



Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

---

Forename(s)

---

Candidate signature

---

# GCSE MATHEMATICS

# H

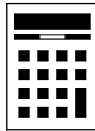
Higher Tier          Paper 2 Calculator

Thursday 7 November 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	
<b>TOTAL</b>	

### Advice

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



N 0 V 1 9 8 3 0 0 2 H 0 1

Answer **all** questions in the spaces provided

- 1 Expand  $4x^2(3x + 5)$   
Circle your answer.

[1 mark]

$32x^3$

$12x^3 + 20x^2$

$7x^3 + 9x^2$

$12x^2 + 5$

1

- 2 How many millimetres are there in a kilometre?  
Circle your answer.

[1 mark]

$10^3$

$10^5$

$10^6$

$10^9$

1

- 3 Circle the number half way between  $\frac{7}{12}$  and  $\frac{3}{4}$

[1 mark]

$\frac{7}{32}$

$\frac{5}{8}$

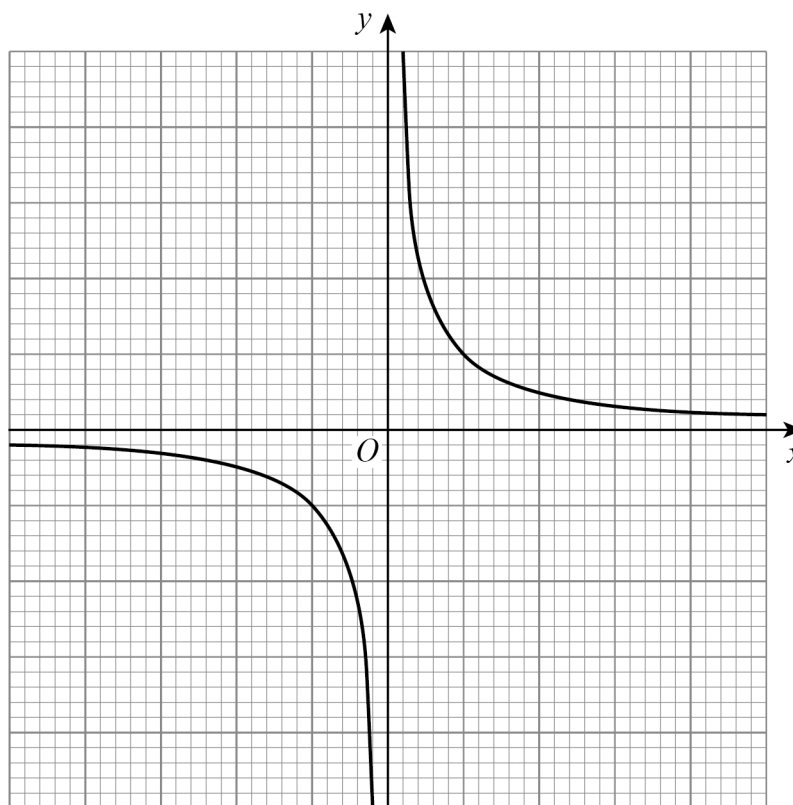
$\frac{2}{3}$

$\frac{1}{2}$

1



4 Here is the sketch of a graph.



Circle the equation of the graph.

[1 mark]

$y = x$

$y = -x^2$

$y = -x^3$

$y = \frac{1}{x}$  (1)

5 Work out the lowest common multiple (LCM) of 120 and 144

[2 marks]

