Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
TOTAL	

General Certificate of Secondary Education
Higher Tier

Methods in Mathematics (Linked Pair Pilot) 93652H

Unit 2 Higher Tier

Specimen Paper

H

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

Time allowed
- 1 hour 30 minutes

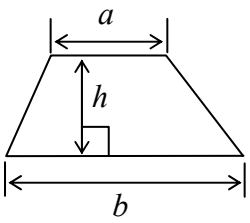
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- The quality of your written communication is specifically assessed in questions 7, 10 and 21.
  These questions are indicated with an asterisk (✳)
- You may ask for more answer paper, graph paper and tracing paper
  These must be tagged securely to this answer booklet.
- You are expected to use a calculator where appropriate.

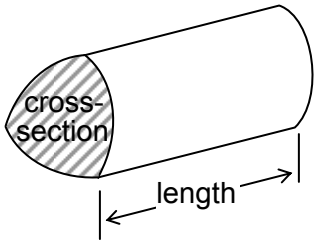
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$

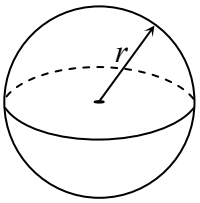


Volume of prism = area of cross-section × length



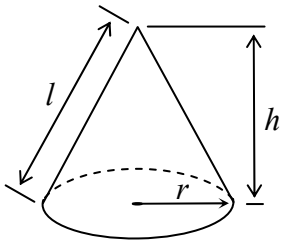
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

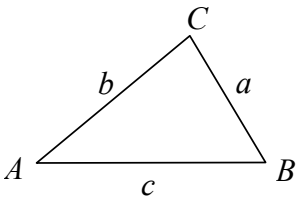


In any triangle ABC

Area of triangle = $\frac{1}{2}ab\sin C$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$



The Quadratic Equation

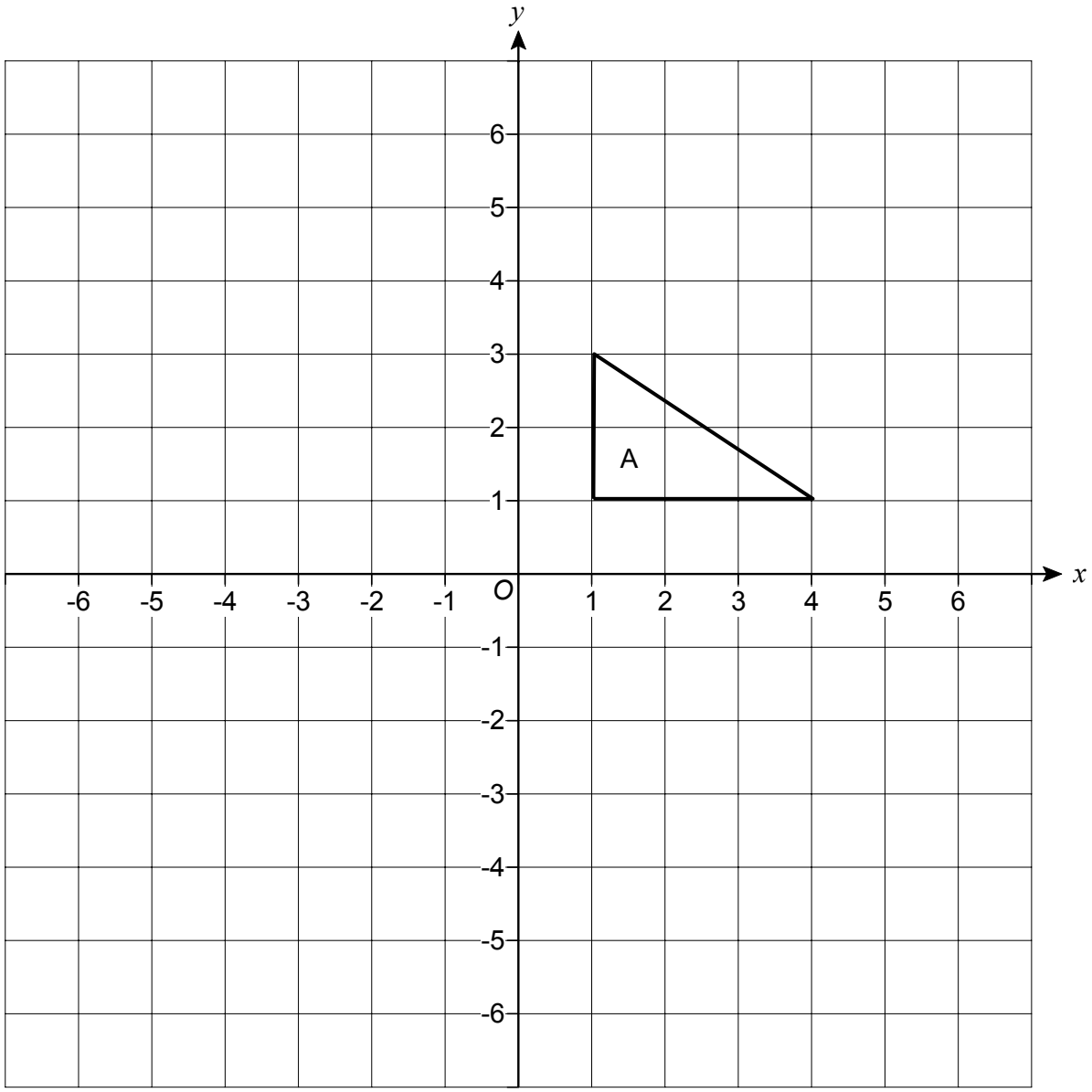
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Do not write outside the box

