AQA

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.

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	
26–27	
TOTAL	

Answer **all** questions in the spaces provided

1 Work out $\sqrt[3]{64 \times 1000}$

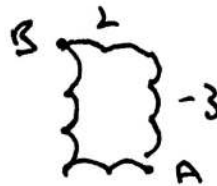Circle your answer.

4 × 10

[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.

[1 mark]

$\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ $\left(\begin{pmatrix} 2 \\ -3 \end{pmatrix}\right)$

3 Circle the expression that is equivalent to $3a - a \times 4a + 2a$

[1 mark]

$8a^2 + 2a$ $12a^2$ $\left(5a - 4a^2\right)$ $3a - 6a^2$

4   Circle the number that is closest in value to $\dfrac{9.8}{0.0195}$

$\dfrac{1000}{2}$

[1 mark]

5   50   (500)   5000

5   Solve $5(x + 3) < 60$

[2 marks]

$$5x + 15 < 60$$
$$5x < 45$$
$$x < 9$$

Answer $x < 9$

Turn over for the next question

6

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.

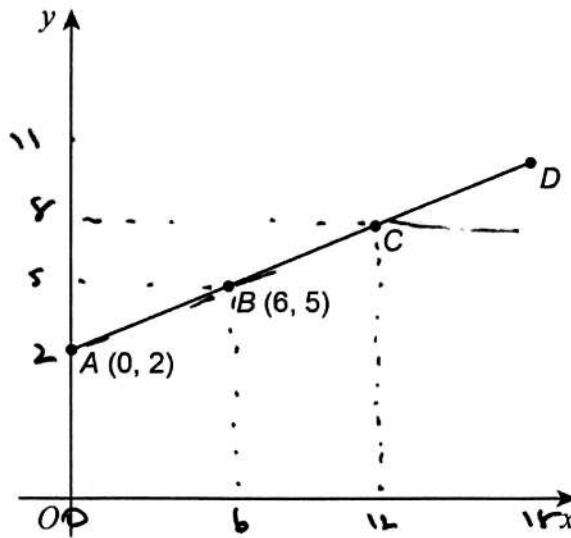Give your answer in its simplest form.

[3 marks]

$$\frac{1.86}{1.6} = \frac{186}{160} = \frac{93}{80} = 1\frac{13}{80}$$

Answer _____

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]

$(18, 11)$

Answer   (_____ , _____)

Turn over for the next question

6

8 A coin is thrown 50 times.

It lands on heads 31 times.

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

[1 mark]

Answer $\frac{31}{50}$ 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]
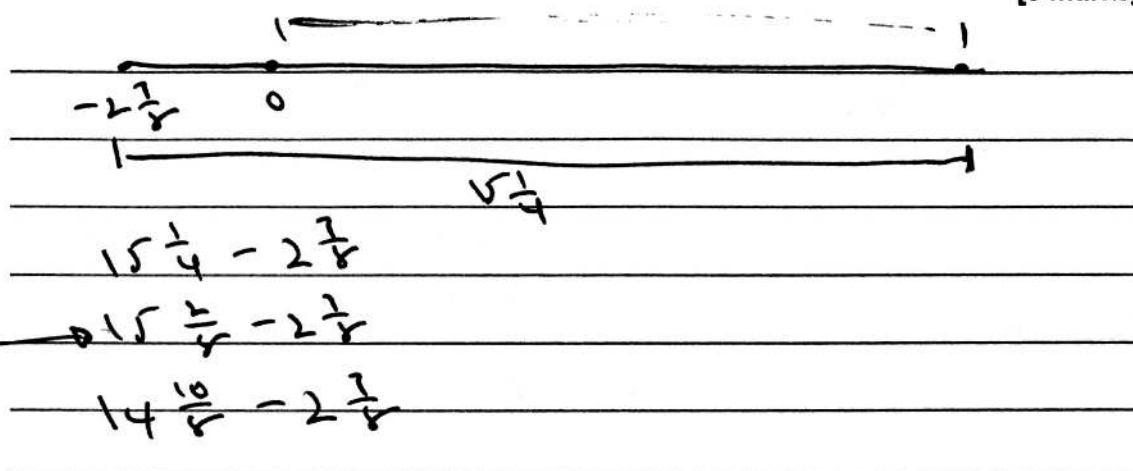
Correct, as you would expect $\frac{25}{50}$ or 0.5

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]

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

$14\frac{5}{8} \longrightarrow 15\frac{2}{8} - 2\frac{7}{8}$

$14\frac{10}{8} - 2\frac{7}{8}$

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

10 y is inversely proportional to x.

