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GCSE MATHS

Geometry and measures

Edexcel 1MA1 | Subtopic collection Topic 41

Circle theorems

Higher tier

Past paper question booklet

91	2001-2025	Higher
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

Question 17 (6 marks)

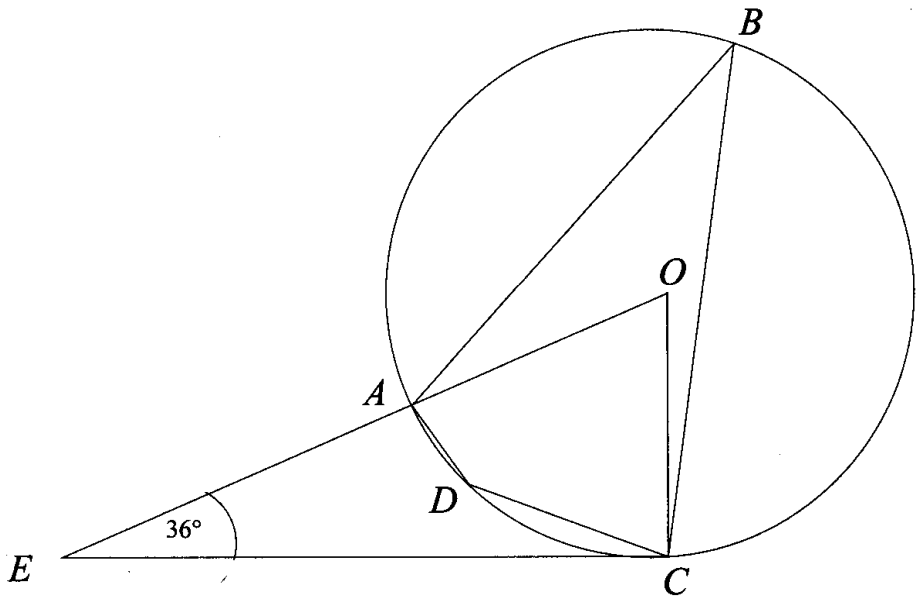


Diagram **NOT** accurately drawn.

A, B, C and D are points on the circumference of a circle centre O. A tangent is drawn from E to touch the circle at C. Angle AEC = 36°. EAO is a straight line.
(a) Calculate the size of angle ABC. Give a reason for your answer.
(b) Calculate the size of angle ADC. Give a reason for your answer.

12.

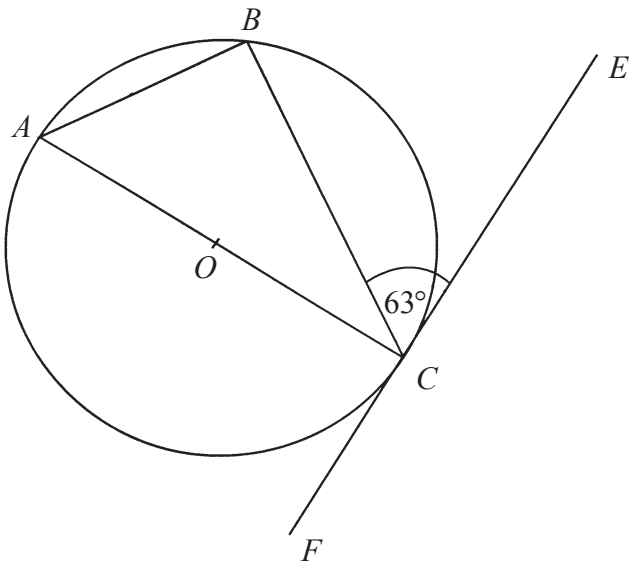


Diagram **NOT** accurately drawn

Leave blank

In the diagram, A, B and C are points on the circle, centre O.
Angle $BCE = 63°$.
FE is a tangent to the circle at point C.

(i) Calculate the size of angle ACB.
Give reasons for your answer.

.....°

(ii) Calculate the size of angle BAC.
Give reasons for your answer.

.....°

(4)

15.

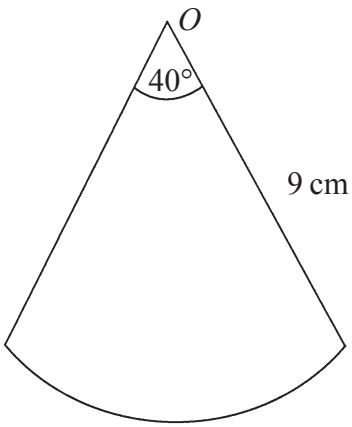


Diagram **NOT** accurately drawn

Leave blank

The diagram shows a sector of a circle, centre O.
The radius of the circle is 9 cm.
The angle at the centre of the circle is 40°.

Find the perimeter of the sector.
Leave your answer in terms of π.

.....cm

(4)

10.

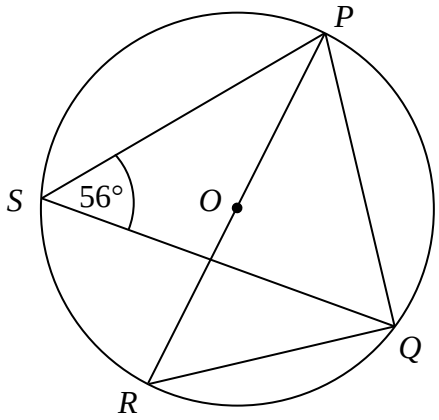


Diagram **NOT** accurately drawn

P, *Q*, *R* and *S* are points on the circumference of a circle, centre *O*.
PR is a diameter of the circle.
Angle *PSQ* = 56°.

(a) Find the size of angle *PQR*.
Give a reason for your answer.

..... °
(2)

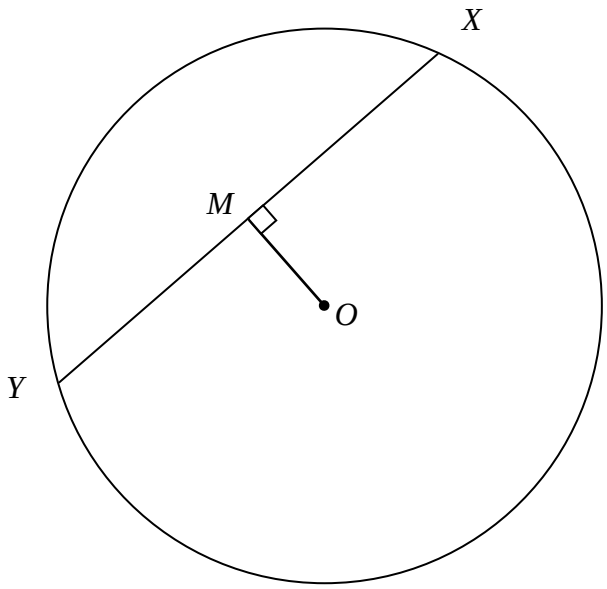
(b) Find the size of angle *PRQ*.
Give a reason for your answer.

..... °
(2)

(c) Find the size of angle *POQ*.
Give a reason for your answer.

..... °
(2)

18.



X and Y are points on the circle, centre O.
M is the point where the perpendicular from O meets the chord XY.

Prove that M is the midpoint of the chord XY.

(3)

11.

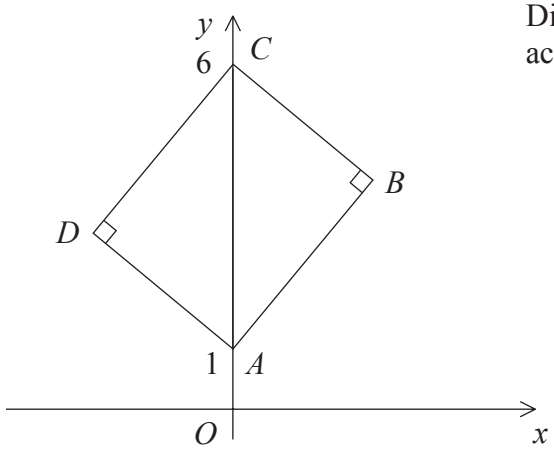


Diagram **NOT** accurately drawn

ABCD is a rectangle.
A is the point (0, 1).
C is the point (0, 6).

The equation of the straight line through *A* and *B* is $y = 2x + 1$

(a) Find the equation of the straight line through *D* and *C*.

.....

(2)

(b) Find the equation of the straight line through *B* and *C*.

.....

(2)

(c) It is always possible to draw a circle which passes through all four vertices of a rectangle.
Explain why.

.....

.....

(1)

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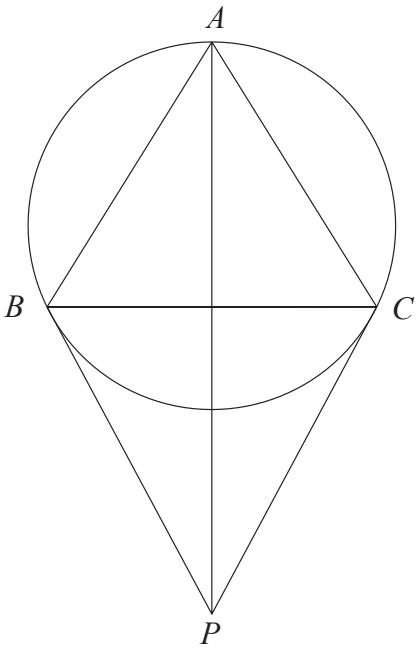
Page Total

16.



A, B and C are three points on the circumference of a circle.
Angle ABC = Angle ACB.
PB and PC are tangents to the circle from the point P.

(a) Prove that triangle APB and triangle APC are congruent.

(3)

Angle $BPA = 10°$.

(b) Find the size of angle ABC.

°

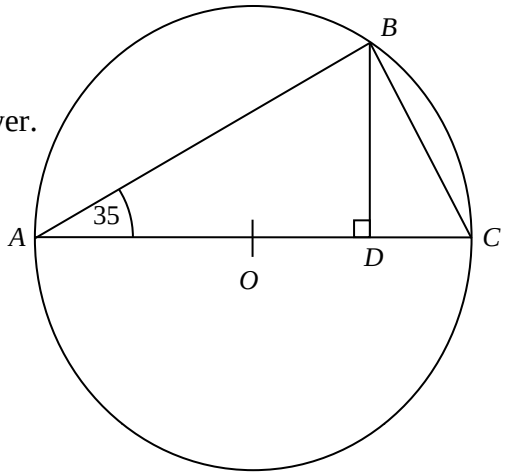
.....

