



Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

Thursday 24 May 2018

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments



You must **not** use a calculator.

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.



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IB/M/Jun18/E8

8300/1H

Answer all questions in the spaces provided

- 1 Work out $\sqrt[3]{64 \times 1000}$ $\sqrt[3]{64000}$
Circle your answer. ~~4200~~ $40 \times 40 \times 40$
 $64 \ 000$ [1 mark]
- (40) 80 400 4000

- 2 The vector $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ translates A to B.
Circle the vector that translates B to A. $\times -1$ [1 mark]
- $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$

- 3 Circle the expression that is equivalent to $3a - (a \times 4a) + 2a$ [1 mark]
 $-4a^2$
- $8a^2 + 2a$ $12a^2$ $5a - 4a^2$ $3a - 6a^2$



- 4 Circle the number that is closest in value to $\frac{9.8}{0.0195}$ [1 mark]

5

50

500

5000

- 5 Solve $5(x + 3) < 60$ [2 marks]

$$5x + 15 < 60$$

$$\quad -15 \quad -15$$

$$5x < 45$$

$$x < 9$$

Answer $x < 9$

Turn over for the next question

Turn over ►



6

The height of Zak is 1.86 metres.

The height of Fred is 1.6 metres.

Write the height of Zak as a fraction of the height of Fred.

Give your answer in its simplest form.

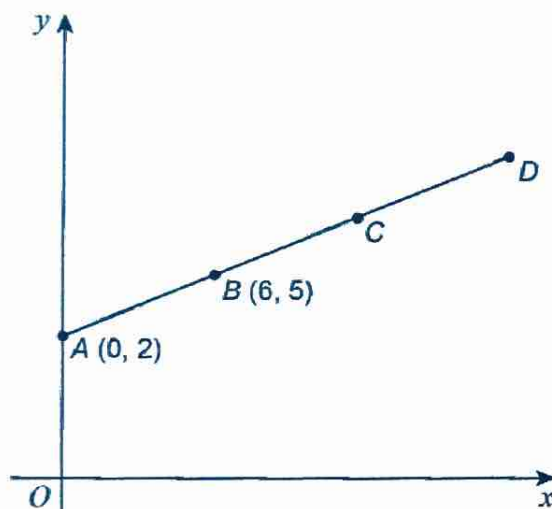
[3 marks]

Zak = 1.86 m	F : Z
Fred = 1.6 m	1 $\frac{1.86}{1.6}$
	1 : $\frac{186}{160}$

Answer $\frac{186}{160}$



- 7 $A(0, 2)$ and $B(6, 5)$ are points on the straight line $ABCD$.



Not drawn
accurately

$$AB = BC = CD$$

Work out the coordinates of D .

[3 marks]

$$+6 \left(\begin{array}{c} 0 \\ 6 \end{array} , \begin{array}{c} 2 \\ 5 \end{array} \right) + 3$$

$$+6 \left(\begin{array}{c} 12 \\ 8 \end{array} , \begin{array}{c} 8 \\ 8 \end{array} \right) + 3 = C$$

$$+6 \left(\begin{array}{c} 18 \\ 11 \end{array} , \begin{array}{c} 11 \\ 11 \end{array} \right) + 3 = D$$

Answer $(\underline{18} , \underline{11})$

Turn over for the next question

Turn over ►



- 8 A coin is thrown 50 times.
It lands on heads 31 times.

- 8 (a) Write down the relative frequency it lands on heads.

$$\frac{31}{50} = \frac{62}{100}$$

[1 mark]

Answer _____ 0.62 _____

- 8 (b) Raj says,

"The coin is biased towards heads."

Use the data to give a reason why he might be correct.

[1 mark]

Heads and tails should be roughly equal
31 >> 19 not ver equal.



9 The range of a set of numbers is $15\frac{1}{4}$

The smallest number is $-2\frac{7}{8}$

Work out the largest number.