$120 = 2 \times 2 \times 2 \times 3 \times 5$

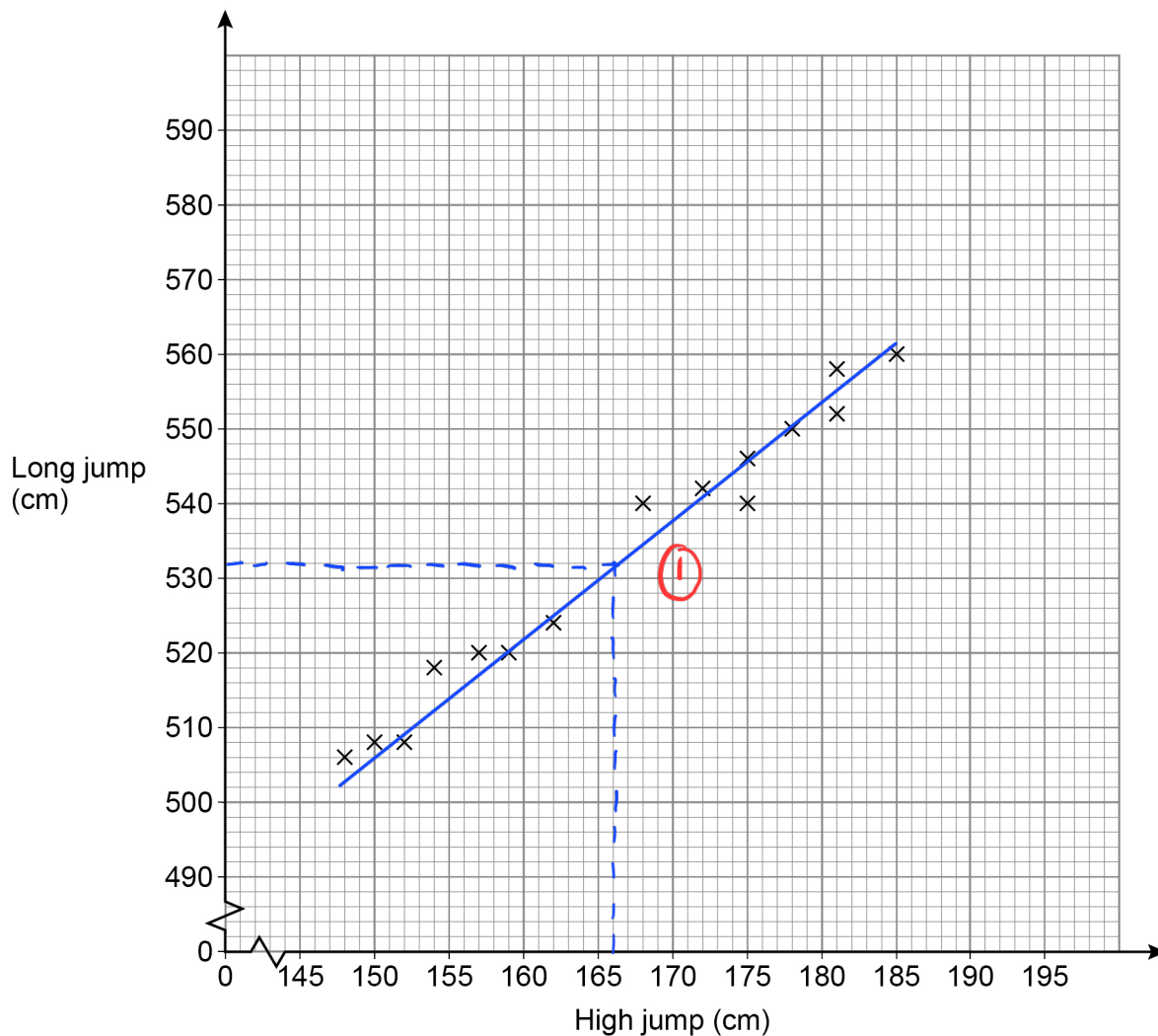
$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$  (1)

Lcm:  $2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 = 720$  (1)

Answer 720



6 The scatter graph shows the best high jump and the best long jump for 15 boys.



6 (a) Write down the type of correlation shown.

[1 mark]

Answer Positive (1)





6 (b) Liam has a best high jump of 166 cm

Use a line of best fit to estimate his best long jump.

[2 marks]

Answer 532 ~~12~~ cm

6 (c) Another boy has a best high jump of 195 cm

Give a reason why you should **not** use a line of best fit to estimate his best long jump.