Complete the table.

[2 marks]

x	12	6	3
y	2	4	8

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

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

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

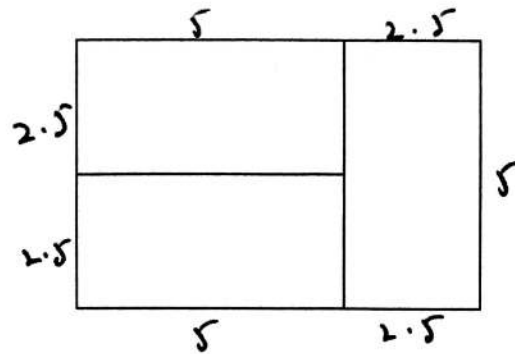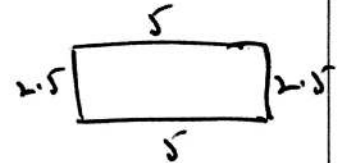$24 = k$

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

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]

25 cm.

Answer _____ cm

12 Put these numbers in order from smallest to largest.

8×10^{-4} 4×10^{-2} 6×10^{-4} 0.07

[2 marks]

0.0008   0.04   0.0006   0.07

Smallest 6×10^{-4}

8×10^{-4}

4×10^{-2}

Largest   0.07

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

cm $\rightarrow$ mm $\times 10$
cm^2 $\rightarrow$ mm^2 $\times 10^2$
cm^3 $\rightarrow$ mm^3 $\times 10^3$

[1 mark]

15 000 mm^3 1.5 mm^3 0.0015 mm^3 150 mm^3

15×10^3 15 000

Turn over for the next question

7

Turn over ▶

14 Patterns are made using straight lines and arcs.

14 (a)

Pattern A (one row)   Pattern B (two rows)

Linal : Arcs
5 : 8
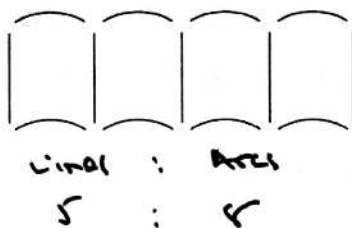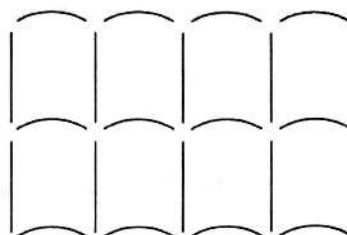
More rows are added to **Pattern B** so that

number of straight lines : number of arcs = 10 : 9

How many rows are added?

[2 marks]

5 : 8   30 : 28
10 : 12   35 : 32
15 : 16   40 : 36   10 : 9 .
20 : 20
25 : 24   6 rows.

Answer _____

IB/M/Jun18/8300/1H

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]

Price per straight line $\frac{£12}{20}$ = 60p.

Cost of arc $1\frac{1}{2} \times$ more $\frac{3}{2}$ = $60 \times 1\frac{1}{2}$ = 90p.

Straight lines   Arc.

$(20 \times 60) + (16 \times 90) = 2640p$.

Answer £ __26.40__

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]

$$0.25$$
$$0.15 +$$
$$0.30$$
$$\overline{0.70}$$

$$200 \times 0.7$$
$$= 140.$$

Answer _____

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

Circle the ratio

[handwritten] $1 : 1 \cdot 2$
$x : y$
$10 : 12$

[1 mark]

