

Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier

Paper 3 Calculator

Tuesday 11 June 2019

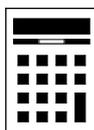
Morning

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.
- 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	
TOTAL	

Advice

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



Answer **all** questions in the spaces provided

- 1 Work out £1.50 as a fraction of 60p
Circle your answer.

$$\frac{150}{60} = \frac{15}{6} = \frac{5}{2}$$

[1 mark]

$\frac{2}{5}$

$\frac{1}{4}$

$\frac{4}{1}$

$\frac{5}{2}$

- 2 For a biased dice, $P(6) = \frac{3}{5}$ $P(6)$ and $P(6) = P(6) \times P(6)$
Circle the probability of two sixes when the dice is rolled twice.

[1 mark]

$\frac{6}{25}$

$\frac{6}{10}$

$\frac{9}{25}$

$\frac{9}{5}$

- 3 Circle the lowest common multiple (LCM) of 5, 15 and 25

[1 mark]

5

45

75

150

15 25
30 50
45 75
60
75

5 goes into both
15 and 25 so focus
on the others.



- 4 Circle the **two** roots of $(x - 5)(x + 3) = 0$

[1 mark]

-5

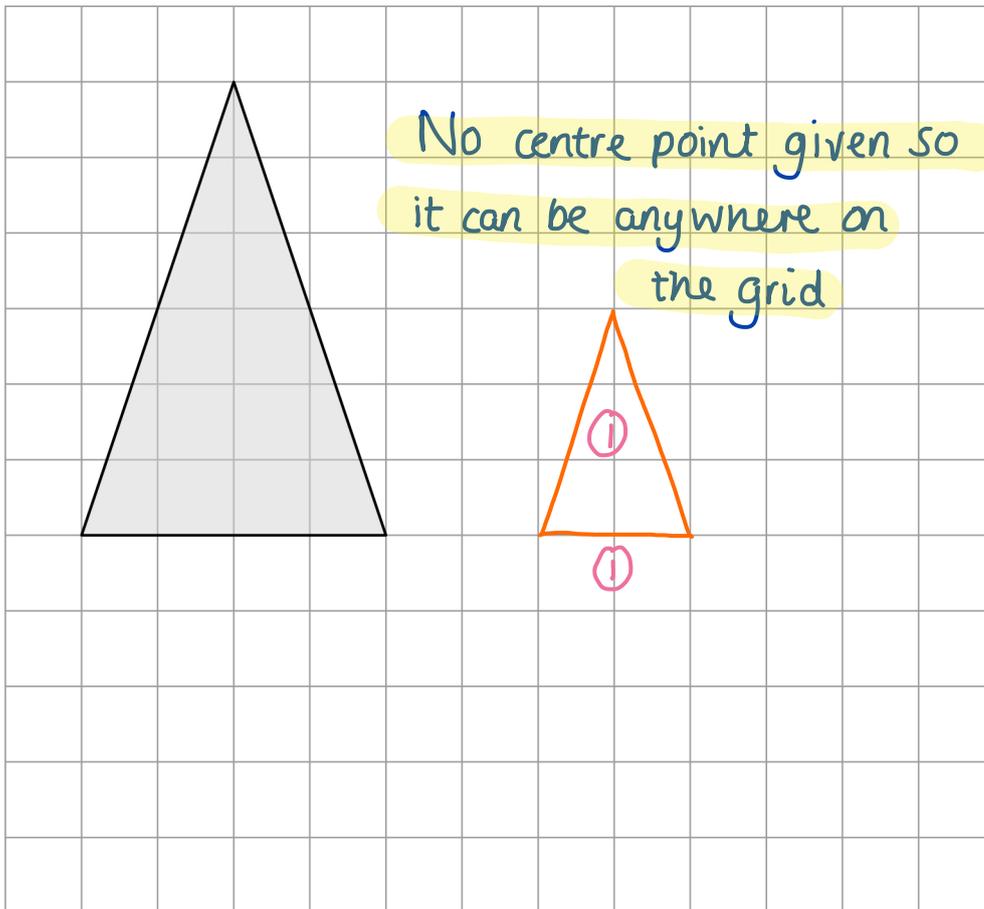
-3

3

5

- 5 On the grid, draw an enlargement of the triangle with scale factor $\frac{1}{2}$

[2 marks]



- 6 To the nearest pound, Jon has £9
To the nearest 50p, Ellie has £6.50
Work out the maximum possible total amount of money. [3 marks]

Work out the bounds for each

$$\text{Jon} \rightarrow \pounds 9 \quad 8.50 \leq 9 < 9.50 \quad (1)$$

$$\text{Ellie} \rightarrow 50\text{p} \quad 6.25 \leq 6.50 < 6.75$$

Select the correct intervals for the maximum

value * As its money and the top intervals are
not included - these are used ~ 9.49 and 6.74
 $9.49 + 6.74 \quad (1)$

$$\text{Answer } \pounds 16.23 \quad (1)$$



- 7 Two solids, J and K, have the same density.

