AQA

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.

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	
TOTAL	

2

Answer **all** questions in the spaces provided

1 Expand $4x^2(3x + 5)$

Circle your answer.

[1 mark]

$32x^3$ $\qquad$ $\boxed{12x^3 + 20x^2}$ $\qquad$ $7x^3 + 9x^2$ $\qquad$ $12x^2 + 5$

2 How many millimetres are there in a kilometre?

Circle your answer.

1000×1000

[1 mark]

10^3 $\qquad$ 10^5 $\qquad$ $\boxed{10^6}$ $\qquad$ 10^9

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

[1 mark]
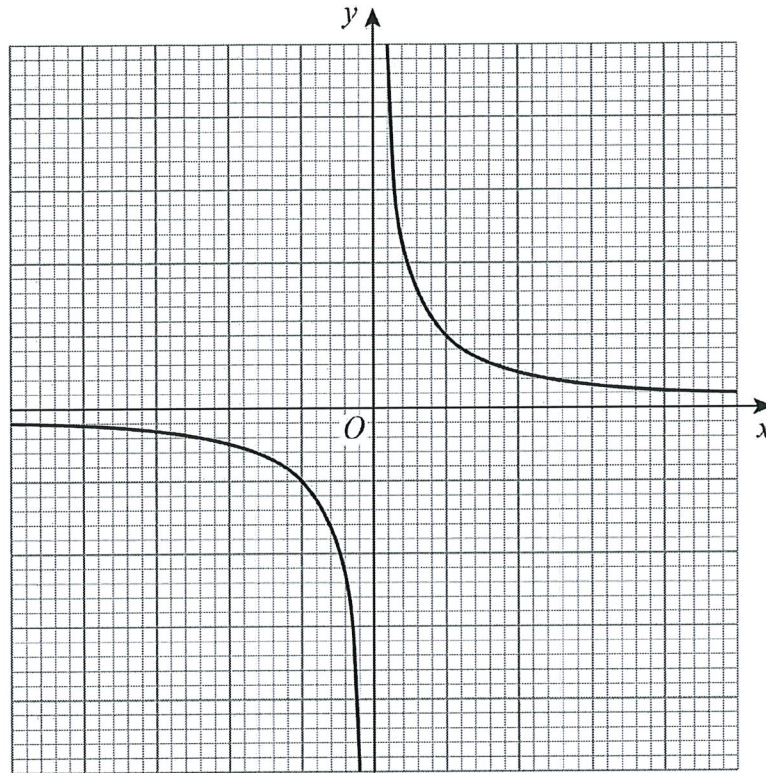
$\dfrac{7}{32}$ $\qquad$ $\dfrac{5}{8}$ $\qquad$ $\boxed{\dfrac{2}{3}}$ $\qquad$ $\dfrac{1}{2}$

4 Here is the sketch of a graph.

Circle the equation of the graph.
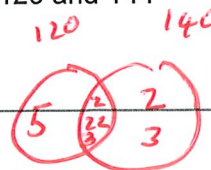
[1 mark]

$y = x$ $y = -x^2$ $y = -x^3$ $\boxed{y = \dfrac{1}{x}}$

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

[2 marks]