(4)

Question 13 (5 marks)

The diagram shows a circle, centre O. AC is a diameter.
Angle $BAC = 35°$. D is the point on AC such that angle BDA is a right angle.

(a) Work out the size of angle BCA. Give reasons for your answer.
(b) Calculate the size of angle DBC.
(c) Calculate the size of angle BOA.

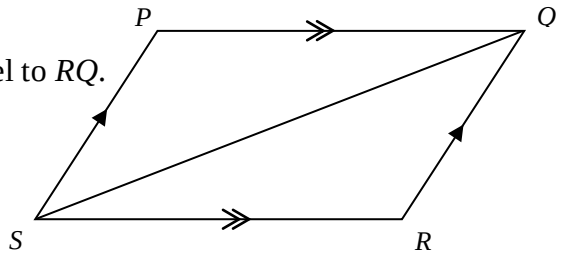


Question 15 (5 marks)

PQRS is a quadrilateral. *PQ* is parallel to *SR*. *SP* is parallel to *RQ*.

(*a*) Prove that triangle *PQS* is congruent to triangle *RSQ*.

(*b*) In quadrilateral *PQRS*, angle *SPQ* is obtuse.
Explain why *PQRS* cannot be a cyclic quadrilateral.



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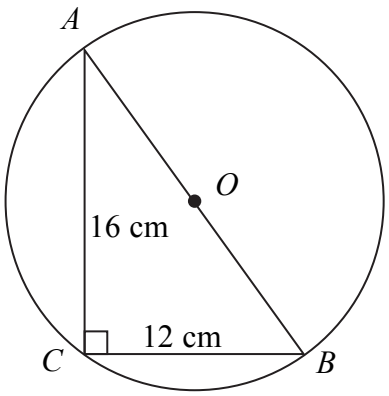


Diagram **NOT** accurately drawn

The diagram shows triangle ABC and a circle, centre O.
A, B and C are points on the circumference of the circle.
AB is a diameter of the circle.

$AC = 16$ cm and $BC = 12$ cm.

(a) Angle $ACB = 90°$.
Give a reason why.

.....

(1)

(b) Work out the diameter AB of the circle.

..... cm

(3)

(c) Work out the area of the circle.
Give your answer correct to 3 significant figures.

..... cm^2

(3)

Q4

(Total 7 marks)

Blank

13.

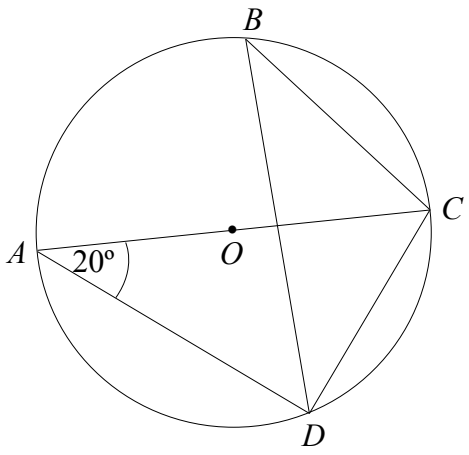


Diagram **NOT** accurately drawn

A, B, C and D are points on the circumference of a circle, centre O.
AC is a diameter of the circle.

Angle $DAC = 20°$.

(a) Find the size of angle ACD.

.....°

(2)

(b) Find the size of angle DBC.
Give a reason for your answer.

.....°

.....

.....

(2) **Q13**

(Total 4 marks)

18.

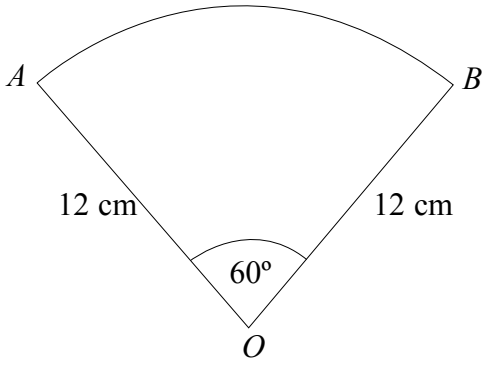


Diagram **NOT** accurately drawn

OAB is a sector of a circle, centre *O*.
Angle *AOB* = 60°.
OA = *OB* = 12 cm.

Work out the length of the arc *AB*.
Give your answer in terms of π.

..... cm

Q18

(Total 3 marks)

18.

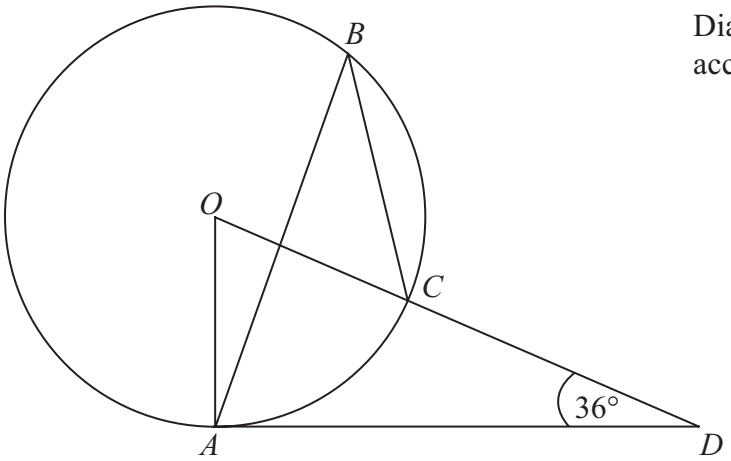


Diagram **NOT** accurately drawn

The diagram shows a circle centre O.
A, B and C are points on the circumference.

DCO is a straight line.
DA is a tangent to the circle.

Angle $ADO = 36°$

(a) Work out the size of angle AOD.

.....°

(2)

(b) (i) Work out the size of angle ABC.

.....°

(ii) Give a reason for your answer.

.....

(3)

Q18

(Total 5 marks)

24.

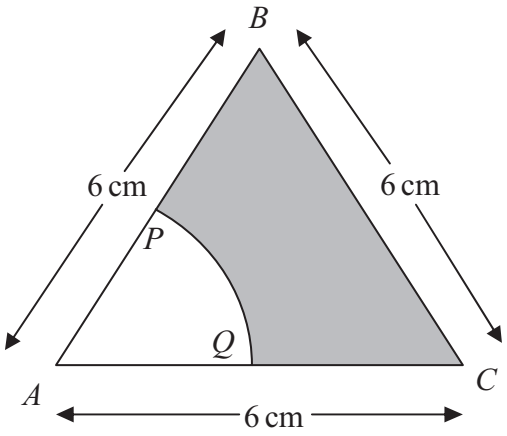


Diagram **NOT** accurately drawn

The diagram shows an equilateral triangle ABC with sides of length 6 cm.

P is the midpoint of AB.
Q is the midpoint of AC.
APQ is a sector of a circle, centre A.

Calculate the area of the shaded region.
Give your answer correct to 3 significant figures.

..... cm^2

(Total 4 marks)

Q24

18.

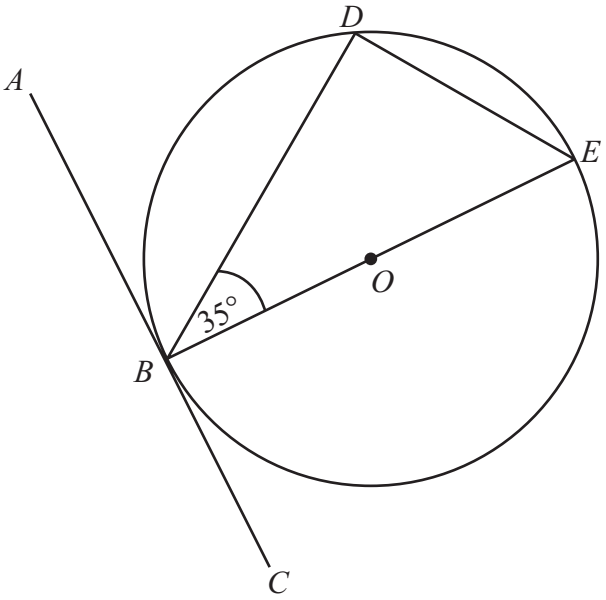


Diagram **NOT** accurately drawn

B, *D* and *E* are points on a circle centre *O*.
ABC is a tangent to the circle.
BE is a diameter of the circle.
Angle *DBE* = 35°.

(a) Find the size of angle *ABD*.
Give a reason for your answer.

..... °
(2)

(b) Find the size of angle *DEB*.
Give a reason for your answer.

..... °
(2) **Q18**

(Total 4 marks)

27.

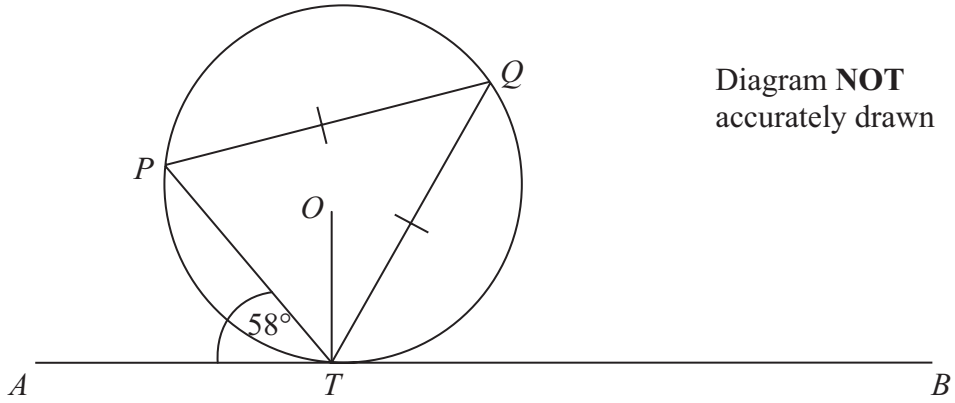


Diagram **NOT** accurately drawn

P, *Q* and *T* are points on the circumference of a circle, centre *O*.
The line *ATB* is the tangent at *T* to the circle.

