

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname StemUp Model Solution

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

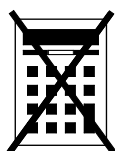
Wednesday 8 November 2023 Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments
- the Formulae Sheet (enclosed).



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	
26	
TOTAL	



N 0 V 2 3 8 3 0 0 1 H 0 1

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

- 1 Work out the lowest common multiple (LCM) of 20 and 25 [1 mark]

$$20 = 2^2 \times 5, \quad 25 = 5^2$$

$$LCM = 2^2 \times 5^2 = 4 \times 25 = 100$$

Answer 100

- 2 Work out the size of an **exterior** angle of a regular hexagon. [1 mark]

$$\text{Exterior angles add up to } 360^\circ$$

$$360 \div 6 = 60$$

Answer 60 °

- 3 A is (2, 0) and B is (0, -4)
Work out the midpoint of AB . [1 mark]

$$x: (2 + 0) \div 2 = 1 \quad y: (0 + -4) \div 2 = -2$$

Answer (1 , -2)



4 Simplify $a + 3a \div a$

[1 mark]

Division first: $3a \div a = 3$

$a + 3$

Answer $a + 3$

5 Work out the value of $(8^2 \times 8) \div (8^9 \div 8^5)$

Give your answer as a decimal.

[3 marks]

