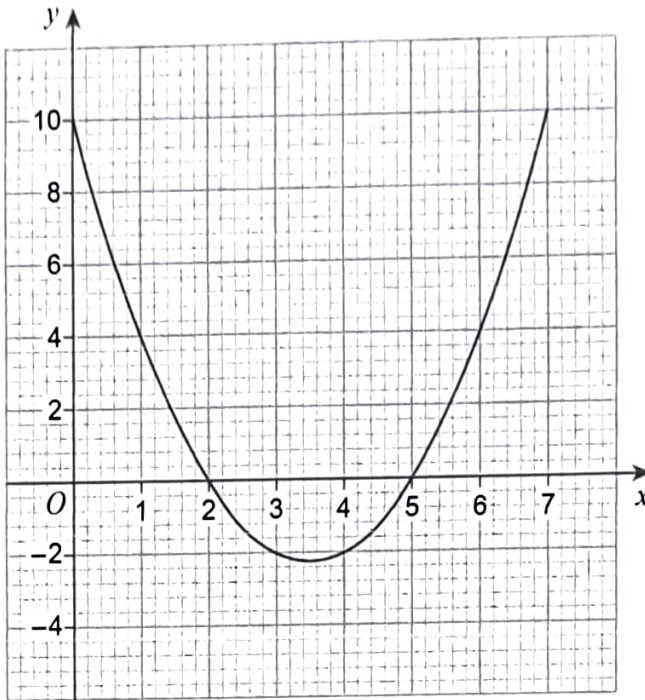
$$105 = 3 \times 5 \times 7$$

$$\text{HCF} = 3 \times 5 = 15$$

Answer 15



- 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 2 and 5

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

[1 mark]

$$(2+5) \div 2 = 3.5$$

Answer 3.5



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]

$$W: 48 \rightarrow 40 \text{ (divisible by 10 and less than 48)}$$

$$M: 42 \rightarrow 44 \text{ (divisible by 11 and more than 42)}$$

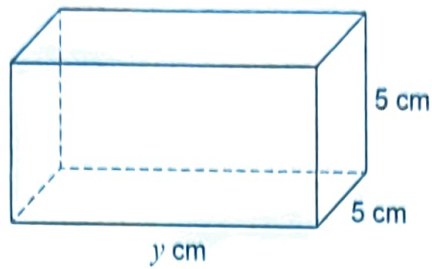
$$40:44 = 10:11 \checkmark$$

$$40 + 44 = 84 < 90, \text{ so less than 90.}$$

Turn over for the next question

Turn over ►





- 9 (a) Assume that the total surface area of the cuboid is 200 cm^2

Work out the volume of the cuboid.

[3 marks]

$$\text{Surface area} \Rightarrow 2 \times (5 \times 5) + 4 \times (5 \times y) = 200$$

$$\Rightarrow 50 + 20y = 200$$

$$\Rightarrow 20y = 150$$

$$\Rightarrow y = 7.5$$

$$\text{Volume} = 7.5 \times 5 \times 5 = 187.5 \text{ cm}^3$$

Answer 187.5 cm^3



9 (b) In fact, the total surface area of the cuboid is smaller than 200 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

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]

$$\text{Alex's mean score \%} = \frac{5 \times 60 + 48}{6} = 58\%$$

$$\frac{24}{50} = 48\%$$

Let x = Bev's score % on 6th test

$$\rightarrow \text{Bev's mean score \%} = \frac{5 \times 52 + x}{6} = 58$$

$$\Rightarrow x = 58 \times 6 - 5 \times 52 = 88$$

$$88\% \text{ of } 50 = 44$$

Answer 44 out of 50



11

A solid piece of silver has
mass 2.625 kilograms
volume 250 cm³

Work out the density of the piece of silver.

Give your answer in grams per cubic centimetre.

