



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 2 Calculator

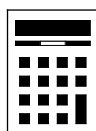
Wednesday 4 June 2025

Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).



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	



J U N 2 5 8 3 0 0 2 H 0 1

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

- 1 (a) Work out the highest common factor (HCF) of 16 and 24

[1 mark]

Factors of 16: 1, 2, 4, 8, 16

Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

Answer 8

- 1 (b) Work out the lowest common multiple (LCM) of 10 and 15

[1 mark]

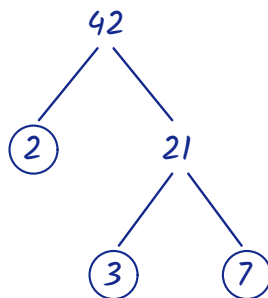
Multiples of 10: 10, 20, 30, 40

Multiples of 15: 15, 30, 45

Answer 30

- 1 (c) Write 42 as a product of its prime factors.

[1 mark]

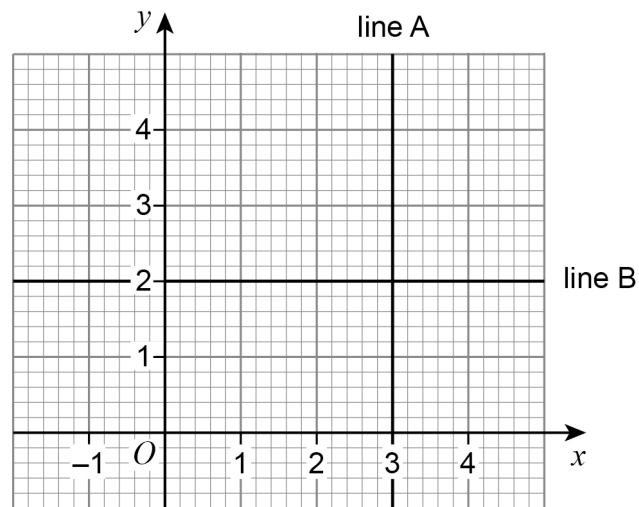


Answer $2 \times 3 \times 7$



2

Here are lines A and B.



Complete these statements.

[2 marks]

The **equation** of line A is $x = 3$ The **gradient** of line B is 0

Turn over for the next question

Turn over ►



3

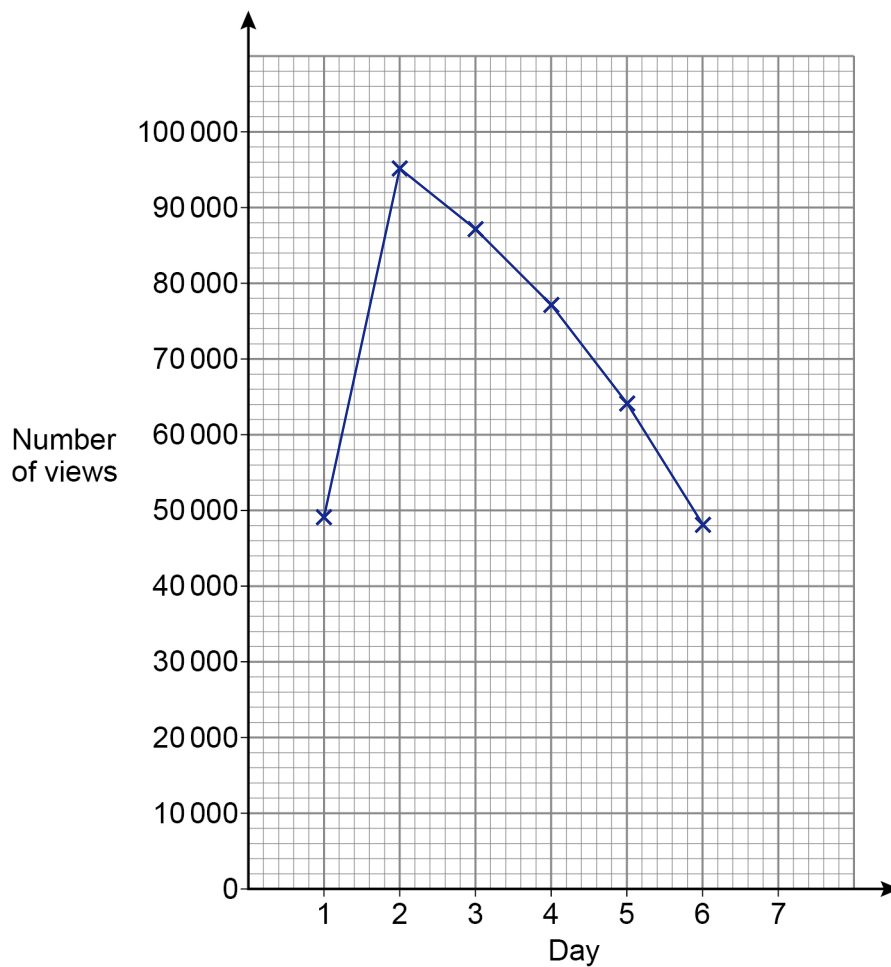
Youssuf posted an advert on his social media channel.