$8^2 \times 8 = 8^{2+1} = 8^3$

$8^9 \div 8^5 = 8^{9-5} = 8^4$

$8^3 \div 8^4 = 8^{3-4} = 8^{-1}$

$8^{-1} = \frac{1}{8} = 1 \div 8$

$1 \div 8 = 0.125$

Answer 0.125

Turn over for the next question

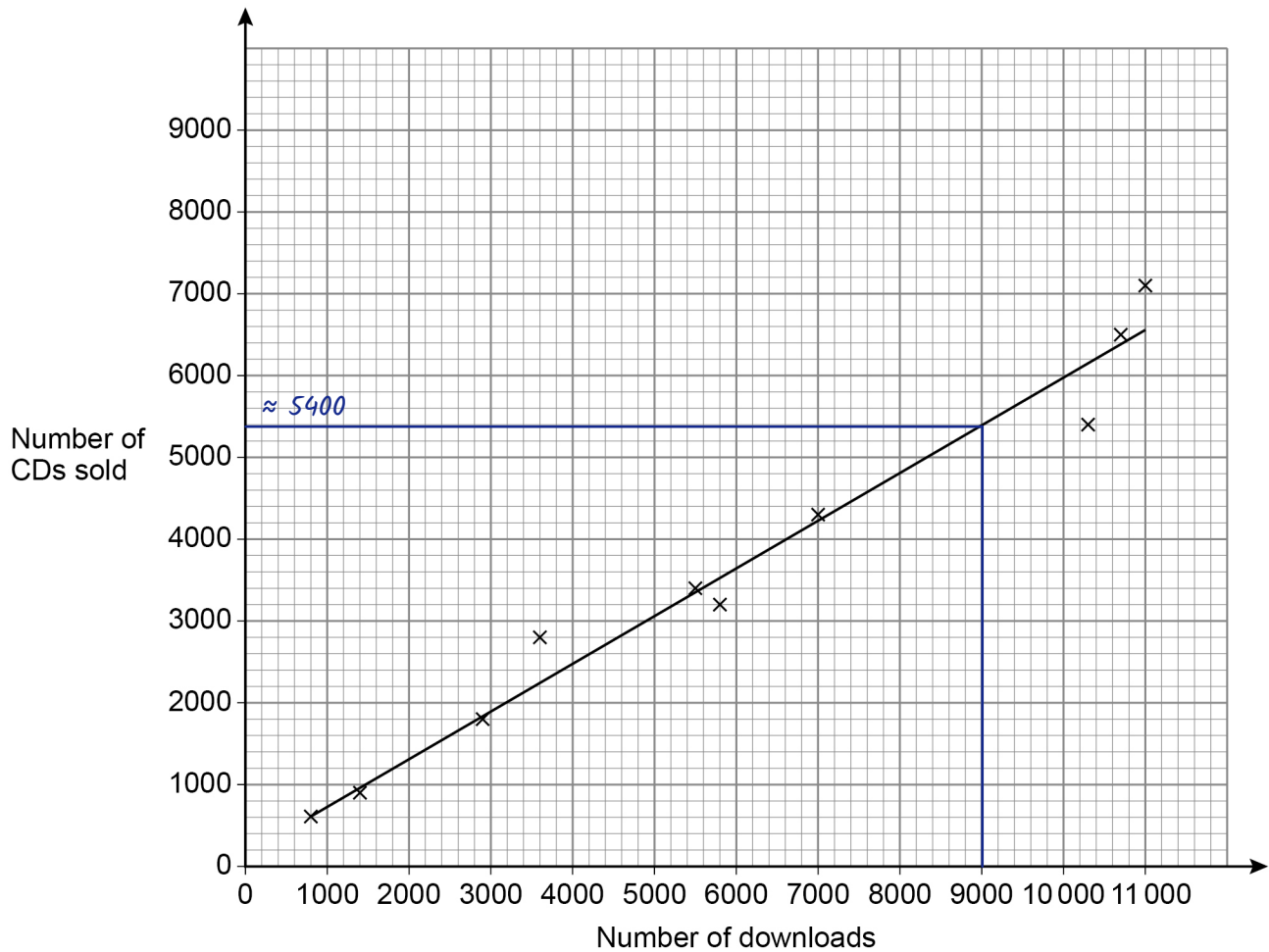


6

A music company releases 10 albums.

The scatter graph shows, for each album,
the number of downloads on the first day
and
the number of CDs sold on the first day.

A line of best fit has been drawn on the scatter graph.



- 6 (a) The scatter graph shows positive correlation.

Describe the relationship between number of downloads and number of CDs sold.

[1 mark]

*As the number of downloads increases, the number
of CDs sold also increases.*

- 6 (b) The company earns

£2.50 for each download

and

£3 for each CD sold.

The company releases another album.

On the first day it has 9000 downloads.

Estimate the **total** amount the company earns from downloads and CDs of the album that day.

[3 marks]

From the line of best fit: 9000 downloads → about 5400 CDs

Downloads: $9000 \times £2.50 = £22\ 500$

CDs: $5400 \times £3 = £16\ 200$

Total = $22\ 500 + 16\ 200$

= £38 700

Answer £ 38 700



7

70% of a number is 350

Work out 120% of the number.

[3 marks]

$$70\% = 350$$

$$10\% = 350 \div 7 = 50$$

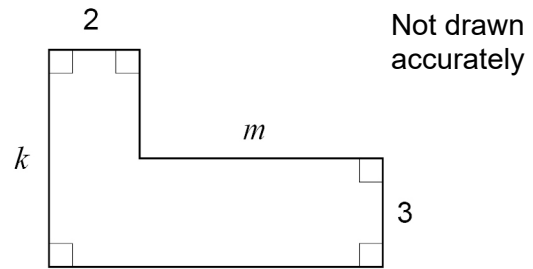
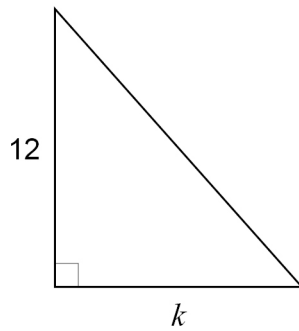
$$100\% = 50 \times 10 = 500$$

$$120\% = 50 \times 12 = 600$$

Answer 600

8

In the diagrams, all lengths are in centimetres.



The two shapes have equal areas.