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

$144 = 2^4 \times 3^2$

120 140

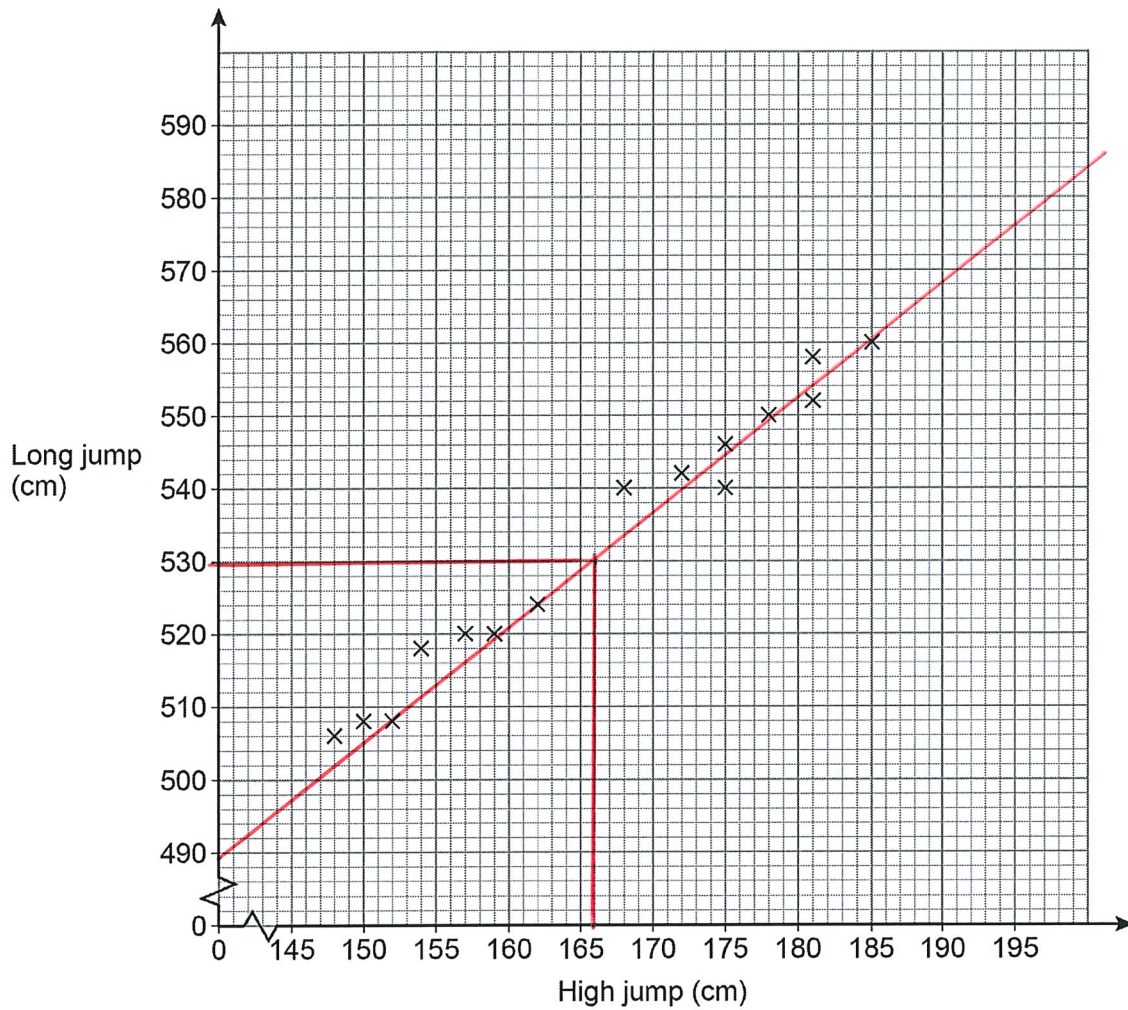5 2^4 3 2

$120 \times 2 \times 3 = 720$

Answer 720

6

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 _Strong positive_

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 _____ 530 _____ 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]

This is outside of the data range, so we would be extrapolating which is unreliable.

Turn over for the next question

4

Turn over ▶

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]

$S = {}^D/_T = {}^{110}/_2 = 55 \text{ mph}$

$T = D/S = 44/55 = 0.8 \text{ hours}$

$0.8 \times 60 = 48 \text{ minutes}$

Answer _____ minutes

8 Here is an identity.

$$a(3x - 10) \equiv 21x + 2b$$

Work out the values of a and b.

[3 marks]

$3ax - 10a \equiv 21x + 2b$

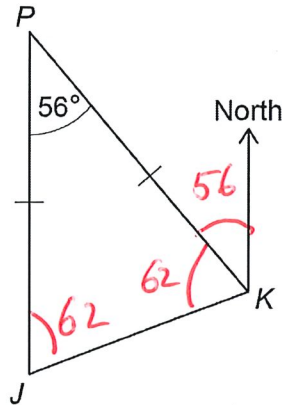So $3a = 21 \Rightarrow a = 7$

$-10a = 2b$

$-70 = 2b \Rightarrow b = -35$

$a =$ _____ $b =$ _____

9   *J* and *K* are ships.