$\boxed{5 : 6}$ *(circled)* $6 : 5$ $4 : 5$ $5 : 4$

17 Here is a triangle.

Not drawn accurately

[Triangle with vertex A (angle 42°), side b = 15 cm, vertex B (angle 104°), angle 34°, side x cm labelled a]
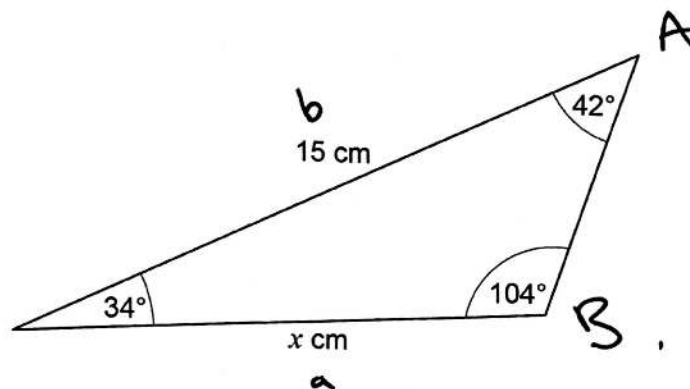
Circle the correct equation.

[1 mark]

$$\frac{\sin x}{42} = \frac{\sin 15°}{104}$$

$$\boxed{\frac{x}{\sin 42°} = \frac{15}{\sin 104°}}$$ *(circled)*
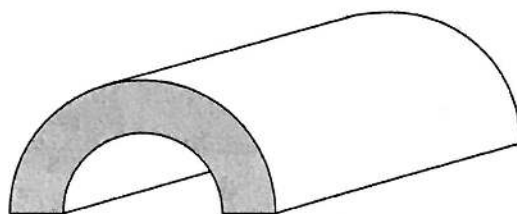
$$\frac{\sin x}{34} = \frac{\sin 15°}{104}$$

$$\frac{x}{\sin 42°} = \frac{15}{\sin 34°}$$

18   Here is a tunnel for a toy train.

The diagram below shows the cross section of the tunnel.

Not drawn
accurately

7 cm

A   3 cm   B   C   3 cm   D
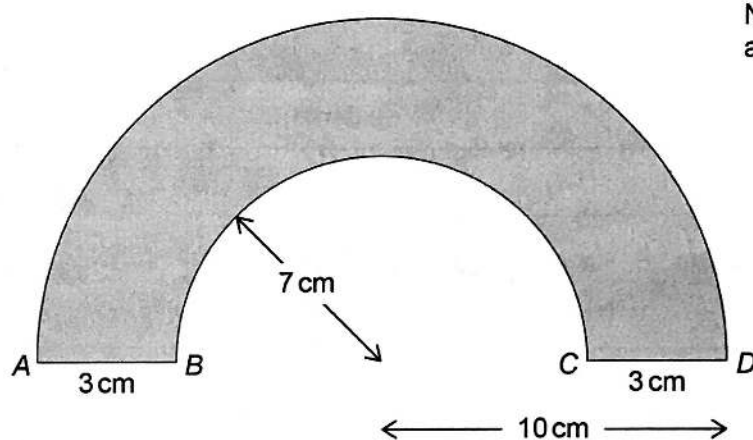
← 10 cm →

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]

Circle AD

$$\frac{\pi r^2}{2} = \frac{100\pi}{2} = 50\pi$$

Shaded Area

$$50\pi - 24.5\pi$$

$$= 25.5\pi$$

Circle BC

$$\frac{\pi r^2}{2} = \frac{49\pi}{2} = 24.5\pi$$

BOTH SIDES 51π ①

Base 3 × 30 = 90

BOTH BASES = 180 ②

INSIDE BC.

$$\frac{\pi D}{2} \times 30 = \frac{14\pi}{2} \times 30 = 210\pi ③$$

OUTSIDE AD

$$\frac{\pi D}{2} \times 30 = \frac{20\pi}{2} \times 30 = 300\pi ④$$

516π + 180 cm.

