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Centre number

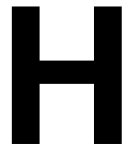
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Surname \_\_\_\_\_

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# GCSE MATHEMATICS



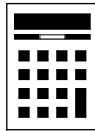
Higher Tier Paper 2 Calculator

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]**

$32x^3$

$12x^3 + 20x^2$

$7x^3 + 9x^2$

$12x^2 + 5$

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

**[1 mark]**

$10^3$

$10^5$

$10^6$

$10^9$

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

**[1 mark]**

$\frac{7}{32}$

$\frac{5}{8}$

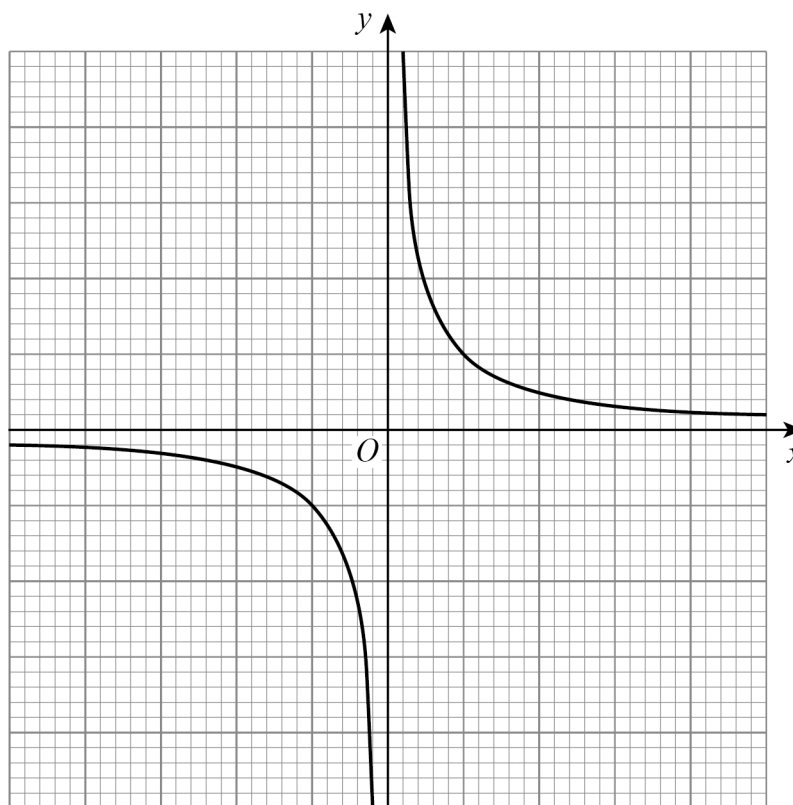
$\frac{2}{3}$

$\frac{1}{2}$



Do not write outside the box

4 Here is the sketch of a graph.



Circle the equation of the graph.

[1 mark]

$y = x$

$y = -x^2$

$y = -x^3$

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

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

[2 marks]

