AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname Miss Perry worked solutions

Forename(s)

Candidate signature

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier Paper 1 Non-Calculator

Tuesday 19 May 2020 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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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	

Answer **all** questions in the spaces provided.

Do not write outside the box

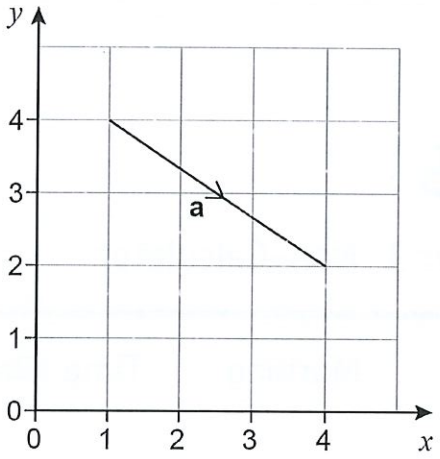
1 Circle the fraction that is equivalent to 4.75

4.75 = 4 3/4

[1 mark]

$\frac{15}{4}$ $\frac{19}{4}$ $\frac{21}{4}$ $\frac{23}{4}$

2 Here is vector **a**.



Circle the column vector that represents **a**.

top number ⇒ horizontal movement
bottom ⇒ vertical movement.

[1 mark]

$\begin{pmatrix}3\\2\end{pmatrix}$ $\begin{pmatrix}-3\\2\end{pmatrix}$ $\begin{pmatrix}3\\-2\end{pmatrix}$ $\begin{pmatrix}-3\\-2\end{pmatrix}$

3 Which one of these is a square number **and** a cube number?

Circle your answer.

[1 mark]

100 1000 10 000 1 000 000

$100^3 = 1,000,000$

~~10^3~~

$1000^2 = 1,000,000$

Do not write outside the box

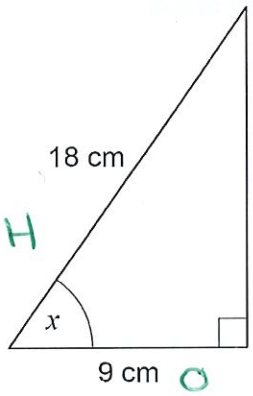
4 Circle the reciprocal of $\frac{5}{6}$

$\frac{5}{6} \times ? = 1$

[1 mark]

$\frac{6}{5}$ $\frac{1}{6}$ $-\frac{1}{6}$ $-\frac{6}{5}$

5 Use trigonometry to work out the size of angle x.



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[2 marks]

$\sin x = 9/18$

$\sin x = 1/2$

$x = 30$ (need to learn)

Answer 30 degrees

6

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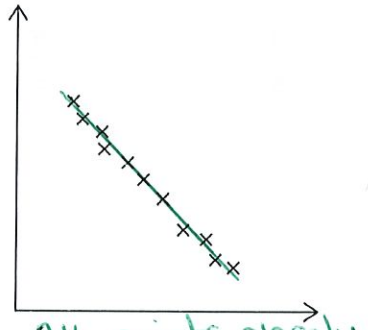
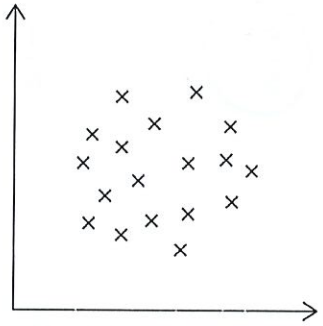
6 A and B are scatter graphs.

Graph A



All points closely match LOBF.

Graph B



What type of correlation is shown by each graph?

Choose from

Weak positive
Strong positive
Weak negative
Strong negative
No correlation

[2 marks]

Graph A Strong negative

Graph B No correlation

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7 Here is some information about 80 people who play in bands.

12 are singers but not guitar players.

30% are neither a singer nor a guitar player. - 30%. 80 = 24.

$\frac{1}{4}$ of the guitar players are also singers.

Guitar total = 4x

Complete this Venn diagram to represent the information.

