Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

Higher Tier Paper 3 Calculator

Tuesday 13 June 2017 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- 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	
TOTAL	

Do not write outside the box

Answer **all** questions in the spaces provided

1 $\mathbf{a} = \begin{pmatrix} -4 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

Circle the vector $2\mathbf{a} + \mathbf{b}$

[1 mark]

$\begin{pmatrix} -5 \\ -3 \end{pmatrix}$ $\begin{pmatrix} -11 \\ -3 \end{pmatrix}$ $\begin{pmatrix} -5 \\ -1 \end{pmatrix}$ $\begin{pmatrix} -11 \\ -1 \end{pmatrix}$

2 Which of these values of n makes 2.7×10^{n} a cube number?

Circle your answer.

[1 mark]

0 1 2 3

3 Rearrange $2x = \frac{y}{w}$ to make w the subject.

Circle your answer.

[1 mark]

$w = \frac{2y}{x}$ $w = \frac{2x}{y}$ $w = \frac{y}{2x}$ $w = \frac{x}{2y}$

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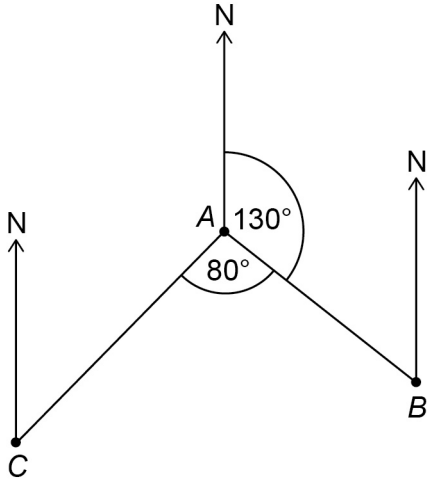
4



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Work out the bearing of *C* from *A*.

Circle your answer.

[1 mark]

030° 130° 150° 210°

Turn over for the next question

4

Do not write outside the box

5 A coin lands on Tails 200 times.

The relative frequency of Tails is 0.4

Work out the number of times the coin was thrown.

[2 marks]

Answer _____

6 How are the whole number solutions to A and B different?

A Solve $3 \leqslant 3x < 18$

B Solve $3 < 3x \leqslant 18$

[2 marks]

Do not write outside the box

7 (a) The length of a pipe is 6 metres to the nearest metre.

Complete the error interval for the length of the pipe.

[2 marks]

Answer _____ m $\leqslant$ length $<$ _____ m

7 (b) The length of a different pipe is 4 metres to the nearest metre.

Olly says,

"The total length of the two pipes is 11 metres to the nearest metre."

Give an example to show that he could be correct.

[2 marks]

_____

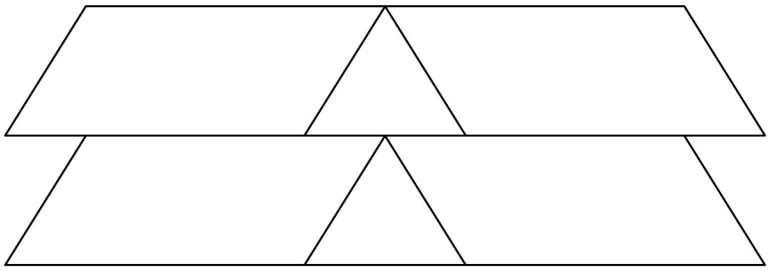
_____

Turn over for the next question

8

Do not write outside the box

8 This shape is made from two triangles and four congruent parallelograms.



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For each statement, tick the correct box.

8 (a) The triangles are equilateral.

[1 mark]

☐ Must be true

☐ Could be true

☐ Must be false

8 (b) The triangles are congruent.

[1 mark]

☐ Must be true

☐ Could be true

☐ Must be false

Do not write outside the box

9 There are 720 boys and 700 girls in a school.

The probability that a boy chosen at random studies French is $\frac{2}{3}$

The probability that a girl chosen at random studies French is $\frac{3}{5}$

9 (a) Work out the number of students in the school who study French.

[3 marks]

Answer _____

9 (b) Work out the probability that a student chosen at random from the whole school does **not** study French.

