

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

C300UB0-1



THURSDAY, 7 NOVEMBER 2019 – MORNING

MATHEMATICS – Component 2
Calculator-Allowed Mathematics
HIGHER TIER

2 hours 15 minutes

ADDITIONAL MATERIALS

A calculator will be required for this examination.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
You may use a pencil for graphs and diagrams only.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** the questions in the spaces provided.
If you run out of space, use the continuation page(s) at the back of the booklet, taking care to number the question(s) correctly.
Take π as 3.142 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.
Unless stated, diagrams are not drawn to scale.
Scale drawing solutions will not be acceptable where you are asked to calculate.
The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the need for good English and orderly, clear presentation in your answers.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	3	
2.	3	
3.	4	
4.(a)	3	
4.(b)(c)(d)	6	
5.	8	
6.	7	
7.(a)(b)	7	
7.(c)	8	
8.	9	
9.	9	
10.	5	
11.	4	
12.	12	
13.	6	
14.	6	
15.	9	
16.	7	
17.	4	
Total	120	

C300UB01
01

Formula list*Area and volume formulae*

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

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

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

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

1. 25 years ago, Raveena’s grandparents invested £500 for her in an account paying 3.4% compound interest per annum.
No extra money was paid in and no money was withdrawn during these 25 years.

Raveena has decided to withdraw all the money in the account after 25 years.

How much should Raveena receive?
Give your answer correct to the nearest penny.
You must show all your working.

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C300UB01
03

2.

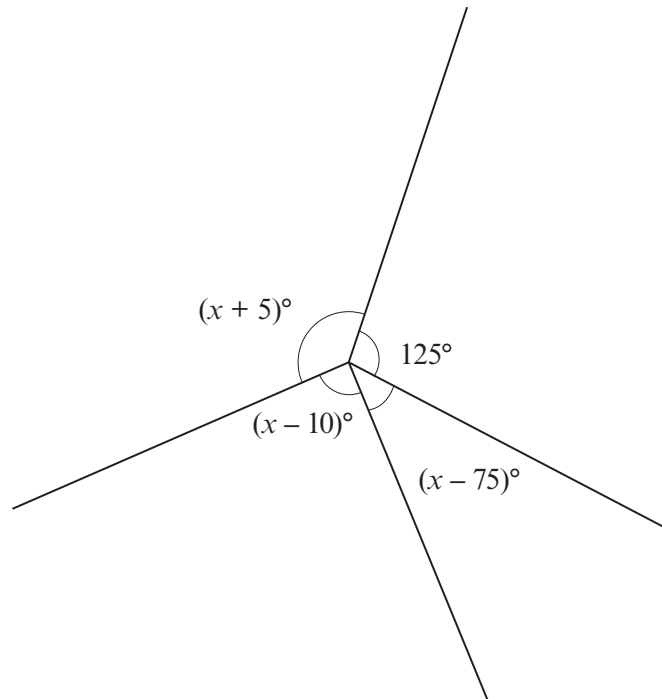


Diagram not drawn to scale

Write an equation in terms of x and solve it.
You must show all your working.

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$x =$

3. The table below gives information from the Highway Code on stopping distances for cars.

Speed	Stopping distance in metres = Thinking distance + Braking distance (Thinking distance is given first, followed by Braking distance)
20 mph	
30 mph	
40 mph	
50 mph	

Remember 50 mph is 80 km/h.

The stopping distances given in the Highway Code assume good driving conditions and alert drivers.

When a driver is tired and the road is wet, the thinking distance increases by 30% and the braking distance increases by 20%.

A tired driver travels at 64 km/h in wet driving conditions.

Calculate their stopping distance in metres. [4]

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C300UB01 05

4. (a) Expand and simplify $(2x - 7)(3x - 8)$.

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- (b) Solve $w^2 + 8w - 33 = 0$.

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- (c) Factorise $b^2 - 144$.

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- (d) Rearrange the following to make e the subject.
Simplify your answer.

$$9e^2 = t^4$$

[2]

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5. (a) In Queenbridge, the mean daily snowfall for a week was 1.6 cm. If there had been 1 cm more snowfall on each day, what would the mean daily snowfall have been? [1]

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- (b) In Sansburg, the snowfall for each of the first 10 days in January was measured. The results are summarised in the table below.