[3 marks]

$$-2\frac{7}{8} + 15\frac{1}{4}$$

$$15\frac{1}{4} + -2\frac{7}{8}$$

$$15 + -2 = 13$$

$$\frac{1}{4} + \frac{7}{8}$$

$$\frac{2}{8} + \frac{7}{8} = \frac{9}{8} = 1\frac{1}{8}$$

$$13 - \frac{5}{8} = 12\frac{3}{8}$$

Answer $12\frac{3}{8}$

10 y is inversely proportional to x .

Complete the table.

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

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

$$4 = \frac{k}{6}$$

$$k = 24$$

[2 marks]

$$y = \frac{24}{x}$$

$$y = \frac{24}{12} = 2$$

$$8 = \frac{24}{x}$$

x	12	6	3
y	2	4	8

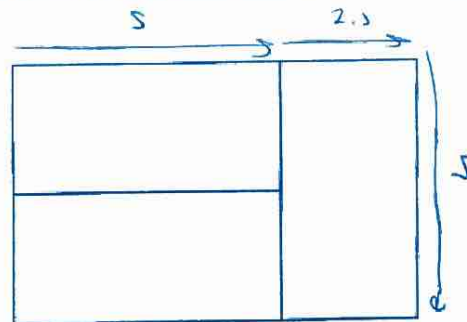
Turn over for the next question

Turn over ►



11

A large rectangle is made by joining three identical small rectangles as shown.

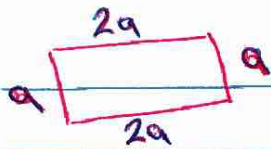


Not drawn
accurately

The perimeter of one small rectangle is 15 cm

Work out the perimeter of the large rectangle.

[4 marks]



~~2a + 2a + a + a = 15~~

$$2a + 2a + a + a = 15$$

$$6a = 15$$

$$a = 2.5$$



$$(s + 2.5 + s) \times 2 = 2s$$

Answer 25 cm



12 Put these numbers in order from smallest to largest.

$$8 \times 10^{-4} \quad 4 \times 10^{-2} \quad 6 \times 10^{-4} \quad 0.07$$

$$0.0008 \quad 0.04 \quad 0.0006$$

[2 marks]

Smallest 6×10^{-4} , ~~8×10^{-4}~~ , ~~4×10^{-2}~~ , ~~0.07~~

$$8 \times 10^{-4}$$

$$4 \times 10^{-2}$$

Largest 0.07

13 Circle the volume that is the same as 15 cm^3

[1 mark]

$$15\,000 \text{ mm}^3$$

$$1.5 \text{ mm}^3$$

$$0.0015 \text{ mm}^3$$

$$150 \text{ mm}^3$$

Turn over for the next question

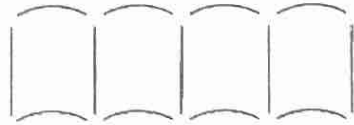
Turn over ►



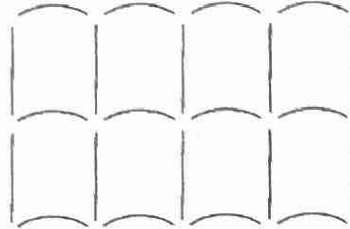
14 Patterns are made using straight lines and arcs.

14 (a)

Pattern A (one row)



Pattern B (two rows)



More rows are added to Pattern B so that
 number of straight lines : number of arcs = 10 : 9

How many rows are added?

[2 marks]

R1	3	8
R2	10	12
3	15	16
4	20	20
5	25	24
6	30	28
7	35	32
8	40	36
9	45	40

$10:9$ (pointing to row 8)
 $9:8$ (pointing to row 9)

Answer 6



Do not write
outside the
box

14 (b) A different pattern is made using 20 straight lines and 16 arcs.

The straight lines and arcs are made from metal.

20 straight lines cost £12

cost of one straight line : cost of one arc = 2 : 3

Work out the total cost of the metal in the pattern.