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

1 Rotate triangle A, 90° clockwise, about the origin.



(3 marks)

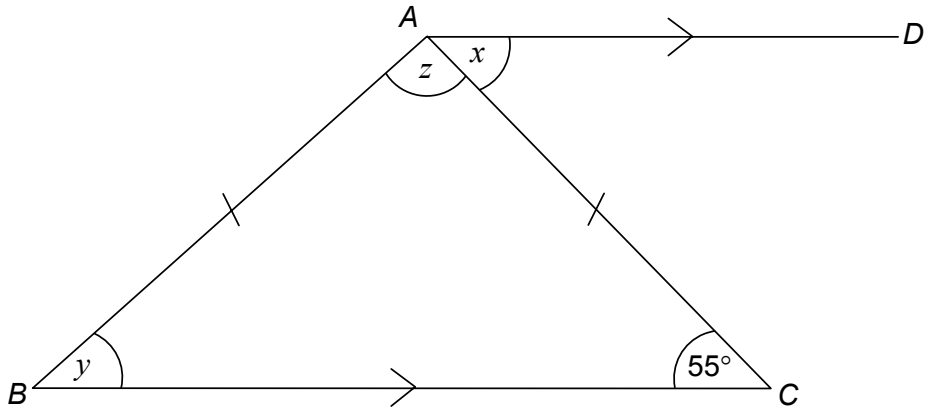
3

Do not write outside the box

2 *ABC* is an isosceles triangle with $AB = AC$

BC is parallel to *AD* and angle $BCA = 55°$

Not drawn accurately



Work out the sizes of the angles marked x, y and z.

.....

.....

Answer $x =$ ..... degrees

$y =$ ..... degrees

$z =$ ..... degrees

(4 marks)

Do not write outside the box

3 In a class of 30 pupils

16 have a mobile phone and a computer.
27 have a mobile phone.
17 have a computer.

Work out how many pupils do not have a mobile phone or a computer.

.....

.....

Answer ..... *(3 marks)*

4 Use your calculator to evaluate $\dfrac{6.1 \times 5.9}{8.7 - 3.4}$

4 (a) Write down your full calculator display.

Answer ..... *(1 mark)*

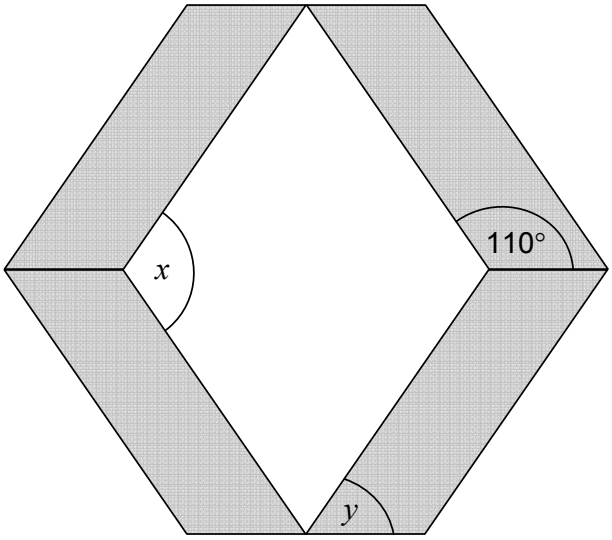
4 (b) Write down your answer to a suitable degree of accuracy.