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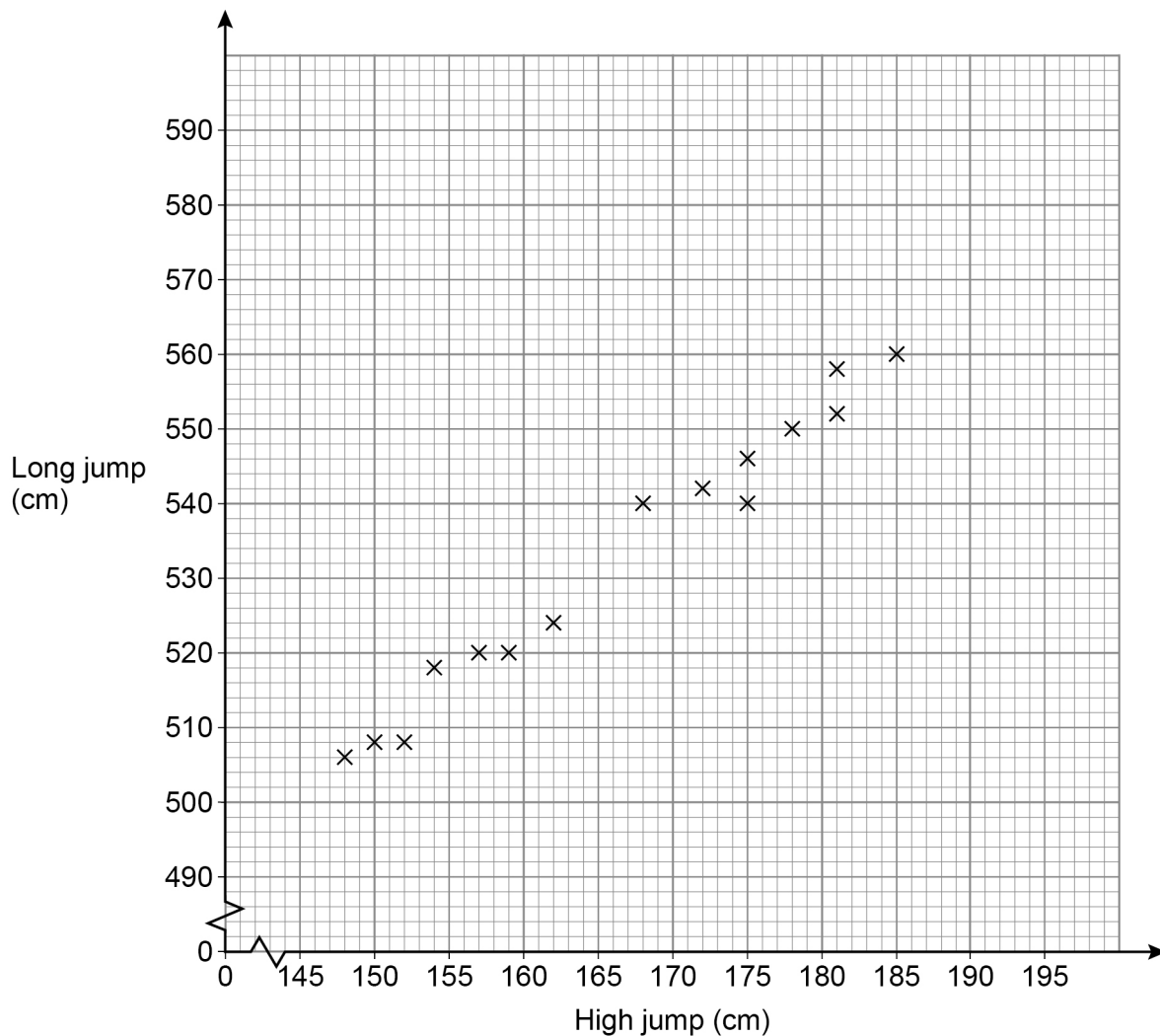
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Answer \_\_\_\_\_

Turn over ►



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 \_\_\_\_\_



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 \_\_\_\_\_ 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]

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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]**

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

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

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$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_



9

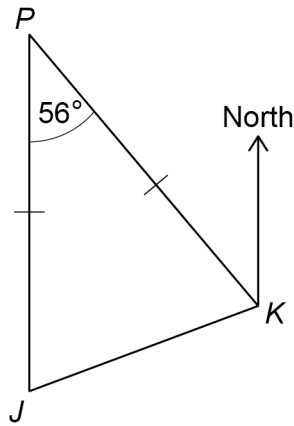
*J* and *K* are ships.

*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]

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Answer \_\_\_\_\_ °

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]**

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Answer \_\_\_\_\_

- 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]**

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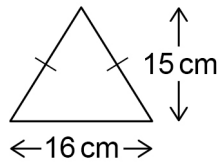
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Answer £ \_\_\_\_\_



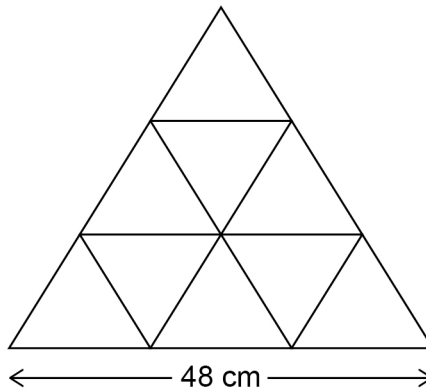


12 An isosceles triangle has base 16 cm and perpendicular height 15 cm



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]

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Answer \_\_\_\_\_ 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		
$30 \leq t < 50$	76		
$50 \leq t < 60$	52		
$60 \leq t < 90$	48		
	Total = 200		