Work out $k : m$ **[3 marks]**

$$\text{Triangle area} = (k \times 12) \div 2 = 6k$$

$$\text{L-shape area} = 2 \times k + 3 \times m = 2k + 3m$$

$$\text{Equal areas: } 6k = 2k + 3m$$

$$4k = 3m$$

$$\text{so } k \div m = 3 \div 4$$

$$k : m = 3 : 4$$

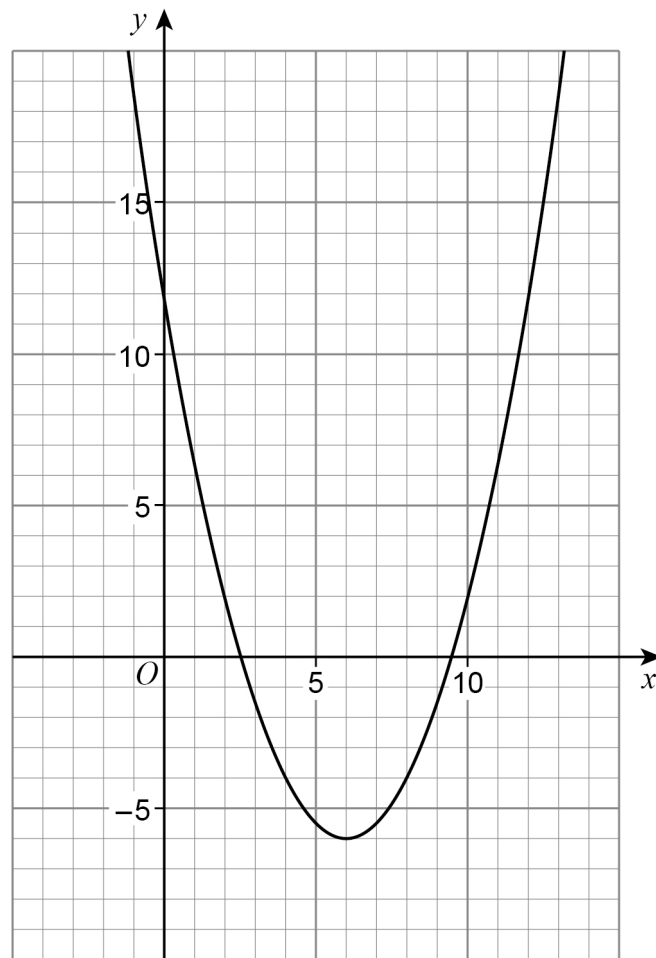
Answer 3 : 4

Turn over for the next question

Turn over ►



9 Here is the graph of $y = 0.5x^2 - 6x + 12$



Use the graph to estimate the solutions of $0.5x^2 - 6x + 12 = 0$

[2 marks]

Answer $x \approx 2.5$ and $x \approx 9.5$



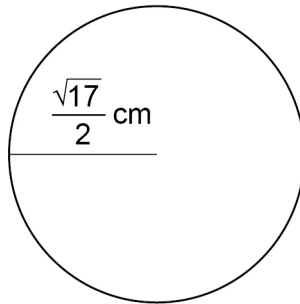
10

Shape A is a circle with radius $\frac{\sqrt{17}}{2}$ cm

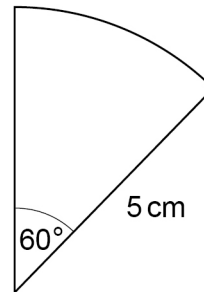
Shape B is a sector of a circle with radius 5 cm

Not drawn
accurately

Shape A



Shape B



Which shape has the greater area, A or B?

You **must** show your working.

[5 marks]

$$\begin{aligned} \text{Area A} &= \pi \times \left(\frac{\sqrt{17}}{2}\right)^2 = \pi \times \frac{17}{4} = \frac{17}{4} \pi \\ &= \frac{51}{12} \pi \quad (= 4.25\pi) \end{aligned}$$

$$\begin{aligned} \text{Area B} &= \frac{60}{360} \times \pi \times 5^2 = \frac{1}{6} \times 25\pi \\ &= \frac{25}{6} \pi = \frac{50}{12} \pi \quad (= 4.1666...\pi) \end{aligned}$$

$$\frac{51}{12} \pi > \frac{50}{12} \pi$$

so A has the greater area (bigger by $\pi \div 12$)

Answer A



11 Factorise $x^2 + 2x - 24$

[2 marks]

$$6 \times -4 = -24 \text{ and } 6 + -4 = 2$$

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

12 (a) Write 2×10^3 as an ordinary number.