[1 mark]

195 exceeds this data ①

Turn over for the next question



- 7 A car journey is in two stages.  
 Stage 1 The car travels 110 miles in 2 hours.  
 Stage 2 The car travels 44 miles at the same average speed as Stage 1  
 Work out the time for Stage 2  
 Give your answer in minutes. [3 marks]

$$\text{speed}_1 : \frac{110}{2} = 55 \quad (1)$$

$$\text{time}_2 : \frac{44}{55} = 0.8 \text{ hours} \quad (1)$$

$$0.8 \times 60 = 48 \text{ min} \quad (1)$$

Answer 48 minutes

- 8 Here is an identity.  
 $a(3x - 10) \equiv 21x + 2b$   
 Work out the values of  $a$  and  $b$ . [3 marks]

$$a = 7 \quad (2)$$

$$7(3x - 10) = 21x - 70$$

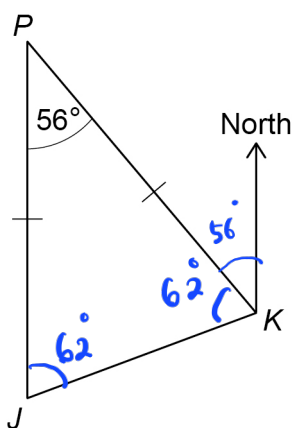
$$2b = -70$$

$$b = -35 \quad (1)$$

$a =$  7  $b =$  -35



- 9 *J* and *K* are ships.  
*P* is a port.  
*J* is due South of *P*.  
Angle  $JPK = 56^\circ$   
 $JP = KP$



Not drawn  
accurately

Work out the bearing of *J* from *K*.

[3 marks]

$$180^\circ - 56^\circ = 124^\circ$$

$$124 \div 2 = 62^\circ \quad (1)$$

$$360^\circ - 62^\circ - 56^\circ = 242^\circ \quad (1)$$

Answer 242 °

Turn over for the next question



- 10 The 5th term of a linear sequence is 17  
The 6th term of the sequence is 21  
Work out the 100th term of the sequence. [3 marks]

$$T_5 = a + 4d = 17$$

$$d = 4 \quad (1)$$

$$a = 17 - 4(4)$$

$$= 1 \quad (1)$$

$$T_{100} = 1 + 99(4)$$

$$= 397 \quad (1)$$

Answer 397

- 11 The value of a house is £120 000  
The value is expected to increase by 5% each year.  
Work out the expected value after 4 years.  
Give your answer to 2 significant figures.  
You **must** show your working. [4 marks]

$$120\,000 \times 1.05 = 126\,000 \quad (1)$$

$$126\,000 \times 1.05 = 132\,300$$

$$132\,300 \times 1.05 = 138\,915 \quad (1)$$

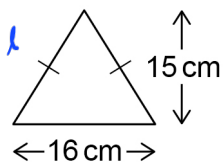
$$138\,915 \times 1.05 = 145\,860.75 \quad (1)$$

$$\approx 150\,000$$

Answer £ 150 000 (1)

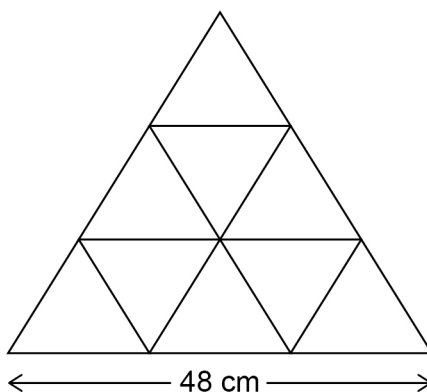


12 An isosceles triangle has base 16 cm and perpendicular height 15 cm



Not drawn accurately

Some of these triangles are used to make a large triangle.



Not drawn accurately

Work out the perimeter of the large triangle.

[4 marks]

$$\frac{16}{2} = 8 \quad (1)$$

$$\begin{aligned} \text{By using Pythagoras' Theorem : } l &= \sqrt{15^2 + 8^2} \\ &= \sqrt{225 + 64} \\ &= \sqrt{289} \quad (1) \\ &= 17 \end{aligned}$$

$$\begin{aligned} \text{Perimeter : } &17 + 17 + 17 + 17 + 17 + 17 + 48 \quad (1) \\ &= 102 + 48 \\ &= 150 \quad (1) \end{aligned}$$

Answer 150 cm



- 13 200 people recorded the time they spent on social media one day.  
The table shows the results.

Time, $t$ (mins)	Frequency	Midpoint	
$0 \leq t < 30$	24	15	360
$30 \leq t < 50$	76	40	3040
$50 \leq t < 60$	52	55	2860
$60 \leq t < 90$	48	75	3600
	Total = 200		

- 13 (a) Work out an estimate of the mean time.