[2 marks]

$$\text{mass} = 2.625 \text{ kg} = 2625 \text{ g}$$

$$\text{density} = \frac{2625}{250} = 10.5 \text{ g/cm}^3$$

Answer 10.5 g/cm³

12

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

[2 marks]

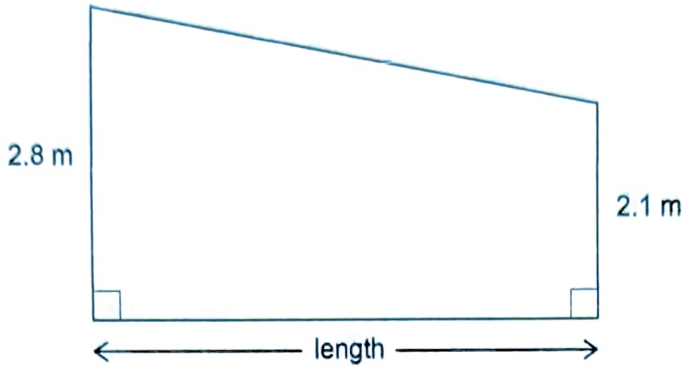
$$\text{gradient} = \frac{9-3}{1-(-2)} = \frac{6}{3} = 2$$

Answer 2

Turn over for the next question



- 13 The diagram shows a wall.



Not drawn
accurately

The area of the wall is 39.2 m^2

Work out the length of the wall.

[3 marks]

$$\text{Area of a trapezium} = \frac{1}{2} \times (2.8 + 2.1) \times h$$

$$\Rightarrow 2.45l = 39.2$$

$$\Rightarrow l = \frac{39.2}{2.45} = 16 \text{ m}$$

Answer 16 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]

$$6500 \times 1.05^3 = 7524.5625$$

So predicted runners in 2023 \approx 7525

Therefore yes, more than 7500.

Turn over for the next question



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

[3 marks]

$$a = \frac{b}{c} + 5$$

$$\Rightarrow \frac{b}{c} = a - 5$$

$$\Rightarrow c = \frac{b}{a - 5}$$

Answer $c = \frac{b}{a - 5}$



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]

$$\frac{4}{11} \times 22 = 8 \text{ (g.f mains)}$$

$$7 \text{ (g.f rice dishes)}$$

$$40\% \text{ of } 5 = 2 \text{ (g.f naans)}$$

$$8 \times 7 \times 2 = 112 \text{ possible g.f dishes}$$

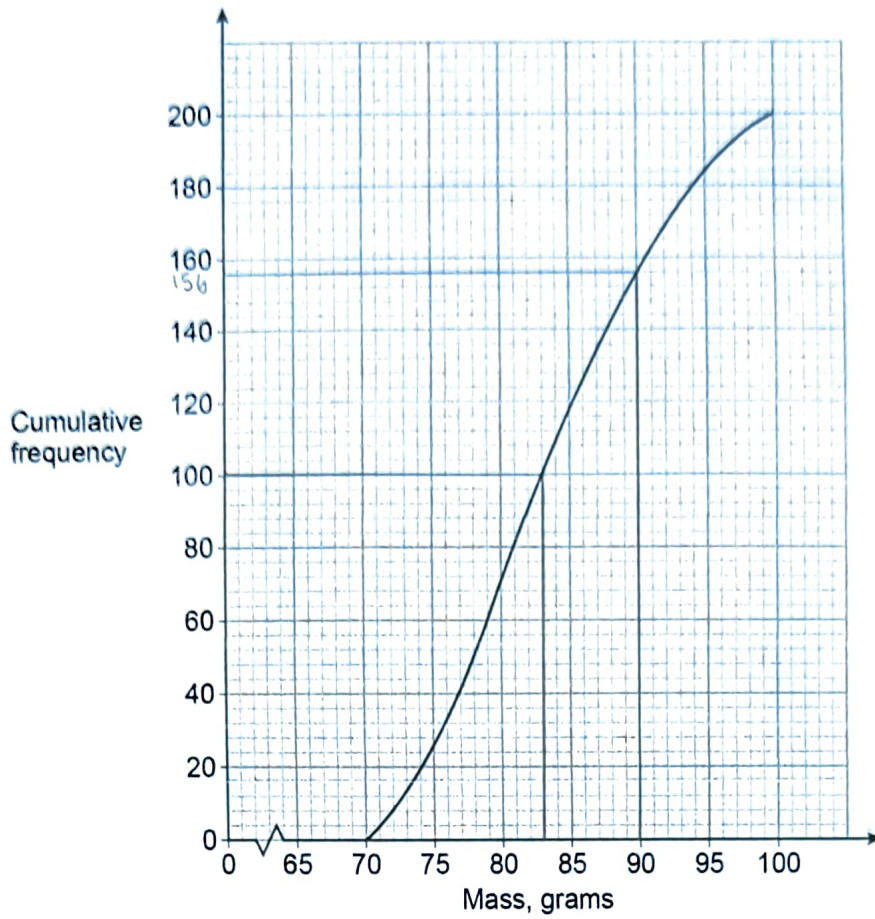
Answer 112

Turn over for the next question



Do not write outside the box

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



17 (a) Estimate the median mass.