[2 marks]

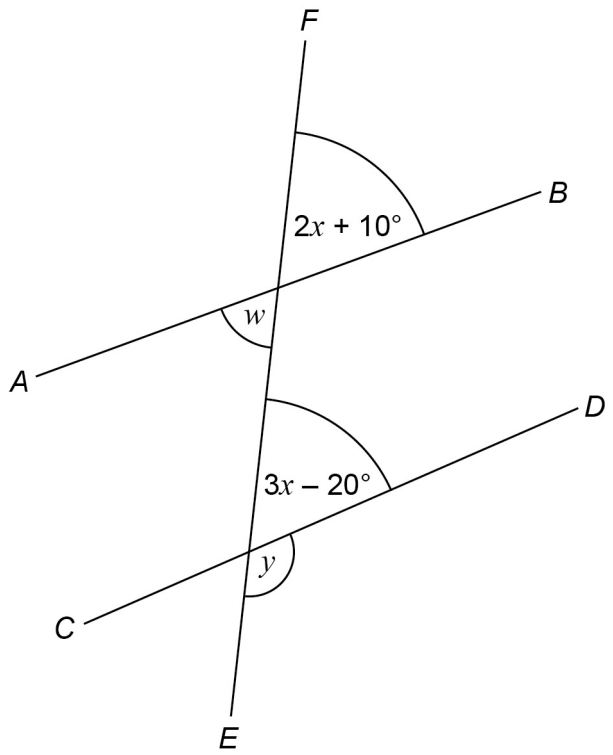
Answer _____

Turn over for the next question

7

Do not write outside the box

10 *AB*, *CD* and *EF* are straight lines.



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10 (a) Ava assumes that *AB* and *CD* are parallel.

What answer should she get for the size of angle y?

[4 marks]

Answer _____ degrees

Do not write outside the box

10 (b) In fact,

AB and *CD* are **not** parallel

angle w is 60°

What effect does this have on the size of angle y?

Tick a box.

☐ y is bigger

☐ y is the same

☐ y is smaller

Show working to support your answer.

[3 marks]

Turn over for the next question

7

Do not write outside the box

11 Purple paint is made by mixing red paint and blue paint in the ratio 5 : 2

Yan has 30 litres of red paint and 9 litres of blue paint.

What is the **maximum** amount of purple paint he can make?

[3 marks]

Answer _____ litres

12 $\left(ar^{b}\right)^{4} = 16r^{20}$ where a and b are positive integers.

Work out a and b

[2 marks]

a = _____ b = _____

Do not write outside the box

13 In a class of 28 students

the mean height of the 12 boys is 1.58 metres

the mean height of all 28 students is 1.52 metres.

Work out the mean height of the girls.

[4 marks]

Answer _____ metres

14 $xy = c$ where c is a constant.

Circle the correct statement.

[1 mark]