Answer ..... *(1 mark)*

9

Do not write outside the box

5 Four identical parallelograms are joined to form this pattern.



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Work out the sizes of the angles marked x and y.

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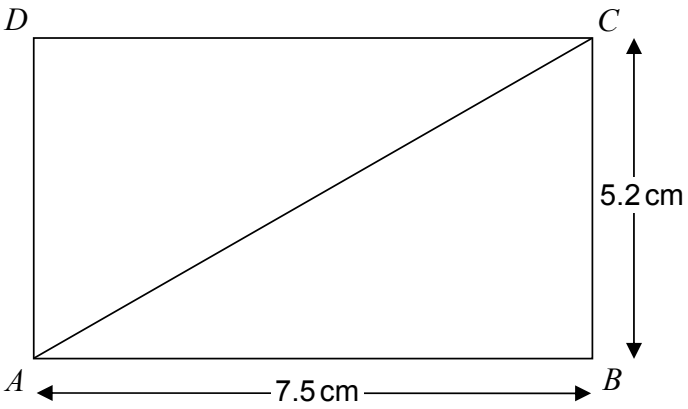
Answer $x =$ ..... degrees, $y =$ ..... degrees *(3 marks)*

Do not write outside the box

6 *ABCD* is a rectangle.
$AB = 7.5\,\text{cm}$ and $BC = 5.2\,\text{cm}$



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Calculate the length of the diagonal, *AC*.

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Answer ..... cm *(3 marks)*

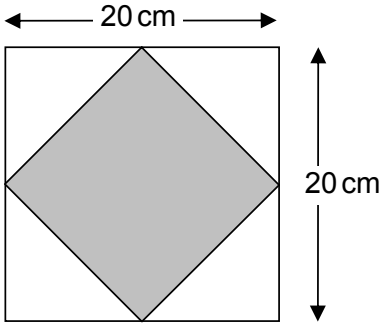
Turn over for the next question

6

Do not write outside the box

✳ **7** Emily is drawing and shading shapes.
Each time she starts with a square of side 20 cm.

7 (a) She draws a second square by joining the midpoints of the original one.
She shades the second square.



Not drawn accurately

Show that half of the original square is shaded.

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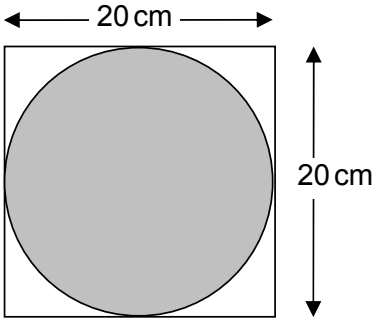
(2 marks)

7 (b) Emily now draws a circle that just touches the sides of the original square.
She shades the circle.



Not drawn accurately

Emily says that more than 80% of the original square is shaded.

Is Emily correct?

You **must** show your working.

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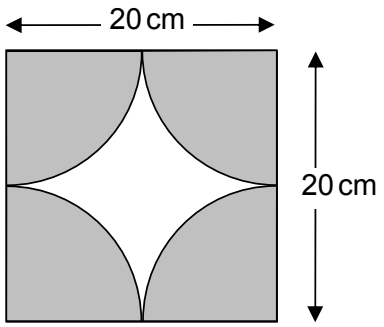
(3 marks)

Do not write outside the box

7 (c) Finally Emily draws quadrants of circles and shades them.



Not drawn accurately

Explain why she does not need to do any further calculations to work out the shaded area.

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(1 mark)

Turn over for the next question

6

Do not write outside the box

8 The nth term of a sequence is $\dfrac{2(n-1)(n-2)}{5}$

Show that the third term is the first non-zero term and find its value.