[3 marks]

$$24 \times 15 = 360$$

$$52 \times 55 = 2860$$

$$76 \times 40 = 3040$$

$$48 \times 75 = 3600$$

$$\text{mean} = \frac{360 + 3040 + 2860 + 3600}{200}$$

$$= \frac{9860}{200} \quad (1)$$

$$= 49.3$$

Answer 49.3 (1) mins



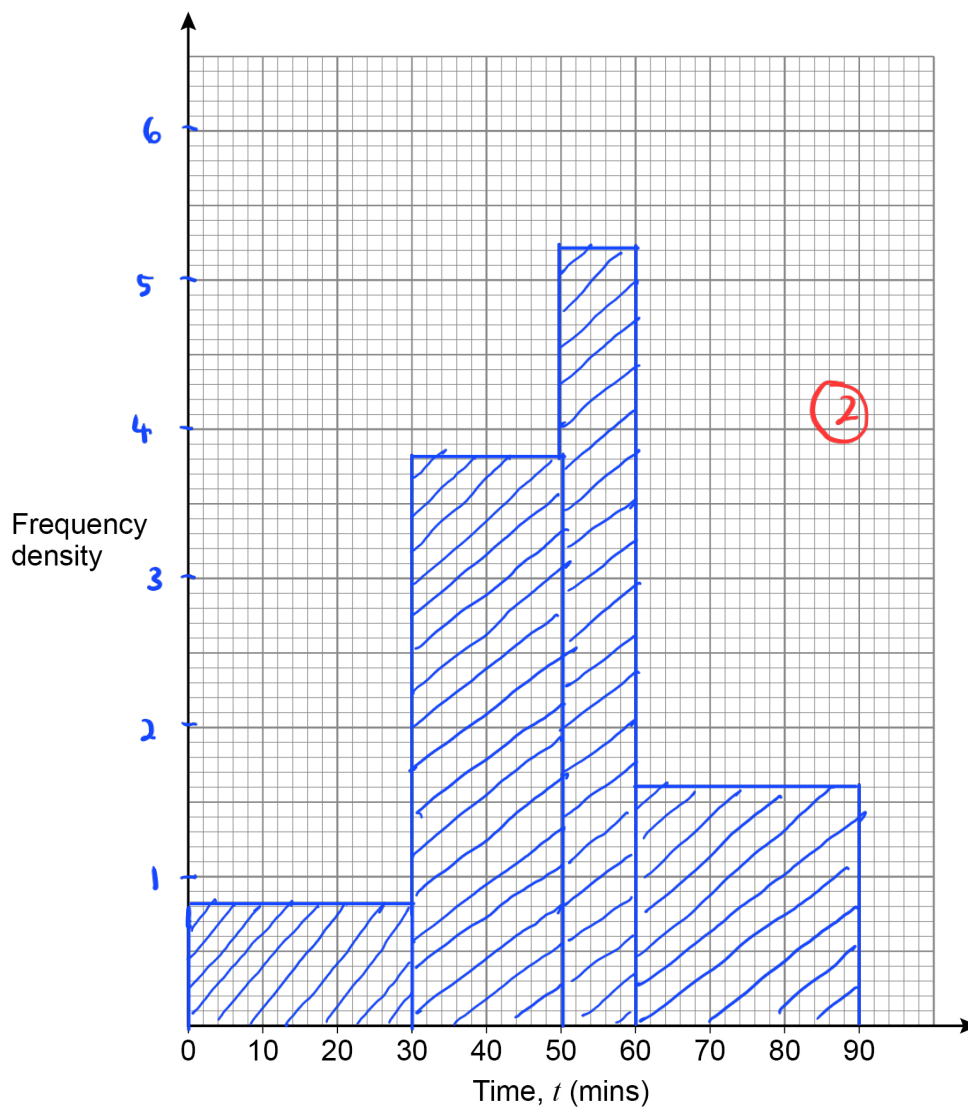
13 (b) Draw a histogram to represent the results.