P is a port.

   J is due South of *P*.

   Angle *JPK* = 56°

   JP = *KP*

P

56°

North

56

62   62

62

K

J

Not drawn accurately

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

[3 marks]

360 − 62 − 56 =   242

Answer _____ °

Turn over for the next question

Turn over ▶

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]

⑤ ⑥

17 21

4

$4n + k = 17$

$4 \times 5 + k = 17$

$k = -3$

Answer $\underline{\quad 4n - 3 \quad}$

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.

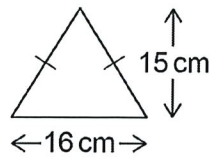You **must** show your working.
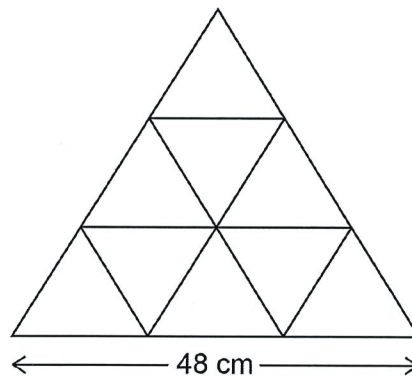
[4 marks]

$120,000 \times 1.05^4 = 145,860.75$

Answer £ $\underline{\quad 150,000 \quad}$

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

15 cm

Not drawn accurately

←16 cm→

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

Not drawn accurately

←——— 48 cm ———→

Work out the perimeter of the large triangle.

[4 marks]

$8^2 + 15^2 = c^2 \Rightarrow c = 17$

$16 \times 3 + 17 \times 6 = 150$

Answer _____ 150 _____ cm

Turn over ▶

13 200 people recorded the time they spent on social media one day.

The table shows the results.

Time, t (mins)	Frequency	Midpoint	fx
$0 \leqslant t < 30$	24	15	360
$30 \leqslant t < 50$	76	40	3040
$50 \leqslant t < 60$	52	55	2860
$60 \leqslant t < 90$	48	75	3600
	Total = 200		9860

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

[3 marks]

$$\frac{9860}{200} = 49.3$$

Answer _____49.3_____ mins

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

[4 marks]

Time, t (mins)	Frequency	Class width	FD = F/cw
$0 \leqslant t < 30$	24	30	0.8
$30 \leqslant t < 50$	76	20	3.8
$50 \leqslant t < 60$	52	10	5.2
$60 \leqslant t < 90$	48	30	1.6

Frequency density

Time, t (mins)