[1 mark]

$$2 \times 1000 = 2000$$

Answer 2000

12 (b) Simplify $(2 \times 10^3) : (5 \times 10^{-1})$

Give your answer in the form $n : 1$

[2 marks]

$$2 \times 10^3 = 2000, \quad 5 \times 10^{-1} = 0.5$$

$$2000 : 0.5$$

$$= 4000 : 1 \quad (2000 \div 0.5 = 4000)$$

Answer $4000 : 1$



- 13 Here is an identity in x .

$$5(2x + d) \equiv cx + 30$$

Work out the values of c and d .

[3 marks]

$$5(2x + d) = 10x + 5d$$

$$10x + 5d \equiv cx + 30$$

$$\text{so } c = 10 \quad \text{and} \quad 5d = 30$$

$$d = 30 \div 5 = 6$$

$$c = \underline{\quad 10 \quad} \quad d = \underline{\quad 6 \quad}$$

- 14 Cora is revising for two subjects, History and French.

The time she spends revising is in the ratio

$$\text{History : French} = 7 : 2$$

The time she spends revising for History is 20 hours **more** than for French.

Work out the **total** time she spends revising.

[3 marks]

$$\text{Difference} = 7 - 2 = 5 \text{ parts}$$

$$5 \text{ parts} = 20 \text{ hours}$$

$$1 \text{ part} = 20 \div 5 = 4 \text{ hours}$$

$$\text{Total} = 7 + 2 = 9 \text{ parts}$$

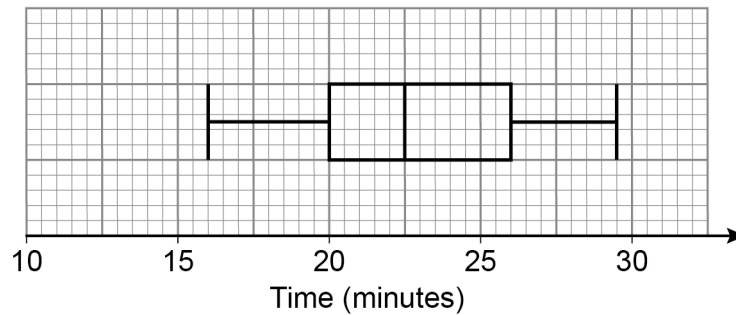
$$9 \times 4 = 36 \text{ hours}$$

Answer 36 hours

Turn over ►



- 15** A race was run in 2019 and in 2020
The box plot shows information about the finishing times in 2019



- 15 (a)** In 2019, what was the fastest time?

[1 mark]

Answer _____ *16* _____ minutes



- 15 (b)** The table shows information about the finishing times in 2020

Lower quartile	21 minutes
Median	24 minutes
Upper quartile	27 minutes

Use the data to comment on each of the following statements.

[4 marks]

On average, times were faster in 2019 than in 2020

True. The median in 2019 is 22.5 minutes, which is lower than the median in 2020 (24 minutes), so on average the times were faster in 2019.

Times were equally consistent in 2019 and 2020

True. IQR in 2019 = $26 - 20 = 6$ minutes

IQR in 2020 = $27 - 21 = 6$ minutes

The IQRs are the same, so the times were equally consistent.

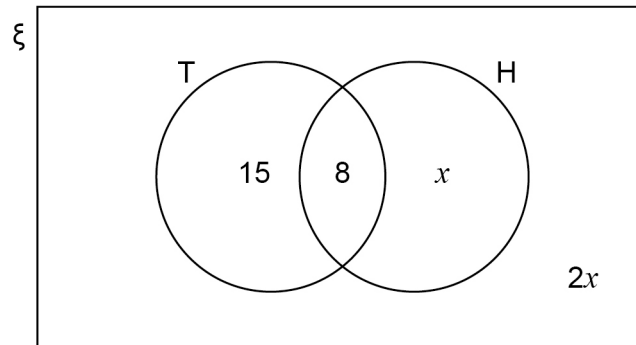


- 16** The Venn diagram shows information about 80 people who visited an online shop.