[3 marks]

$sl : arc$ $20 sl = £12$

 $2 : 3$ $12 \div 20 = £0.6$ per straight line
 $12 : 18$ 0.9 per curved

 $0.6 : 0.9$ $£12 + (0.9 \times 16) = 26.4$

Answer £ 26.4

Turn over for the next question



15

A biased dice is thrown.

Here are the probabilities of each score.

Score	1	2	3	4	5	6
Probability	0.25	0.05	0.15	0.05	0.3	0.2

The dice is thrown 200 times.

Work out the expected number of times the score will be odd.

[3 marks]

$$\text{Even} = 0.05 + 0.05 + 0.2 = 0.3$$

$$\text{Odd} = 0.25 + 0.15 + 0.3 = 0.7$$

$$0.7 \times 200 = 140$$

Answer 140

16

The value of y is 20% more than the value of x .

$$\begin{aligned} x &: y \\ 1 &: 1.2 \\ 5 &: 6 \end{aligned}$$

Circle the ratio $x : y$

[1 mark]

5 : 6

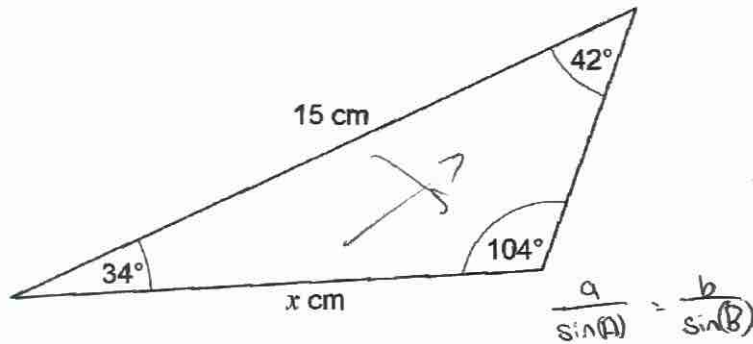
6 : 5

4 : 5

5 : 4

17

Here is a triangle.

Not drawn
accurately

Circle the correct equation.

[1 mark]

~~$$\frac{\sin x}{42} = \frac{\sin 15^\circ}{104}$$~~

$$\frac{x}{\sin 42^\circ} = \frac{15}{\sin 104^\circ}$$

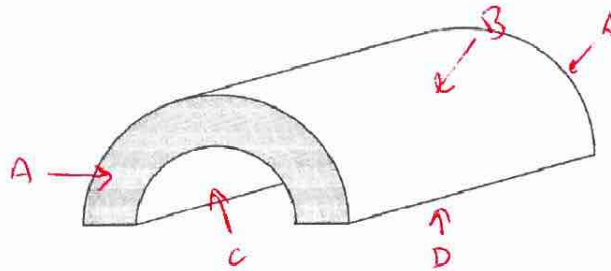
~~$$\frac{\sin x}{34} = \frac{\sin 15^\circ}{104}$$~~

$$\frac{x}{\sin 42^\circ} = \frac{15}{\sin 34^\circ}$$

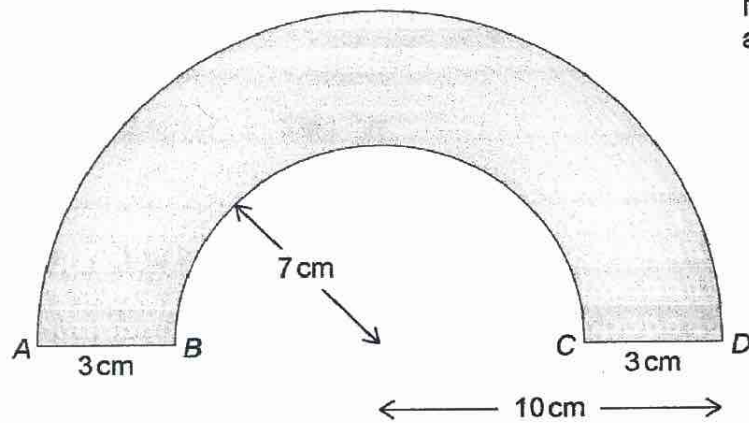


18

Here is a tunnel for a toy train.