[1 mark]

Answer 83 grams



- 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]

$$\text{Approx } 156 \text{ apples } \leq 90 \text{ g}$$

$$\therefore 44 \text{ apples } > 90 \text{ g}$$

$$156 \times \text{£}0.32 = \text{£}49.92$$

$$44 \times \text{£}0.39 = \text{£}17.16$$

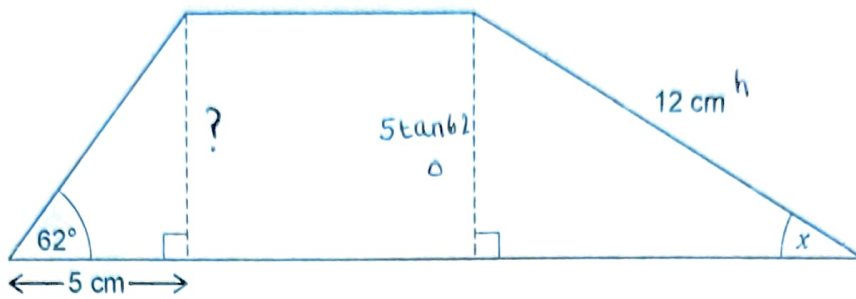
$$\text{Total cost} = \text{£}67.08$$

$$\text{Answer } \text{£ } \underline{67.08}$$

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

18

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

Do not write
outside the
boxNot drawn
accuratelyWork out the size of angle x .

[4 marks]

$$\tan 62 = \frac{?}{5}$$

$$? = 5 \tan 62 = 9.403\dots$$

$$\sin x = \frac{5 \tan 62}{12}$$

$$\Rightarrow x = \sin^{-1} \left(\frac{5 \tan 62}{12} \right) = 51.59^\circ$$

Answer 51.59 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]

$$\frac{7a+2b-3a}{8a+6b+2a-b} = \frac{4a+2b}{10a+5b}$$

$$= \frac{2(2a+b)}{5(2a+b)}$$

$$= \frac{2}{5}$$

Turn over for the next question

7

Turn over ►

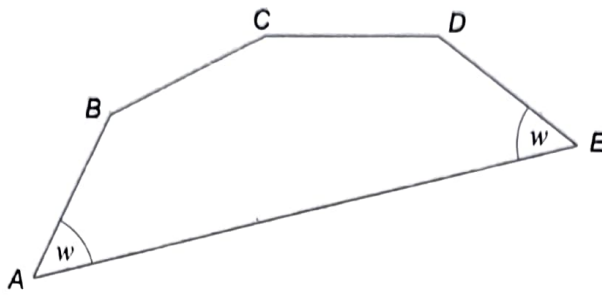


Do not write outside the box

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]

$$180 - \frac{360}{10} = 144$$

$$144 - 90 = 54^\circ$$

Answer 54 degrees



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

[1 mark]

(-1, 1)

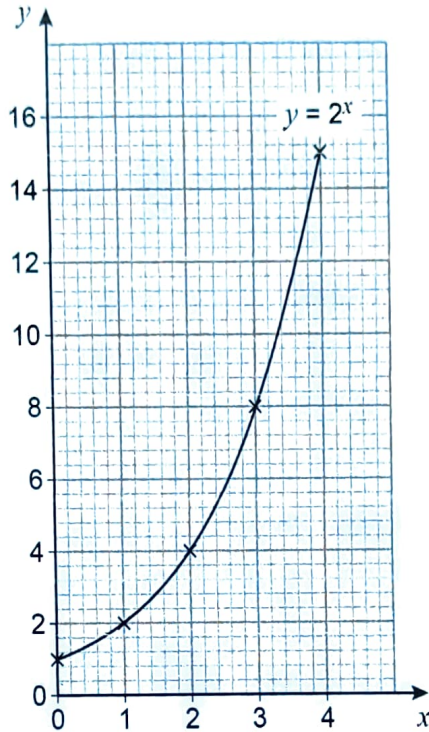
(0.3, 3)