Daily snowfall, s in cm	Number of days
$1.5 \leq s < 2.5$	4
$2.5 \leq s < 3.5$	2
$3.5 \leq s < 4.5$	1
$4.5 \leq s < 5.5$	0
$5.5 \leq s < 6.5$	3

Calculate an estimate for the mean daily snowfall for these 10 days. [4]

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- (c) During the first 5 days of February, the mean snowfall in Awezell was 4.7 cm. On 6th February the snowfall was 23.9 cm. Calculate the mean snowfall for the first 6 days of February. [3]

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6. (a) Shireen has a new shed.

The walls of the shed are vertical.
The shed stands on horizontal ground.
The uniform cross-section has one line of symmetry.

The diagram below shows some of the measurements of the cross-section.

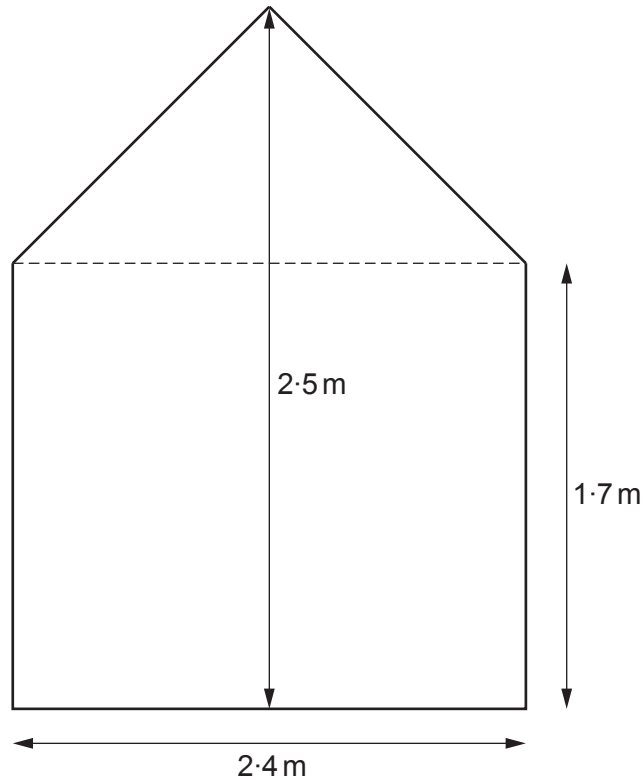
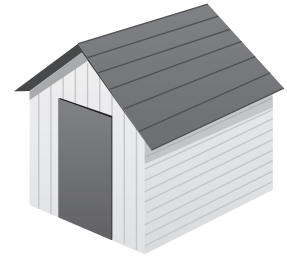


Diagram not drawn to scale

Calculate the size of the angle between the roof of the shed and the horizontal.

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(b) Petra has a mathematically similar shed.

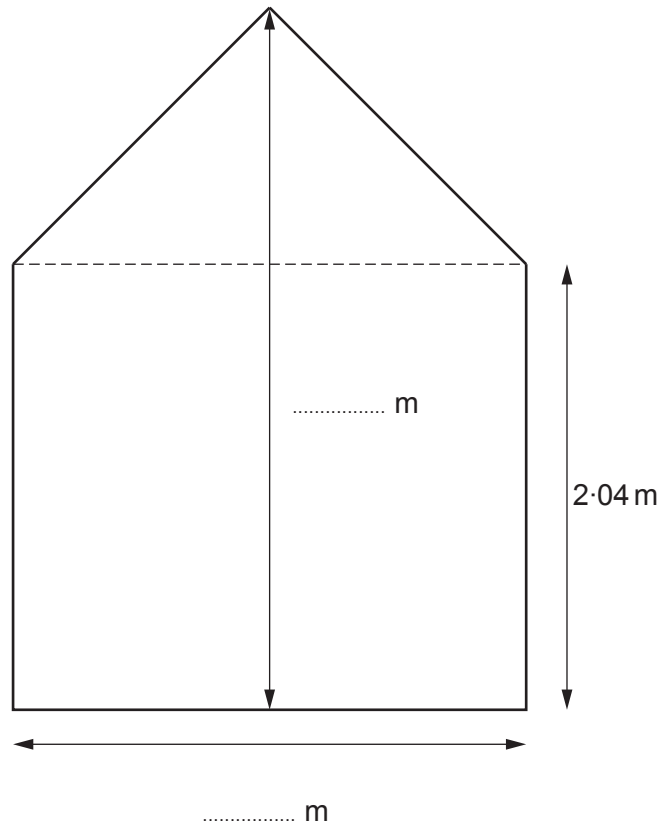


Diagram not drawn to scale

Calculate the two missing measurements on the diagram above.
You must show all your working.