[4 marks]

Time, $t$ (mins)	Frequency	Class width	Frequency density
$0 \leq t < 30$	24	30	0.8
$30 \leq t < 50$	76	20	3.8
$50 \leq t < 60$	52	10	5.2
$60 \leq t < 90$	48	30	1.6

(1)

(1)



(2)

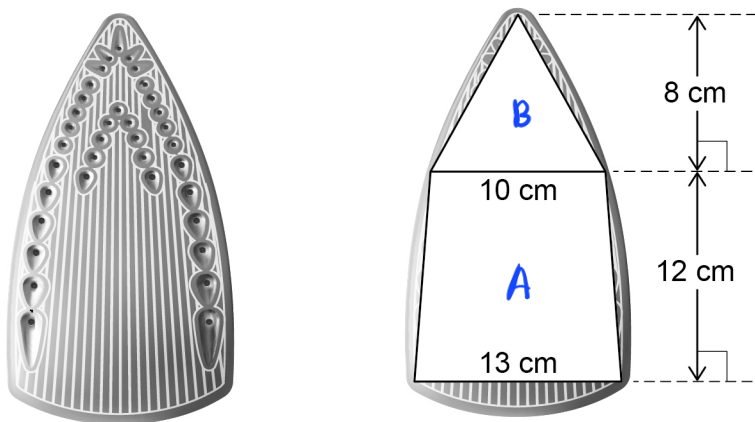
7

Turn over ►



- 14 Ralf has an iron.  
He models the base as a triangle joined to a trapezium.

Not drawn  
accurately



- 14 (a) The iron applies a force of 25 newtons (N)

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Work out the pressure using Ralf's model.

[4 marks]

$$\text{Area of A} : \frac{1}{2} \times (13+10) \times 12 = 138 \quad (1)$$

$$\text{Area of B} : \frac{1}{2} \times 10 \times 8 = 40 \quad (1)$$

$$\text{Total area} : 138 + 40 = 178 \quad (1)$$

$$\text{pressure} = \frac{25}{178} = 0.140 \quad (1)$$

Answer 0.14 N/cm<sup>2</sup>





14 (b) Is the actual pressure greater than, equal to or less than your answer to part (a)?

Tick **one** box.

greater than

equal to

less than

(1)

Give a reason for your answer.

[2 marks]

The actual area is bigger. (1)

15 Rearrange  $y = \sqrt{w^3}$  to make  $w$  the subject.

Circle your answer.

[1 mark]

$$w = y^6$$

$$w = \sqrt[3]{y^2}$$

$$w = \sqrt{y^3}$$

$$w = y^5$$

(1)

Turn over for the next question



16 (a) Show that  $a\%$  of  $b = b\%$  of  $a$

[1 mark]

$$\frac{a}{100} \times b = \frac{b}{100} \times a \rightarrow \frac{ab}{100}$$

(1)

16 (b) Rosie says,

"160% of 40 = 140% of 60 because  $a\%$  of  $b = b\%$  of  $a$ "

Is she correct?

Tick a box.

Yes

No

Give a reason for your answer.

(1)

[1 mark]

It should be 160% of 40 = 40% of 160



- 17 A packet contains 80 sweets.  
The flavour of each sweet is lemon, orange or apple.  
A sweet is taken at random.

17 (a)  $P(\text{lemon or orange}) \leq 0.85$

Work out the minimum possible number of **apple** sweets in the packet.

[2 marks]

$$0.85 \times 80 = 68 = \text{lemon} + \text{orange}$$

$$\text{apple} = 80 - 68$$

$$= 12$$

Answer

12

(2)

17 (b)  $P(\text{lemon or apple}) < 0.71$

There are 31 lemon sweets.

Work out the maximum possible number of **apple** sweets in the packet.

[2 marks]