The diagram below shows the cross section of the tunnel.

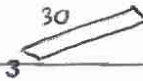
 AD is a semicircular arc of radius 10 cm BC is a semicircular arc of radius 7 cm

The length of the tunnel is 30 cm

Work out the total area of all six faces of the tunnel.

Give your answer in terms of π .**[5 marks]**

A)  $\times 2$

D)  $+ 2$

B) Outer

C) Inner

A)
$$\frac{(\pi \times 10^2) - (\pi \times 7^2)}{2} \times 2 = 100\pi - 49\pi = 51\pi$$

b)
$$\frac{\pi D + L}{2} = \frac{\pi \times 20 + 30}{2} = \frac{600\pi}{2} + 300\pi$$

c)
$$\frac{\pi D + L}{2} = \frac{\pi \times 14 + 30}{2} = \frac{840\pi}{2} + 210\pi$$

$$51\pi + 300\pi + 210\pi = 561\pi$$

D)
$$3 \times 30 + 2 = 180$$

Final answer
$$561\pi + 180$$

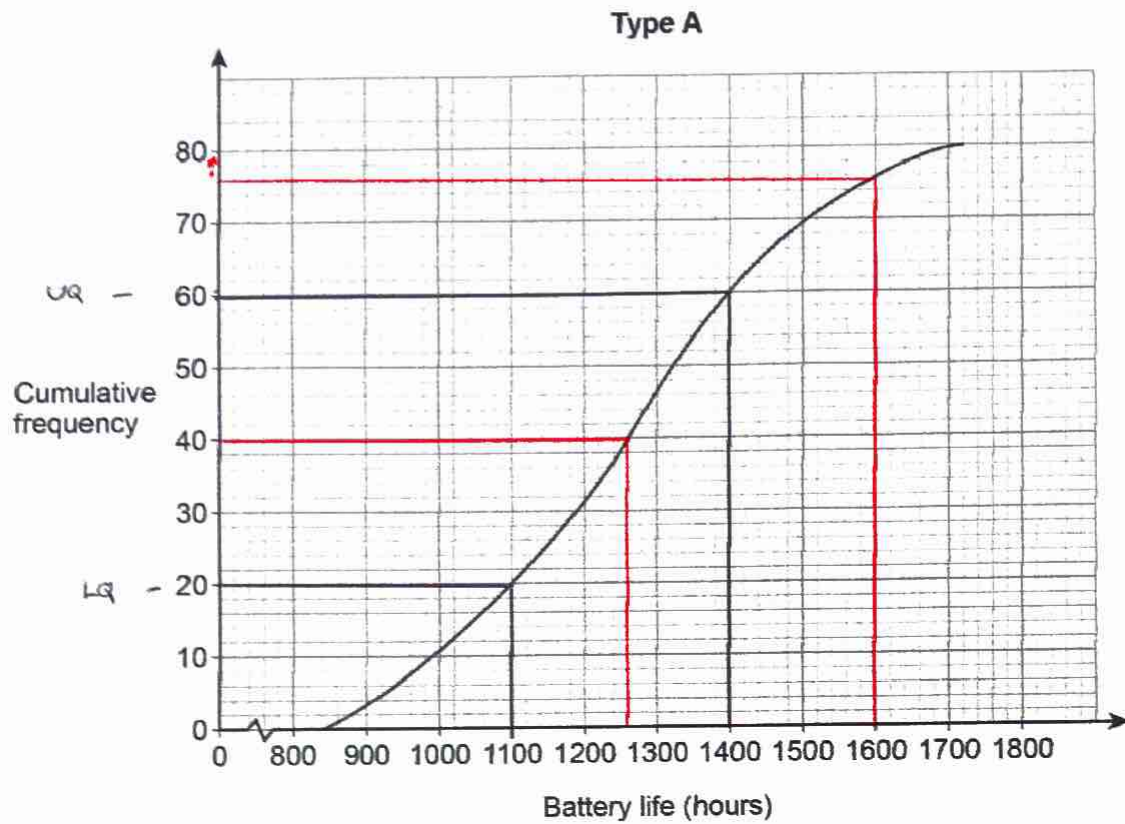
Answer
$$561\pi + 180 \text{ cm}^2$$



19

Type A batteries and type B batteries were tested.