y is directly proportional to x

y is directly proportional to $\frac{1}{x}$

y is inversely proportional to $\frac{1}{x}$

x is directly proportional to y

Turn over for the next question

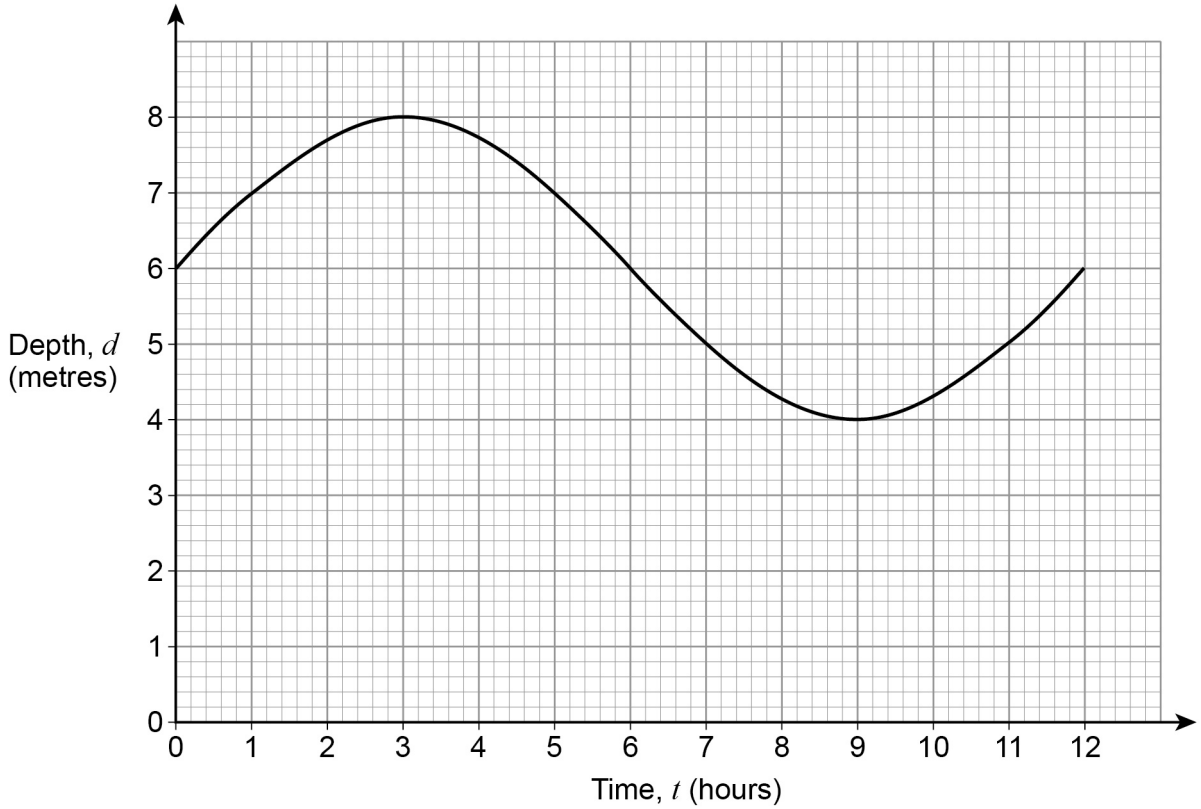
10

Do not write outside the box

15 The graph shows the depth of water in a harbour for 12 hours.

d is the depth of water in a harbour in metres

t is the number of hours after 9 am



15 (a) For how many of the 12 hours is the depth more than 5 metres?

[1 mark]

Answer _____

15 (b) By how much does the depth change between 12 noon and 4 pm?

[1 mark]

Answer _____ metres

Do not write outside the box

16 The value of a new car is £18 000

The value of the car decreases by

25% in the first year

12% in each of the next 4 years.

Work out the value of the car after 5 years.

[3 marks]

Answer £ _____

Turn over for the next question

5

Do not write outside the box

17 Liam drives his car.

He drives the first 9 miles in 9 minutes.

He then drives at an average speed of 70 miles per hour for 1 hour 36 minutes.

He finds this information about his car.

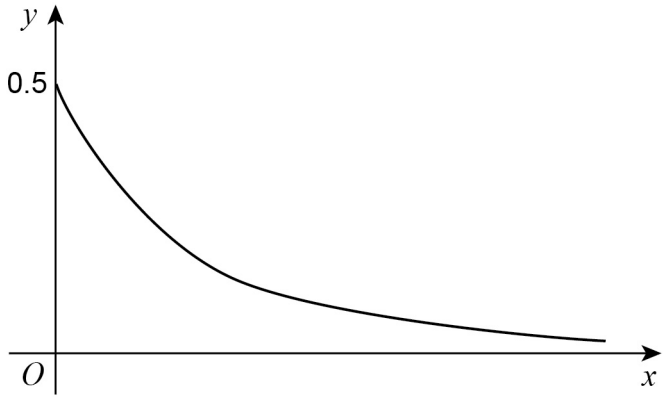
Average speed	Miles travelled per gallon
65 miles per hour or less	50
More than 65 miles per hour	40

Use the information to show that his car uses less than 3 gallons of petrol for the drive.

[5 marks]

Do not write outside the box

18 Nick sketches the graph of $y = 0.5^x$ for $x \geqslant 0$



Make **one** criticism of his sketch.

[1 mark]

Turn over for the next question

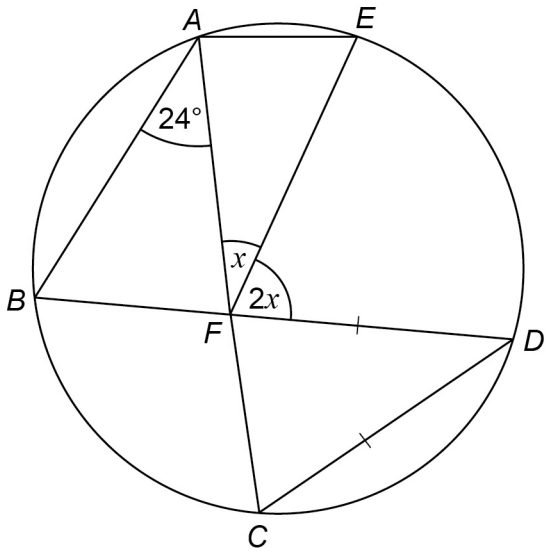
6

Do not write outside the box

19 *A*, *B*, *C*, *D* and *E* are points on a circle.