The table shows the number of views of the advert during its first 6 days.

Day	1	2	3	4	5	6
Number of views	49 000	95 000	87 000	77 000	64 000	48 000

3 (a) On the grid, draw a time series graph to represent the data.

[2 marks]



- 3 (b)** Youssuf receives 0.018p for each view of the advert.
Estimate how much he receives from views of the advert on **day 7**

[3 marks]

The views are falling by about 13 000 to 16 000 a day,

so estimate for day 7 is about 32 000 views

$$32\,000 \times 0.018 = 576p$$

$$576 \div 100 = \pounds 5.76$$

Answer £ 5.76

- 4** 70% of the discs in a box are red and the rest are blue.

- 40% of the red discs are removed.
- 50% of the blue discs are removed.

In total, what percentage of the discs are removed from the box?

[3 marks]

$$\text{Red removed: } 0.4 \times 70 = 28\%$$

$$\text{Blue: } 100 - 70 = 30\%$$

$$\text{Blue removed: } 0.5 \times 30 = 15\%$$

$$\text{Total removed: } 28 + 15 = 43\%$$

Answer 43 %

Turn over ►

- 5 (a) The length of a fence panel is 160 cm to the nearest 10 cm

Complete the error interval.

[2 marks]

Half of 10 cm = 5 cm: $160 - 5 = 155$, $160 + 5 = 165$

Answer 155 cm $\leq$ length $<$ 165 cm

- 5 (b) A different fence panel measures 2 metres to the nearest 10 cm

Kim says that the total length of **three** of these fence panels must be less than 6.2 m

Show that Kim is correct.

[2 marks]

2 m to the nearest 10 cm: upper bound = $2 \text{ m} + 5 \text{ cm} = 2.05 \text{ m}$

Each panel is less than 2.05 m long

Upper bound for three panels = $2.05 \times 3 = 6.15 \text{ m}$

So the total length is less than 6.15 m

$6.15 \text{ m} < 6.2 \text{ m}$, so the total must be less than 6.2 m.

Kim is correct.

- 6 Circle the expression which is a factor of $3x + 15$

[1 mark]

$3x$

$x + 12$

$x + 5$

$x + 15$



7

The five possible outcomes of an event are A, B, C, D and E.
The table shows some of the probabilities.

Outcome	A	B	C	D	E
Probability	0.18	0.2	0.3	0.16	0.16

$$P(C) = P(B) + 0.1$$

$$P(D) = P(E)$$

Work out $P(D)$

[3 marks]

$$P(C) = 0.2 + 0.1 = 0.3$$

$$P(D) + P(E) = 1 - 0.18 - 0.2 - 0.3 = 0.32$$

$$P(D) = 0.32 \div 2 = 0.16$$

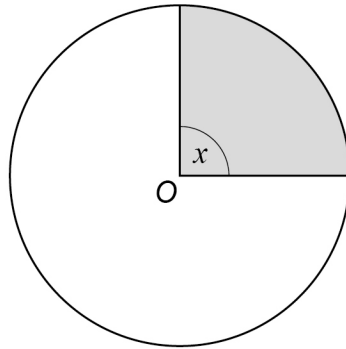
Answer 0.16

Turn over for the next question

Turn over ►



8 Here is a circle, centre O.



Not drawn
accurately

8 (a) The circle has a circumference of 20 cm

Assume that angle x is 90°

Work out the shaded area.