The cumulative frequency diagram shows information about the battery life of type A.



19 (a) Estimate the interquartile range for type A.

[2 marks]

$$1400 - 1100 = 300$$

Answer 300 hours

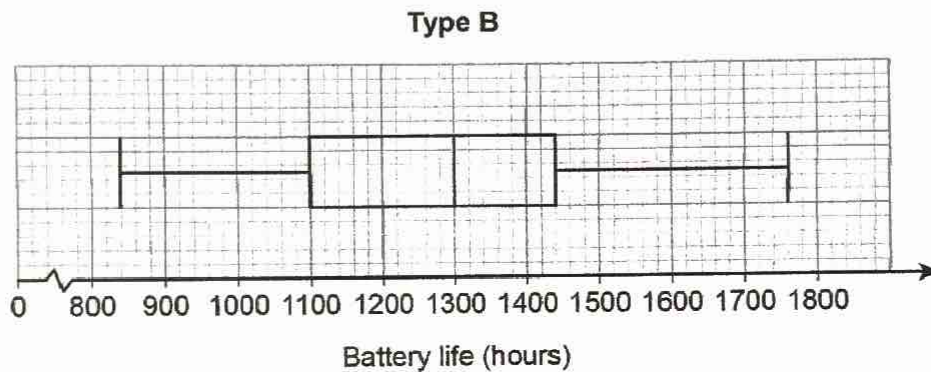


- 19 (b) Estimate the number of type A batteries that had a battery life of more than 1600 hours.

[1 mark]

Answer 4

- 19 (c) The box plot shows information about the battery life of type B.



On average, which type had the greater battery life?

Tick a box.

type A

type B

Using data from **both** diagrams, state how you chose your answer.

[2 marks]

Median A = 1260

Median B = 1300

$1300 > 1260$

B has 40 hours greater median than A.

Turn over ►



20

A linear sequence starts

$$a + 2b \quad a + 6b \quad a + 10b \quad a + 14b \quad a + 18b$$

The 2nd term has value 8

The 5th term has value 44

Work out the values of a and b .

[4 marks]

$$\begin{array}{l} \text{2nd term} \quad 8 \quad a + 6b = 8 \\ \text{5th term} \quad 44 \quad a + 18b = 44 \end{array}$$