$\xi = 80$ people

T = people who bought trainers

H = people who bought a hoodie



- 16 (a)** One person is chosen at random.

Work out the probability that they bought a hoodie.

[3 marks]

$$15 + 8 + x + 2x = 80$$

$$3x + 23 = 80$$

$$3x = 57, \quad x = 57 \div 3 = 19$$

$$\text{Bought a hoodie} = 8 + 19 = 27$$

Answer $\frac{27}{80}$

- 16 (b)** One person who bought trainers is chosen at random.

Work out the probability that they bought a hoodie.

[1 mark]

$$\text{Bought trainers} = 15 + 8 = 23, \text{ of which } 8 \text{ bought a hoodie}$$

Answer $\frac{8}{23}$



17 x and y are integers.

$$8 \leq 4x \leq 20 \quad \text{and} \quad y - 3x < 12$$

Work out the **largest** possible value of y .

[3 marks]

$$8 \leq 4x \leq 20 \quad \text{so} \quad 2 \leq x \leq 5$$

$$\text{Largest } x = 5, \text{ so } 3x = 15$$

$$y - 15 < 12$$

$$y < 27$$

$$y \text{ is an integer, so the largest } y = 26$$

Answer 26

Turn over for the next question

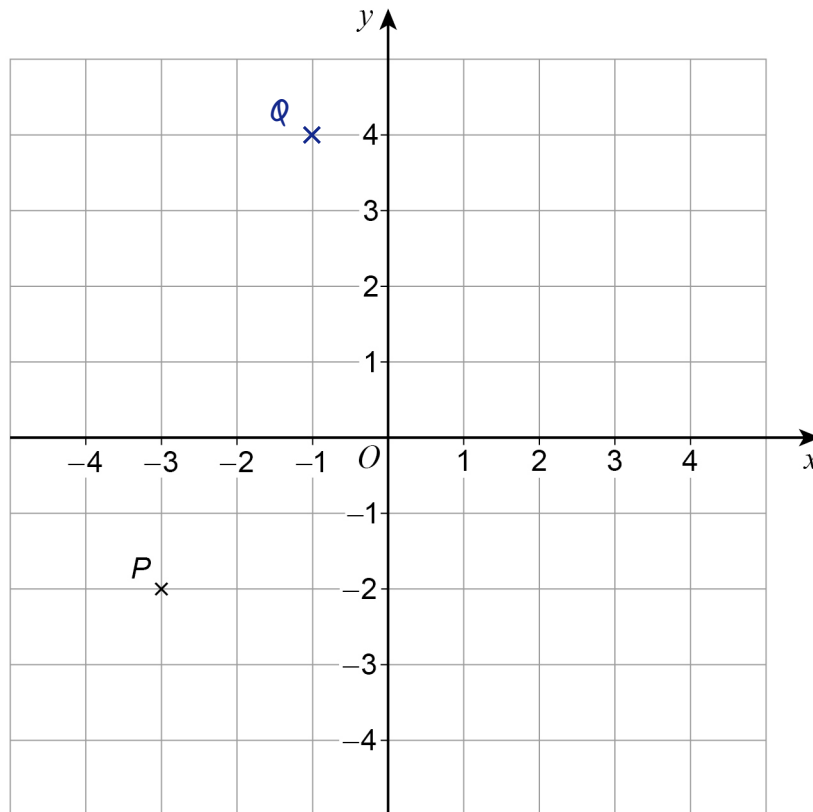
Turn over ►



18 (a) P and Q are points.

$P(-3, -2)$ is mapped to Q by a rotation about $(1, 0)$ through 90° clockwise.

Q is mapped back to P by a **single** transformation.



Complete these two **single** transformations that each map Q back to P .