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

**[3 marks]**

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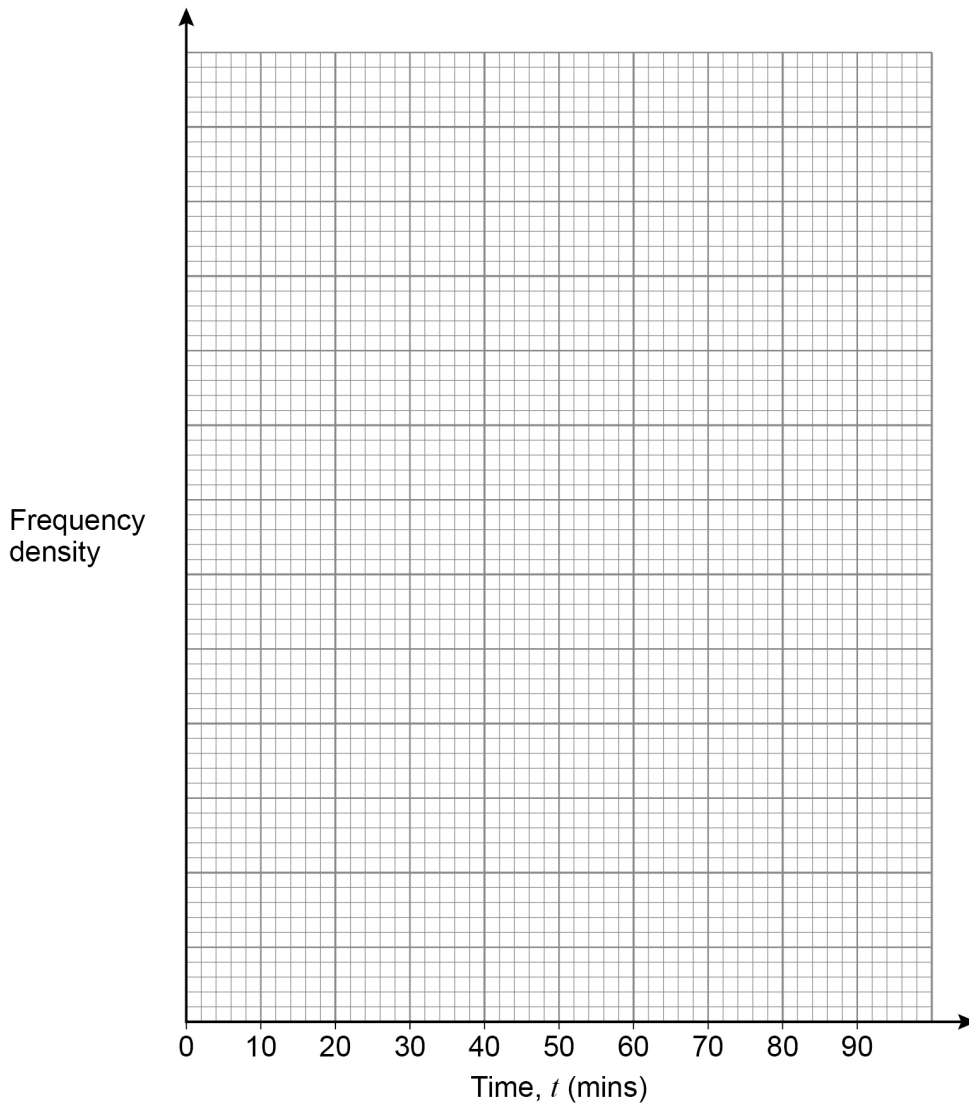
Answer \_\_\_\_\_ mins



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

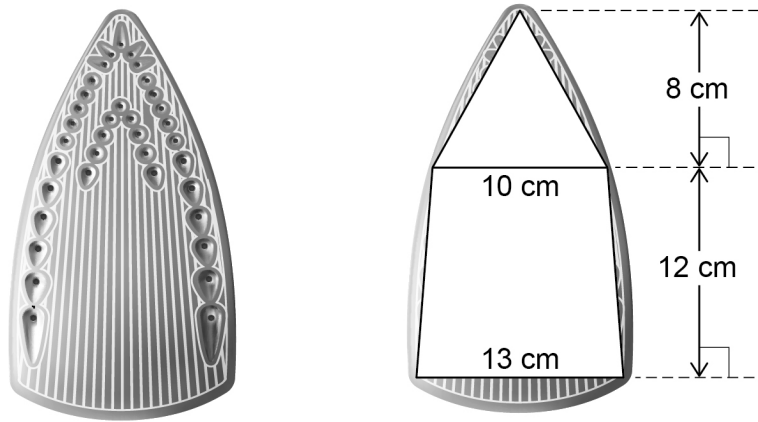
[4 marks]