$$0.71 \times 80 = 56.8 = \text{apple} + \text{lemon}$$

$$\text{apple} = 56.8 - 31$$

$$= 25.8$$

$$\approx 25$$

Answer

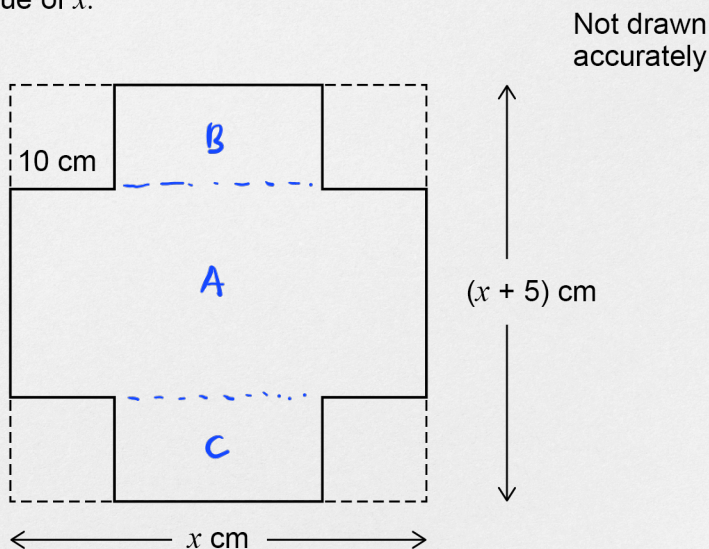
25

(2)



- 18 Kate has the following question for homework.

The net of a box is made by cutting four squares from a piece of cardboard.  
The cardboard is a rectangle with width  $x$  cm and length  $(x + 5)$  cm  
Each square has side length 10 cm  
The area of the net is  $1000 \text{ cm}^2$   
Work out the value of  $x$ .



- 18 (a) Show that Kate can form the equation  $x^2 + 5x - 1400 = 0$

[3 marks]

$$\text{Area of A : } (x-15)(x) = x^2 - 15x \quad (1)$$

$$\text{Area of B : } (x-20)(10) = 10x - 200$$

$$\text{Area of C : } (x-20)(10) = 10x - 200$$

$$\text{Area of net} = \text{total area A, B and C}$$

$$1000 = x^2 - 15x + 10x - 200 + 10x - 200$$

$$1000 = x^2 + 5x - 400 \quad (1)$$

$$x^2 + 5x - 400 - 1000 = 0$$

$$x^2 + 5x - 1400 = 0 \quad (\text{shown})$$

(1)



18 (b) Kate correctly factorises the equation to get  $(x + 40)(x - 35) = 0$

Her answer to the homework question is  $x = -40$  or  $x = 35$

Is her answer correct?

Tick a box.

Yes

No

Give a reason for your answer.

$x$  cannot be negative



[1 mark]

19 Circle the word that describes the graph  $y = \sin x$

[1 mark]

periodic



exponential

cubic

quadratic

20  $(7, 28)$  is a point on the graph  $y = f(x)$

Circle the point which **must** be on the graph  $y = f(x) + 2$

[1 mark]

$(7, 26)$

$(7, 30)$



$(5, 28)$

$(9, 28)$



21

$n$  is the middle integer of three consecutive positive integers.

The three integers are multiplied to give a product.

$n$  is then added to the product.

Prove that the result is a cube number.

**[4 marks]**

let 3 integers to be :  $n-1, n, n+1$  (1)

$$(n-1)(n+1) = n^2 - 1 \quad (1)$$

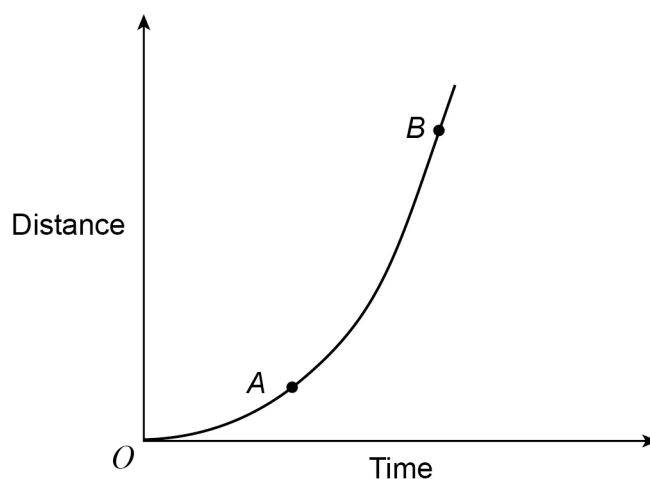
$$n(n^2 - 1) = n^3 - n$$

$$n^3 - n + n = n^3 \quad (1)$$



22

Here is a sketch of a distance-time graph.



Which of these represents the average speed between A and B?

Tick **one** box.