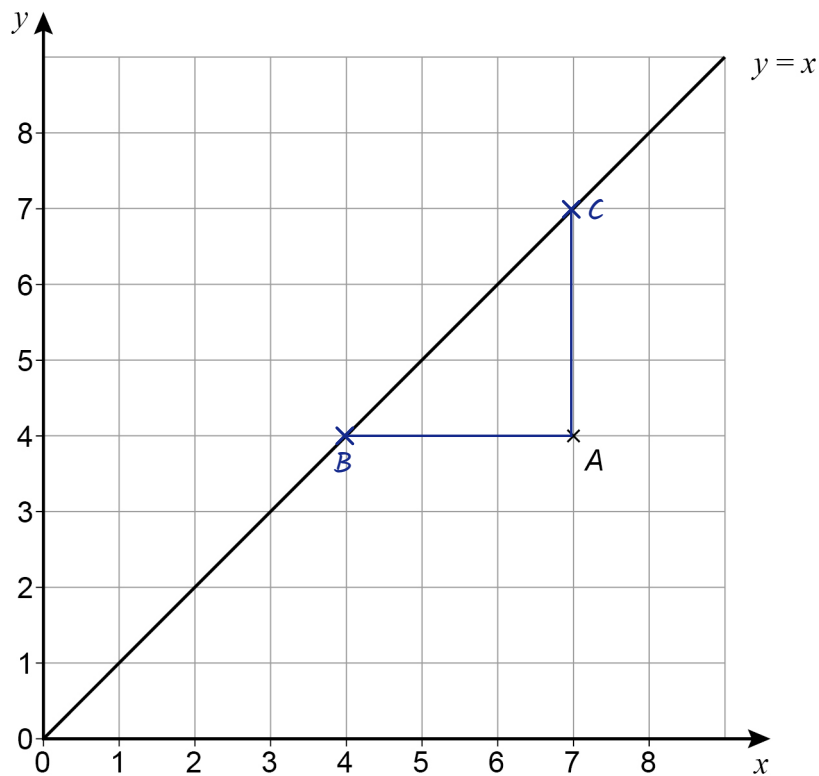
[2 marks]

Rotation about $(1, 0)$ 90° anticlockwise

Translation 2 units left and 6 units down



- 18 (b) Point A (7, 4) and the line $y = x$ are shown on the grid.



B and C are points on the grid, each having positive **integer** coordinates.

BAC is a right-angled triangle.

When BAC is reflected in the line $y = x$ side BC is invariant.

Work out **one** possible set of coordinates for B and C .

[1 mark]

B (4 , 4) C (7 , 7)



19

When converted to a fraction $0.\dot{7} = \frac{7}{9}$

Work out $0.\dot{4} + 0.0\dot{7}$

Give your answer as a fraction.

[3 marks]

$$0.444... = \frac{4}{9} \quad (10x - x = 4.4 - 0.4, \quad 9x = 4)$$

$$0.0777... = 0.777... \div 10 = \frac{7}{9} \div 10 = \frac{7}{90}$$

$$\frac{4}{9} + \frac{7}{90} = \frac{40}{90} + \frac{7}{90} = \frac{47}{90}$$

Answer $\frac{47}{90}$



20

 x and y are acute angles.