$$a + 18b = 44$$

$$a + 6b = 8$$

$$a + 6(x3) = 8$$

$$12b = 36$$

$$a + 18 = 8$$

$$b = 3$$

$$-18 \quad -18$$

$$a = -10$$

$$a = \underline{\quad -10 \quad}$$

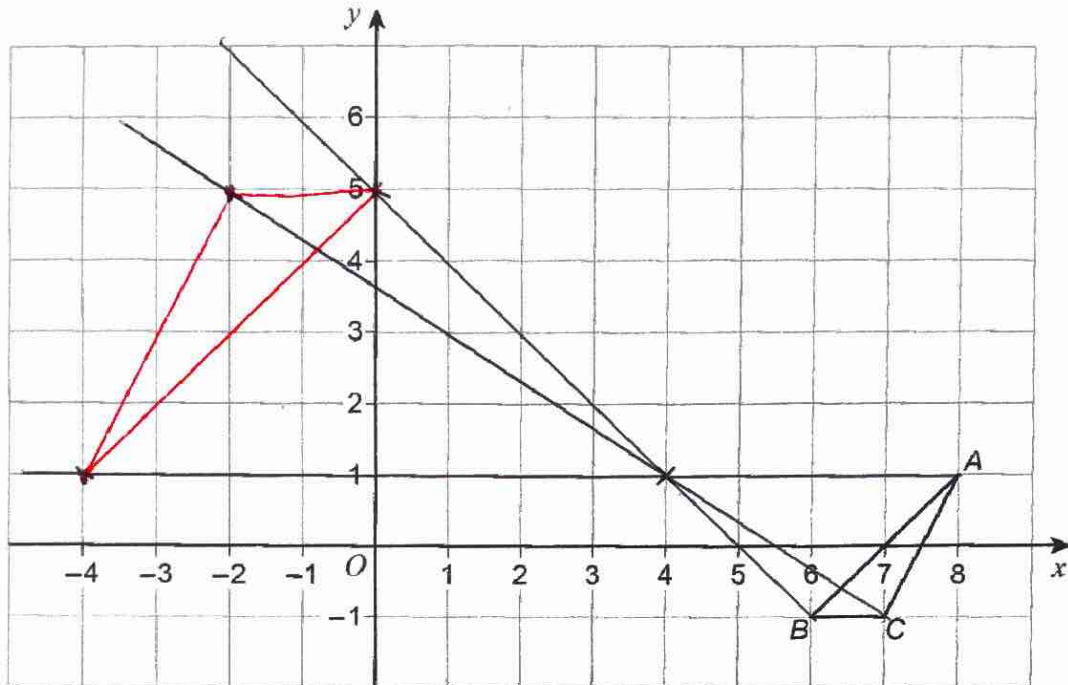
$$b = \underline{\quad 3 \quad}$$



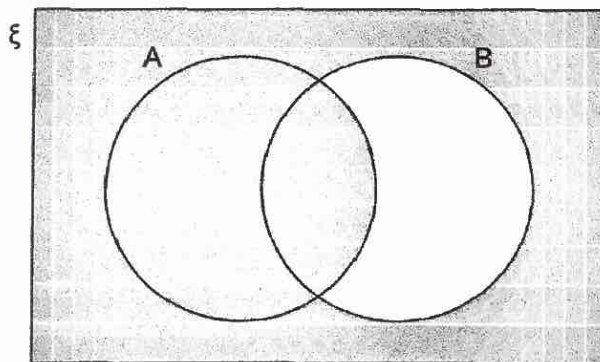
21

Enlarge triangle ABC by scale factor -2 , centre $(4, 1)$

[2 marks]



22



Which of these represents the shaded region?

Circle your answer.

[1 mark]

$A \cap B'$

B'

$A \cup B'$

$A' \cup B'$

7

Turn over ►



23

A shopkeeper compares the income from sales of a laptop in March and April.

April

Price	$\frac{1}{5}$ more than March
Number sold	$\frac{1}{4}$ less than March

By what fraction does the income from these sales decrease in April?

[3 marks]

	march	April	
price	$\frac{5}{5}$	$\frac{6}{5}$	$April = \frac{6}{5} \times \frac{3}{4} = \frac{18}{20} = \frac{9}{10}$
sdld	$\frac{4}{4}$	$\frac{3}{4}$	

$$1 - \frac{9}{10} = \frac{1}{10}$$

$$march = \frac{5}{5} \times \frac{4}{4} = 1$$

Answer $\frac{1}{10}$ 

24 (a)

Work out the value of

$$2^{14} \div (2^9)^2 \quad 2 \times 9$$

Give your answer as a fraction in its simplest form.