Turn over ▶

7

1 1
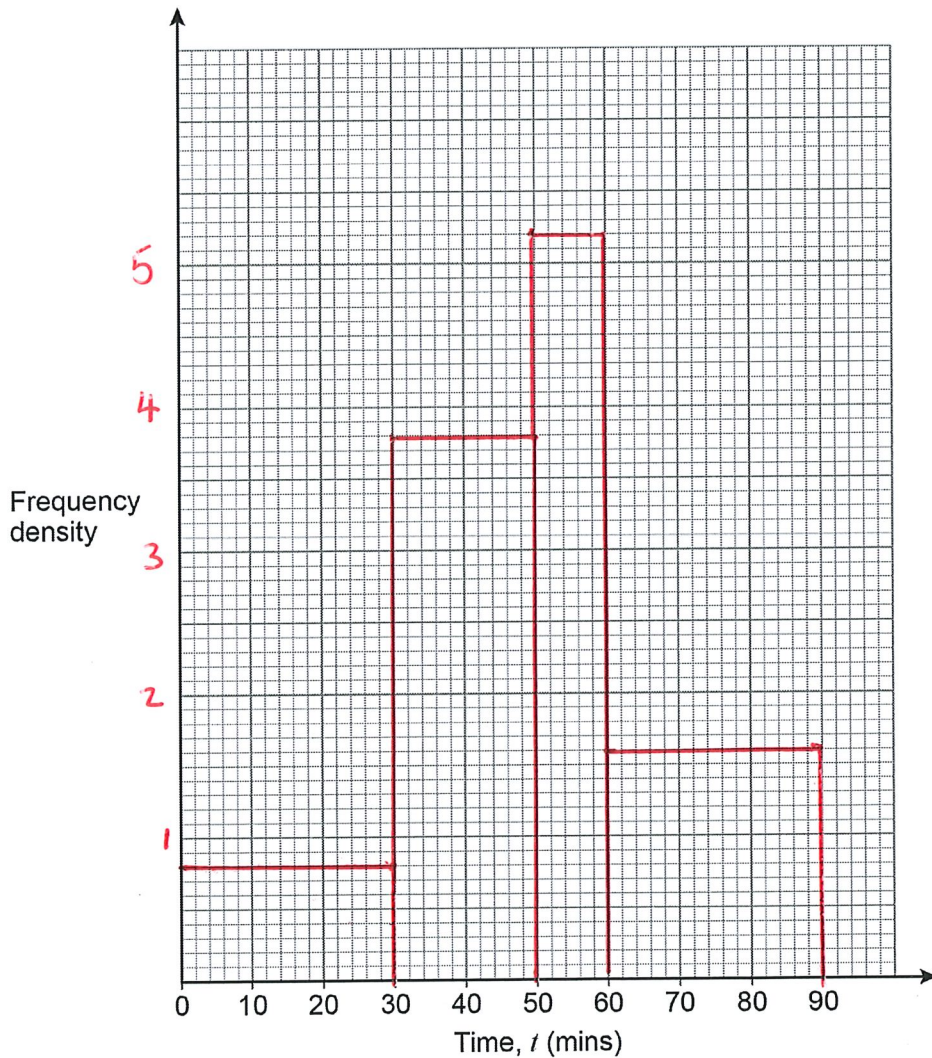
14   Ralf has an iron.

He models the base as a triangle joined to a trapezium.

Not drawn accurately

8 cm

10 cm

12 cm

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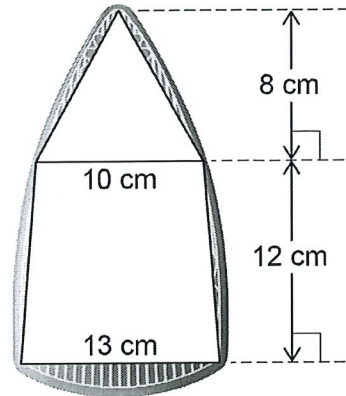
14 (a)   The iron applies a force of 25 newtons (N)

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

Work out the pressure using Ralf's model.

[4 marks]

Area $\dfrac{8 \times 10}{2} + \dfrac{(10+13) \times 12}{2}$

$= 40 + 138 = 178$

Pressure $= \dfrac{25}{178} = 0.1404494382$

Answer _____0.140_____ N/cm²

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]

Area actually bigger, so dividing by a larger area.

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

Circle your answer.

[1 mark]

$w = y^6$ $\boxed{w = \sqrt[3]{y^2}}$ $w = \sqrt{y^3}$ $w = y^5$

Turn over for the next question

7

Turn over ▶

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

[1 mark]

$a\%$ of $b \qquad \dfrac{b}{100} \times a = \dfrac{ab}{100}$

$b\%$ of $a \qquad \dfrac{a}{100} \times b = \dfrac{ab}{100} \quad$ equivalent

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]

Not a and b % $\quad 100+a$ and $100+b$

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(lemon or orange) ⩽ 0.85

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

[2 marks]

If P(L or O) = 0.85

P(A) = 0.15

0.15 × 80 = 12

Answer _____12_____

17 (b) P(lemon or apple) < 0.71

There are 31 lemon sweets.