(0.8, 0.2)

(2.5, 0.4)

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]

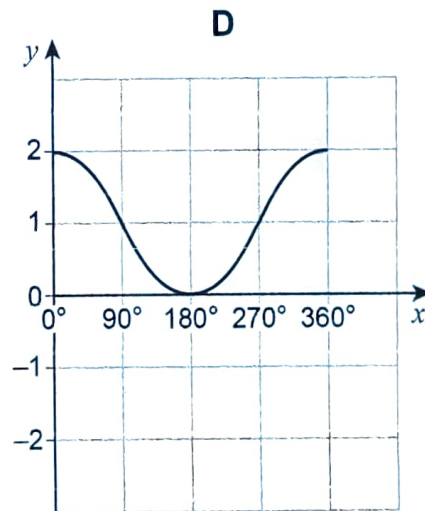
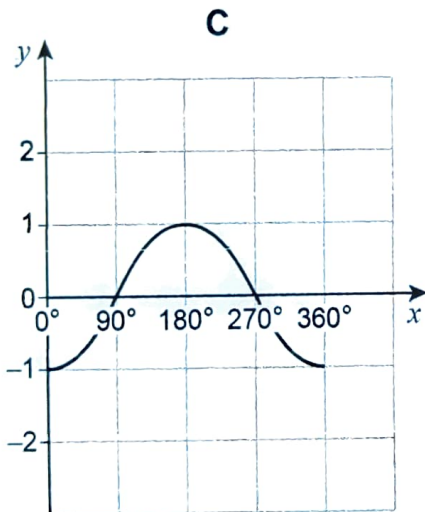
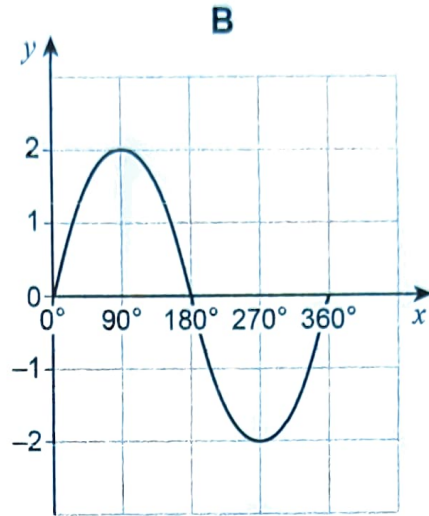
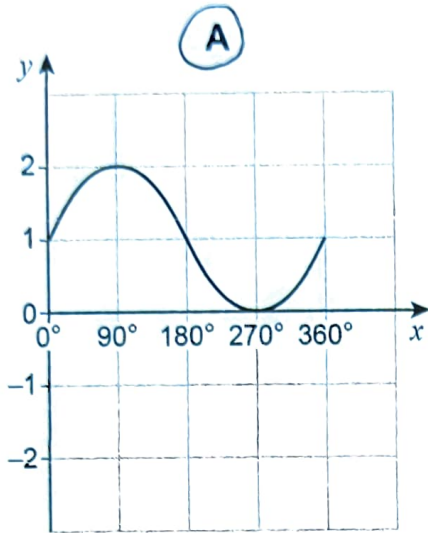
The graph should go through (4, 16)
not (4, 15)



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

Circle the letter above the correct graph.

[1 mark]



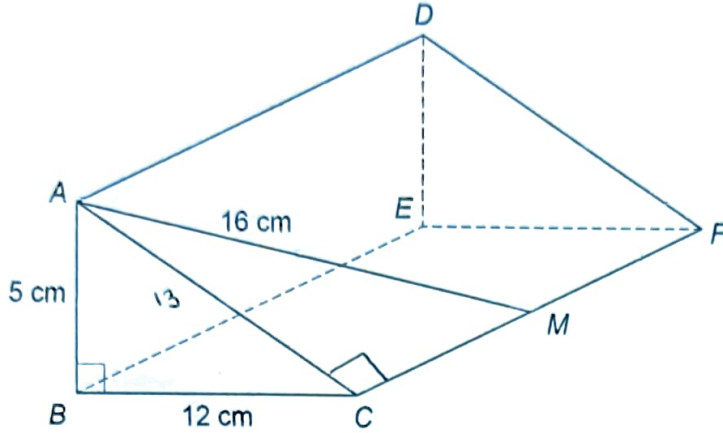
23

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

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

M is the midpoint of CF .