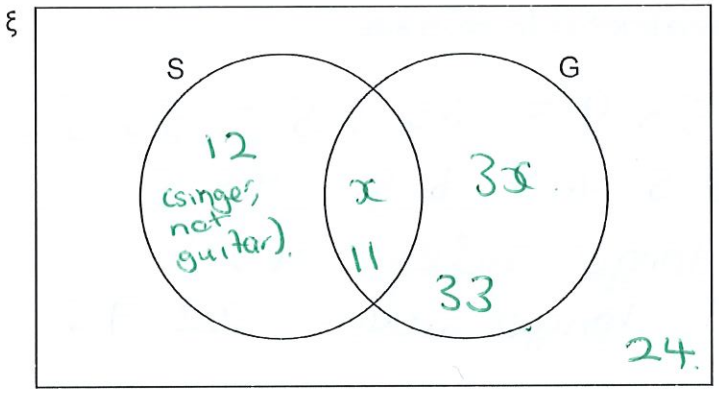
[4 marks]

↗ Full set

ξ = 80 people who play in bands

S = singers

G = guitar players



12 + 24 = 36.

80 - 36 = 44.

4x = 44

x = 11

6

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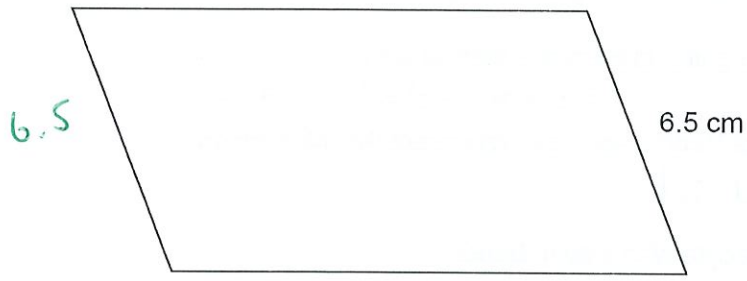
8 The shorter side of a parallelogram has length 6.5 cm

Not drawn accurately



The length of the shorter side is $\frac{1}{9}$ of the perimeter.

Work out the length of the longer side.

[3 marks]

6.5 × 9 = 65 − 6.5 = 58.5.
58.5 − 6.5 − 6.5 = 45.5.
2 longer sides = 45.5
1 longer side = 22.75.

Answer 22.75. cm

Do not write outside the box

9 (a) All the terms of a **geometric** progression are positive.

The second and fourth terms are shown.

..... 4 16

×x ×x

Work out the first and third terms.

[2 marks]

Geometric progress – multiply to get next term

$4 \times x \times x = 16$. $4x^2 = 16$ $x^2 = 4$

$x = 2$. ×2 each time

First term 2

Third term 8.

9 (b) The first two terms of an **arithmetic** progression are shown.

⇒ add to get next

p $5p$ ...$9p$

+4p +4p

The sum of the first three terms is 90

Work out the value of p.

[3 marks]

$p + 5p + 9p = 90$ $15p = 90$

$p = 6$

Answer 6.

8

Do not write outside the box

10 The cost of a holiday is £2400

Rana pays a deposit followed by monthly payments, in the ratio

deposit : total of the monthly payments = 3 : 5

3 + 5 = 8 parts

She makes 6 equal monthly payments.

Work out her monthly payment.

[4 marks]

2400 ÷ 8 = 300.

3 x 300 = 900. Deposit = £900

5 x 300 = 1500

Monthy payment : 1500 ÷ 6 = 250

$\frac{1500}{6} \xrightarrow{\div 3} \frac{500}{2}$.

Answer £ 250.

Do not write outside the box

11 As a decimal $\frac{11}{40} = 0.275$

Work out $\frac{33}{400}$ as a decimal.

[2 marks]

$\frac{11}{40} = 0.275$ ÷10 ↓ $\frac{11}{400} = 0.0275$ ×3 ↓ $\frac{33}{400} = 0.0825$

2 ÷ 10

2 × 3

275 × 3 =
550
+ 275
825.

Answer 0.0825

Turn over for the next question

6

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12 Two wire shapes make an earring.