Give your answer as a decimal.

[3 marks]

$$C = 2\pi r, \text{ so } r = 20 \div 2\pi = 3.1830\dots$$

$$\text{Area of whole circle} = \pi \times 3.1830\dots^2 = 31.830\dots$$

$$\text{Angle } x = 90^\circ, \text{ so shaded area} = 90/360 \text{ of the circle}$$

$$\text{Shaded area} = 31.830\dots \times 90 \div 360$$

$$= 7.9577\dots$$

Answer 7.96 cm²



8 (b) In fact, angle x is smaller than 90°

What does this mean about the shaded area?

Tick **one** box.

[1 mark]

☒

It is smaller than the answer to part (a)

☐

It is the same as the answer to part (a)

☐

It is larger than the answer to part (a)

☐

It could be any of the above

9 The number of people that follow an influencer increases from 35 000 to 70 000

The influencer says,

“My number of followers has increased by 200%, because 70 000 is 35 000 times 2”

Are they correct?

Tick a box.

Yes

☐

No

☒

Give a reason for your answer.

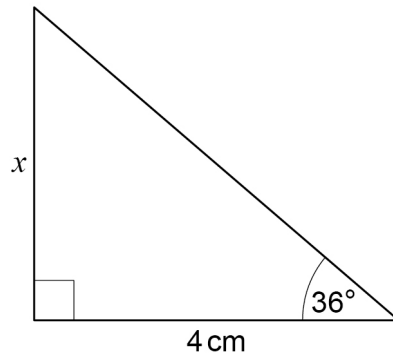
[1 mark]

It has gone up by 100%, as $70\,000 - 35\,000 = 35\,000 = 100\%$ of 35 000.

A 200% increase would give $35\,000 \times 3 = 105\,000$.



10

Not drawn
accurately

Use trigonometry to work out the value of x .

You **must** show your working.

[3 marks]

$$\tan 36^\circ = \frac{x}{4}$$

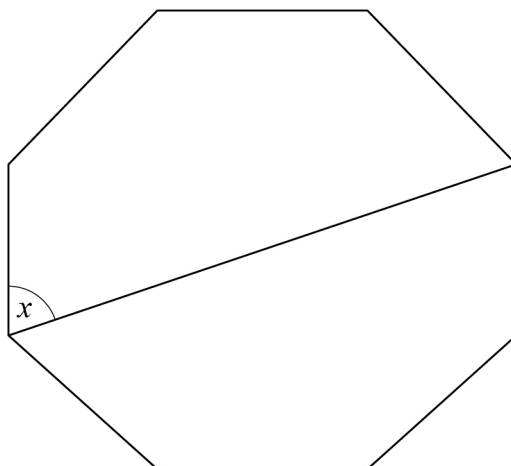
$$x = 4 \times \tan 36^\circ$$

$$x = 2.90617...$$

$$x = \underline{\quad 2.91 \quad} \text{ cm}$$



11

A straight line is drawn across a **regular** octagon.Not drawn
accuratelyWork out the size of angle x .

[3 marks]

$$\text{Exterior angle} = 360 \div 8 = 45^\circ$$

$$\text{Interior angle} = 180 - 45 = 135^\circ$$

The line joins opposite vertices, so it is a line of
symmetry of the octagon and bisects the interior angle

$$x = 135 \div 2 = 67.5^\circ$$

$$x = \underline{\quad 67.5 \quad}^\circ$$

Turn over ►



12 Greg and Hanna want to know if students at their school think lunchtime clubs are important.

12 (a) Greg asks 15 people at the lunchtime chess club.

Give **one** reason why his results may **not** represent the whole school.

[1 mark]

*The sample is biased: he only asks people at the chess club,
and 15 people is too small a sample.*

12 (b) Here are Hanna's results.

- 62% answered Important.
- 24% answered Not Important.
- The rest answered Don't Know.

93 students answered Important.

How many students answered Don't Know?