Recall



Complete the table.

Include units in your answers.

[3 marks]

for the final mark -
remember your
density units

	J	K
Mass	48 g	78 g
Volume	8 cm ³	$78 \div 6 = 13$ ① 13 cm ³
Density	$48 \div 8 = 6$ 6 g/cm ³ ①	Same as J ① 6 g/cm ³

- 8 Rearrange $y = 3x - 2$ to make x the subject.

Circle your answer.

[1 mark]

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

$$x = \frac{y+2}{3}$$

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

$$x = \frac{y}{3} + 2$$

$$y = 3x - 2$$

$$y + 2 = 3x$$

$$\frac{y+2}{3} = x$$

Turn over ►



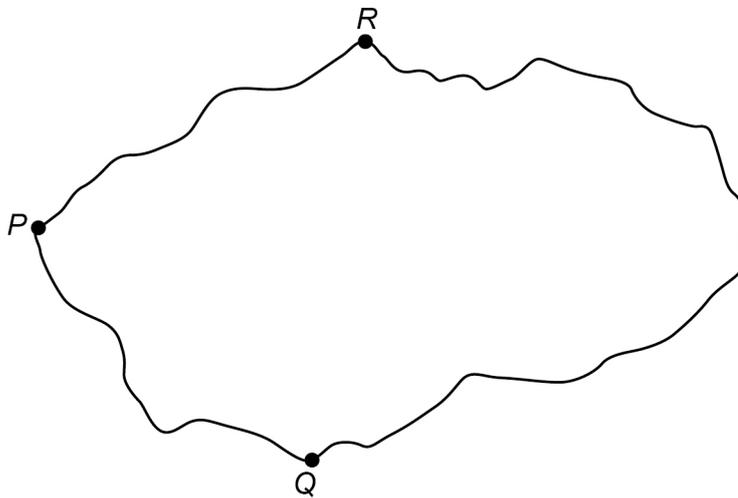
9

Towns P , Q and R are connected by roads PQ , PR and QR .

PR is 10 km longer than PQ .

QR is twice as long as PR .

The total length of the three roads is 170 km



Not drawn
accurately

Use the info
to create
equations

Work out the length of PQ .

[4 marks]

$$\text{Let } PQ = x$$

$$PR = x + 10 \quad (1)$$

$$QR = 2PR = 2(x + 10) \quad (1)$$

$$\text{so } x + x + 10 + 2(x + 10) = 170$$

$$2x + 10 + 2x + 20 = 170$$

$$4x + 30 = 170 \quad (1)$$

$$4x = 140$$

$$x = 35$$

Answer 35 (1) km



- 10 Mia wants to borrow £6000 and repay it, with interest, after two years.
She sees two offers for loans.

Work out
each offer,
then compare

Offer 1
Compound interest
3% per year

Offer 2
Compound interest
First year 1%
Second year 5%

Mia says,

"I will pay back the same amount because the average of 1% and 5% is 3%"

Is she correct?

You **must** show your working.

[3 marks]

$$\text{Offer 1} \rightarrow \pounds 6000 \times 1.03^2 = \pounds 6365.40$$

$$\text{Offer 2} \rightarrow \pounds 6000 \times 1.01 \times 1.05 = \pounds 6363$$

Refer back to Mia's statement

They are not the same as offer 1 you
pay back £2.50 more

Turn over for the next question



11 Here are two sets of numbers, A and B.

Set A

200	160
104	100

Set B

270	400	483
300	x	

mean of Set A : mean of Set B = 3 : 8

Work out the value of x .

[4 marks]

Calculate the mean of set A

$$(200 + 160 + 104 + 100) \div 4 = 141 \text{ (1)}$$

$$141 \rightarrow 3 \text{ parts} \quad 47 \rightarrow 1 \text{ part}$$

$$\therefore 47 \times 8 = 376 \text{ (1)} \leftarrow \text{the mean of set B}$$

Set up and solve an equation for the mean of Set B

$$(270 + 400 + 483 + 300 + x) \div 5 = 376$$

$$(1453 + x) \div 5 = 376 \text{ (1)} \quad 1880 - 1453 = x$$

$$1453 + x = 1880$$

$$x = 427$$

Answer 427 (1)



12

A straight line

has gradient 4

and

passes through the point (5, 23)

Work out the equation of the line.