Answer _____ cm²

19 Type A batteries and type B batteries were tested.

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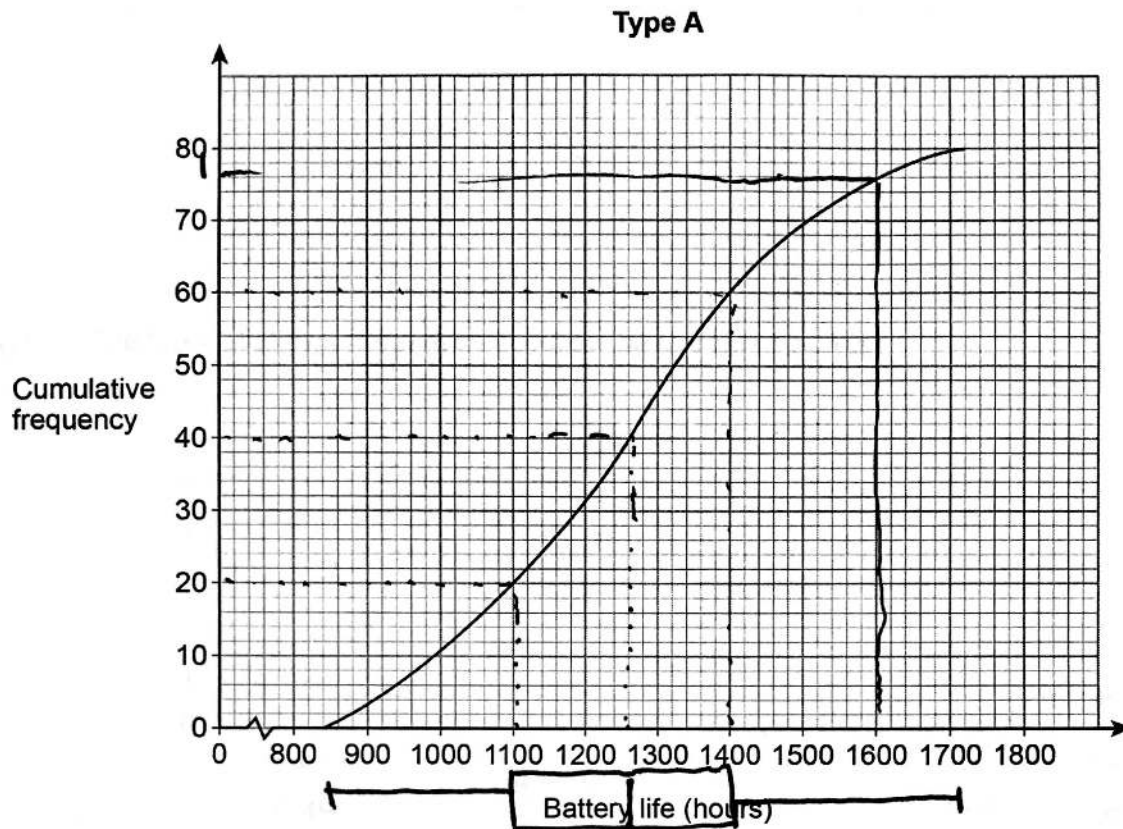
Type A

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

[2 marks]

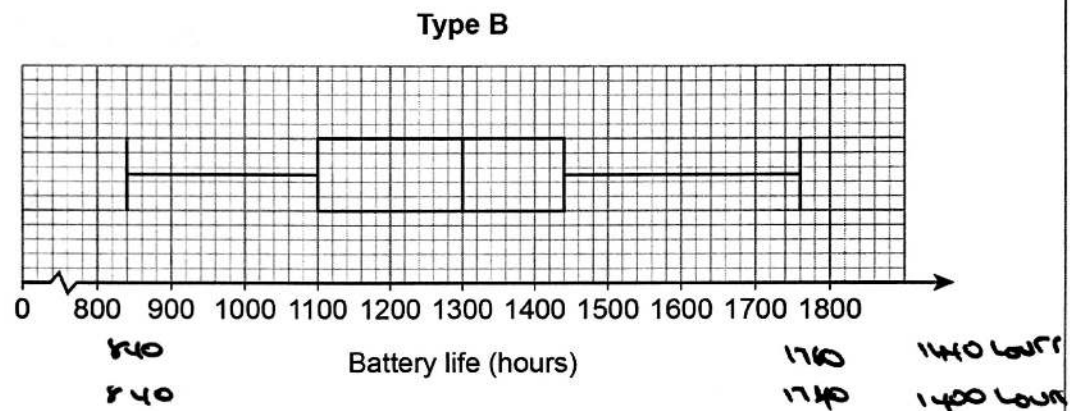1400 − 1100 = 300 hours

Answer _____ hours

1 6

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

[1 mark]

_____

_____

Answer _____4 Batteries._____

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

Type B

0   800   900   1000   1100   1200   1300   1400   1500   1600   1700   1800

Battery life (hours)

840
840

1760
1740

1740 hours   B
1400 hours   A.