[3 marks]

$$2^{14} \div 2^{18} = 2^{14-18} = 2^{-4}$$

$$\frac{1}{2^4} = \frac{1}{16}$$

Answer $\frac{1}{16}$

24 (b)

Work out the value of

$$25^{\frac{3}{2}}$$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m}$$

[2 marks]

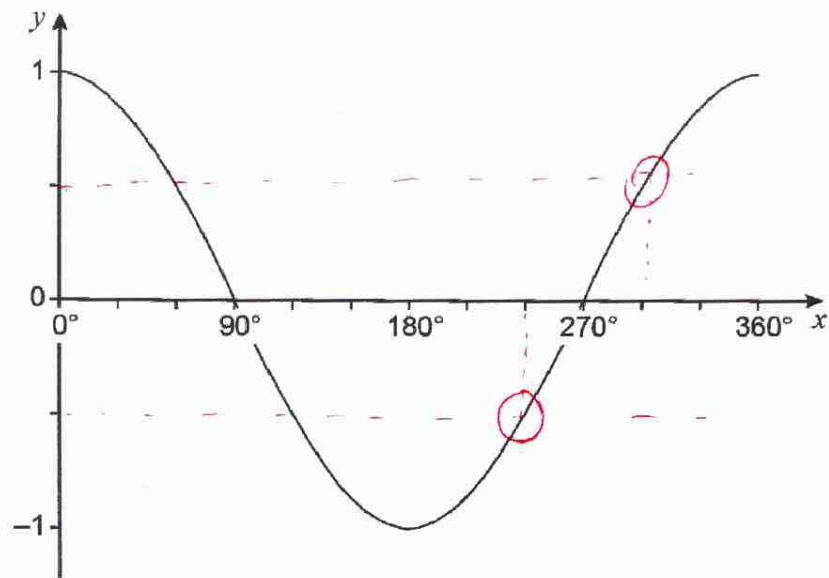
$$25^{\frac{3}{2}} = \sqrt{25^3} = 5^3 = 125$$

Answer 125

Turn over for the next question



25

Here is a sketch of the graph of $y = \cos x$ for values of x from 0° to 360° 

25 (a) $\cos x = \cos 60^\circ$

Work out the value of x when $90^\circ \leq x \leq 360^\circ$

[1 mark]

Answer 300 degrees

25 (b) $\cos x = -\cos 60^\circ$

Work out the value of x when $180^\circ \leq x \leq 360^\circ$

[1 mark]

Answer 240 degrees

26

 b is two thirds of c .

$$5a = 4c$$

Work out the ratio $a : b : c$ Give your answer in its simplest form where a , b and c are integers.

[3 marks]

$$b = \frac{2}{3}c$$

$$a = \frac{4}{5}c$$

$$b : c$$

$$a : c$$

$$\times 3 \left(\frac{2}{3} : 1 \right)$$

$$\times 5 \left(\frac{4}{5} : 1 \right)$$

$$\times 5 \left(\begin{array}{l} 2 : 3 \\ \downarrow \times 5 \\ 10 : 15 \end{array} \right)$$

$$\times 3 \left(\begin{array}{l} 4 : 5 \\ \downarrow \times 3 \\ 12 : 15 \end{array} \right)$$

← the same

$$\text{Answer } \underline{12} : \underline{10} : \underline{15}$$

$$a \qquad b \qquad c$$

Turn over for the next question

Turn over ►



27 (a) Jo wants to work out the solutions of $x^2 + 3x - 5 = 0$

She says,

"The solutions cannot be worked out because $x^2 + 3x - 5$ does not factorise to $(x + a)(x + b)$ where a and b are integers."

Is Jo correct?

Tick a box.

Yes

No

Give a reason for your answer.

[1 mark]

Not all quadratics can be factorised to give a & b
as integers.

It can still be solved by the quadratic formula/
completing the square

27 (b) Without expanding any brackets,

show how to work out the exact solutions of $9(x + 3)^2 = 4$

Give the solutions.

[3 marks]

$$9(x + 3)^2 = 4$$

$$\div 9 \qquad \div 9$$

$$(x + 3)^2 = \frac{4}{9}$$

$$\sqrt{\quad} \qquad \sqrt{\quad}$$

$$x + 3 = \frac{\sqrt{4}}{\sqrt{9}} = x + 3 = \pm \frac{2}{3}$$

$$-4 \qquad -4$$

$$x = \pm \frac{2}{3} - 4$$

$$x_1 = -\frac{7}{3} \qquad x_2 = -\frac{11}{3}$$



28

Simplify $\sqrt{80} + \sqrt{2\frac{2}{9}}$ Give your answer in the form $\frac{a\sqrt{5}}{b}$ where a and b are integers.