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

[3 marks]

Recall $y = mx + c$ and find the y -intercept

$$y = mx + c \rightarrow y = 4x + c$$

If it goes through (5, 23)

$$23 = 4(5) + c$$

$$23 = 20 + c$$

$$c = 3$$

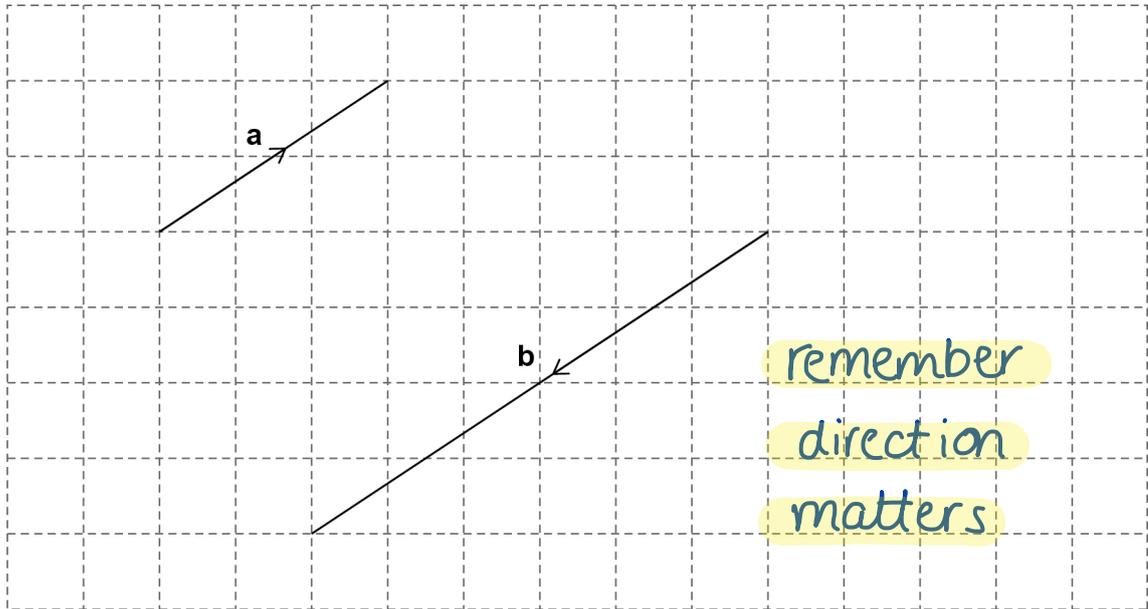
Answer $y = 4x + 3$

Turn over for the next question

Turn over ►



13 (a) Vectors **a** and **b** are drawn on a grid.



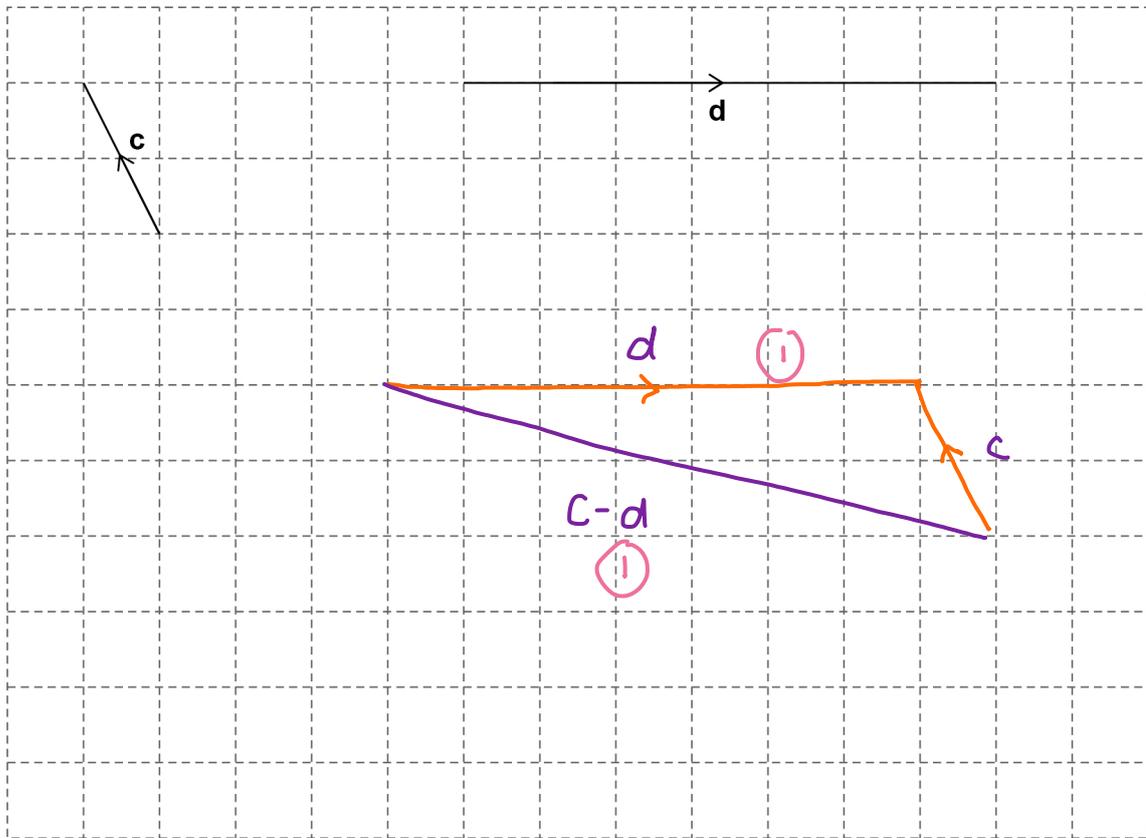
Write **b** in terms of **a**.