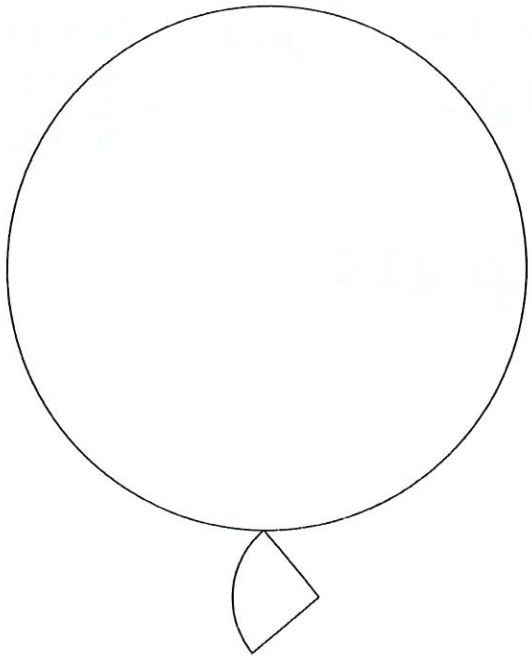
The shapes are

a circle with radius 21 mm

and

a quarter circle.

Not drawn accurately



radius of circle : radius of quarter circle = 7 : 2

12 (a) Show that the radius of the quarter circle is 6 mm

[1 mark]

×3 (7 : 2) ×3
21 : 6

Do not write outside the box

12 (b) Work out the **total** length of the wire in the earring.

Give your answer in the form $a\pi + b$ where a and b are integers.

[4 marks]

Wire for full circle: $\pi \times d$

$= \pi \times 21 \times 2$

$= 42\pi$.

Wire for arc of $\frac{1}{4}$ circle $= (\pi \times d) \div 4$

$= \frac{1}{4}(\pi \times 6 \times 2)$

$= \frac{1}{4} \times 12\pi$

$= 3\pi$.

+ 2 radii (6 + 6) $= 42\pi + 3\pi + 12 = 45\pi + 12$

Answer $45\pi + 12$ mm

Turn over for the next question

5

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13 (a) s and t are **positive** integers.

$(x + s)(x - t)$ is expanded and simplified.

The answer is $x^2 + kx - 40$ where k is a positive integer.

Work out the **smallest** possible value of k.

[2 marks]

$(x+s)(x-t) = x^2 - xt + sx - st$

$= x^2 + sx - xt - st.$

$-st = -40.$

$st = 40.$ factors of 40 - 1, 40; 2, 20; 4, 10; 5, 8 → smallest total

$s = 8$ $t = 5$

(can't be vice versa → says k is positive).

Answer 3.

13 (b) Faisal tries to solve $(x + 2)(x - 7) = 0$

Here is his working.

	$(x + 2) = 0$	or	$(x - 7) = 0$
Answer	$x = 2$	or	$x = 7$

Give a reason why his answer is wrong.

[1 mark]

If $x + 2 = 0$

$x = -2.$

Do not write outside the box

14 (a) $c = 2^{10} \times 3 \times 5^6$

Work out $18c$.

Give your answer as a product of prime factors in index form.

[2 marks]

$2^{10} \times 3 \times 5^6 = c.$

$18c = 18(2^{10} \times 3 \times 5^6)$

$= 2 \times 3^2 (2^{10} \times 3 \times 5^6)$

$= 2^{11} \times 3^3 \times 5^6$

18 → 2, 9 → 3, 3

Answer $2^{11} \times 3^3 \times 5^6$

14 (b) Work out $\sqrt[3]{\frac{2^7 \times 11^3}{2}}$

Give your answer as an integer.

[2 marks]

$\sqrt[3]{\frac{2^7 \times 11^3}{2}}$

$\frac{2^7 \times 11^3}{2} = 2^6 \times 11^3$

$\sqrt[3]{(2^6 \times 11^3)} = (2^6 \times 11^3)^{1/3} = 2^2 \times 11$

$= 44$

Answer 44.

7

Turn over ▶

Do not write outside the box

15 $3x = \frac{1}{2}y$

Circle the ratio $x : y$

[1 mark]

6 : 1 (1 : 6) 3 : 2 2 : 3

$x = \frac{1}{6}y$.

For every 1x, you need 6 y.