[1 mark]

The gradient of the tangent at A

The gradient of the tangent at B



The gradient of the chord from A to B

The gradient of the chord from O to B

Turn over for the next question

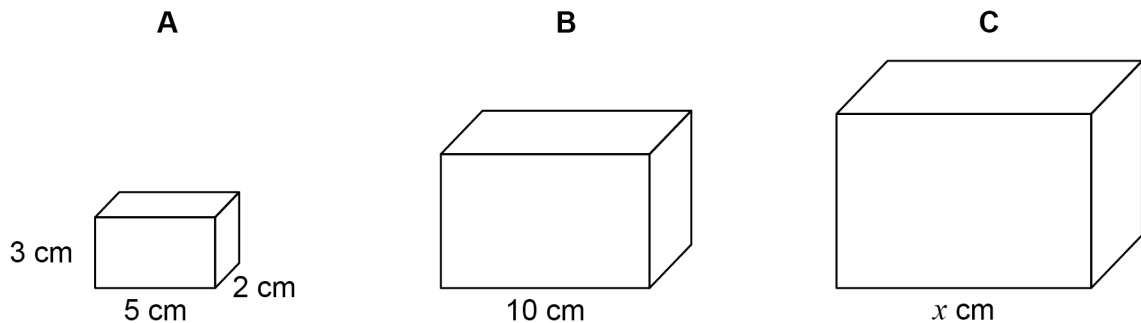


23 Here are three similar cuboids, A, B and C.

A has length 5 cm, width 2 cm and height 3 cm

B has length 10 cm

C has length  $x$  cm



- 23 (a) The total surface area of A is  $62 \text{ cm}^2$   
Tim wants to work out the total surface area of B.  
Here is his working.

$10 \div 5 = 2$ $62 \times 2 = 124$ $\text{Total surface area of B} = 124 \text{ cm}^2$
---

Make **one** criticism of Tim's method.

[1 mark]

The scale factor should be 4. Hence,  $62 \times 4 = 248$  (1)

---



---



---



---





23 (b) Volume of A  $\times \frac{125}{8}$  = Volume of C

Work out the value of  $x$ .

$$\sqrt[3]{\frac{125}{8}} = \frac{5}{2} \quad (1)$$

[3 marks]

$$\text{length of A} \times \frac{5}{2} = \text{length of C}$$

$$5 \times \frac{5}{2} = x \quad (1)$$

$$12.5 = x$$

Answer 12.5 (1)

Turn over for the next question



24

Here are two inequalities.

$$-2 \leq x \leq 3$$

$$9 \leq x + y \leq 11$$

 $x$  and  $y$  are integers.Work out the **greatest** possible value of  $y - x$ **[3 marks]**

To get greatest possible value of  $y - x$ ,

$y$  should be the largest and  $x$  should be the smallest.

Hence,  $x = -2$  (1)

$$x + y \leq 11$$

$$-2 + y < 11$$

$$y < 13$$
 (1)

$$y - x = 13 - (-2)$$

$$= 15$$
 (1)