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Answer ..... *(3 marks)*

9 $N = a^2 b$ is a formula where a and b are prime numbers.

9 (a) Find N when $a = 5$ and $b = 3$

.....

Answer $N =$ ..... *(1 mark)*

9 (b) Find b when $a = 3$ and $N = 99$

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Answer $b =$ ..... *(1 mark)*

9 (c) Find the values of a and b when $N = 2009$

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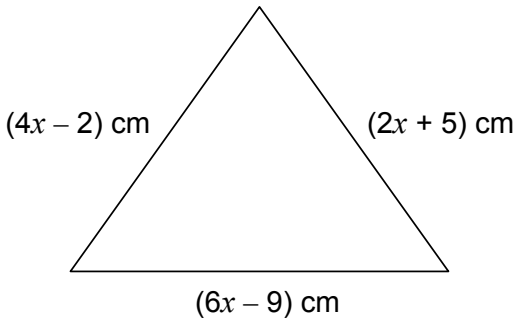
Answer $a =$ ..... $b =$ ..... *(3 marks)*

Do not write outside the box

✳ **10** The triangle has lengths $(4x - 2)$ cm, $(2x + 5)$ cm and $(6x - 9)$ cm.



Not drawn accurately

Find the value of x that makes this triangle equilateral.

Show clearly how you work out your answer.

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Answer ..... *(4 marks)*

12

Do not write outside the box

11 (a) A sequence starts

2, 7, 17, ...

The rule for finding the next term in the sequence is to multiply the previous term by 2 and then add on 3

Work out the next term.

.....

.....

Answer ..... *(1 mark)*

11 (b) The rule for finding the next term in a different sequence is to multiply the previous term by 2 and then add on a, where a is an integer.

The first term is 8 and the fourth term is 127

8 127

Work out the value of a.

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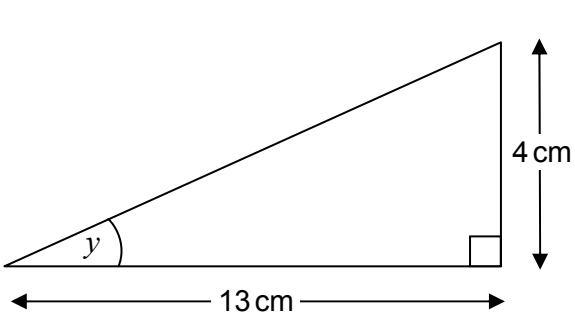
Answer $a =$ ..... *(4 marks)*

Do not write outside the box

12



Calculate the size of angle y.

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Answer ..... degrees *(3 marks)*

13 (a) Factorise fully $10x^2 - 15xy$

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Answer ..... *(2 marks)*

13 (b) Solve $x^2 + 15x - 54 = 0$

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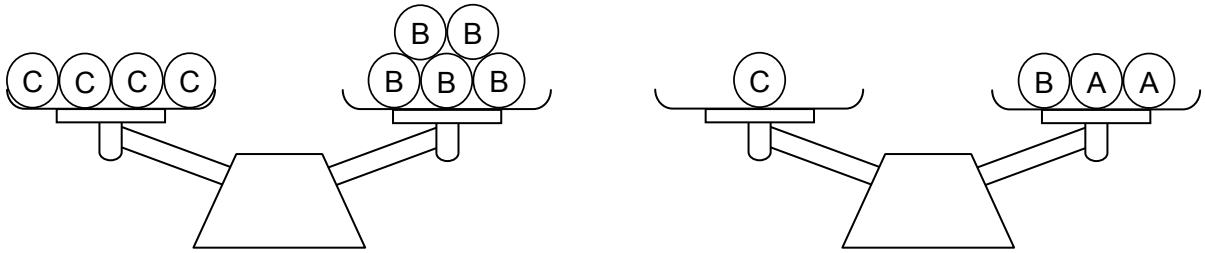
Answer ..... *(3 marks)*

13

Do not write outside the box

14 A, B and C are different weights.
Both the scales shown balance exactly.



Work out how many A weights make a B weight.