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7. (a)

<p style="text-align: center;">Recipe for scones</p> <p>Ratio of ingredients</p> <p style="text-align: center;">flour : butter : sugar</p> <p style="text-align: center;">70 : 17 : 10</p>	
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Nadeen has 102 g of butter and plenty of flour and sugar.
Nadeen uses all this butter to make scones.

Calculate the quantity of flour and sugar Nadeen needs.

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Flour g

Sugar g

(b)

Nutrition per scone				
kcal	fat	carbohydrates	fibre	protein
268	10g	41g	1g	6g

Nadeen has been recommended to eat 2200 kcal per day.
She eats two scones for lunch.
Her breakfast was 390 kcals.

What percentage of the recommended daily kcals does Nadeen have **left** for meals later in the day?
Give your answer correct to the nearest 0.01%.

[4]

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- (c) Nadeen used a cutter to make her scones. The cutter has a circular cross-section, with a diameter of 5 cm. The depth of the scone mixture cut was 0.8 cm.



- (i) Calculate the area of the top face of a scone. [3]

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- (ii) Calculate the total surface area of a scone.
State any assumption you make.

Assumption:

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Total surface area cm²

8. (a) In 2015, the average price of coal sold by a mine in the USA was \$31.83 per ton. This coal was then delivered to power stations. The power stations paid \$42.58 per ton for this coal. The difference in price was the delivery cost.

What percentage of the original price of the coal was this delivery cost?
Give your answer correct to 3 significant figures.

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- (b) In the USA and the UK the word 'ton' means different amounts:
- a UK ton = 1016 kg,
 - a USA ton = 907 kg,
 - a tonne (called a metric ton in the USA) = 1000 kg.

What is the difference between a UK ton and a USA ton?
Give your answer in tonnes.

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- (c) A preformed piece of coal weighs 100 g **correct to the nearest 5 g**.
A bag contains 30 pieces of preformed coal.

Complete the sticker to attach to this bag of coal.

[4]



This bag of coal
weighs **at least**
..... kg

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9. A square lawn has a side of length 8 m.
A builder is asked to make a path around the outside edge of the square lawn.

(a) The plan was for a path of width y metres with all the edges of the path being straight.

Find an expression for the area of this path in terms of y .
Give your answer in its simplest form.

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- (b) Before the builder started, the plan was updated and the following agreed:
- at each corner of the lawn the path should be a quarter circle,
 - the width of the path is to be 1.5 m,
 - the path is to be made of 8 cm thick concrete.

Calculate the volume of the concrete needed for the path. [5]

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11. The diagram shows quadrilateral $OABC$.
 $OA = 5x$, $OB = 12x + 6y$ and $OC = 8y$.

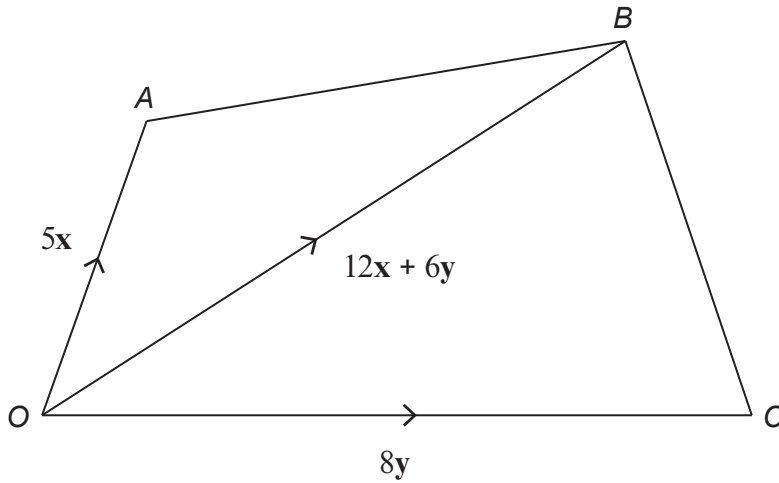


Diagram not drawn to scale

- (a) Express CA in terms of x and y . [1]

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- (b) P is the midpoint of OB .
 Express each of the following in terms of x and y .
 Give each of your answers in the simplest form.

- (i) OP [1]

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- (ii) PA [1]

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- (c) Does P lie on CA ?