[1 mark]

$$\mathbf{b} = \underline{-2\mathbf{a}}$$



13 (b) Vectors \mathbf{c} and \mathbf{d} are drawn on a grid.



On the grid above, draw a vector representing $\mathbf{c} - \mathbf{d}$

[2 marks]

Turn over for the next question



14 For Class X, number of boys : number of girls = 7 : 8

For Class Y, number of boys : number of girls = 3 : 4

Which statement **must** be true?

Tick **one** box.

$$\frac{7}{15} \text{ boys} = 47\%$$

$$\frac{3}{7} \text{ boys} = 43\%$$

[1 mark]

Class X has more boys than class Y

Class X has twice as many girls as class Y

Class X has a greater proportion of boys than class Y

Class X has the same proportion of boys as class Y

15 Simplify fully

$$\frac{a^3b^2}{cd} \times \frac{c}{ab^5}$$

[3 marks]

Combine fractions and cancel down

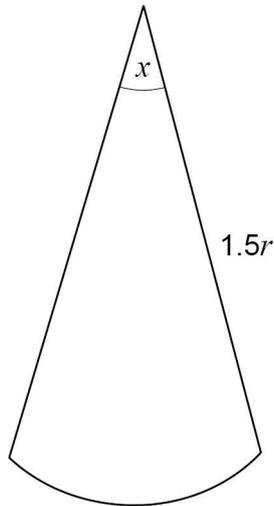
$$\frac{a^3b^2c}{cdab^5} = \frac{\cancel{a}^2\cancel{a}b^2\cancel{c}}{\cancel{c}d\cancel{a}b^5} = \frac{a^2}{bb^3d} = \frac{a^2}{b^3d}$$

Answer $\frac{a^2}{b^3d}$



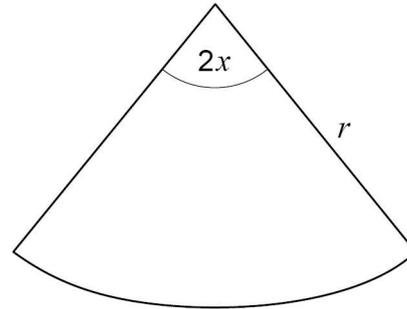
16 Here are two sectors from different circles.

Sector A



Sector B

Not drawn
accurately

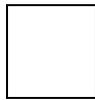


Which sector has the bigger area?

Tick a box.



Sector A



Sector B

Show working to support your answer.

[2 marks]

Recall sector area $\rightarrow \frac{\theta}{360} \times \pi r^2$

$$\text{Sector A} \rightarrow \frac{x}{360} \times \pi \times (1.5r)^2$$

$$= \frac{2.25x\pi r^2}{360}$$

Bigger area (1)

$$\text{Sector B} \rightarrow \frac{2x}{360} \times \pi \times r^2$$

$$= \frac{2x\pi r^2}{360}$$

Turn over ►



17

A factory makes kettles.

Four samples of kettles are tested for faults.

Each sample has size 200

Here are the relative frequencies of faulty kettles in the samples.

Sample	P	Q	R	S
Relative frequency	0.03	0.035	0.015	0.01

Work out the range of the number of faulty kettles in the four samples.

[3 marks]

Calculate the number of faulty kettles in each

$$0.03 \times 200 = 6 \quad (1) \quad 0.015 \times 200 = 3 \quad (1)$$

$$0.035 \times 200 = 7 \quad 0.01 \times 200 = 2$$

Calculate the range (biggest - smallest)

$$7 - 2$$

Answer _____

5 (1)



- 18 (a) Write $x(3x - 9) = 4$ in the form $ax^2 + bx + c = 0$ where a , b and c are integers.

[1 mark]

Expand, simplify and set to zero

$$x(3x - 9) = 4 \longrightarrow 3x^2 - 9x = 4$$

Answer $3x^2 - 9x - 4 = 0$

- 18 (b) Solve $x(3x - 9) = 4$

Give your answers to 2 decimal places.