PQ = *TQ*.
Angle *ATP* = 58°.

Calculate the size of angle *OTQ*.
Give a reason for each stage in your working.

..... °

(Total 5 marks)

Q27

26. The diagram shows a sector of a circle with centre O.
The radius of the circle is 8 cm.

PRS is an arc of the circle.
PS is a chord of the circle.
Angle $POS = 40°$

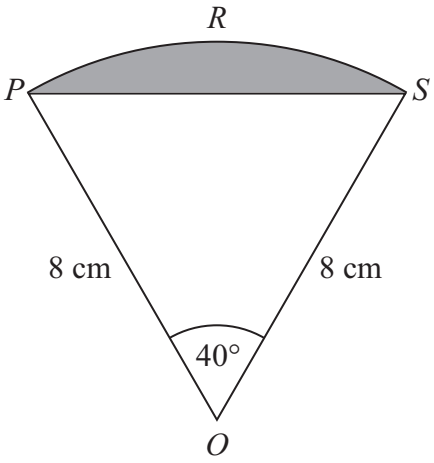


Diagram **NOT** accurately drawn

Calculate the area of the shaded segment.
Give your answer correct to 3 significant figures.

..... cm^2 **Q26**

(Total 5 marks)

22.

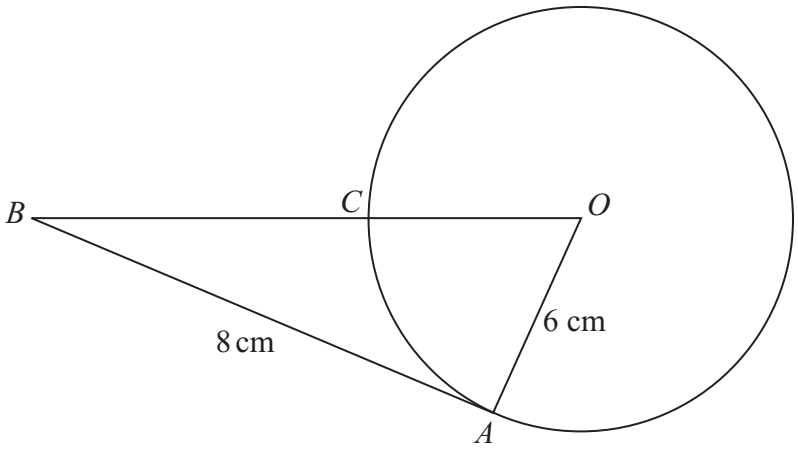


Diagram **NOT** accurately drawn

In the diagram, O is the centre of the circle.
A and C are points on the circumference of the circle.
BCO is a straight line.
BA is a tangent to the circle.

$AB = 8$ cm.
$OA = 6$ cm.

(a) Explain why angle OAB is a right angle.

.....

.....

(1)

(b) Work out the length of BC.

..... cm

(3)

(Total 4 marks)

Q22

23.

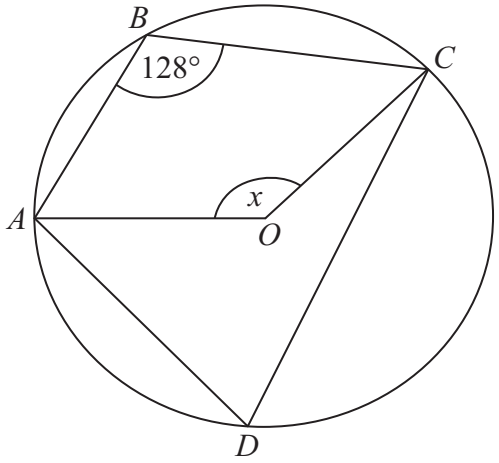


Diagram **NOT** accurately drawn

The diagram shows a circle, centre O.
A, B, C and D are points on the circumference of the circle.

Angle $ABC = 128°$.

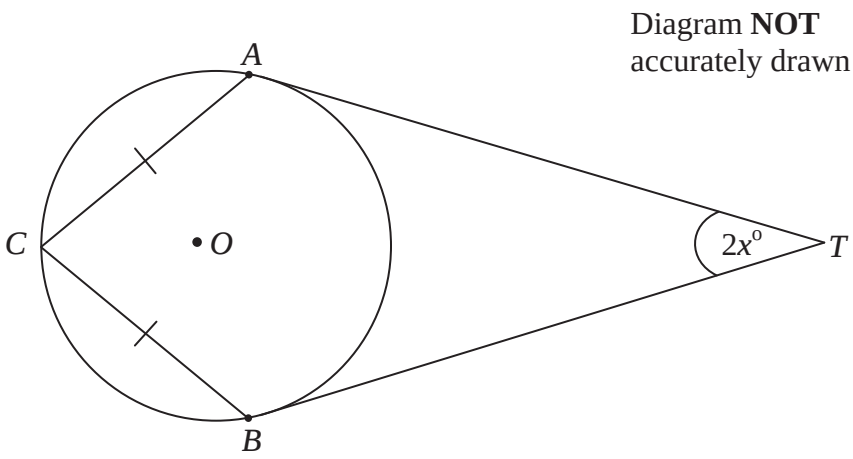
Work out the size of the angle marked x.

..... °

(Total 2 marks)

Q23

***16**



A, *B* and *C* are points on the circumference of the circle, centre *O*.
TA and *TB* are tangents to the circle.
CA = *CB*.
Angle *ATB* = 2*x*°.

Prove that angle *ACB* = (90 – *x*)°.

(Total for Question 16 is 5 marks)

***16**

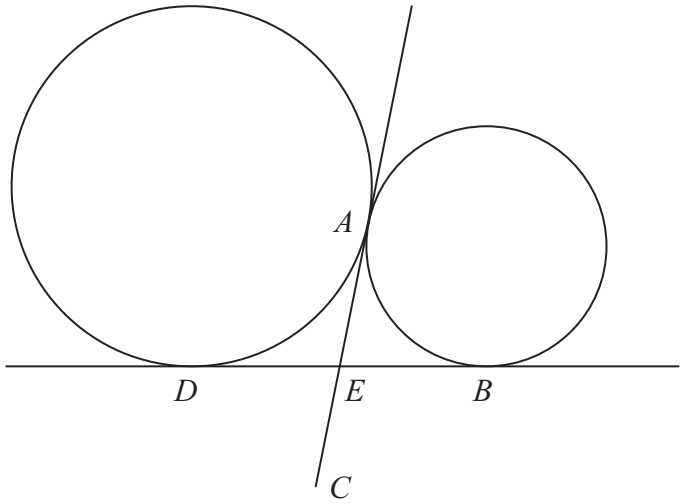


Diagram **NOT** accurately drawn.

A and *D* are two points on the circumference of a circle.
A and *B* are two points on the circumference of a smaller circle.
DB and *AC* are tangents to both circles.
E is the intersection of *DB* and *AC*.
E is the midpoint of *AC*.

Prove that *ABCD* is a rectangle.

(Total for Question 16 is 4 marks)

21.

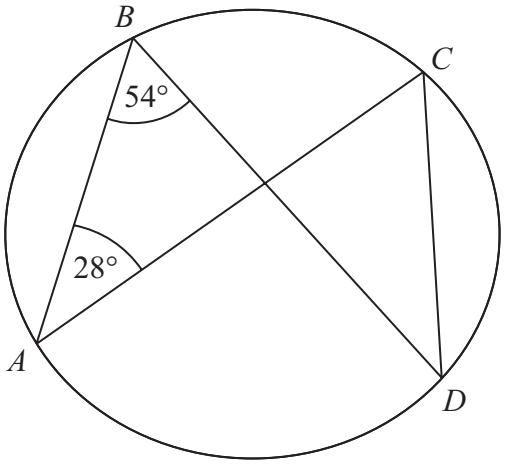


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle.
Angle *ABD* = 54°.
Angle *BAC* = 28°.

(i) Find the size of angle *ACD*.

..... °

(ii) Give a reason for your answer.

.....

.....

Q21

(Total 2 marks)

***13**

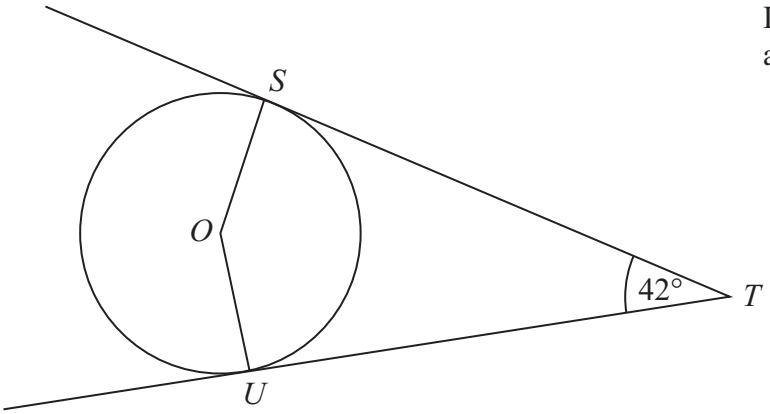


Diagram **NOT** accurately drawn

S and *U* are points on the circumference of a circle, centre *O*.
ST and *UT* are tangents to the circle.
Angle *STU* = 42°

Work out the size of angle *SOU*.
Give reasons for your answer.

(Total for Question 13 is 3 marks)

19.

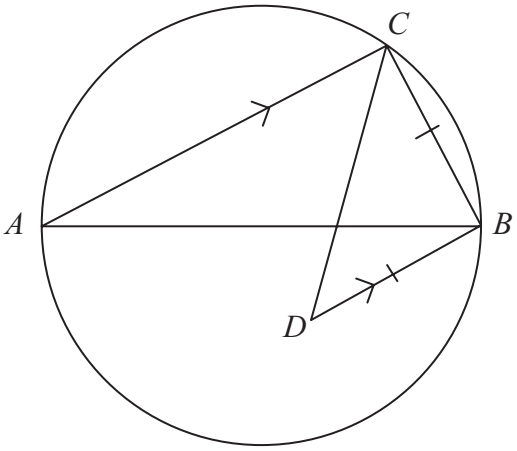


Diagram **NOT** accurately drawn

AB is a diameter of a circle.
C is a point on the circle.
D is the point inside the circle such that *BD* = *BC* and *BD* is parallel to *CA*.
Find the size of angle *CDB*.
You must give reasons for your answer.