BFD and *AFC* are straight lines.

DC = *DF*



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Work out the size of angle x.

You **must** show your working which may be on the diagram.

[4 marks]

Answer _____ degrees

Do not write outside the box

20 This sign shows when a lift is safe to use.

Total mass of people must be 450 kg or less

Ben and some other people are in the lift.
Their total mass is 525 kg to the nearest 5 kg

Ben gets out.
He has a mass of 78 kg to the nearest kg

Is the lift now safe to use?
You **must** show your working.

[4 marks]

Answer _____

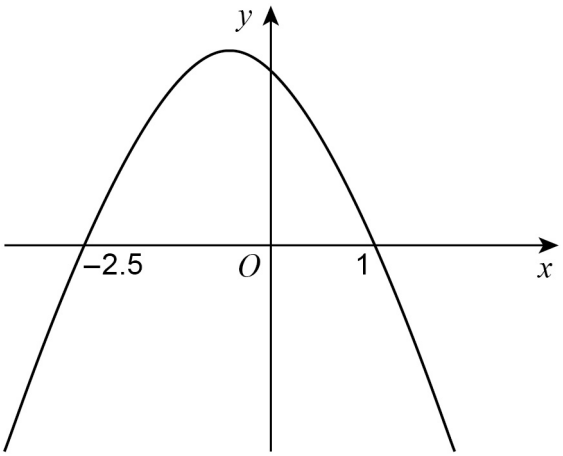
Turn over for the next question

8

Do not write outside the box

21 Here is a sketch of $y = f(x)$ where $f(x)$ is a quadratic function.

The graph intersects the x-axis where $x = -2.5$ and $x = 1$



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Circle the solution of $f(x) > 0$

[1 mark]

$x < -2.5$ or $x > 1$

$x > -2.5$ or $x > 1$

$-2.5 < x < 1$

$x > -2.5$ or $x < 1$

Do not write outside the box

22 Work out an expression for the nth term of the quadratic sequence

2 17 40 71 ....

Give your answer in the form $an^2 + bn + c$ where a, b and c are constants.

[3 marks]

Answer _____

Turn over for the next question

4

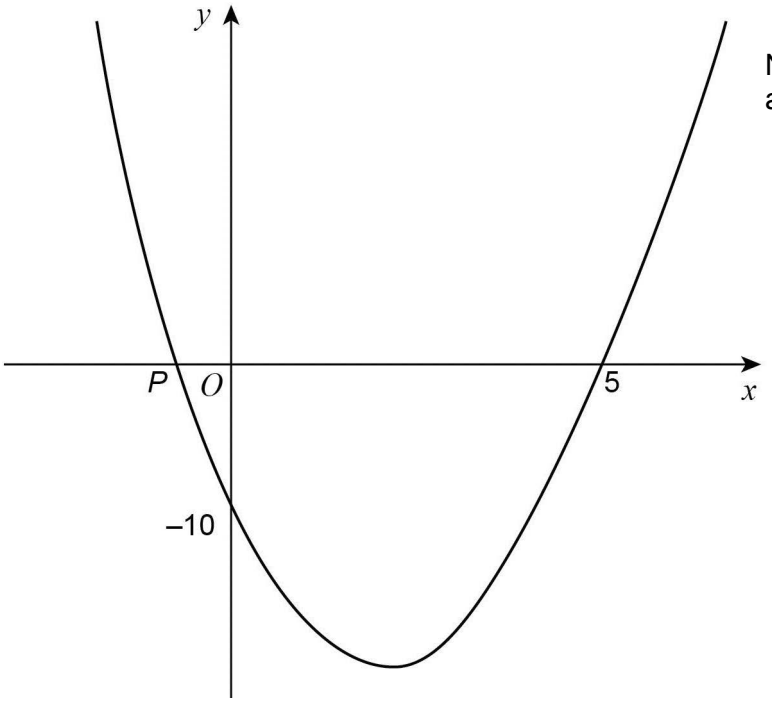
Do not write outside the box

23 Here is a sketch of $y = x^2 + bx + c$

The curve intersects

the x-axis at (5, 0) and point P

the y-axis at (0, –10)



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Work out the x-coordinate of the turning point of the graph.