Big clue

quadratic formula [2 marks]

$$3x^2 - 9x - 4 = 0$$

Recall $\rightarrow \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Remember to simplify as much as possible

$$a = 3, b = -9, c = -4$$

before using the calculator.

$$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4 \times 3 \times -4}}{2 \times 3} \quad x = \frac{9 \pm \sqrt{81 + 48}}{6}$$

$$x = \frac{9 \pm \sqrt{129}}{6}$$

Answer $x = 3.39$ or $x = -0.39$

Turn over for the next question

Turn over ►

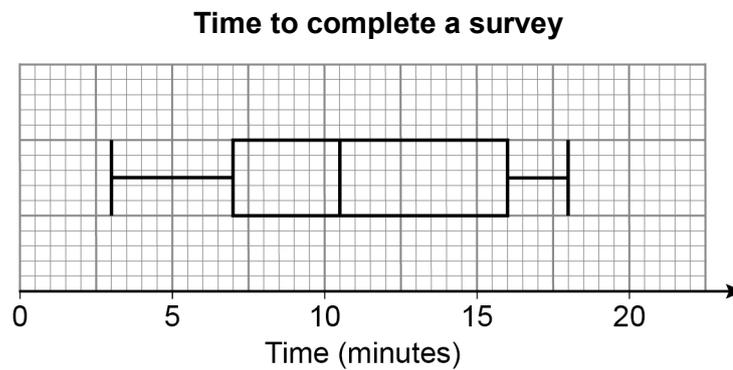


19

Here is some information about the times people took to complete a survey.

Fastest time	3 minutes
Slowest time	18 minutes
Median	11 minutes
Lower quartile	7 minutes
Interquartile range	8 minutes

Ben draws this box plot to show the information.



Make **two** criticisms of his box plot.

[2 marks]

Criticism 1 The IQR should be 8, so the upper quartile needs to be at 15. (1)

Criticism 2 The median should be 11, it reads 10.5 (1)



20 d is directly proportional to the square of v .

$$d = 6 \text{ when } v = 20$$

20 (a) Work out an equation connecting d and v .

[3 marks]

Write the equation $d \propto v^2$

$$d = kv^2 \quad \therefore k = 0.015 \quad (1)$$

so (1)

$$6 = 20^2 k$$

$$k = 6/400$$

Answer $d = 0.015v^2 \quad (1)$

20 (b) Work out the value of d when $v = 30$

[2 marks]

Substitute into the equation above

$$d = 0.015 \times 30^2$$

$$d = 0.015 \times 900 \quad (1)$$

Answer $d = 13.5 \quad (1)$

Turn over for the next question



21

Hanif makes green paint by mixing blue paint and yellow paint in the ratio

blue : yellow = 7 : 3

He buys blue paint in 50-litre containers, each costing £225

He buys yellow paint in 20-litre containers, each costing £80

He wants to

sell the green paint in 5-litre tins

make 40% profit on each tin.

How much should he sell each tin for?

[5 marks]

Find the unit cost for each colour

$$225 \div 50 = 4.50 \text{ per litre for blue } \textcircled{1}$$

$$80 \div 20 = 4 \text{ per litre for yellow } \textcircled{1}$$

Let's make 10 litres using the 7:3 ratio

$$4.50 \times 7 + 4 \times 3 = 43.50 \textcircled{1}$$

$$\text{Half for 5 litres} = 21.75$$

$$\text{Calculate 40\% profit } 21.75 \times 1.4 \textcircled{1}$$

Answer £ 30.45 $\textcircled{1}$

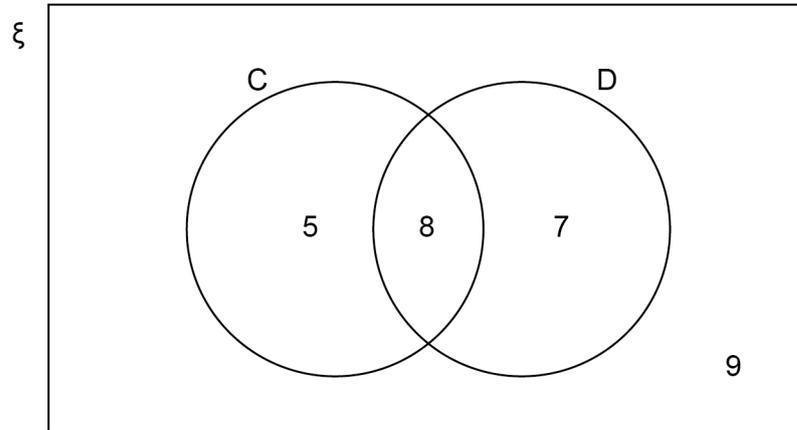


22

 $\xi = 29$ students in a class

C = students who own a cat

D = students who own a dog



22 (a) A student is chosen at random.