.....°

Q19

(Total 4 marks)

***14**

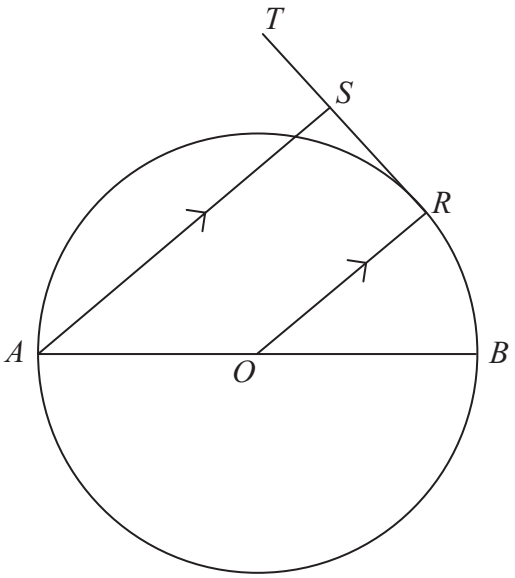


Diagram **NOT** accurately drawn

AB is a diameter of a circle centre *O*.
The point *R* is on the circumference of the circle.
RST is the tangent to the circle at *R*.
AS is parallel to *OR*.

Prove that the size of angle *AST* is 90°.

(Total for Question 14 is 3 marks)

12

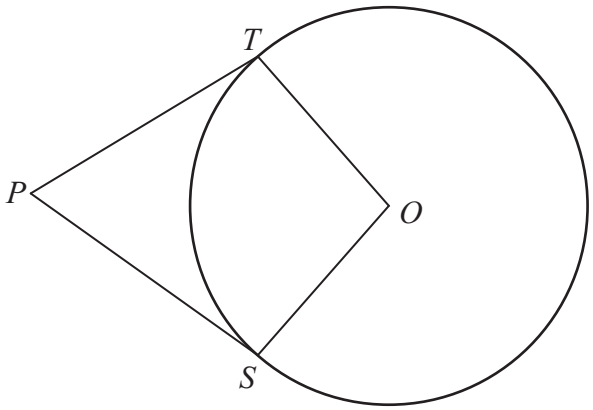


Diagram **NOT** accurately drawn

S and *T* are points on the circumference of a circle, centre *O*.
PT and *PS* are tangents.
Angle *TPO* = 24°.

Work out the size of angle *SOT*.

.....°

(Total for Question 12 is 3 marks)

***21**

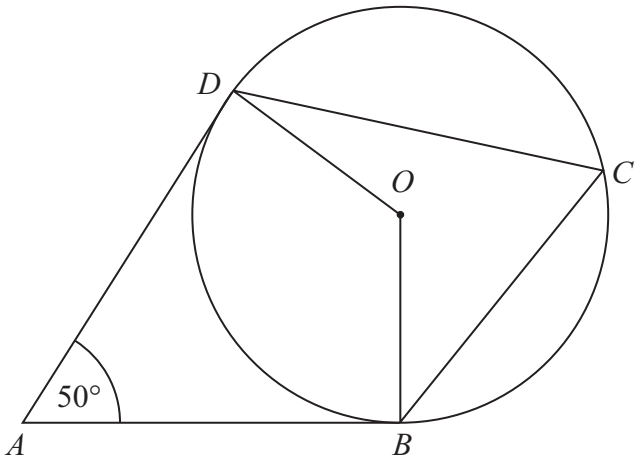


Diagram **NOT** accurately drawn

B, *C* and *D* are points on the circumference of a circle, centre *O*.
AB and *AD* are tangents to the circle.

Angle *DAB* = 50°

Work out the size of angle *BCD*.
Give a reason for each stage in your working.

(Total for Question 21 is 4 marks)

***15**

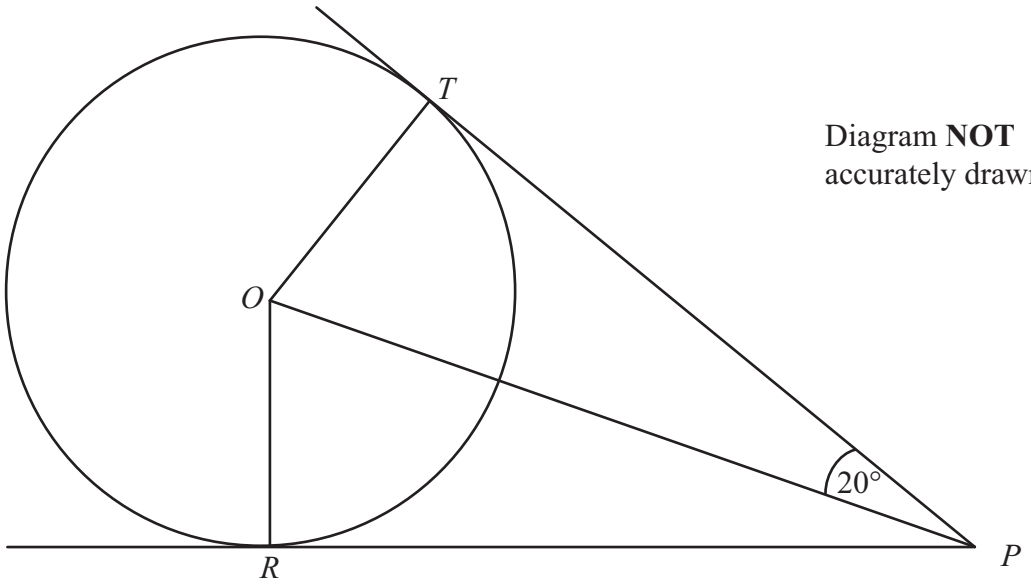


Diagram **NOT** accurately drawn

T and *R* are two points on a circle centre *O*.

PT and *PR* are the tangents to the circle from *P*.

Angle *TPO* = 20°.

Work out the size of angle *TOR*.
You must give reasons for each stage of your working.

(Total for Question 15 is 4 marks)

*15

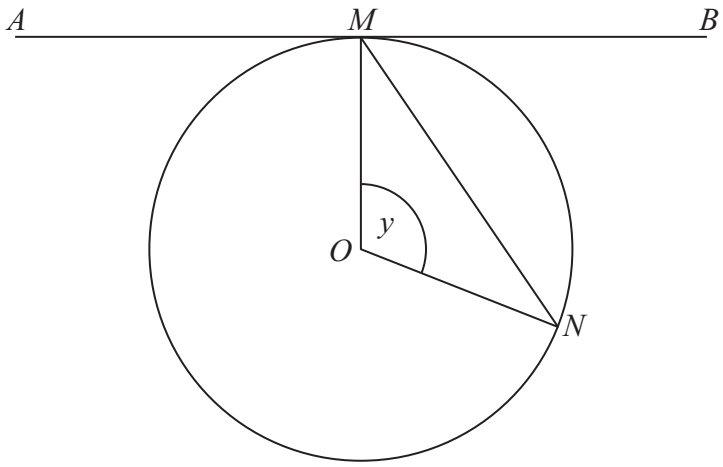


Diagram **NOT** accurately drawn

M and *N* are two points on the circumference of a circle centre *O*.
The straight line *AMB* is the tangent to the circle at *M*.

Angle *MON* = *y*

Prove that angle $BMN = \frac{1}{2}y$

(Total for Question 15 is 5 marks)

19

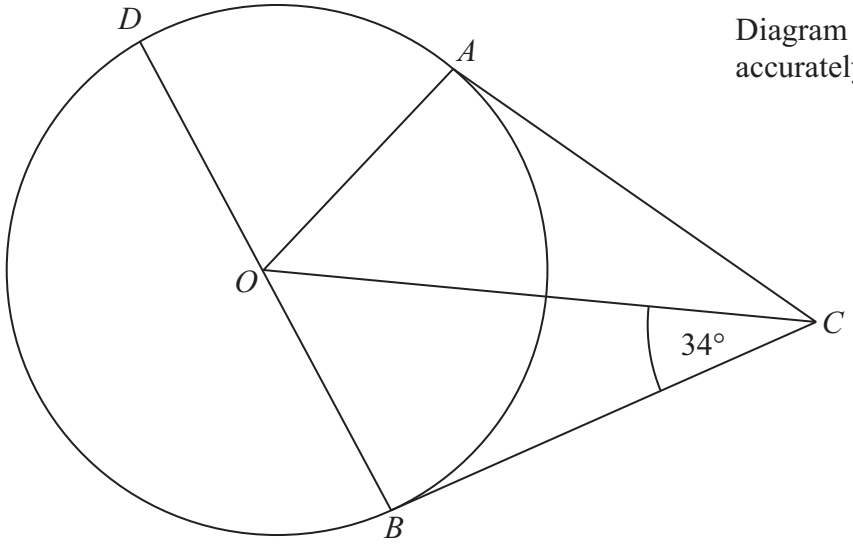


Diagram **NOT** accurately drawn

A, *B* and *D* are points on the circumference of a circle, centre *O*.
BOD is a diameter of the circle.
BC and *AC* are tangents to the circle.
Angle *OCB* = 34°.

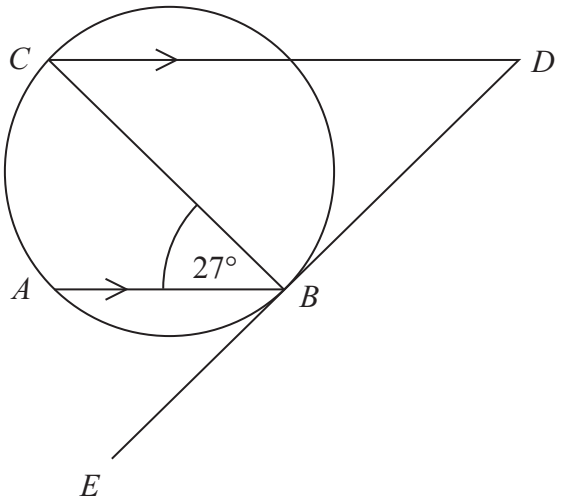
Work out the size of angle *DOA*.