Yes No

You must give a reason for your answer. [1]

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12. (a) Factorise and hence solve the following equation. [3]

$$4x^2 + 16x + 15 = 0$$

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- (b) Find the n th term of the following sequence. [2]

$$7, 10, 15, 22, 31, 42, \dots$$

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- (c) Ali walks slowly from home through a forest and back home again.

He walks a total distance of $(3x + 1)$ km in a time of $(\frac{x}{2} + 6)$ hours.
 Ali's average speed is 2 km/h.
 He left home at 9 a.m.

At what time did Ali return home?

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Ali returned home at

- (d) The expression $x^2 + 18x + 2$ has a minimum value.
By **completing the square**, complete the statements below.
You must show all your working.

[3]

'The minimum value of $x^2 + 18x + 2$ occurs when $x = \dots\dots\dots$ '

'The minimum value of $x^2 + 18x + 2$ is $\dots\dots\dots$ '

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13. Solve the following simultaneous equations.

$$y = 3x^2 + 4x - 7$$
$$y = 2x + 5$$

Use an algebraic method and give your answers correct to 2 decimal places.

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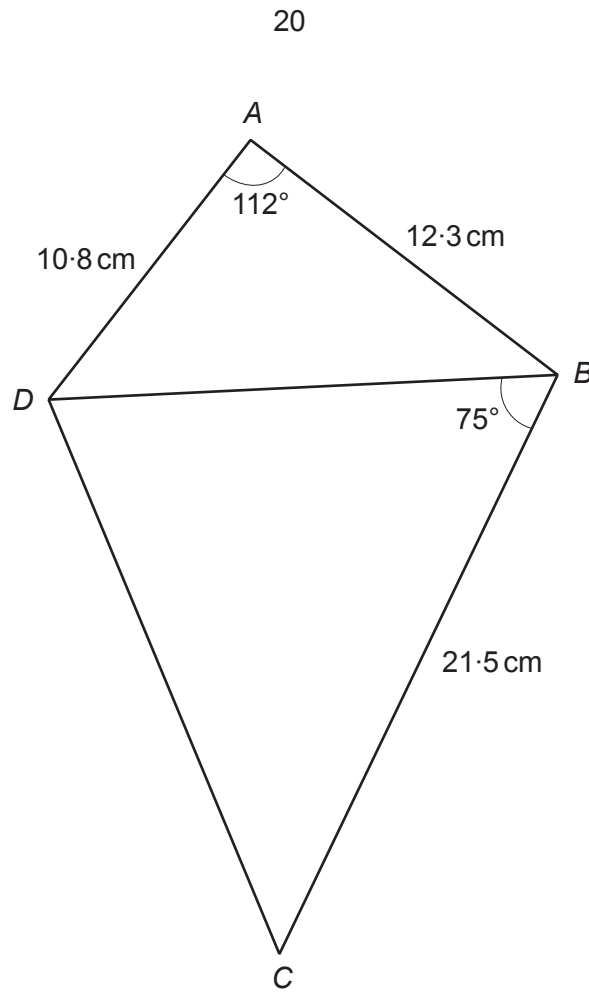


Diagram not drawn to scale

Calculate the area of $ABCD$.