[3 marks]

$$\text{Total} = 93 \div 0.62 = 150 \text{ students}$$

$$\text{Don't Know} = 100 - 62 - 24 = 14\%$$

$$14\% \text{ of } 150 = 0.14 \times 150 = 21$$

Answer 21



13

Emma and Chan each drive 154 miles from A to B.

Emma drives the whole way at an average speed of 56 miles per hour.

Chan drives

85 miles at an average speed of 50 miles per hour

and then

the rest of the way at an average speed of 60 miles per hour.

Who takes **less** time, Emma or Chan?

Show working to support your answer.

[4 marks]

$$\text{Emma: } 154 \div 56 = 2.75 \text{ hours}$$

$$\text{Chan: } 85 \div 50 = 1.7 \text{ hours}$$

$$154 - 85 = 69 \text{ miles left}$$

$$69 \div 60 = 1.15 \text{ hours}$$

$$\text{Chan's total} = 1.7 + 1.15 = 2.85 \text{ hours}$$

$$2.75 \text{ hours} < 2.85 \text{ hours, so Emma takes less time}$$

Answer Emma



14

 a , b and c are **positive integers**.

$$a(9x + 2) \equiv 45x + 3b + c$$

Work out **one** possible set of values for a , b and c .**[3 marks]**

$$a(9x + 2) = 9ax + 2a$$

$$\text{Compare } x \text{ terms: } 9a = 45, \text{ so } a = 5$$

$$\text{Compare numbers: } 3b + c = 2a = 2 \times 5 = 10$$

$$\text{Try } b = 2: 3 \times 2 + c = 10, \text{ so } c = 4$$

$$a = \underline{\quad 5 \quad} \quad b = \underline{\quad 2 \quad} \quad c = \underline{\quad 4 \quad}$$



15

Solve $3x^2 + 5x - 9 = 0$

Give your solutions as decimals.

[2 marks]

$$a = 3, \quad b = 5, \quad c = -9$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4 \times 3 \times (-9)}}{2 \times 3}$$

$$x = \frac{-5 \pm \sqrt{133}}{6}$$

$$x = 1.08876... \quad \text{or} \quad x = -2.75542...$$

Answer 1.09 and -2.76

16

The value of a second-hand car decreases by 12.1% per year.

Work out the number of full years until the car loses **more** than half its value.You **must** show your working.

[3 marks]

$$\text{Multiplier} = 1 - 0.121 = 0.879$$

$$\text{After 5 years: } 0.879^5 = 0.5247... \quad (52.5\% \text{ of value left})$$

$$\text{After 6 years: } 0.879^6 = 0.4612... \quad (46.1\% \text{ of value left})$$

$$0.4612... < 0.5, \text{ so after 6 years it has lost more than half}$$

Answer 6 years

8

Turn over ►



17

When a biased coin is spun, $P(\text{Heads}) : P(\text{Tails}) = 5 : 2$

In a game, the player spins the coin four times.

The player can win in **two** ways.

1st way to win

Spin 4 heads

2nd way to win

Spin a Head, then a Tail, then a Head, then a Tail

How many times more likely is a player to win the 1st way than the 2nd way?

[3 marks]

$$P(H) = \frac{5}{7}, \quad P(T) = \frac{2}{7}$$

$$\text{1st way: } P(HHHH) = \frac{5 \times 5 \times 5 \times 5}{7^4} = \frac{625}{2401}$$

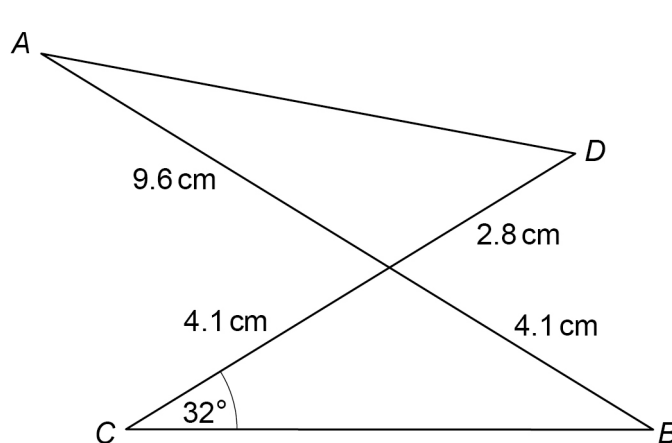
$$\text{2nd way: } P(HTHT) = \frac{5 \times 2 \times 5 \times 2}{7^4} = \frac{100}{2401}$$