.....°

(Total for Question 19 is 3 marks)

***14**

Diagram **NOT** accurately drawn



A, *B* and *C* are three points on a circle.
DBE is a tangent to the circle.
AB is parallel to *CD*.
BC is a diameter.
Angle *ABC* = 27°.

Find the size of angle *CDB*.
Give reasons for your answer.

(Total for Question 14 is 4 marks)

***16**

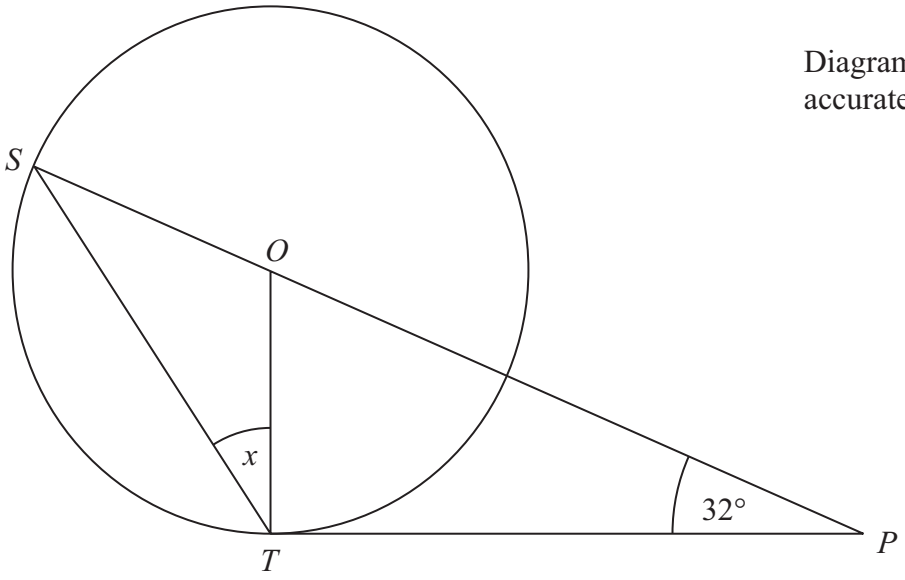


Diagram **NOT** accurately drawn

S and *T* are points on the circumference of a circle, centre *O*.
PT is a tangent to the circle.
SOP is a straight line.

Angle *OPT* = 32°

Work out the size of the angle marked *x*.
Give reasons for your answer.

°

.....

(Total for Question 16 is 5 marks)

***13**

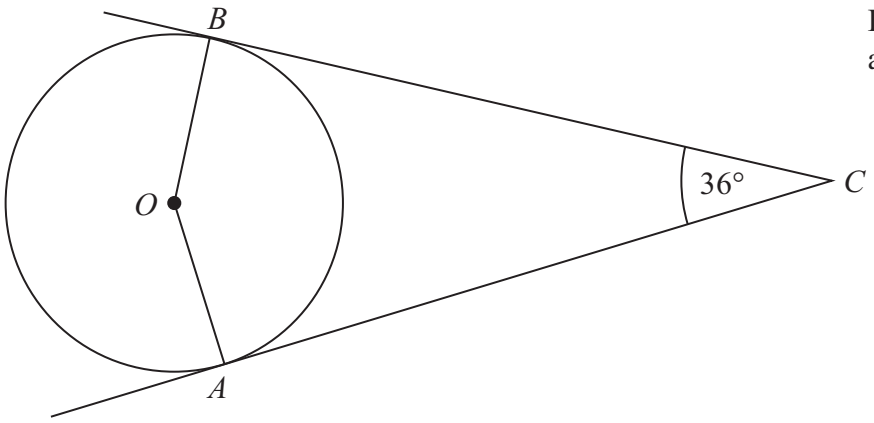


Diagram **NOT** accurately drawn

A and *B* are points on the circumference of a circle, centre *O*.
AC and *BC* are tangents to the circle.

Angle *ACB* = 36°.

Find the size of angle *OBA*.
Give reasons for your answer.

(Total for Question 13 is 4 marks)

***22**

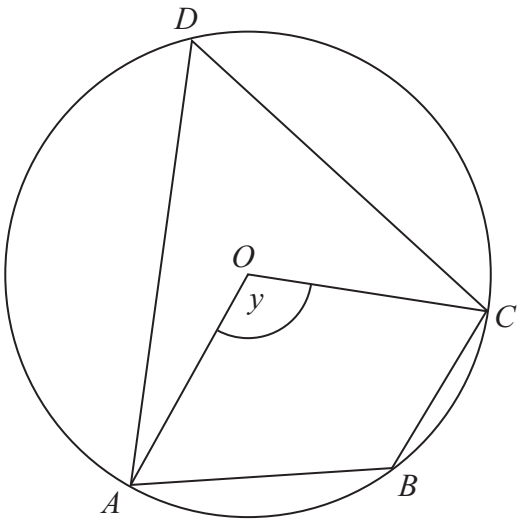


Diagram **NOT** accurately drawn

A, B, C and D are points on the circumference of a circle, centre O.

Angle $AOC = y$.

Find the size of angle ABC in terms of y.
Give a reason for each stage of your working.

(Total for Question 22 is 4 marks)

***28**

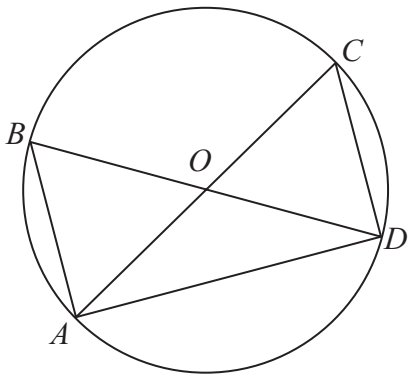


Diagram **NOT** accurately drawn

AOC and *BOD* are diameters of a circle, centre *O*.

Prove that triangle *ABD* and triangle *DCA* are congruent.

(Total for Question 28 is 3 marks)

***14**

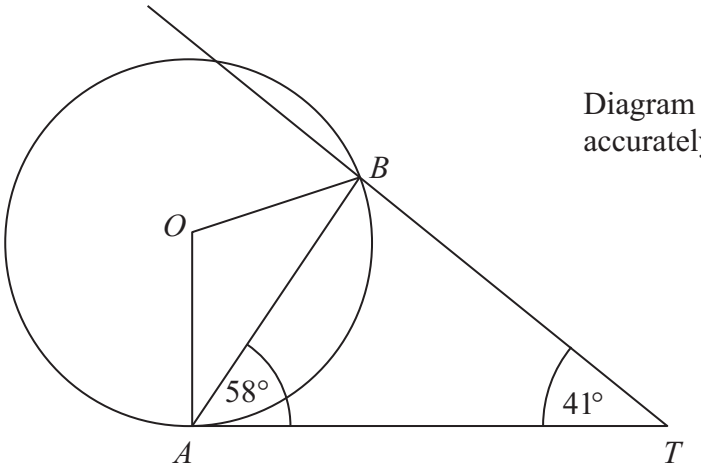


Diagram **NOT** accurately drawn

A and *B* are points on the circumference of a circle, centre *O*.

AT is a tangent to the circle.
Angle *TAB* = 58°.
Angle *BTA* = 41°.

Calculate the size of angle *OBT*.
You must give reasons at each stage of your working.

(Total for Question 14 is 5 marks)

***18**

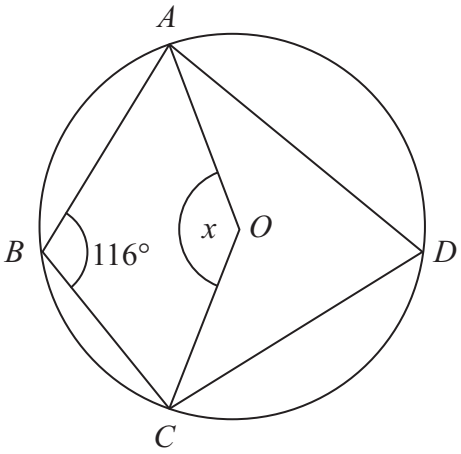


Diagram **NOT** accurately drawn

A, B, C and D are points on the circumference of a circle with centre O.
Angle $ABC = 116°$

Find the size of the angle marked x.
Give reasons for your answer.

(Total for Question 18 is 4 marks)

***18**

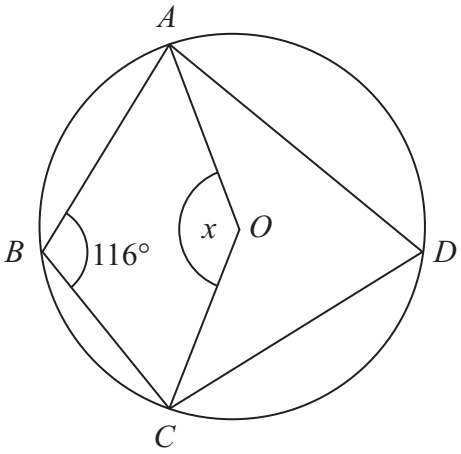


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle with centre *O*.
Angle *ABC* = 116°

Find the size of the angle marked *x*.
Give reasons for your answer.

(Total for Question 18 is 4 marks)

21

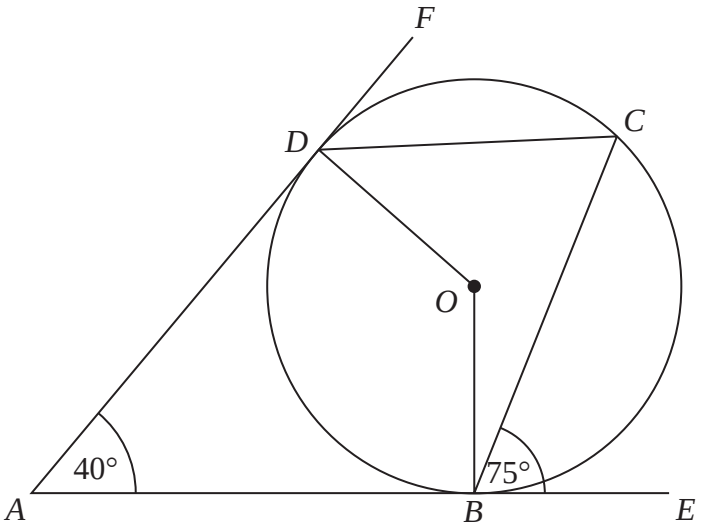


Diagram **NOT** accurately drawn

B, *C* and *D* are points on the circumference of a circle, centre *O*.
ABE and *ADF* are tangents to the circle.