Time, $t$ (mins)	Frequency	Class width	
$0 \leq t < 30$	24		
$30 \leq t < 50$	76		
$50 \leq t < 60$	52		
$60 \leq t < 90$	48		



- 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]

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Answer \_\_\_\_\_ 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

Give a reason for your answer.

[2 marks]

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

Circle your answer.

[1 mark]

$$w = y^6$$

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

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

$$w = y^5$$

Turn over for the next question

Turn over ►



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

[1 mark]

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**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 mark]

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- 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]**

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Answer \_\_\_\_\_

- 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]**

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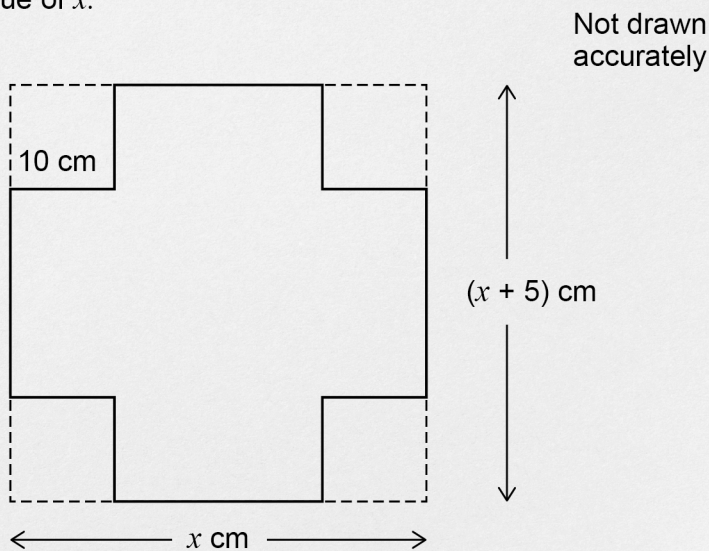
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Answer \_\_\_\_\_



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]

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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.

[1 mark]

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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]**

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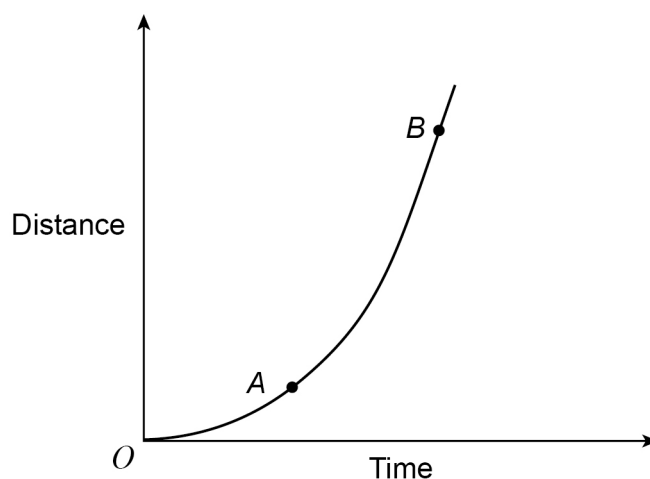
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22

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

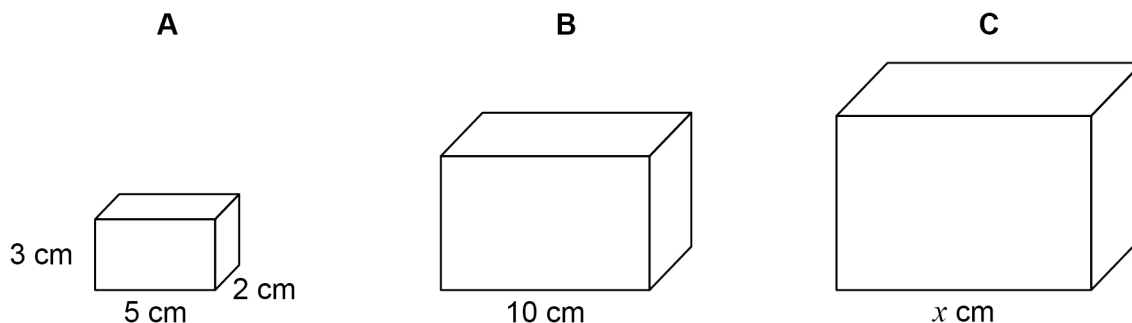


23 Here are three similar cuboids, A, B and C.

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.