$$\sin x = \frac{\sqrt{3}}{2} \quad \tan y = 1$$

$$w = 3x - 2y$$

Work out the value of $\cos w$ You **must** show your working.**[3 marks]**

$$\sin x = \frac{\sqrt{3}}{2} \text{ so } x = 60^\circ$$

$$\tan y = 1 \text{ so } y = 45^\circ$$

$$w = 3 \times 60 - 2 \times 45 = 180 - 90 = 90^\circ$$

$$\cos w = \cos 90^\circ = 0$$

Answer 0

Turn over for the next question

Turn over ►



21

$$f(x) = \frac{x-9}{8}$$

$$g(x) = 2x^2 + 9$$

$$h(x) = 4x$$

Solve $f^{-1}(x) = gh(x)$ **[5 marks]**

$$\text{Let } y = \frac{x-9}{8} \quad \text{swap: } x = \frac{y-9}{8}$$

$$8x = y - 9, \text{ so } y = 8x + 9$$

$$f^{-1}(x) = 8x + 9$$

$$gh(x) = g(4x) = 2(4x)^2 + 9 = 32x^2 + 9$$

$$8x + 9 = 32x^2 + 9$$

$$32x^2 - 8x = 0$$

$$8x(4x - 1) = 0$$

$$x = 0 \quad \text{or} \quad 4x - 1 = 0$$

$$x = 0 \quad \text{or} \quad x = \frac{1}{4}$$

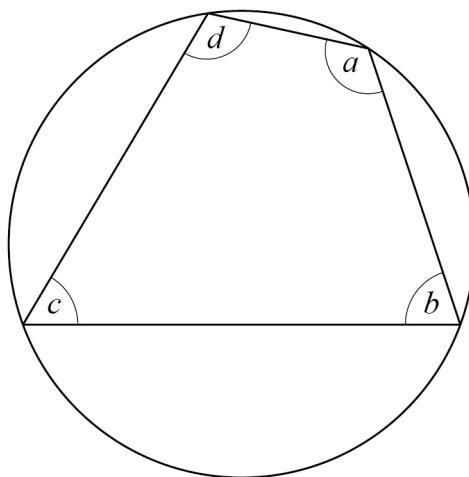
Answer $x = 0 \quad \text{or} \quad x = \frac{1}{4}$



22

Here is a cyclic quadrilateral.

$$a : b : c = 9 : 5 : 3$$

Not drawn
accuratelyWork out the size of angle d .

[3 marks]

Opposite angles in a cyclic quadrilateral add up to 180°

a and c are opposite: $9 + 3 = 12$ parts = 180°

1 part = $180 \div 12 = 15^\circ$

$b = 5 \times 15 = 75^\circ$

b and d are opposite, so $d = 180 - 75$

$= 105^\circ$

$d =$ 105 $^\circ$

Turn over ►



23

Work out $\frac{7}{\sqrt{2}} \times \frac{\sqrt{3}}{\sqrt{10}}$

Give your answer in the form $\frac{x\sqrt{15}}{y}$ where x and y are integers.

[3 marks]

$$\frac{7}{\sqrt{2}} \times \frac{\sqrt{3}}{\sqrt{10}} = \frac{7\sqrt{3}}{\sqrt{20}} = \frac{7\sqrt{3}}{2\sqrt{5}}$$

$$\frac{7\sqrt{3}}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{7\sqrt{15}}{2 \times 5} = \frac{7\sqrt{15}}{10}$$

Answer $\frac{7\sqrt{15}}{10}$



- 24** Line A is perpendicular to line B.
The gradient of line A is -2
Work out the gradient of line B.

[1 mark]

$$\text{Perpendicular gradient} = -1 \div (-2)$$

Answer $\frac{1}{2}$

- 25** The n th term of a geometric progression is r^n where $r > 0$
The second term is $\frac{8}{9}$

Work out the third term.

Give your answer in the form $\frac{c\sqrt{2}}{d}$ where c and d are integers.

[2 marks]

$$r^2 = \frac{8}{9} \quad \text{so} \quad r = \frac{\sqrt{8}}{\sqrt{9}} = \frac{2\sqrt{2}}{3}$$

$$r^3 = r^2 \times r = \frac{8}{9} \times \frac{2\sqrt{2}}{3} = \frac{16\sqrt{2}}{27}$$

Answer $\frac{16\sqrt{2}}{27}$

Turn over ►

- 26 (a) Work out the value of $\left(5\frac{1}{16}\right)^{\frac{1}{4}}$

[2 marks]

$$5\frac{1}{16} = \frac{80+1}{16} = \frac{81}{16}$$

$$\left(\frac{81}{16}\right)^{1/4} = \frac{\sqrt[4]{81}}{\sqrt[4]{16}} = \frac{3}{2}$$

Answer $\frac{3}{2}$

- 26 (b) Write $(49^m)^{2.5}$ as a power of 7 in terms of m .