[3 marks]

$$\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5} \quad \leftarrow \text{need to get } \frac{4}{3}$$

$$\sqrt{2\frac{2}{9}} = \sqrt{\frac{20}{9}} = \frac{\sqrt{20}}{\sqrt{9}} = \frac{\sqrt{4 \times 5}}{3} = \frac{2\sqrt{5}}{3}$$

$$\frac{12\sqrt{5}}{3} + \frac{2\sqrt{5}}{3} = \frac{14\sqrt{5}}{3}$$

Answer $\frac{14\sqrt{5}}{3}$

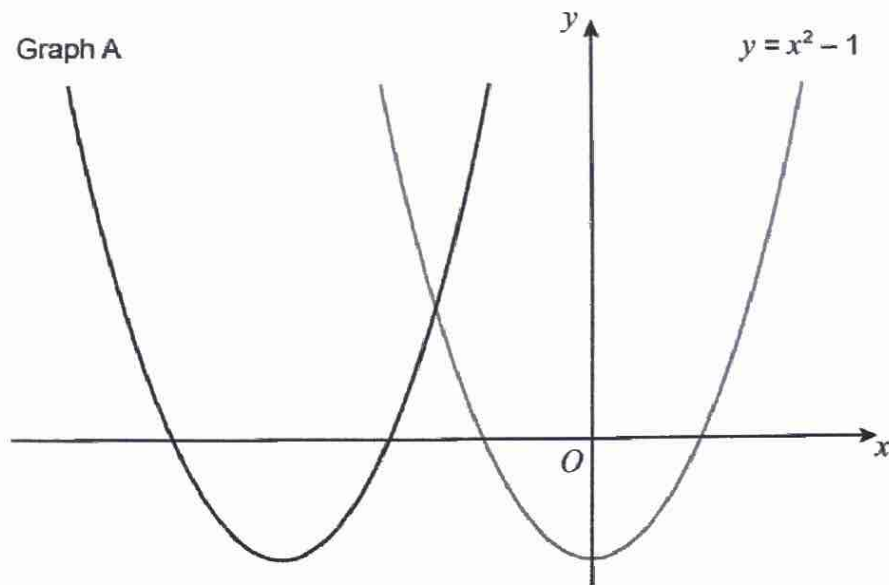
Turn over for the next question

Turn over ►



29

Here are sketches of two graphs.



The graph of $y = x^2 - 1$ is translated 3 units to the left to give graph A.
x - shift

29 (a) The equation of graph A can be written in the form $y = x^2 + bx + c$

Work out the values of b and c .

[3 marks]

*3 places
last man
+ 3*

$$y = (x + 3)^2 - 1$$

$$y = (x + 3)(x + 3) - 1$$

$$y = x^2 + 6x + 9 - 1$$

$$y = x^2 + 6x + 8$$

$$b = \underline{\quad 6 \quad}$$

$$c = \underline{\quad 8 \quad}$$



29 (b) The graph of $y = x^2 - 1$ is reflected in the x -axis to give graph B.

Work out the equation of graph B.

[1 mark]

$$y = -(x^2 - 1)$$

$$y = -x^2 + 1$$

Answer $y = -x^2 + 1$

30 Show that the value of $\cos 30^\circ \times \tan 60^\circ + \sin 30^\circ$ is an integer.

[3 marks]

$$\sqrt{3} \times \sqrt{3} = 3$$

$$\frac{\sqrt{3}}{2} \times \sqrt{3} + \frac{1}{2}$$

$$\frac{\sqrt{3} \times \sqrt{3}}{2} = \frac{3}{2} + \frac{1}{2} = 2$$

$$\frac{3}{2} + \frac{1}{2} = \frac{4}{2} = 2$$

END OF QUESTIONS