$AM = 16 \text{ cm}$



Work out the volume of the prism.

[4 marks]

$$AC = \sqrt{5^2 + 12^2} = 13 \text{ cm}$$

$$CM = \sqrt{16^2 - 13^2} = \sqrt{87}$$

$$CF = 2\sqrt{87}$$

$$\text{Volume} = \frac{1}{2} \times 5 \times 12 \times 2\sqrt{87}$$

$$= 559.64 \text{ cm}^3$$

Answer 559.64 cm³

5

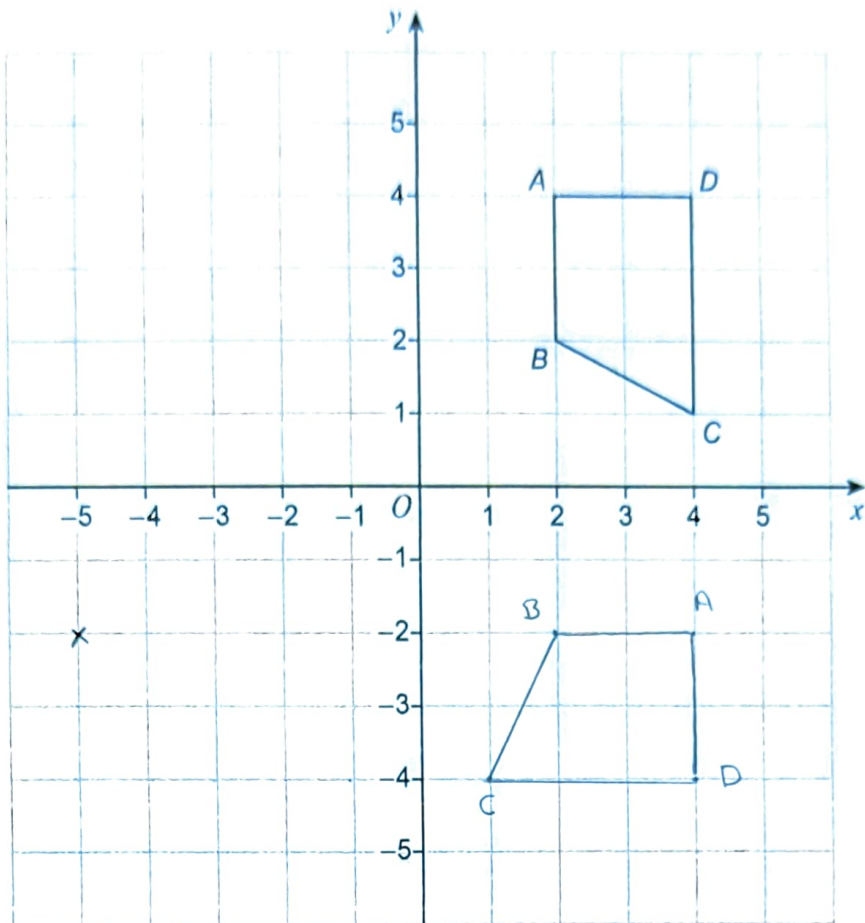
Turn over ►



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24

Quadrilateral $ABCD$ is shown.



- 24 (a) Work out the coordinates of C when $ABCD$ is rotated 90° clockwise about O then translated by $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$