$$\frac{625}{2401} \div \frac{100}{2401} = 625 \div 100 = 6.25$$

Answer 6.25



18

Lines AB , BC , CD and AD form two triangles.Not drawn
accuratelyWork out the length of AD .**[4 marks]***Let X be the point where AB and CD cross.**Triangle CXB is isosceles ($CX = XB = 4.1$ cm), so angle $CBX = 32^\circ$* *Angle $CXB = 180 - 32 - 32 = 116^\circ$* *Angle $AXD = 116^\circ$ (vertically opposite angles are equal)* *$AD^2 = 9.6^2 + 2.8^2 - 2 \times 9.6 \times 2.8 \times \cos 116^\circ$* *$AD^2 = 92.16 + 7.84 - 53.76 \times \cos 116^\circ$* *$AD^2 = 123.5668...$* *$AD = \sqrt{123.5668...} = 11.1160...$* Answer 11.1 cm

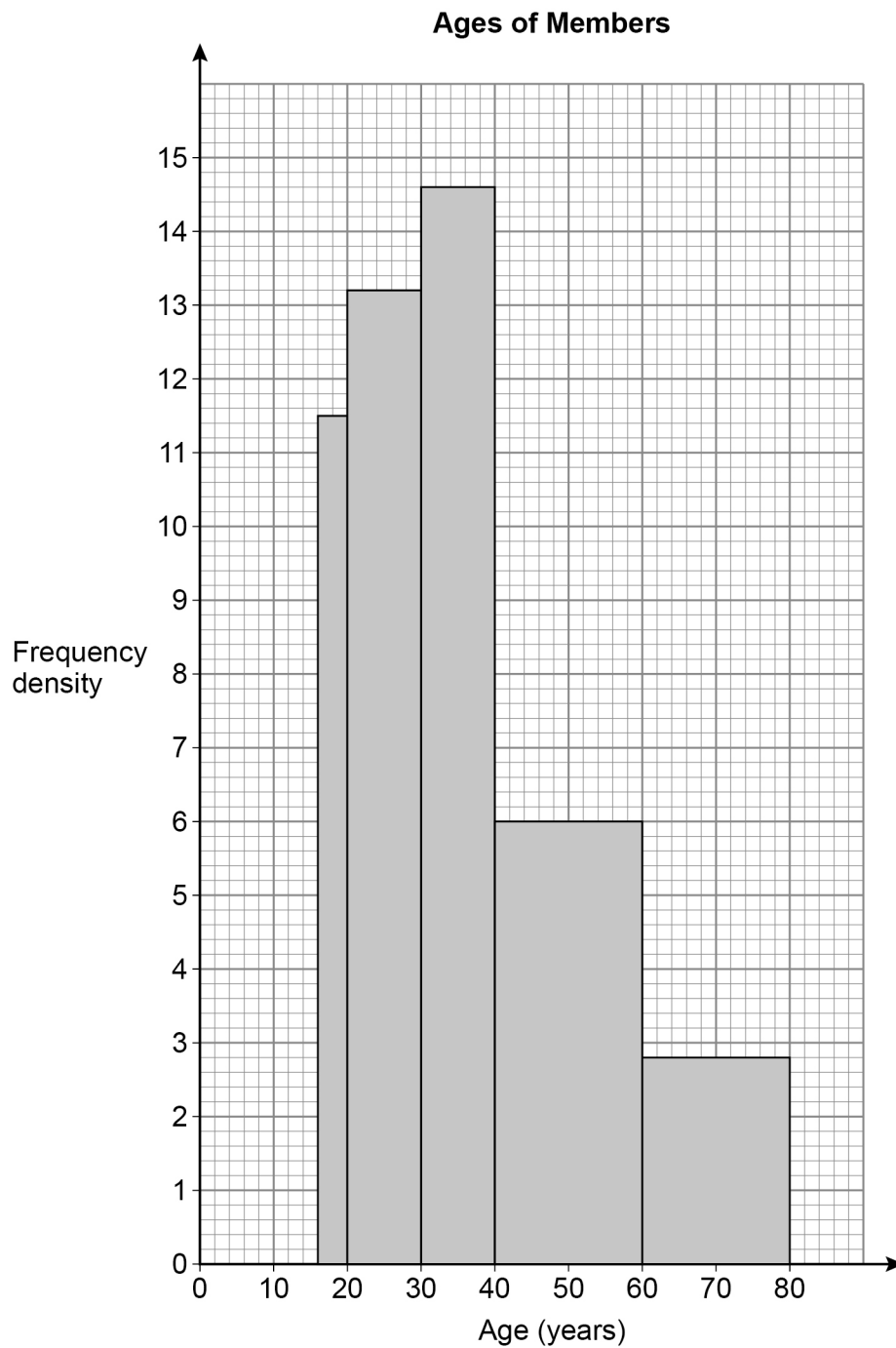
Turn over ►



19

The histogram represents the ages of the 500 members of a gym.

The first bar represents the members aged at least 16 and under 20



Each member pays an annual fee based on their age.

Age	Under 65	65 or over
Annual fee	£275	£129

Use the histogram to estimate the **total** annual fees paid by these members.

[4 marks]

$$\text{Frequency} = \text{frequency density} \times \text{class width}$$