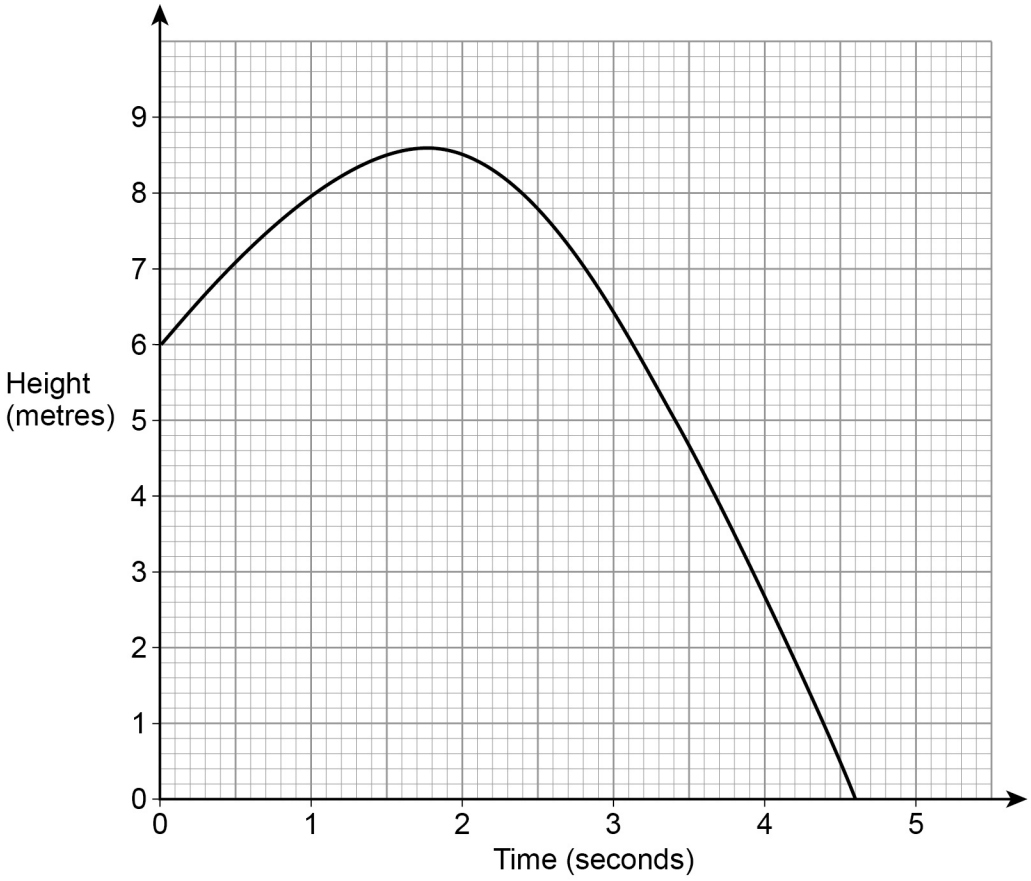
[4 marks]

Answer _____

Do not write outside the box

24 A ball is thrown from a point 6 metres above the ground.

The graph shows the height of the ball above the ground, in metres.



Estimate the speed of the ball, in m/s, after 1 second.

You **must** show your working.