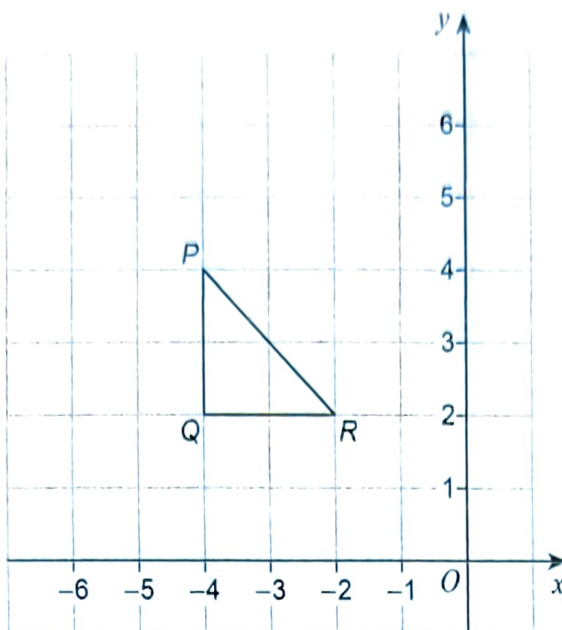
[2 marks]

Answer (-5 , -2)



Do not write outside the box

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]

$y = x + 6$

$y = -x$

$y = 2$

$x = -4$

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

[2 marks]

$$(3x - 4)(x + 5) = 3x^2 + 15x - 4x - 20$$

$$= 3x^2 + 11x - 20$$

Answer $(3x - 4)(x + 5)$

Turn over ►



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]

max value of potatoes < 25.5 kg

max value of carrots < 7.55

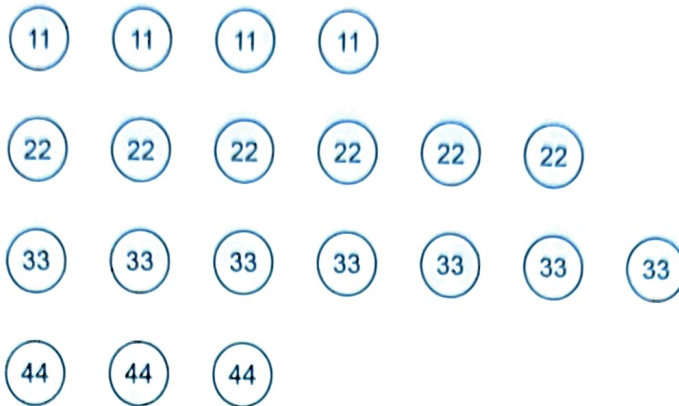
$$30 \times 25.5 + 20 \times 7.55 = 916 \text{ Kg}$$

916 < 920, so yes she can.



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.

$$P(11, 22 \text{ or } 33 \text{ or } 44) = \frac{4}{20} \times \frac{16}{19} = \frac{4}{19} \times \frac{16}{19} \quad [4 \text{ marks}]$$

$$P(22, 33 \text{ or } 44) = \frac{6}{20} \times \frac{10}{19} = \frac{3}{19}$$

$$P(33, 44) = \frac{7}{20} \times \frac{3}{19} = \frac{21}{380}$$

$$P(1^{st} < 2^{nd}) = \frac{16}{95} + \frac{3}{19} + \frac{21}{380} = \frac{29}{76}$$