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

[2 marks]

$^{31}/80$ = 0.3875

0.71 − 0.3875 = 0.3225

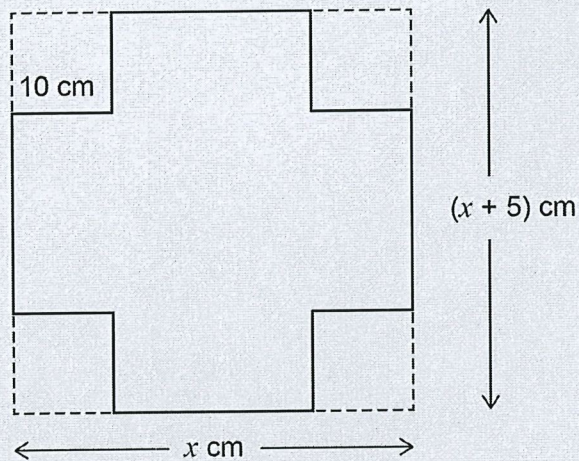0.3225 × 80 = 25.8

Answer _____25_____

6

Turn over ▶

1 5

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 cm^2

Work out the value of x.

Not drawn accurately

10 cm

$(x + 5)$ cm

x cm

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

[3 marks]

$1000 = x(x+5) - 4 \times 10 \times 10$

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

$0 = x^2 + 5x - 1400$

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]

If we substitute these values in we get zero as the answer.

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)

6

Turn over ▶

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]

$$(n-1), \quad n, \quad (n+1)$$

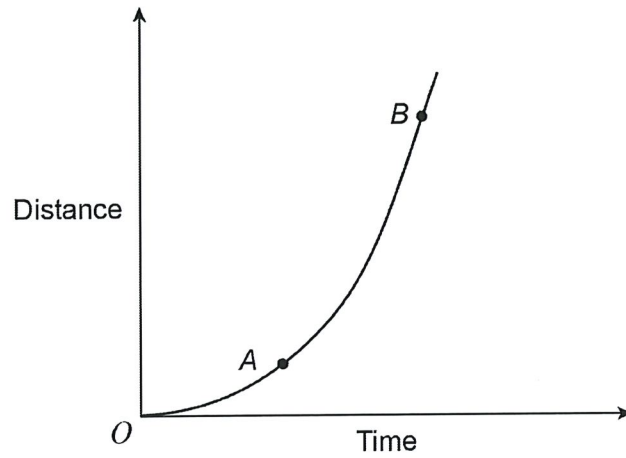$$(n-1)\,n\,(n+1) + n$$

$$(n^2-n)(n+1) + n$$

$$n^3 + n^2 - n^2 - n + n$$

$$\underline{\underline{n^3}}$$

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*
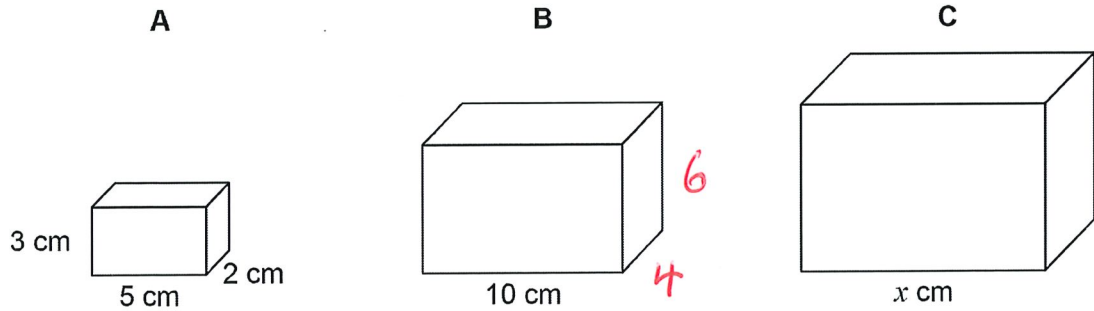
Turn over for the next question

5

Turn over ▶

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

A

B

C

3 cm

5 cm   2 cm

6

10 cm   4

x cm

23 (a) The total surface area of A is 62 cm^2

Tim wants to work out the total surface area of B.

Here is his working.

$10 \div 5 = 2$ ✓

$62 \times 2 = 124$

Total surface area of B $= 124$ cm^2

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

[1 mark]

need to multiply 62 by 2², rather than by 2.

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

Work out the value of x.

[3 marks]

$3 \times 5 \times 2 \quad \times \dfrac{125}{8} = 468.75$

Answer _____

Turn over for the next question

Turn over ▶

4

24 Here are two inequalities.

$$-2 \leqslant x \leqslant 3$$

$$9 \leqslant x + y \leqslant 11$$

x and y are integers.