$10 \div 5 = 2$ $62 \times 2 = 124$ <p>Total surface area of B = <math>124 \text{ cm}^2</math></p>
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Make **one** criticism of Tim's method.

[1 mark]

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

Work out the value of  $x$ .

[3 marks]

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Answer \_\_\_\_\_

Turn over for the next question

Turn over ►



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]**

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Answer \_\_\_\_\_



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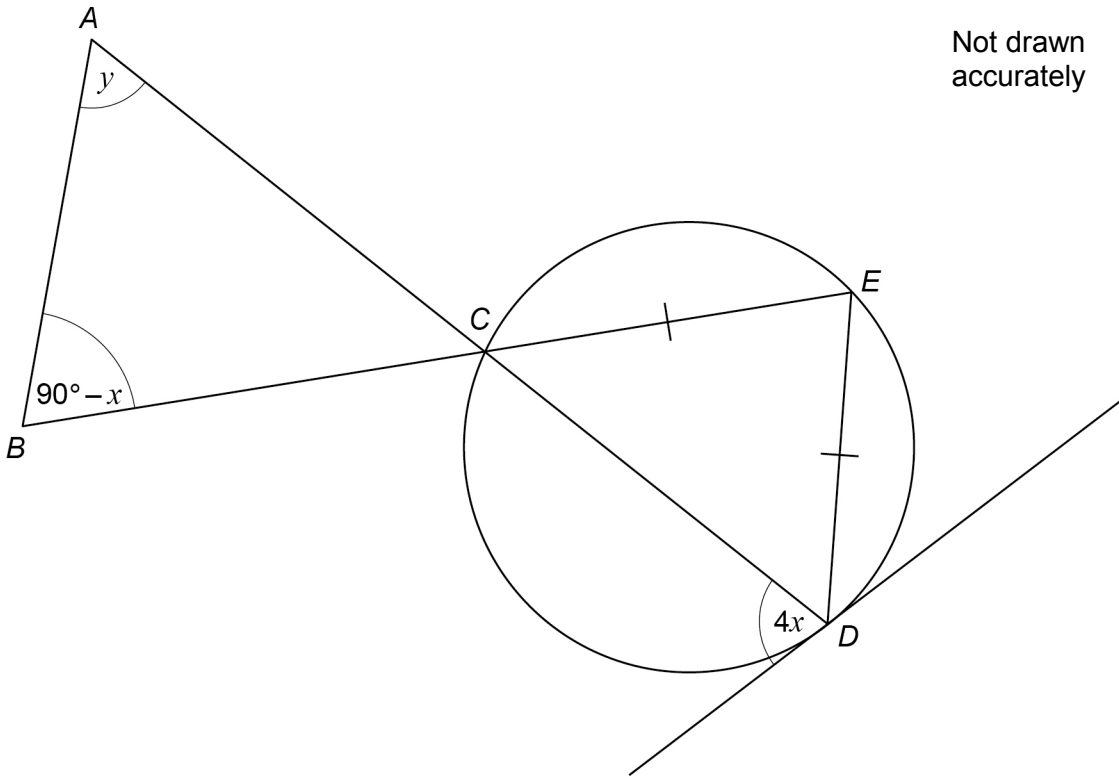
$C$ ,  $D$  and  $E$  are points on a circle.

$CE = DE$

The tangent at  $D$  is shown.

$ACD$  and  $BCE$  are straight lines.

Not drawn  
accurately



Prove that  $y = 3x$

[4 marks]

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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]

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Answer \_\_\_\_\_





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]

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Answer \_\_\_\_\_

END OF QUESTIONS



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2 8



1 9 B G 8 3 0 0 / 2 H

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