Angle *DAB* = 40°
Angle *CBE* = 75°

Work out the size of angle *ODC*.

.....°

(Total for Question 21 is 3 marks)

12

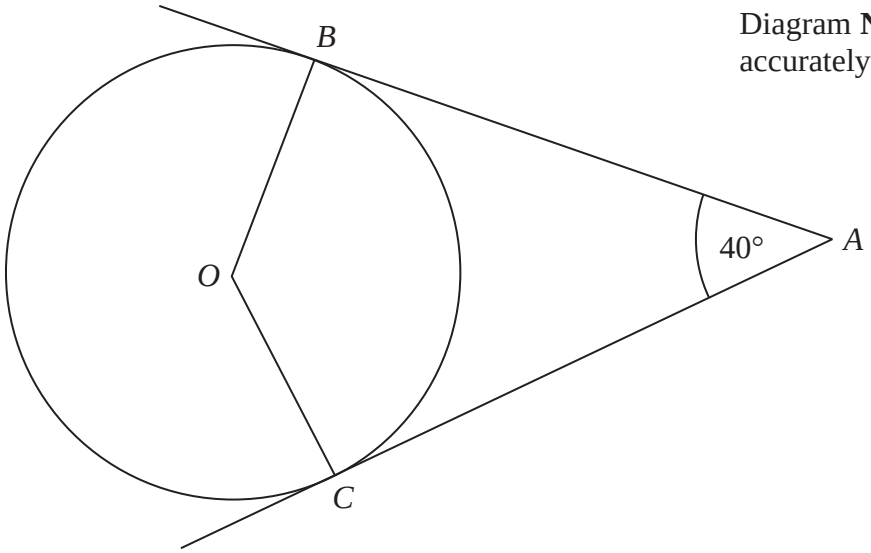


Diagram **NOT** accurately drawn

B and *C* are points on the circumference of a circle, centre *O*.
AB and *AC* are tangents to the circle.
Angle *BAC* = 40°.

Find the size of angle *BCO*.

.....°

(Total for Question 12 is 3 marks)

17

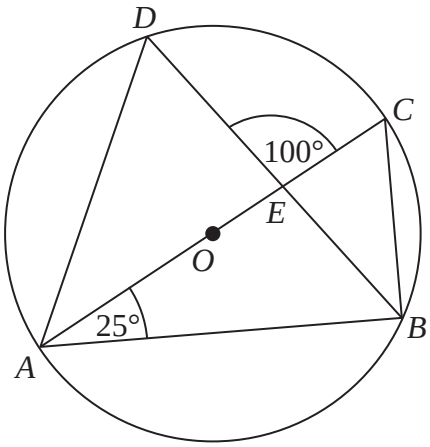


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
AC is a diameter of the circle.
AC and *BD* intersect at *E*.

Angle *CAB* = 25°
Angle *DEC* = 100°

Work out the size of angle *DAC*.
You must show all your working.

.....°

(Total for Question 17 is 4 marks)

*14

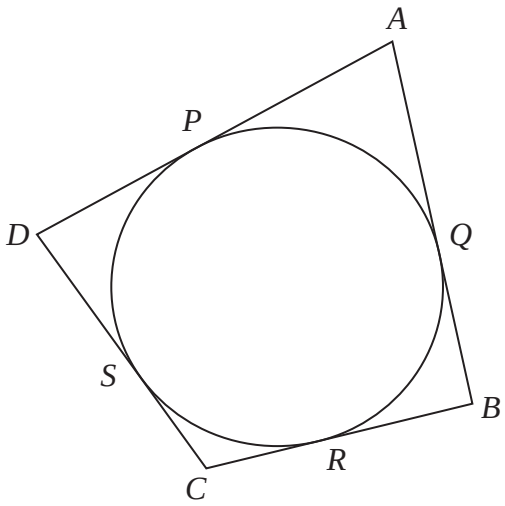


Diagram **NOT** accurately drawn

ABCD is a quadrilateral.
AB, *AD*, *BC* and *CD* are tangents to a circle.
The tangents touch the circle at *Q*, *P*, *R* and *S* respectively.
AC goes through the centre of the circle.

AP : *PD* is in the ratio 3 : 2
AQ : *QB* is in the ratio 3 : 2

Prove that *ABCD* is a kite.

(Total for Question 14 is 5 marks)

***17**

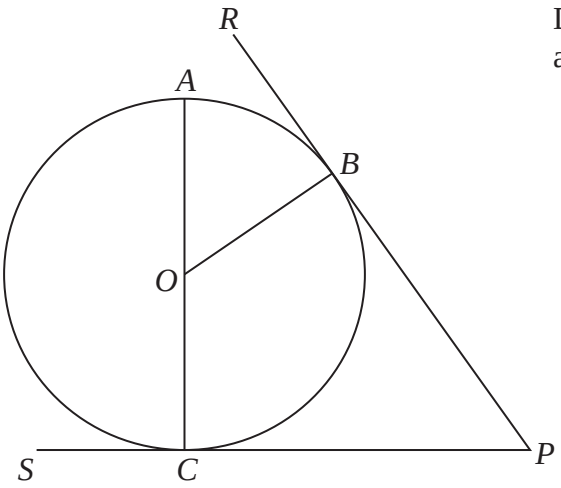


Diagram **NOT** accurately drawn

A, *B* and *C* are points on a circle, centre *O*.

RBP is the tangent to the circle at *B*.
SCP is the tangent to the circle at *C*.
AOC is a diameter of the circle.

Prove that angle *AOB* is equal to angle *CPB*.
You must give reasons at each stage.

(Total for Question 17 is 5 marks)

13

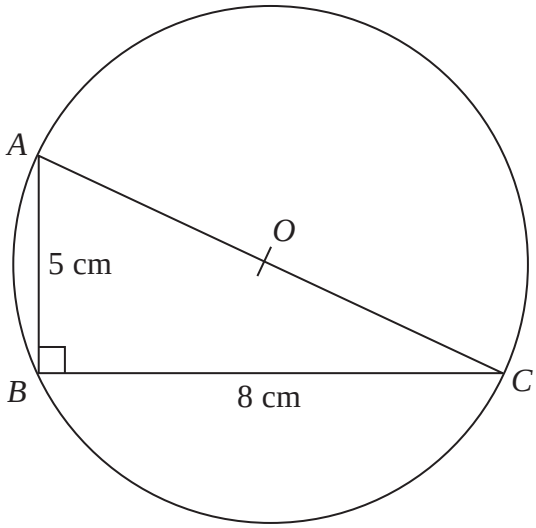


Diagram **NOT** accurately drawn

ABC is a right-angled triangle.
A, *B* and *C* are points on the circumference of a circle centre *O*.
AB = 5 cm
BC = 8 cm

AOC is a diameter of the circle.

Calculate the circumference of the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 13 is 4 marks)

***14**

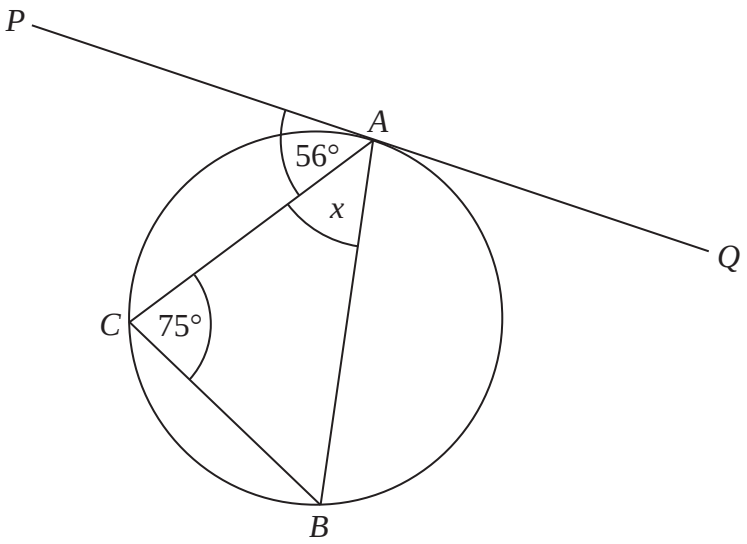


Diagram **NOT** accurately drawn

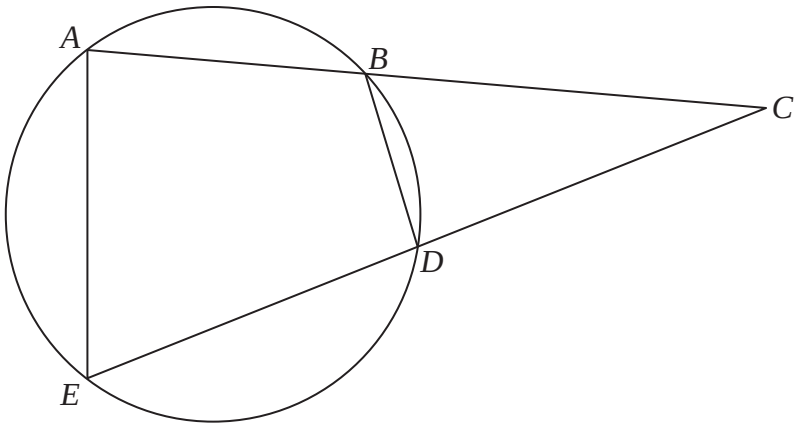
A, *B* and *C* are points on the circumference of a circle.
The straight line *PAQ* is a tangent to the circle.
Angle *PAC* = 56°
Angle *ACB* = 75°

Work out the size of the angle marked *x*.
Give reasons for each stage of your working.