Circle the probability that the student owns a cat or a dog but not both.

[1 mark]

$\frac{12}{29}$ $\frac{13}{29}$ $\frac{15}{29}$ $\frac{20}{29}$

(Handwritten: The fraction $\frac{12}{29}$ is circled in purple, and a circled '1' is written above it.)

22 (b) A student who owns a dog is chosen at random.

Circle the probability that the student also owns a cat.

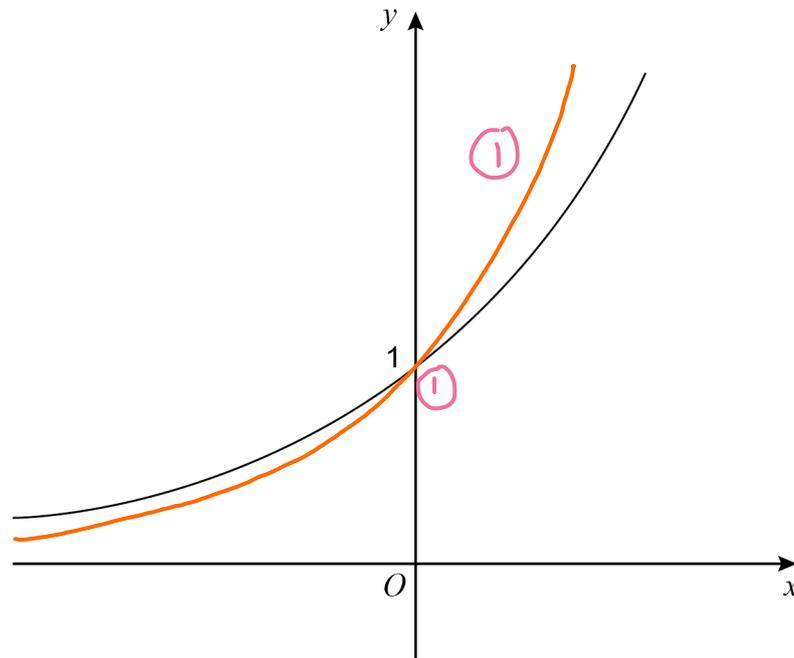
[1 mark]

$\frac{7}{15}$ $\frac{8}{15}$ $\frac{7}{29}$ $\frac{8}{29}$

(Handwritten: The fraction $\frac{8}{15}$ is circled in purple, and a circled '1' is written above it. A blue arrow points from the text 'now its only out of 15 not 29' to the circled fraction.)



23

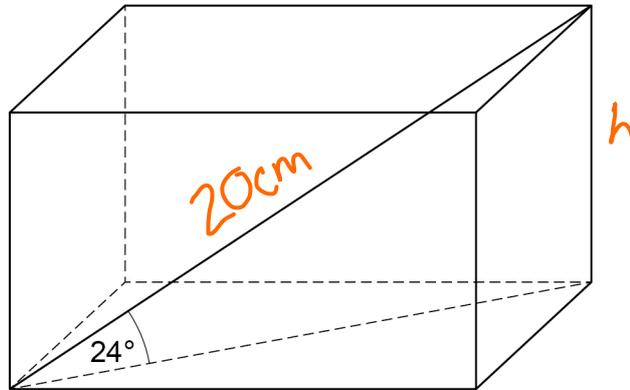
Here is a sketch of the curve $y = 2^x$ On the axes above, sketch the curve $y = 3^x$ **[2 marks]**

If unsure, try a few values



24

The length of a diagonal of a cuboid is 20 cm
 The diagonal makes an angle of 24° with the base.
 The area of the base is 150 cm^2



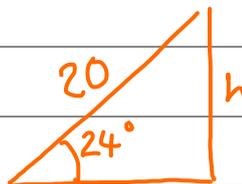
Work out the volume of the cuboid.

[3 marks]