$$16 \text{ to } 20: 4 \times 11.5 = 46$$

$$20 \text{ to } 30: 10 \times 13.2 = 132$$

$$30 \text{ to } 40: 10 \times 14.6 = 146$$

$$40 \text{ to } 60: 20 \times 6 = 120$$

$$60 \text{ to } 80: 20 \times 2.8 = 56$$

$$65 \text{ or over: } (80 - 65) \times 2.8 = 15 \times 2.8 = 42 \text{ members}$$

$$\text{Under 65: } 500 - 42 = 458 \text{ members}$$

$$\text{Under 65 fees: } 458 \times 275 = \text{£}125\,950$$

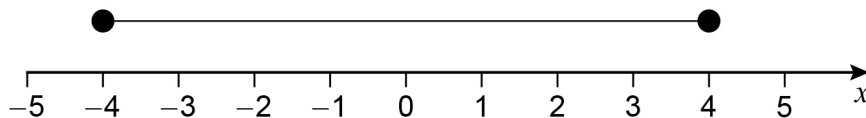
$$65 \text{ or over fees: } 42 \times 129 = \text{£}5418$$

$$\text{Total} = 125\,950 + 5418 = \text{£}131\,368$$

Answer £ 131 368



- 20 David has solved the inequality $x^2 < 16$ and represented his solution on the number line below.

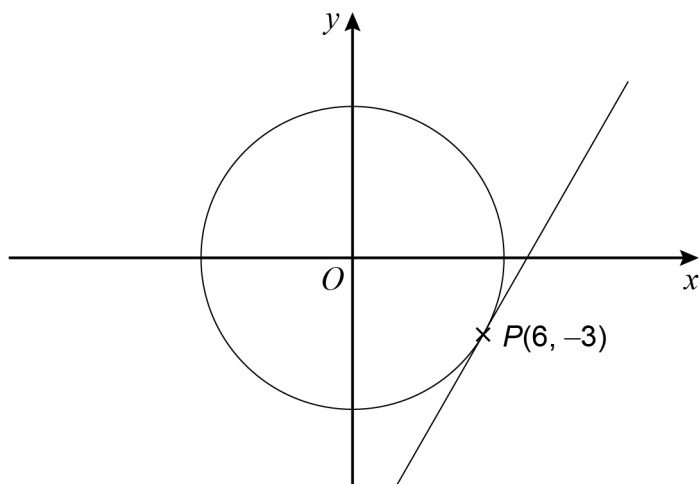


Give **one** reason why David's solution is wrong.

[1 mark]

The circles should be open (not shaded), because $x = 4$ and $x = -4$ are not solutions: $4^2 = 16$, which is not less than 16.

- 21 A circle with centre O and radius $\sqrt{45}$ has a tangent drawn at point $P(6, -3)$



Not drawn
accurately

- 21 (a) Write down the equation of the **circle**.