Answer $\frac{29}{76}$

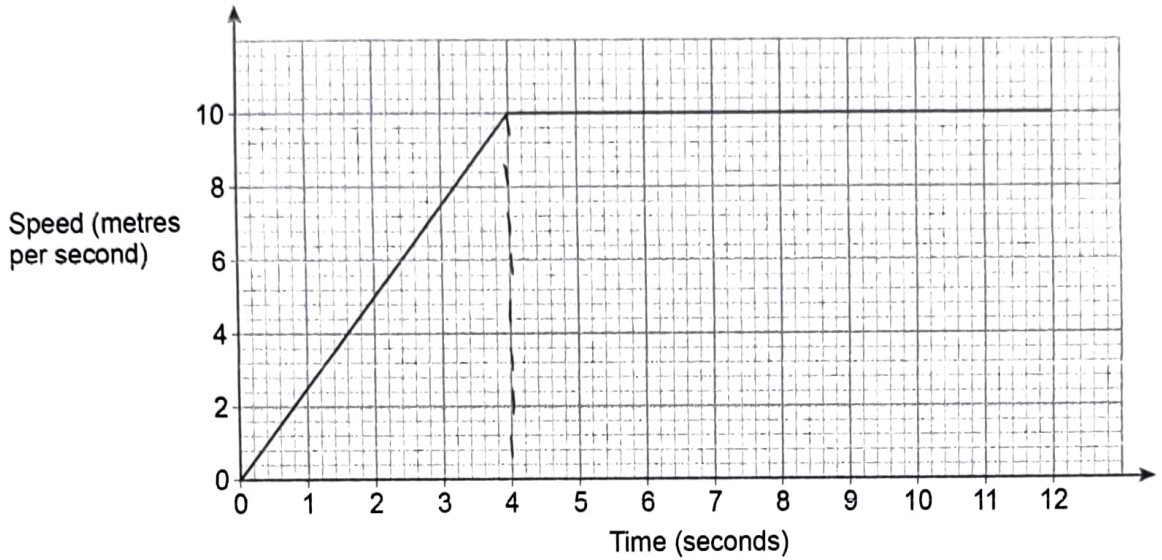


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28

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]

After 4 seconds, horse had ran $\frac{1}{2} \times 4 \times 10 = 20$ m.

$$55 \text{ m} = 10 \times t_2$$

$$t_2 = 5.5 \text{ seconds}$$

$$t = 4 + 5.5 = 9.5$$

Answer 9.5 seconds



29

Solve $\frac{5}{4x+1} = \frac{2x}{x^2+3}$

Give your solutions to 3 significant figures.

You **must** show your working.

[5 marks]

$$\frac{5}{4x+1} = \frac{2x}{x^2+3}$$

$$\Rightarrow 5(x^2+3) = 2x(4x+1)$$

$$\Rightarrow 5x^2+15 = 8x^2+2x$$

$$\Rightarrow 3x^2+2x-15 = 0$$

$$x = \frac{-2 \pm \sqrt{2^2 - 4 \times 3 \times -15}}{2 \times 3}$$

$$= 1.93 \text{ and } -2.59$$

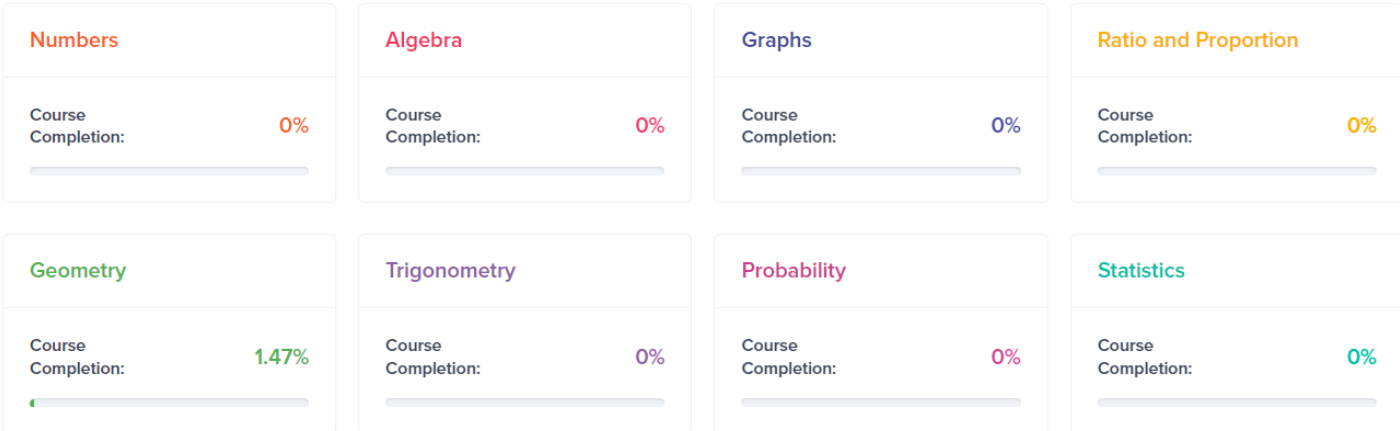
Answer 1.93 and -2.59

END OF QUESTIONS



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2. Algebra	0% Completed	+
3. Graphs	0% Completed	-
3.1 Gradients of Straight Line Graphs		+
3.2 $y=mx+c$		+
3.3 Coordinates and Midpoints		+
3.4 Drawing Straight Line Graphs		+
3.5 Parallel Lines		-
3.6 Quadratic and Cubic Graphs		+
3.7 Turning Points of Quadratic Graphs		+
3.8 Circle Graphs and Tangents		+