$$\text{Volume} = l \times w \times h$$

$$l \times w = \text{area of base} = 150$$

Calculate the height



s H

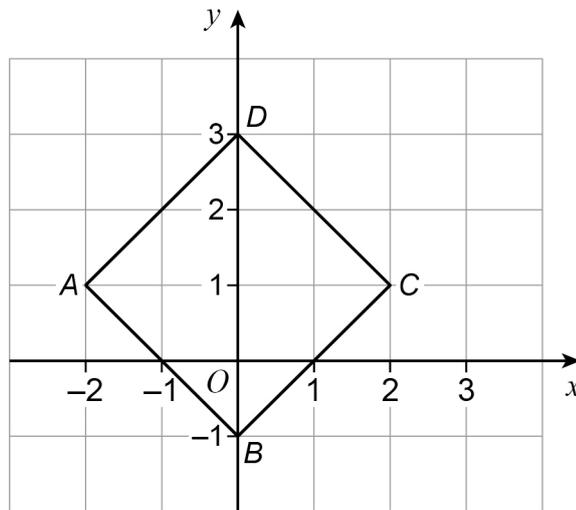
$$\sin 24 \times 20 = 8.1347$$

$$150 \times 8.1347 = 1220.21$$

Answer 1220.21 cm^3



25

 $ABCD$ is a square. A is $(-2, 1)$ B is $(0, -1)$ C is $(2, 1)$ D is $(0, 3)$ 25 (a) A **single** transformation of $ABCD$ is such that B is mapped to D D is mapped to B A and C are invariant points.

← these remain fixed

Describe fully the transformation.

[2 marks]

① Reflection in the line $y = 1$ ①



25 (b) A different **single** transformation of $ABCD$ is such that

B is mapped to D

D is mapped to B

the only invariant point is $(0, 1)$

Describe fully the transformation.

Rotation, 180° at the centre point $(0, 1)$ [3 marks]

26 $g(x) = 16 - x$ $h(x) = x^3$

Solve $gh(x) = 24$

[3 marks]

$gh(x) \rightarrow$ put $h(x)$ into $g(x)$

$$gh(x) = 16 - x^3$$

$$16 - x^3 = 24$$

$$-8 = x^3$$

$$x = -2$$

$$x = -2$$

Turn over for the next question



27

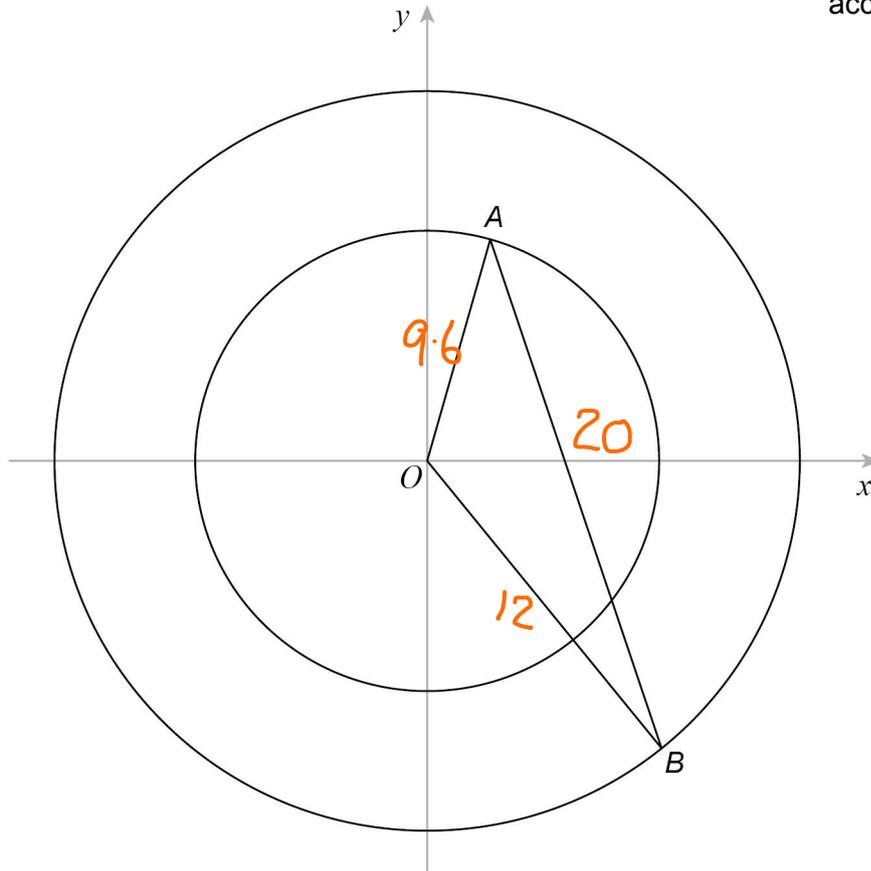
In this question, all lengths are in centimetres.

A is a point on a circle, centre O .

B is a point on a different circle, centre O .

$AB = 20$

Not drawn
accurately



The equation of the larger circle is $x^2 + y^2 = 144$

radius of smaller circle : radius of larger circle = 4 : 5



Work out the size of angle AOB .