(Total for Question 14 is 3 marks)

***22**

Diagram **NOT** accurately drawn



A, *B*, *D* and *E* are points on a circle.
ABC and *EDC* are straight lines.

Prove that triangle *BCD* is similar to triangle *ECA*.
You must give reasons for your working.

(Total for Question 22 is 5 marks)

15

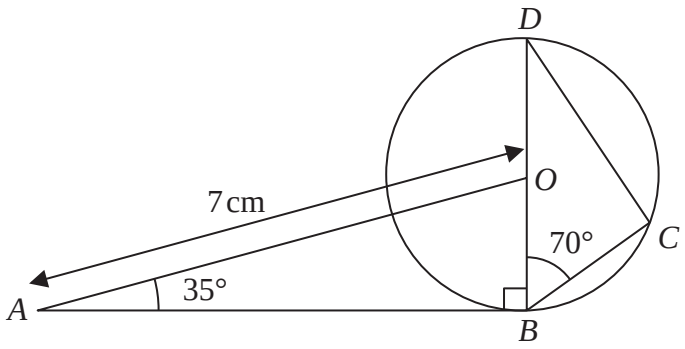


Diagram **NOT** accurately drawn

B, *C* and *D* are points on the circumference of a circle, centre *O*.
BOD is a diameter of the circle.

AO = 7 cm Angle *ABO* = 90° Angle *OAB* = 35° Angle *DBC* = 70°

*(a) Explain why angle *BCD* is 90°

.....

.....

(1)

(b) Calculate the length of *BC*.
Give your answer correct to 3 significant figures.

..... cm

(4)

(Total for Question 15 is 5 marks)

***17**

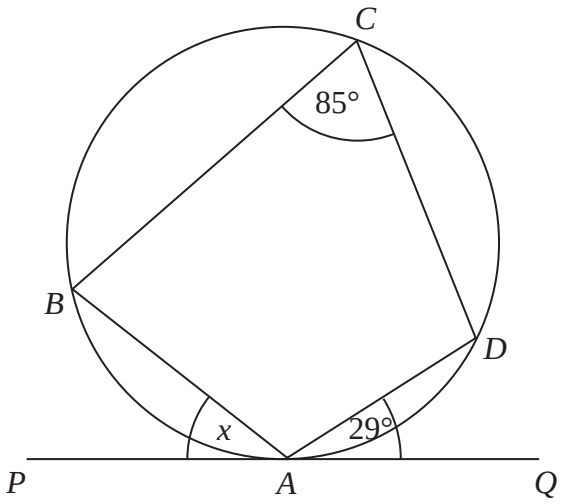


Diagram **NOT** accurately drawn

In the diagram,

the points *A*, *B*, *C* and *D* are on the circumference of a circle
the line *PAQ* is a tangent to the circle
angle *DAQ* = 29°
angle *BCD* = 85°

Work out the size of the angle marked *x*.
Give a reason for each stage of your working.

(Total for Question 17 is 3 marks)

***20**

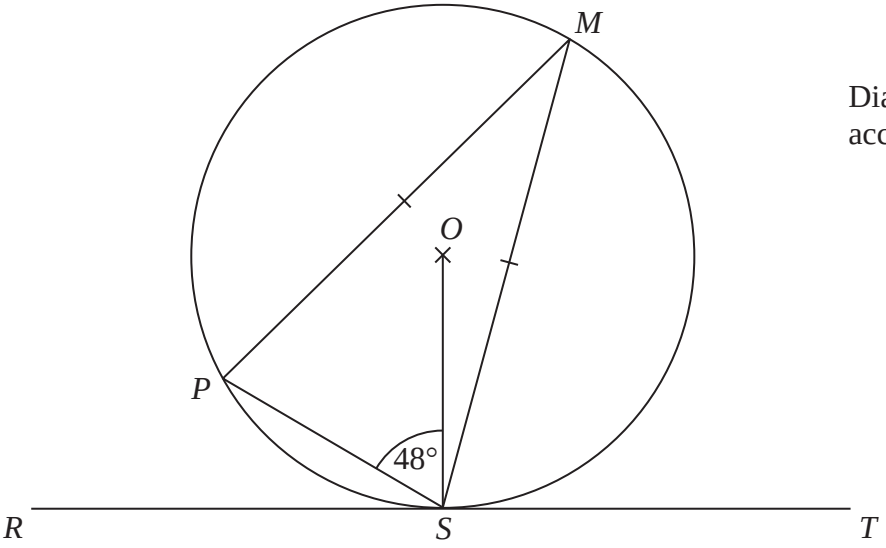


Diagram **NOT** accurately drawn

P, *M* and *S* are points on a circle, centre *O*.
RST is a tangent to the circle.

Angle *PSO* = 48°
MP = *MS*

Work out the size of angle *MST*.
Give reasons for each stage of your working.

(Total for Question 20 is 5 marks)

22

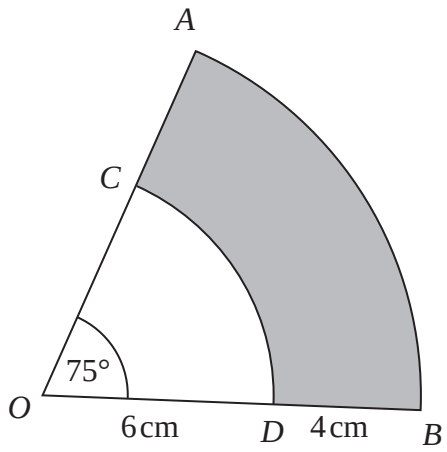


Diagram **NOT** accurately drawn

OAB is a sector of a circle, centre *O*.
OCD is a sector of a circle, centre *O*.
OCA and *ODB* are straight lines.

Angle *AOB* = 75°
OD = 6 cm
DB = 4 cm

Calculate the perimeter of the shaded region.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 22 is 3 marks)

***14**

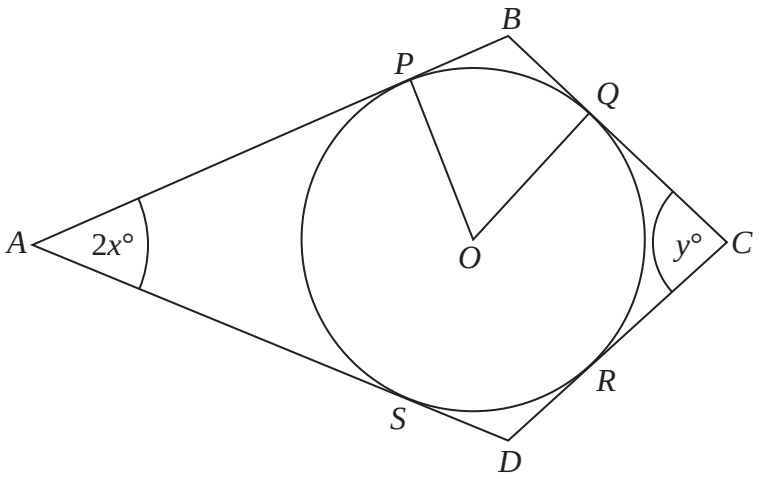


Diagram **NOT** accurately drawn

P, *Q*, *R* and *S* are points on the circumference of a circle, centre *O*.
APB, *BQC*, *CRD* and *DSA* are tangents to the circle.
ABCD is a kite.

Angle *PAS* = $2x°$
Angle *QCR* = $y°$

Find an expression in terms of x and y for the size, in degrees, of the angle *POQ*.
Give your expression in its simplest form.
Give reasons for your answer.

(Total for Question 14 is 5 marks)

16

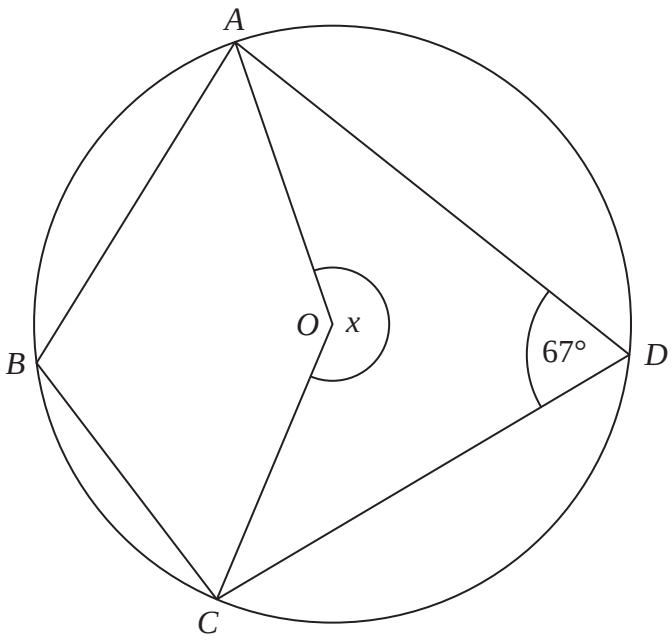


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
Angle *ADC* = 67°

Find the size of the angle marked *x*.

.....°

(Total for Question 16 is 2 marks)

***18**

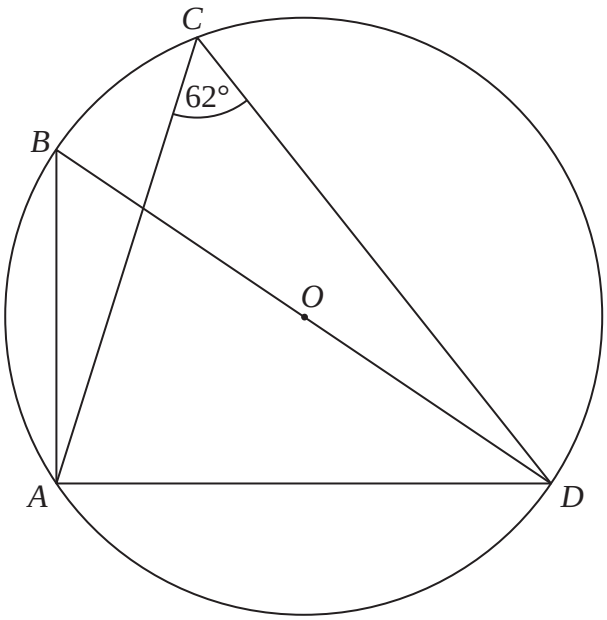


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
BOD is a straight line.
Angle *ACD* = 62°

Find the size of angle *ADB*.
Give a reason for each stage in your working.