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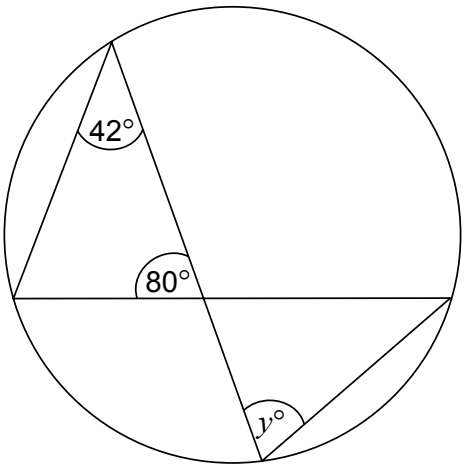
Answer ..... *(3 marks)*

15



Not drawn accurately

Work out the value of y.

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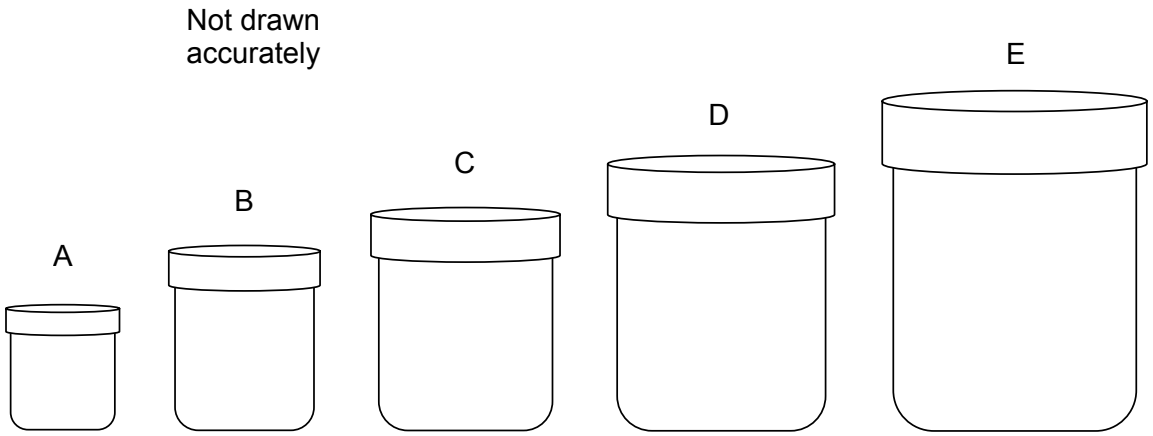
Answer ..... degrees *(2 marks)*

Do not write outside the box

16 Five toy beakers A, B, C, D and E are mathematically similar.

Their heights are in the ratio 2 : 3 : 4 : 5 : 6

Beaker B has height 4.2 cm and surface area 45 cm^2.



16 (a) Work out the height of beaker D.

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Answer ..... cm *(2 marks)*

16 (b) Work out the surface area of beaker C.

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Answer ..... cm^2 *(2 marks)*

16 (c) Beaker A is used to fill beaker E with sand.

How many full beakers of sand are needed to fill beaker E?

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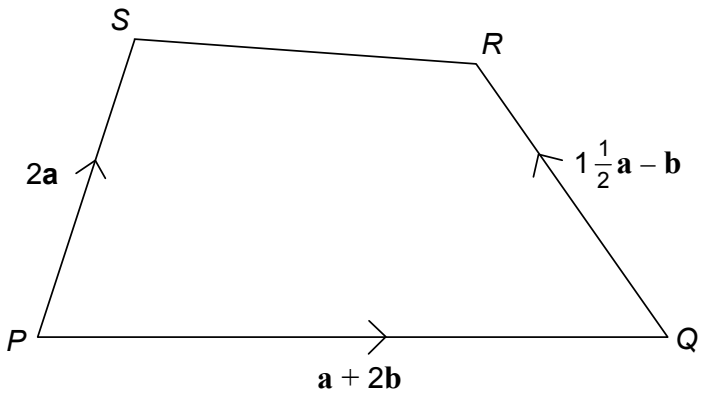
Answer ..... *(2 marks)*

11

Do not write outside the box

17 In the diagram $\overrightarrow{PQ} = \mathbf{a} + 2\mathbf{b}$, $\overrightarrow{PS} = 2\mathbf{a}$, $\overrightarrow{QR} = 1\frac{1}{2}\ \mathbf{a} - \mathbf{b}$



Not drawn accurately

17 (a) Work out $\overrightarrow{SR}$

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Answer ..... *(2 marks)*

17 (b) What type of quadrilateral is *PQRS*?
Give a reason for your answer.