16 A sequence of numbers is formed by the iterative process

$$u_{n+1} = \frac{4}{u_n - 1} \qquad u_1 = 9$$

Work out the values of u_2 and u_3

[2 marks]

$u_2 = \frac{4}{9-1} = \frac{4}{8} = 0.5$,

$u_3 = \frac{4}{0.5-1} = \frac{4}{-0.5} = -8$

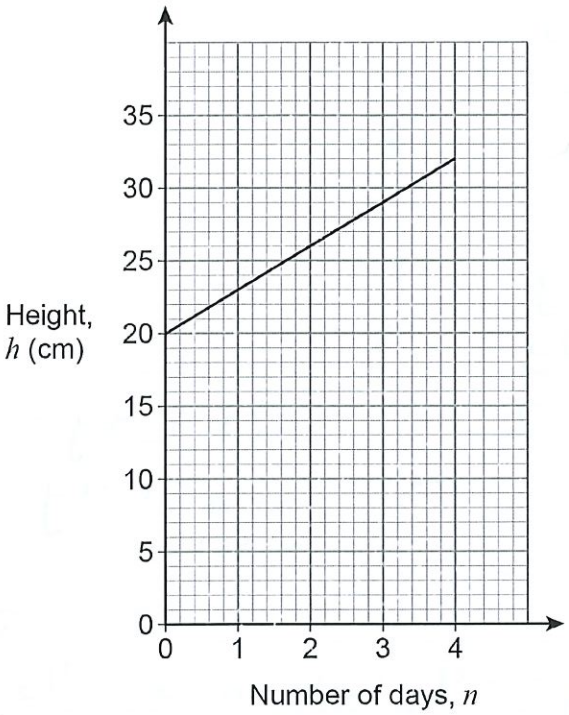
$u_2 =$ 1/2

$u_3 =$ −8.

Do not write outside the box

17 Jim buys a plant of height 20 cm

The graph shows how the height of the plant changes during the next 4 days.



Work out a formula for h in terms of n.

[3 marks]

n = 0 1 2 3

h = 20, 23, 26, 29, (from graph)

+3 +3 +3

3n + 20.

Answer 3n + 20.

6

Do not write outside the box

18 Solve the simultaneous equations

$$2x + 4y = -9$$

$$2y = 4x - 7$$

[4 marks]

$-4x \quad -4x$

$2y = 4x - 7$

$2y - 4x = -7.$

① $2x + 4y = -9.$

② $-4x + 2y = -7$

③ = ② × 2 = $-8x + 4y = -14.$

$- \quad 2x + 4y = -9.$

$-10x = -5$

$x = \frac{-5}{-10} = 1/2.$

① $2x + 4y = -9$ sub in $x = 1/2$

$2 \times \frac{1}{2} + 4y = -9.$ $\quad 1 + 4y = -9 \quad 4y = -10$

$y = -10/4 = -5/2.$ check: $2y = 4x - 7$

$-5 = 2 - 7$ ✓

$x =$ 1/2 $\quad y =$ −5/2

Do not write outside the box

19 Circle the expression that is equivalent to $\frac{x}{5} + \frac{x}{10}$

[1 mark]

$\frac{3x}{10}$ $\quad$ $\frac{2x}{15}$ $\quad$ $\frac{x}{25}$ $\quad$ $\frac{x^2}{50}$

$\frac{x}{5} \times 2 = \frac{2x}{10}$ $\quad$ $\frac{2x}{10} + \frac{x}{10} = \frac{3x}{10}$

20 (a) Write down the value of 7^0

[1 mark]

Answer 1.

20 (b) Work out the value of $32^{-\frac{3}{5}}$

[2 marks]

$32^{-3/5} \quad (32^{1/5})^{-3}$

$32^{1/5} = \sqrt[5]{32} = 2. \quad (2)^{-3} = \frac{1}{2^3} = 1/8.$

Answer 1/8.

Turn over for the next question

8

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21 Write these numbers in order of size.

$15.6 \qquad 3\sqrt{23} \qquad 2.1^4 \qquad \frac{47}{3}$

Start with the smallest.

[2 marks]

$\frac{47}{3} = 15\frac{2}{3}$.

$3\sqrt{23} \approx 3\sqrt{25} = 3 \times 5 = 15$. $3\sqrt{23} < 15$.

$2.1^4 \approx 2^4$. $2^4 = 16$. $2.1^4 > 16$.