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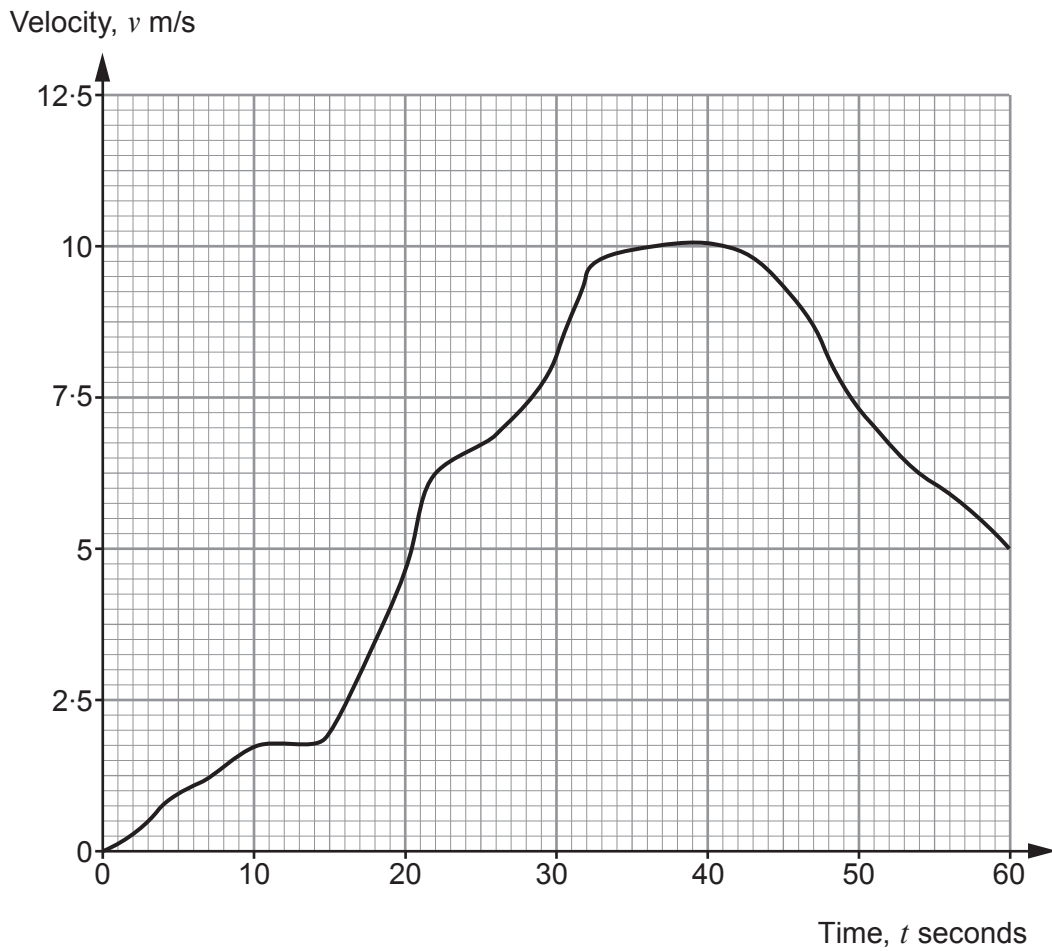
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15. The velocity-time graph below shows the first 60 seconds of a car's journey.



(a) After how many seconds was the velocity of the car 9 km/h?

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After seconds

- (b) Harriet argues that the acceleration at $t = 22$ represents the typical acceleration of the car during the first 32 seconds of this period.

Explain why Harriet's argument is correct.

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- (c) Over the same 60 seconds, the velocity, v m/s, at time, t seconds, of another car is given by the following equation.

$$v = 7 + \frac{t^2}{1000}$$

Find two times for which the difference in the two cars' velocities was 2.5 m/s.
Give these times correct to the nearest second.
You must show all your working.

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- 16.** (a) The volume of a cone is equal to the volume of a sphere.
The radius of the cone is four times the radius of the sphere.

Show that the perpendicular height of the cone is a quarter of the radius of the sphere.

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- (b) The radii of two spheres are in the ratio 2 : 7.
The volume of the smaller sphere is 10.4 cm^3 .

Calculate the volume of the larger sphere.

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17. The diagram shows a circle with centre O .
Points A, B, C and D all lie on the circumference of the circle.

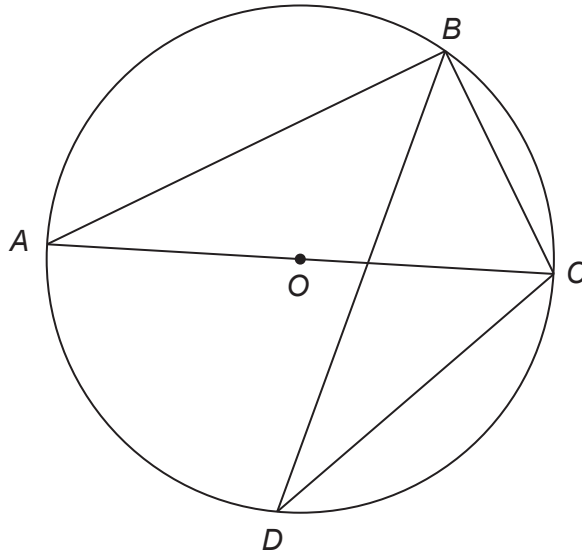


Diagram not drawn to scale

The radius of the circle is 3.6 cm, $BC = 4.1$ cm and $\widehat{BCD} = 93^\circ$.

Prove that $\widehat{DBC} = 52.3^\circ$, correct to 3 significant figures.

You must show all your working and give a reason for each stage of your proof.

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