Answer 15



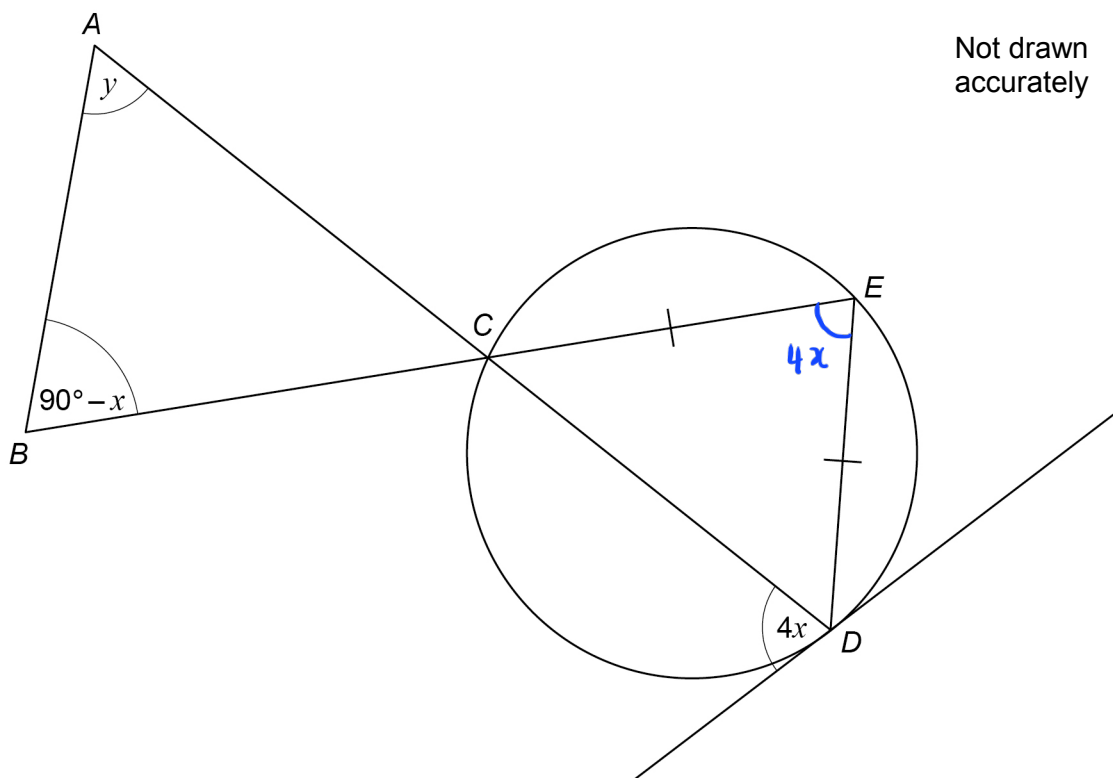
25

$C$ ,  $D$  and  $E$  are points on a circle.

$$CE = DE$$

The tangent at  $D$  is shown.

$ACD$  and  $BCE$  are straight lines.



Prove that  $y = 3x$

[4 marks]

$$\angle CED = 4x \quad (1) \quad (\text{alternate segment theorem})$$

$$\angle ACB = 180^\circ - (90^\circ - x) - y$$

$$= 90^\circ + x - y = \angle DCE \quad (1) \quad (\text{vertically opposite angles are equal})$$

$$\angle DCE = \frac{180 - 4x}{2} \quad (\text{base angles of isosceles are equal})$$

$$\frac{180 - 4x}{2} = 90 + x - y \quad (1)$$

$$180 - 4x = 180 + 2x - 2y$$

$$6x = 2y$$

$$y = 3x \quad (\text{shown})$$

7

Turn over ►



26

 $P$ ,  $Q$  and  $R$  have positive values. $P$  is directly proportional to the square of  $Q$ .When  $P = 1.25$ ,  $Q = 0.5$  $Q$  is inversely proportional to  $R$ .When  $Q = 0.5$ ,  $R = 6$ Work out the value of  $R$  when  $P = 0.8$ **[5 marks]**

$$P = kQ^2$$

$$1.25 = k(0.5)^2$$

$$k = \frac{1.25}{0.5^2} = 5$$

$$Q = \frac{m}{R}$$

$$0.5 = \frac{m}{6}$$

$$m = 3$$

$$P = 5Q^2, \quad Q = \frac{3}{R}$$

$$P = 5\left(\frac{3}{R}\right)^2$$

$$P = 5\left(\frac{9}{R^2}\right) = \frac{45}{R^2}$$

$$0.8 = \frac{45}{R^2}, \quad R^2 = \frac{45}{0.8} = 56.25$$

Answer

$$R = 7.5$$



27

$$x_{n+1} = \sqrt[3]{3x_n + 7}$$

Use a starting value of  $x_1 = 2$  to work out a solution to  $x = \sqrt[3]{3x+7}$

Give your answer to 3 decimal places.

**[3 marks]**

$$x_1 = 2$$

$$x_2 = \sqrt[3]{3(2) + 7} = \sqrt[3]{13} \quad (1)$$

$$= 2.351\dots$$

$$x_3 = \sqrt[3]{3(2.351\dots) + 7}$$

$$= 2.413\dots$$

$$x_4 = \sqrt[3]{3(2.413\dots) + 7} \quad (1)$$

$$= 2.4238\dots$$

$$x_5 = \sqrt[3]{3(2.4238\dots) + 7}$$

$$= 2.4256\dots$$

$$x_6 = \sqrt[3]{3(2.4256\dots) + 7}$$

$$= 2.4259$$

Answer 2.426 (1)

**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**



**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**



**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](http://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 B G 8 3 0 0 / 2 H

IB/M/Nov19/8300/2H