Smallest $3\sqrt{23}$

15.6

$15\frac{2}{3}$

Largest 2.1^4

Do not write outside the box

22 (a) y is directly proportional to x^3

$y = 17$ when $x = 4$

Work out an equation connecting y and x.

[3 marks]

$y = kx^3$

$17 = k \times 4^3$ $\quad 17 = k \times 64$

$k = 17/64$ $\quad y = 17/64\ x^3$

Answer $y = 17/64\ x^3$

22 (b) m is inversely proportional to $\sqrt{r}$

The value of r is multiplied by 4

Circle what happens to the value of m.

[1 mark]

× 2 × 16 (÷ 2) ÷ 16

$m = \frac{k}{\sqrt{r}}$ If r is 4 x bigger $\sqrt{r}$ is 2x bigger.

Turn over for the next question

6

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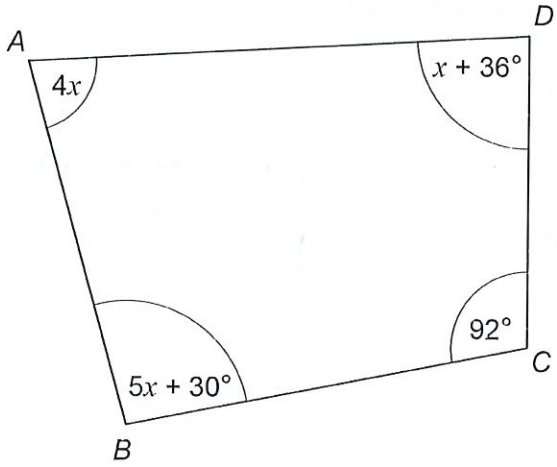
23 *ABCD* is a quadrilateral.

Not drawn accurately



Prove that *ABCD* is **not** a cyclic quadrilateral.

[4 marks]

If cyclic, $4x + 92 = 180$

and $5x + 30 + x + 36 = 180$

If $4x + 92 = 180$, then $4x = 88$

$x = 22$

sub into 2nd equation:

$5x + 30 + x + 36 = 180$

$5 \times 22 + 30 + 22 + 36 = 180$

$110 + 30 + 22 + 36 \neq 180$

∴ NOT a cyclic quad.

Do not write outside the box

24 y is an obtuse angle.

Which statement is true?

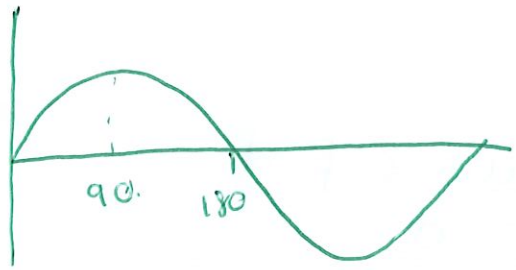
Tick **one** box.

[1 mark]

- ☐ $\sin y > 0$ and $\cos y > 0$
- ☑ $\sin y > 0$ and $\cos y < 0$
- ☐ $\sin y < 0$ and $\cos y > 0$
- ☐ $\sin y < 0$ and $\cos y < 0$

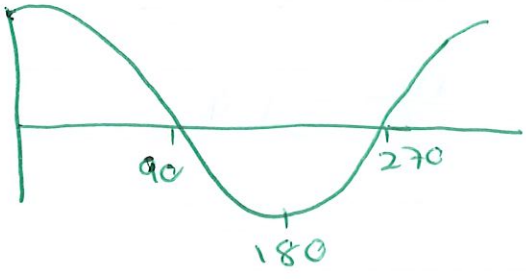
Don't be put off by them using y instead of x.

∴ sin y



obtuse; 90–180°
y positive
must be 1st or 2nd option.

cos y.



y negative between 90 and 180.