Work out the **greatest** possible value of $y - x$

[3 marks]

*want y largest possible and x smallest possible,
so let x = 3 and y ⇒ -2 + y = 11
y = 13*

so 13 - ⁻2 = 15

Answer _____

25   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

[figure: circle with points C, D, E and triangle through A, B. Annotations in red: 90−2x near C, 180−4x and below it ÷2 = 90−2x, 4x near E, 4x at D. Angle y at A, angle 90°−x at B.]
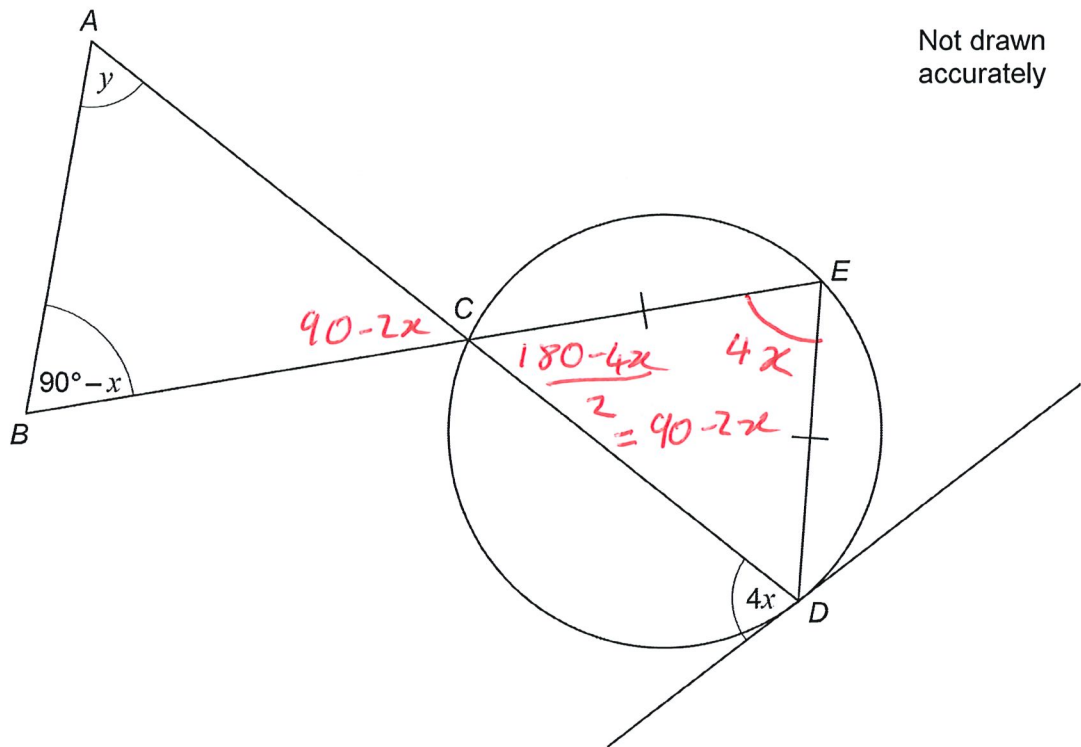
Prove that $y = 3x$

[4 marks]

$180 = y + 90 - x + 90 - 2x$

$0 = y - 3x$

$y = 3x$

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]

$$P \propto Q^2$$
$$P = k Q^2$$
$$1.25 = k \times 0.5^2$$
$$k = 5$$

$$P = 5Q^2$$

Answer _____

27 $\quad x_{n+1} = \sqrt[3]{3x_n + 7}$

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]

$x_1 = 2$

$x_2 = \sqrt[3]{3 \times 2 + 7} = 2.35133\,4688$

$x_3 = 2.413237275$

$x_4 = 2.423820198$

$x_5 = 2.425620238$

$x_6 = 2.4259\,2614$

$x_7 = 2.425978118$

$x_8 = 2.42598695$

$x_9 = 2.42598845$

Answer $\quad 2.426$

END OF QUESTIONS

8