[1 mark]

Answer $x^2 + y^2 = 45$



21 (b) Work out the equation of the **tangent**.

Give your answer in the form $y = mx + c$

[4 marks]

$$\text{Gradient of } OP = \frac{-3 - 0}{6 - 0} = \frac{-1}{2}$$

The tangent is perpendicular to the radius OP

$$\text{Gradient of tangent} = -1 \div (-1/2) = 2$$

$$y - (-3) = 2(x - 6)$$

$$y + 3 = 2x - 12$$

$$y = 2x - 15$$

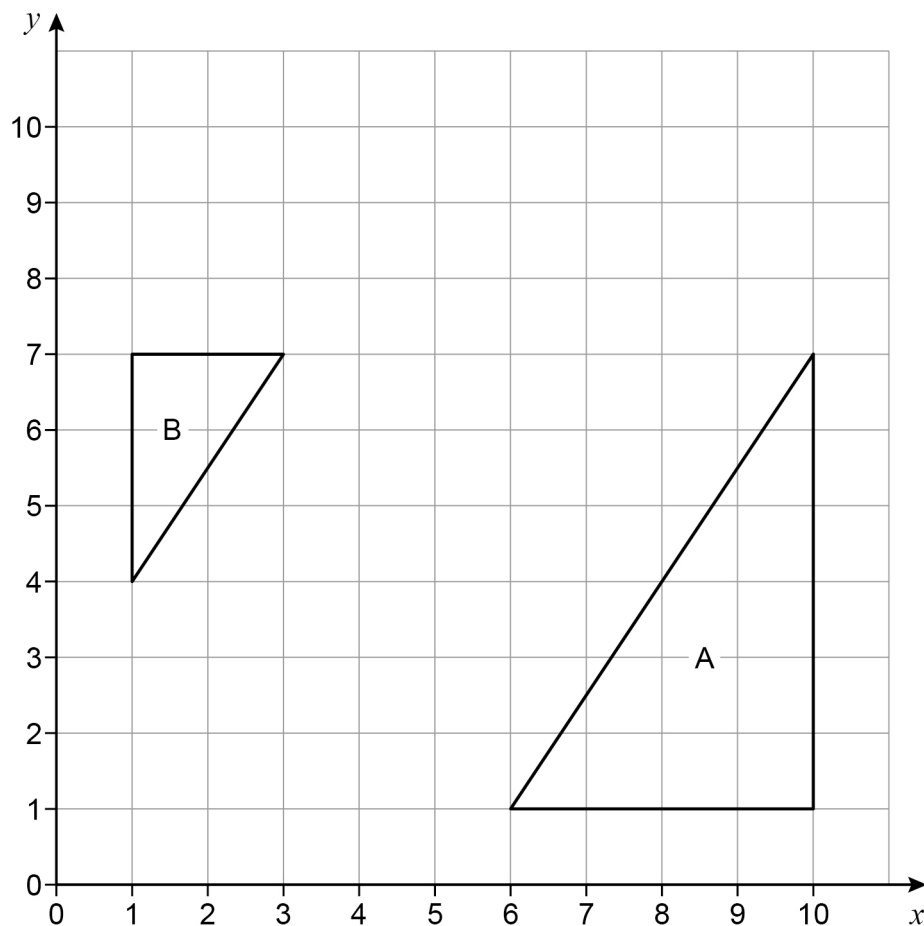
Answer $y = 2x - 15$

Turn over for the next question



22

Shape A and shape B are shown on the grid.

Describe the **single** transformation that maps shape A to shape B.**[3 marks]***Enlargement**Scale factor $-\frac{1}{2}$* *Centre of enlargement (4, 5)*