Turn over for the next question

5

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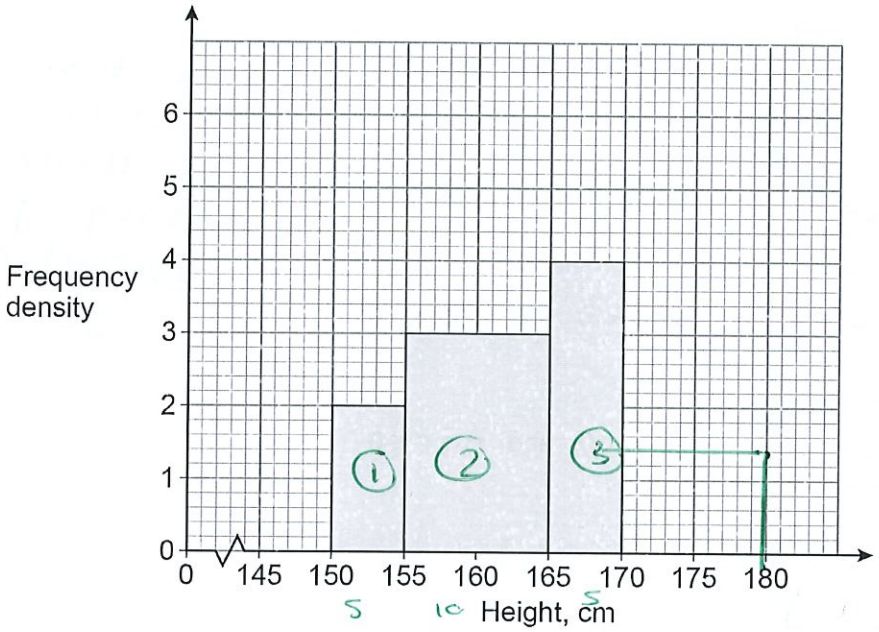
25 A histogram is drawn to represent the heights of a sample of women.

Three of the four bars are shown.

The bar for $170 \text{ cm} \leqslant \text{height} < 180 \text{ cm}$ is missing.



There are 74 women in the sample.

Complete the histogram.

[4 marks]

Frequencies: class width x f.d.

① = 5 x 2 = 10

② = 10 x 3 = 30

③ = 5 x 4 = 20. 10+30+20 = 60

74 − 60 = 14.

F.D = $\frac{\text{freq}}{\text{class width}} = \frac{14}{10} = 1.4$.

Do not write outside the box

26 (a) Show that $\frac{14}{\sqrt{7}}$ can be written in the form $a\sqrt{b}$ where a and b are integers.

[2 marks]

$\frac{14}{\sqrt{7}} \times \frac{\sqrt{7}}{\times\sqrt{7}} = \frac{14\sqrt{7}}{7} = 2\sqrt{7}.$

26 (b) Work out $2\sqrt{10} \times \sqrt{80} \times \sqrt{18}$

Give your answer as an integer.

[3 marks]

$2\sqrt{10} \times \sqrt{80} \times \sqrt{18}.$

$\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}.$

$\sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}.$

$2\sqrt{10} \times 4\sqrt{5} \times 3\sqrt{2} = 24 \times \sqrt{10 \times 5 \times 2}$

$= 24 \times \sqrt{100}$

$= 24 \times 10$

Answer 240.

Turn over for the next question

9

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27 A and B are similar solid cylinders.

base area of A : base area of B = 9 : 25

Complete these ratios.

[2 marks]

curved surface area of A : curved surface area of B = 9 : 25

If Area ratio = 9 : 25,

length ratio = $\sqrt{9} : \sqrt{25}$

height of A : height of B = 3 : 5

28 Factorise fully $144 - 4x^2$

[2 marks]

Difference of 2 squares

$(12 - 2x)(12 + 2x)$

$2(6 - x)\ 2(6 + x)$

$= 4(6 - x)(6 + x)$

Answer $4(6 - x)(6 + x)$

Do not write outside the box

29 The graph of $y = x^3 + 6$ is translated 4 units to the right.

The translated graph has equation $y = f(x)$

Work out $f(x)$.

Give your answer in the form $x^3 + ax^2 + bx + c$ where a, b and c are integers.

[4 marks]

translate 4 to the right affects the x axis. replace x with x - 4.

$y = (x-4)^3 + 6$.

$(x-4)(x-4)(x-4) + 6$

$(x-4)(x-4) = x^2 - 4x - 4x + 16$

$= x^2 - 8x + 16$

$(x^2 - 8x + 16)(x-4) + 6$

$= x^3 - 8x^2 + 16x - 4x^2 + 32x - 64 + 6$

$x^3 - 12x^2 + 48x - 58$

Answer $x^3 - 12x^2 + 48x - 58$

END OF QUESTIONS

8

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