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]

Full range shows an increase of 40 hours

_____

_____

_____

_____

_____

5

Turn over ▶

20 A linear sequence starts

1st   2nd   3rd   4th   5th

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

+4b   +4b

The 2nd term has value 8

The 5th term has value 44

Work out the values of a and b.

[4 marks]

$a + 6b = 8$ +3.

$a + 18b = 44$

$3a + 18b = 24$ $a + b = 8$

$a + 18b = 44$ $-10 + b = 8$

$2a = -20$ $6b = 18$

$a = -10$ $b = 3$

$a = -10$

$b = 3.$

$a = $ _____

$b = $ _____

21 Enlarge triangle *ABC* by scale factor −2, centre (4, 1)

[2 marks]
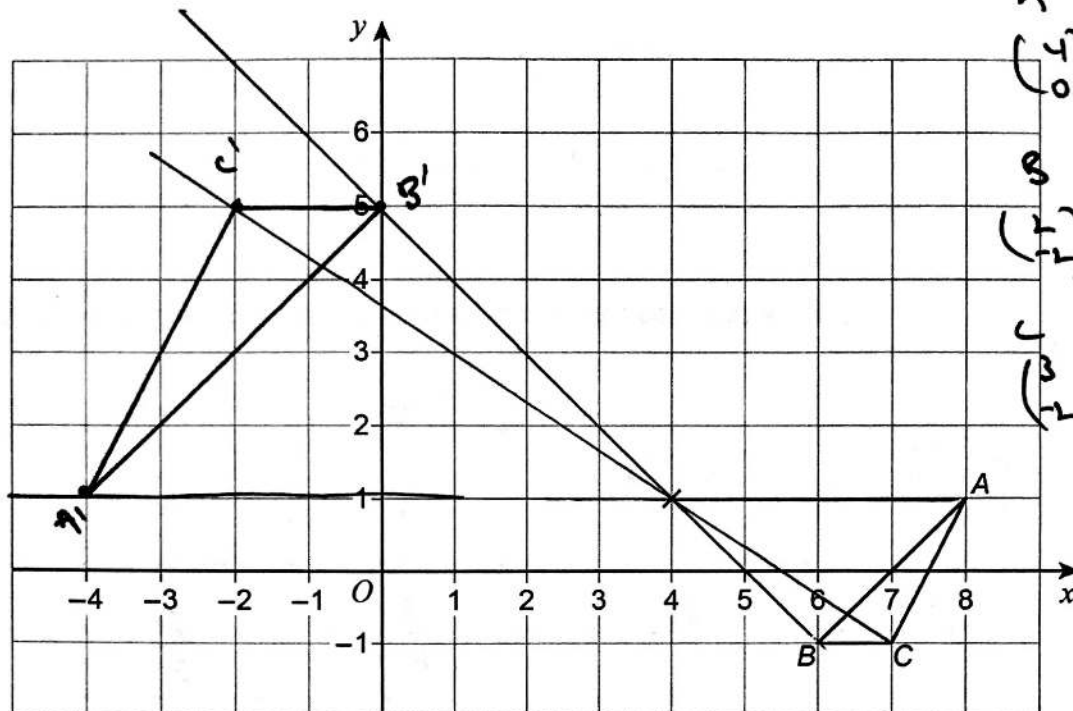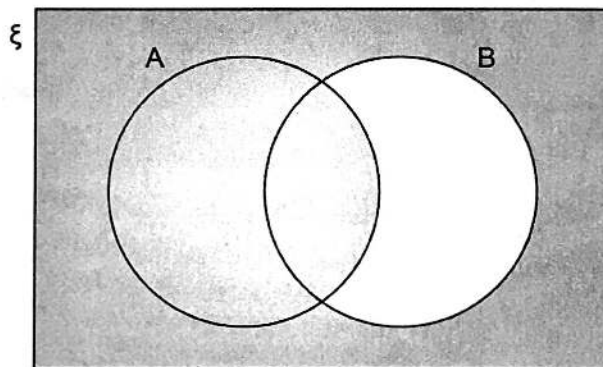
A
$\begin{pmatrix} 4 \\ 0 \end{pmatrix} \times^{-2} \begin{pmatrix} -8 \\ 0 \end{pmatrix}$