[2 marks]

$$49 = 7^2, \text{ so } 49^m = 7^{2m}$$

$$(7^{2m})^{2.5} = 7^{2m \times 2.5}$$

$$= 7^{5m}$$

Answer 7^{5m}

- 27 Write down the solution of $x^2 < 16$

[1 mark]

Answer $-4 < x < 4$

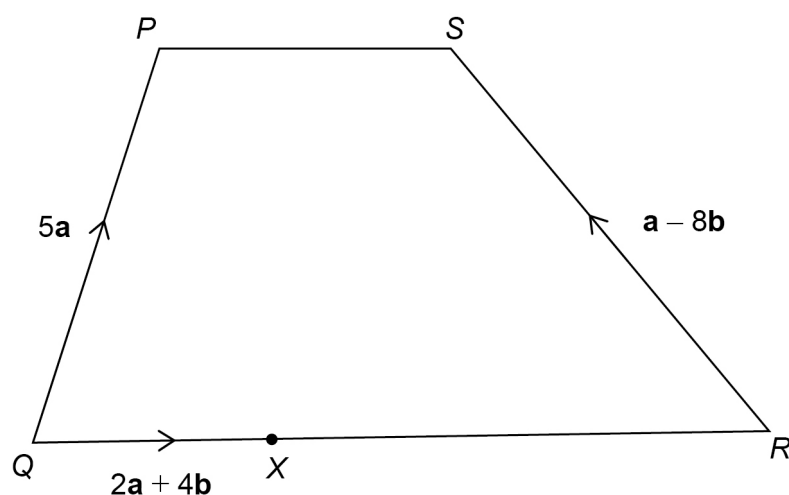


28

 $PQRS$ is a quadrilateral. PQ is not parallel to SR . X is a point on QR .

$$QX : XR = 2 : 3$$

$$\overrightarrow{QX} = 2\mathbf{a} + 4\mathbf{b}$$

Not drawn
accuratelyProve that $PQRS$ is a trapezium.**[3 marks]**

$$\overrightarrow{QR} = \frac{5}{2} \overrightarrow{QX} = \frac{5}{2} (2\mathbf{a} + 4\mathbf{b}) = 5\mathbf{a} + 10\mathbf{b}$$

$$\overrightarrow{PS} = \overrightarrow{PQ} + \overrightarrow{QR} + \overrightarrow{RS}$$

$$= -5\mathbf{a} + (5\mathbf{a} + 10\mathbf{b}) + (\mathbf{a} - 8\mathbf{b}) = \mathbf{a} + 2\mathbf{b}$$

$$\overrightarrow{QR} = 5\mathbf{a} + 10\mathbf{b} = 5(\mathbf{a} + 2\mathbf{b}) = 5\overrightarrow{PS}$$

 QR is a multiple of PS , so PS is parallel to QR . PQ is not parallel to SR , so $PQRS$ has exactly onepair of parallel sides, so $PQRS$ is a trapezium.

29 Here are the equations of three graphs.

$$y = \sin x$$

$$y = \cos x$$

$$y = \tan x$$

29 (a) Which statement is true?

Tick **one** box.

[1 mark]

☐

$y = \sin x$ passes through $(180^\circ, -1)$

☒

$y = \cos x$ passes through $(180^\circ, -1)$

☐

$y = \tan x$ passes through $(180^\circ, -1)$

☐

None of the graphs pass through $(180^\circ, -1)$

29 (b) Which statement is true?

Tick **one** box.

[1 mark]

☐

$y = \sin x$ passes through $(270^\circ, 1)$

☐

$y = \cos x$ passes through $(270^\circ, 1)$

☐

$y = \tan x$ passes through $(270^\circ, 1)$

☒

None of the graphs pass through $(270^\circ, 1)$

END OF QUESTIONS



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3 2



2 3 B G 8 3 0 0 / 1 H