Answer .....

Reason .....

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(2 marks)

18 Show that the solutions of the quadratic equation

$x^2 - 4x - 3 = 0$ are $x = 2 \pm \sqrt{7}$

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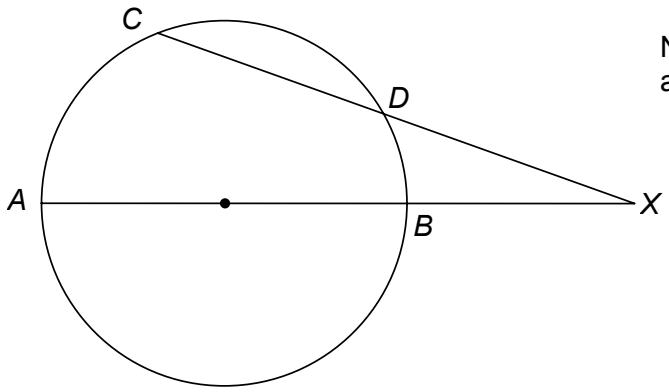
(3 marks)

Do not write outside the box

19 *AB* is the diameter and *CD* a chord of a circle.
AB and *CD* are extended to meet at *X*.
AX is 20 cm, *CD* is 7 cm and *DX* is 8 cm.



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Calculate *AB*, the diameter of the circle.

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Answer ..... cm *(3 marks)*

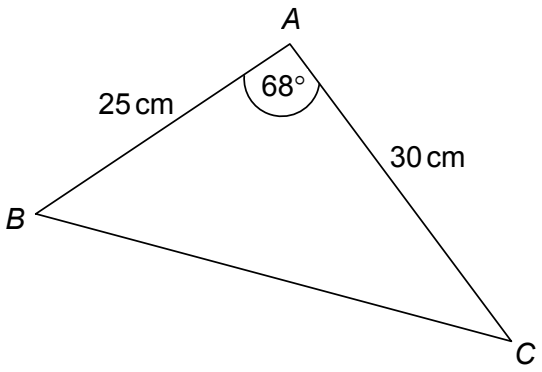
Turn over for the next question

10

Do not write outside the box

20 In the triangle *ABC*

AB = 25 cm, *AC* = 30 cm and angle *BAC* = 68°



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20 (a) Calculate the area of triangle *ABC*.

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Answer ..... cm^2 *(2 marks)*

20 (b) Calculate the length *BC*

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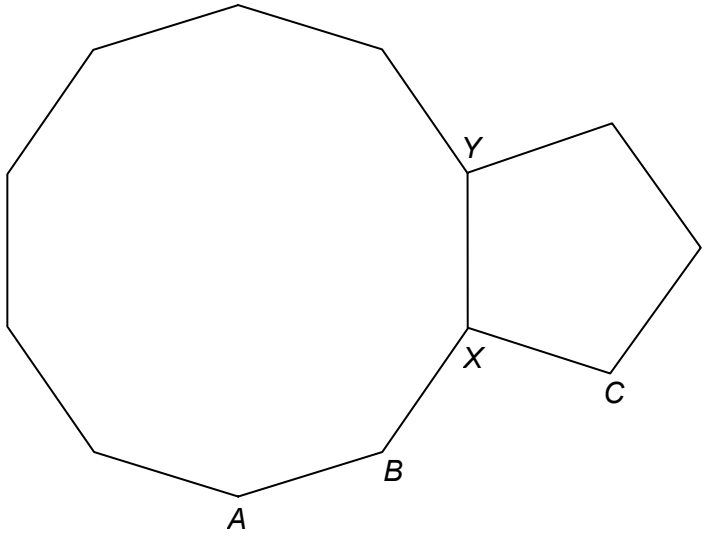
Answer ..... cm *(3 marks)*

Do not write outside the box

✳ **21** The diagram shows a regular pentagon and a regular decagon joined at side *XY*.



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Prove that points *A*, *B* and *C* lie on a straight line.

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(5 marks)

END OF QUESTIONS

10

There are no questions printed on this page

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