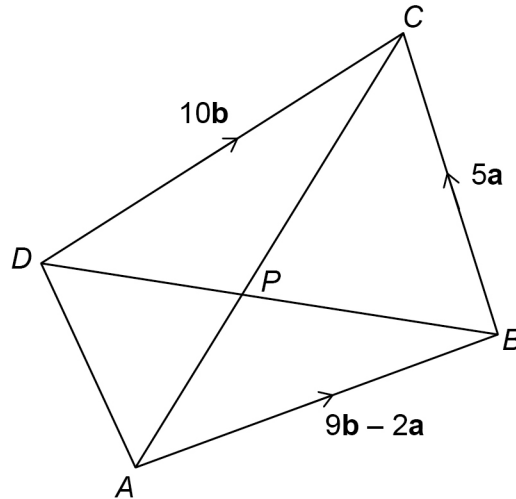
23

 $ABCD$ is a quadrilateral. AC and BD intersect at P .

$$\overrightarrow{AB} = 9\mathbf{b} - 2\mathbf{a}$$

$$\overrightarrow{BC} = 5\mathbf{a}$$

$$\overrightarrow{DC} = 10\mathbf{b}$$

Not drawn
accurately

$$BP : PD = 3 : 2$$

$$AP : PC = 1 : k$$

Work out the value of k .You **must** show your working.**[5 marks]**

$$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC} = 9\mathbf{b} - 2\mathbf{a} + 5\mathbf{a} = 3\mathbf{a} + 9\mathbf{b}$$

$$\overrightarrow{AD} = \overrightarrow{AC} + \overrightarrow{CD} = 3\mathbf{a} + 9\mathbf{b} - 10\mathbf{b} = 3\mathbf{a} - \mathbf{b}$$

$$\overrightarrow{BD} = \overrightarrow{BA} + \overrightarrow{AD} = 2\mathbf{a} - 9\mathbf{b} + 3\mathbf{a} - \mathbf{b} = 5\mathbf{a} - 10\mathbf{b}$$

$$\overrightarrow{BP} = \frac{3}{5} \text{ of } \overrightarrow{BD} = \frac{3}{5} (5\mathbf{a} - 10\mathbf{b}) = 3\mathbf{a} - 6\mathbf{b}$$

$$\overrightarrow{AP} = \overrightarrow{AB} + \overrightarrow{BP} = 9\mathbf{b} - 2\mathbf{a} + 3\mathbf{a} - 6\mathbf{b} = \mathbf{a} + 3\mathbf{b}$$

$$\overrightarrow{PC} = \overrightarrow{AC} - \overrightarrow{AP} = 3\mathbf{a} + 9\mathbf{b} - \mathbf{a} - 3\mathbf{b} = 2\mathbf{a} + 6\mathbf{b} = 2(\mathbf{a} + 3\mathbf{b})$$

$$\text{So } \overrightarrow{PC} = 2\overrightarrow{AP}, \quad AP : PC = 1 : 2$$

$$k = \underline{\hspace{2cm}} 2 \underline{\hspace{2cm}}$$

Turn over ►



24

A study suggests a student's exam mark, m , is directly proportional to the cube root of total revision time, t hours.

A student doubles their total revision time.

Work out the percentage increase in their exam mark.

[3 marks]

$$m = k\sqrt[3]{t}$$

$$\text{Revision time } t: m_1 = k\sqrt[3]{t}$$

$$\text{Revision time } 2t: m_2 = k\sqrt[3]{(2t)} = \sqrt[3]{2} \times k\sqrt[3]{t} = \sqrt[3]{2} \times m_1$$

$$\sqrt[3]{2} = 1.259921\dots$$

$$\text{Percentage increase} = (1.259921\dots - 1) \times 100$$

$$= 25.9921\dots\%$$

Answer 25.99 %



25

$f(x) = ax + b$ and $g(x) = \frac{x+b}{a}$ where a and b are positive integers.

Prove that $fg(x) - af^{-1}(x)$ is always a multiple of 3

[4 marks]

$$fg(x) = a\left(\frac{x+b}{a}\right) + b = x + b + b = x + 2b$$

$$y = ax + b \rightarrow x = \frac{y-b}{a}, \text{ so } f^{-1}(x) = \frac{x-b}{a}$$

$$fg(x) - af^{-1}(x) = x + 2b - a \frac{x-b}{a}$$

$$= x + 2b - (x - b)$$

$$= x + 2b - x + b$$

$$= 3b$$

b is a positive integer, so $3b = 3 \times b$ is always a multiple of 3

END OF QUESTIONS



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ANSWER IN THE SPACES PROVIDED**



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