B
$\begin{pmatrix} 2 \\ -2 \end{pmatrix} \times^{-2} \begin{pmatrix} -4 \\ 4 \end{pmatrix}$

C
$\begin{pmatrix} 3 \\ -2 \end{pmatrix} \times -2 \begin{pmatrix} -6 \\ +4 \end{pmatrix}$

22

Which of these represents the shaded region?

Circle your answer.

[1 mark]

A ∩ B′   B′   Ⓐ U B′   A′ U B′

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	$\frac{5}{5}$	$\frac{6}{5}$
Number	$\frac{4}{4}$	$\frac{3}{4}$

Price/Number $\frac{5}{5} \times \frac{4}{4} = \frac{20}{20}$

Sold $\frac{6}{5} \times \frac{3}{4} = \frac{18}{20}$

Reduction $= \frac{2}{20} = \frac{1}{10} = 10\%$.

$\frac{1}{10}$

Answer _____

24 (a) Work out the value of $\quad 2^{14} \div \left(2^9\right)^2$

Give your answer as a fraction in its simplest form.

[3 marks]

$$\frac{2^{14}}{2^{18}} = 2^{-4} = \frac{1}{2^4} = \frac{1}{16}$$

Answer _____

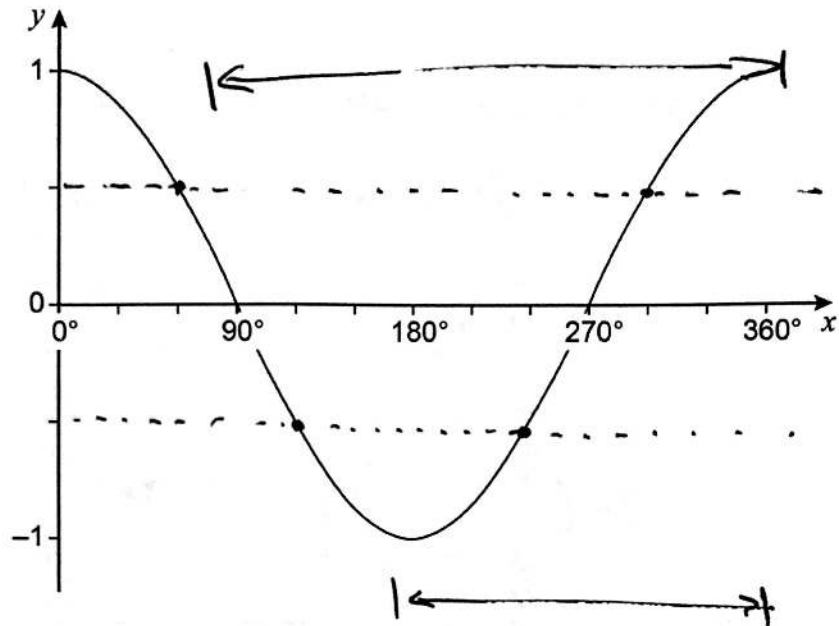**24 (b)** Work out the value of $\quad 25^{\frac{3}{2}}$

[2 marks]

$$\left(25^{\frac{1}{2}}\right)^3 = 5^3$$

$$= 125.$$

Answer _____

Turn over for the next question

8

Turn over ▶

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

25 (a) $\cos x = \cos 60°$

Work out the value of x when $90° \leqslant x \leqslant 360°$

[1 mark]