[2 marks]

Answer _____ m/s

6

Turn over ►

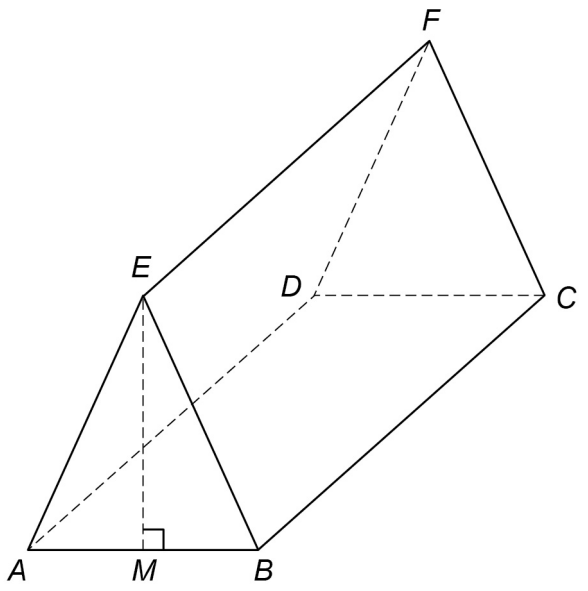
Do not write outside the box

25 Rectangle *ABCD* is the horizontal base of a triangular prism *ABCDEF*.

AE = *BE*

E is vertically above *M*, the midpoint of *AB*.

AB = 16 cm *AE* = 17 cm *BC* = 30 cm



25 (a) Show that *EM* = 15 cm

[2 marks]

Do not write outside the box

25 (b) Work out the size of angle *ECM*.

[4 marks]

Answer _____ degrees

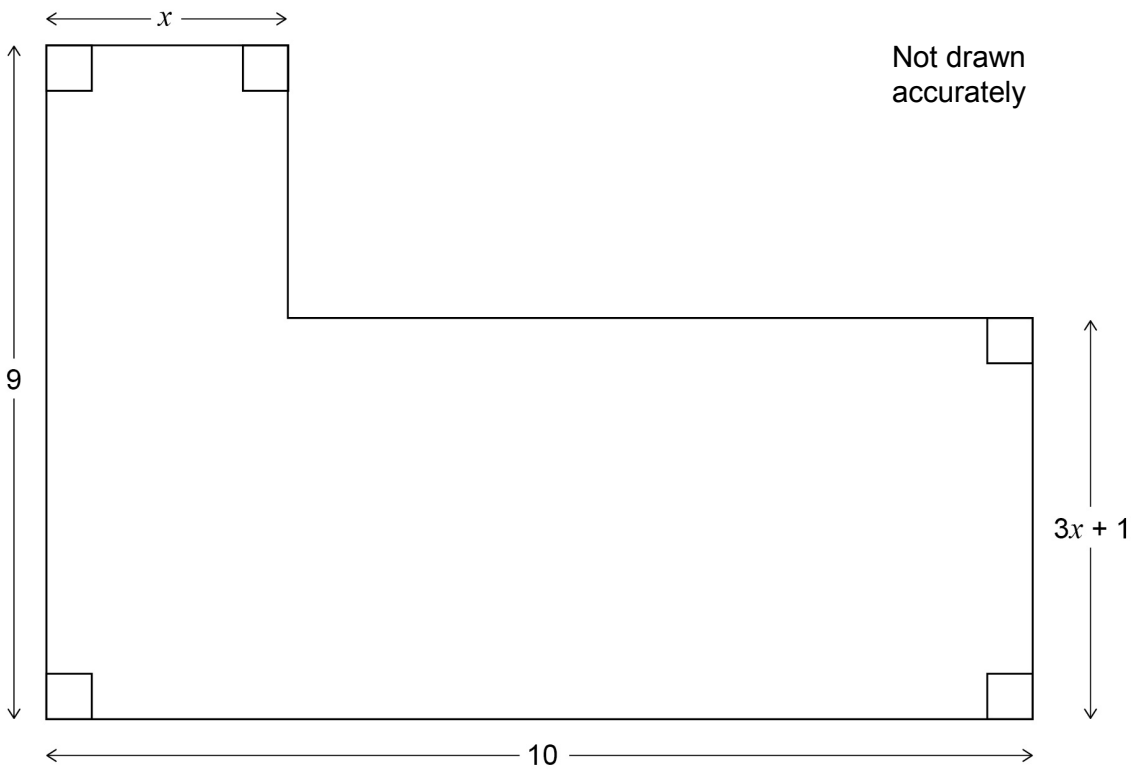
Turn over for the next question

6

Do not write outside the box

26 Here is an L-shape.

All dimensions are in centimetres.



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The area of the L-shape is 65 cm^2

Work out the value of x.

[6 marks]

Answer _____

Turn over for the next question

6

Do not write outside the box

27 Prove that $x^2 + x + 1$ is always positive.

[3 marks]

END OF QUESTIONS

3

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