[5 marks]

Use $x^2 + y^2 = 144$ to find radius

Larger circle radius 12 (1)

Use 4:5 to calculate smaller radius

$(12 \div 5) \times 4 = 9.6$ (1)

Use the cosine rule to calculate angle

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$20^2 = 12^2 + 9.6^2 - 2 \times 12 \times 9.6 \cos A$$

$$400 = 144 + 92.16 - 230.4 \cos A$$
 (1)

$$400 = 236.16 - 230.4 \cos A$$

$$163.84 = -230.4 \cos A$$

$$-0.712 = \cos A$$
 (1)

$$A = \cos^{-1}(-0.712)$$

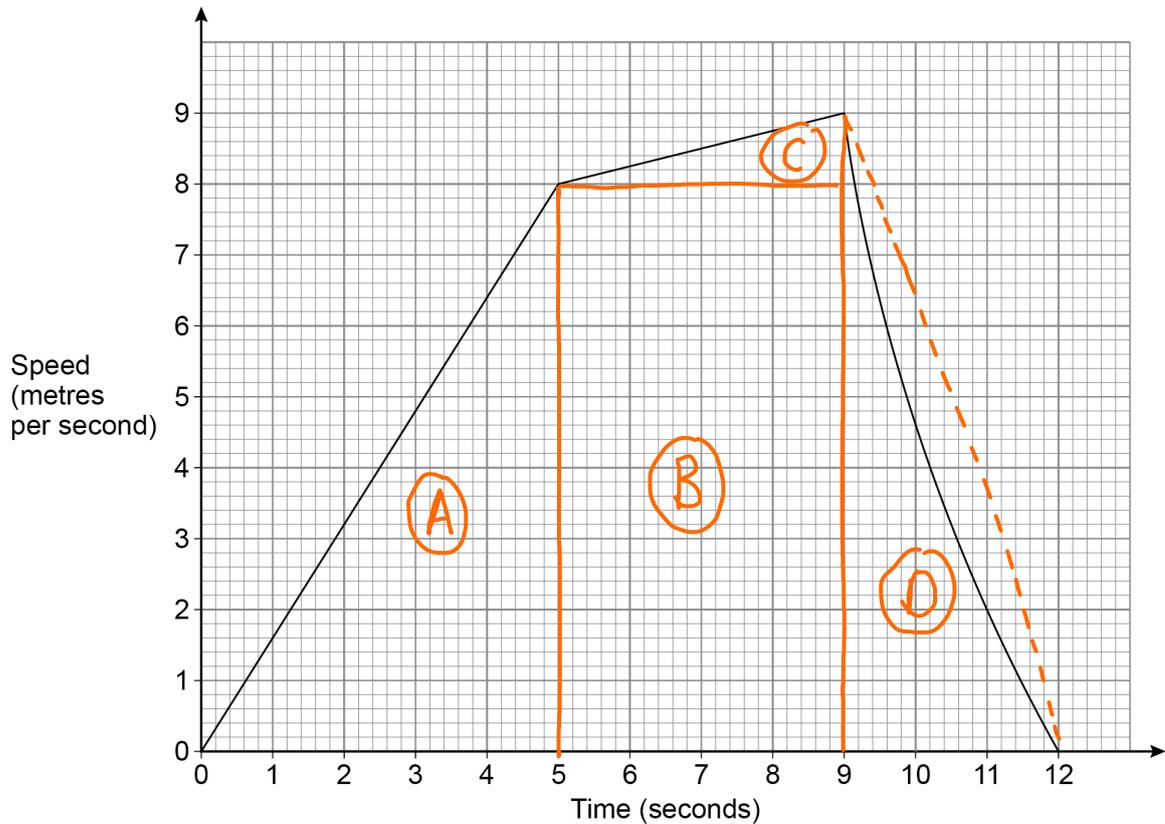
Answer 135.325 (1) degrees

Turn over for the next question



28

Leo runs for 12 seconds.
The graph shows his speed.



28 (a) Show that the distance he runs is less than 67.5 metres.

[4 marks]

In speed-time graphs the distance is the area under the curve

$$(A) \rightarrow (5 \times 8) \div 2 = 20 \quad (B) \rightarrow 4 \times 8 = 32$$

$$(C) \rightarrow (4 \times 1) \div 2 = 2 \quad (D) \rightarrow (3 \times 9) \div 2 = 13.5$$

$$40 + 32 + 2 + 13.5 = 67.5$$

The last part is an overestimate as it's a curve, so less distance is run.



- 28 (b) Work out his average acceleration for the first 9 seconds.
State the units of your answer.

[2 marks]

Acceleration \rightarrow speed \div time $| \div | = |$

Answer

1 m/s²

END OF QUESTIONS



There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Copyright information

For confidentiality purposes, from the November 2015 examination series, acknowledgements of third-party copyright material are published in a separate booklet rather than including them on the examination paper or support materials. This booklet is published after each examination series and is available for free download from www.aqa.org.uk after the live examination series.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2019 AQA and its licensors. All rights reserved.



2 8



1 9 6 G 8 3 0 0 / 3 H

IB/M/Jun19/8300/3H