Answer   300°   degrees

25 (b) $\cos x = -\cos 60°$

Work out the value of x when $180° \leqslant x \leqslant 360°$

[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]

$$b = \frac{2}{3}c \qquad\qquad a = \frac{4}{5}c.$$

$$\frac{2}{3} : 1 \qquad\qquad \frac{4}{5} : 1$$

$$\frac{b}{2} : \frac{c}{3} \qquad\qquad \frac{a}{} : \frac{c}{}$$

$$\times 5 \left(\frac{b}{2} : \frac{c}{3} \right) \times 5 \qquad \times 3 \left(\frac{4}{} : \frac{5}{} \right) \times 3$$

$$\underset{10}{\overset{b}{10}} : \underset{15}{\overset{c}{15}} \qquad\qquad \underset{12}{\overset{a}{12}} : \underset{15}{\overset{c}{15}}$$

Answer __12__ : __10__ : __15__

Turn over for the next question

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]

Can be factorised - formula or completing square
completing

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]

$\div 9 \qquad (x+3)^2 = \dfrac{4}{9}$

$x + 3 = \pm\sqrt{\dfrac{4}{9}} \qquad\qquad \dfrac{-9}{3} + \dfrac{2}{3} = \dfrac{-7}{3}$

$x + 3 = \pm\dfrac{2}{3}$

$-3 \qquad\qquad -3 \qquad\qquad \dfrac{-9}{3} - \dfrac{2}{3} = \dfrac{-11}{3}$

$x = -3 + \dfrac{2}{3} = \dfrac{-7}{3}$

$x = -3 - \dfrac{2}{3} = \dfrac{-11}{3}$

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]

$\sqrt{80} + \frac{\sqrt{20}}{\sqrt{9}}$ $-\sqrt{4}\sqrt{5}$

$\sqrt{80} + \frac{2\sqrt{5}}{3}$

$\sqrt{16}\sqrt{5}$

$4\sqrt{5} + \frac{2\sqrt{5}}{3}$

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

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

Answer _____

Turn over for the next question

7

Turn over ▶

29   Here are sketches of two graphs.
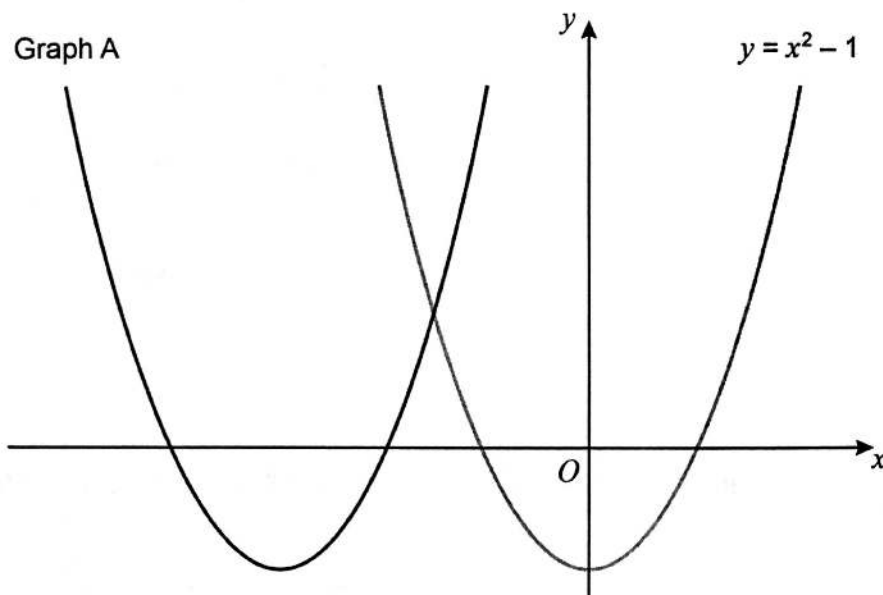
Graph A

$y = x^2 - 1$

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

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]

$$y = (x+3)^2 - 1$$
$$= (x+3)(x+3) - 1$$
$$= (x^2 + 6x + 9) - 1$$
$$= x^2 + 6x + 8$$

$b =$ 6

$c =$ 8

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 _____

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

[3 marks]

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

$$\frac{\sqrt{9}}{2} + \frac{1}{2}$$

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

$$\frac{4}{2} = 2$$

END OF QUESTIONS

	0	30	45	60	90
Sin					
Cos					
Tan	0				NA

7

There are no questions printed on this page

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