(Total for Question 18 is 4 marks)

***14**

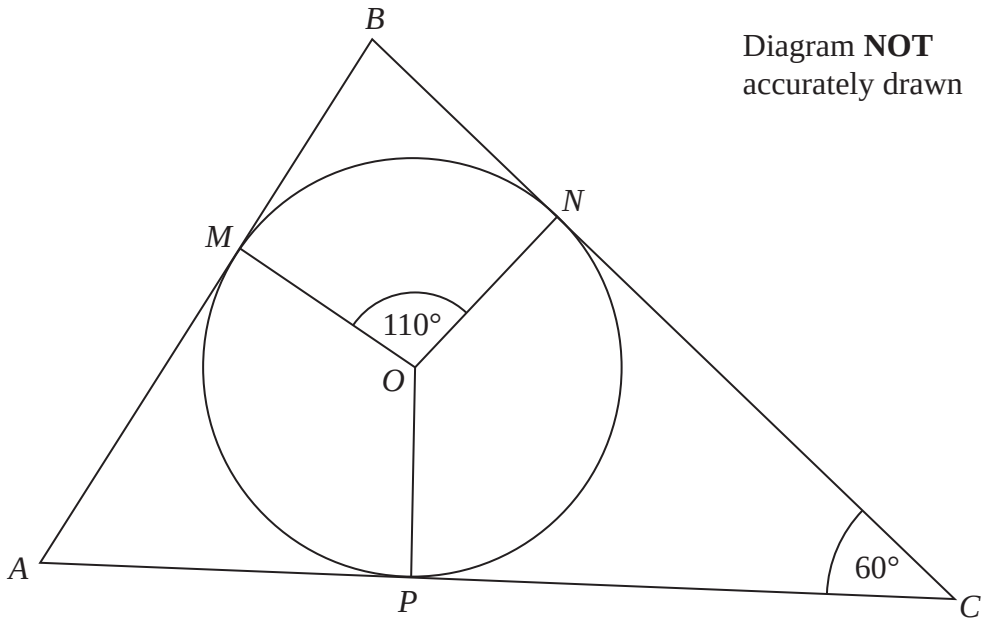


Diagram **NOT** accurately drawn

M, *N* and *P* are points on the circumference of a circle, centre *O*.
AMB, *BNC*, and *CPA* are tangents to the circle.

Angle *MON* = 110°
Angle *BCA* = 60°

Work out the size of angle *BAC*.
Give reasons for each stage of your working.

(Total for Question 14 is 4 marks)

***16**

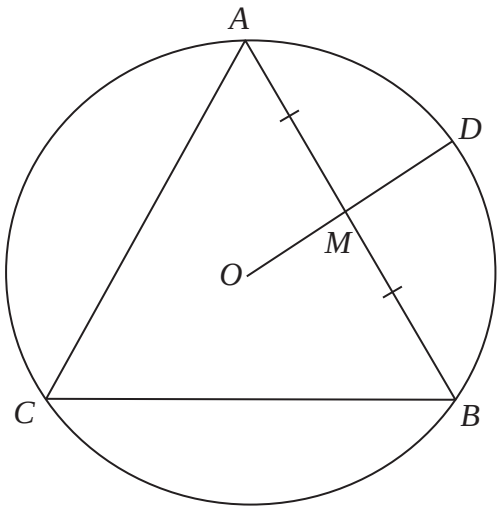


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.

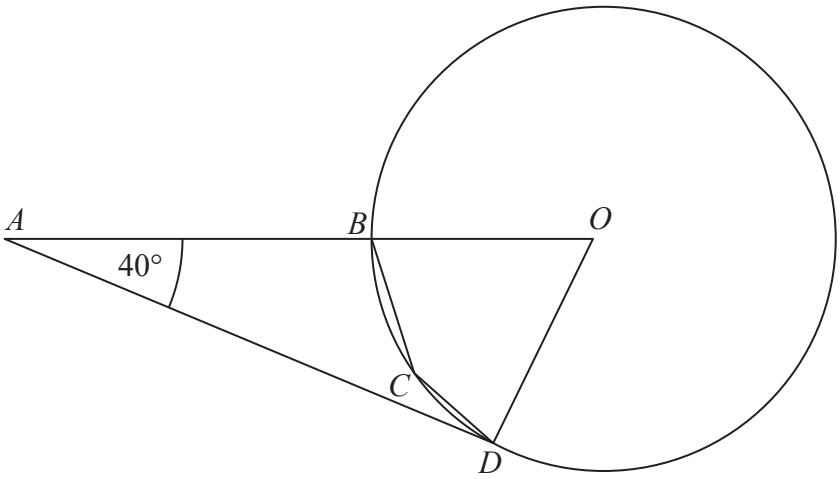
ABC is an equilateral triangle.
OD bisects side *AB* at *M*.

Prove that *ODA* is an equilateral triangle.
Give reasons for each stage of your working.

(Total for Question 16 is 4 marks)

***22**

Diagram **NOT** accurately drawn

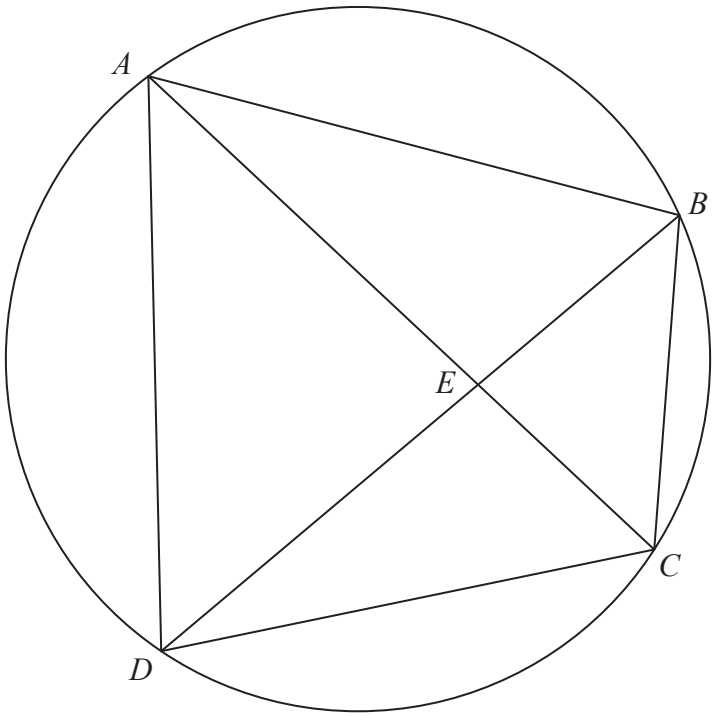


B, *C* and *D* are points on the circumference of a circle, centre *O*.
ABO is a straight line.
AD is the tangent at *D* to the circle.
Angle *DAO* = 40°

Work out the size of angle *BCD*.
Give a reason for each stage of your working.

(Total for Question 22 is 5 marks)

15 A, B, C and D are four points on the circumference of a circle.

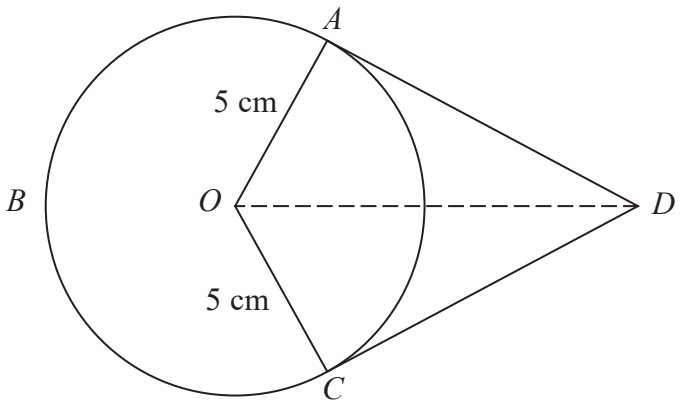


AEC and BED are straight lines.

Prove that triangle ABE and triangle DCE are similar.
You must give reasons for each stage of your working.

(Total for Question 15 is 3 marks)

18



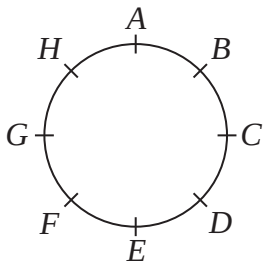
A, *B* and *C* are points on a circle of radius 5 cm, centre *O*.
DA and *DC* are tangents to the circle.
DO = 9 cm

Work out the length of arc *ABC*.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 18 is 5 marks)

3 Hasmeet walks once round a circle with diameter 80 metres.



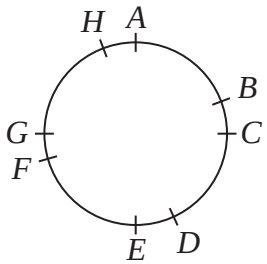
There are 8 points equally spaced on the circumference of the circle.

(a) Find the distance Hasmeet walks between one point and the next point.

.....m

(2)

Four of the points are moved, as shown in the diagram below.



Hasmeet walks once round the circle again.

(b) Has the mean distance that Hasmeet walks between one point and the next point changed? You must give a reason for your answer.

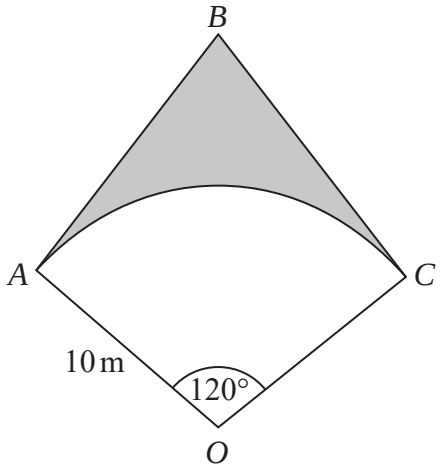
.....

.....

(1)

(Total for Question 3 is 3 marks)

20



OAC is a sector of a circle, centre *O*, radius 10 m.

BA is the tangent to the circle at point *A*.
BC is the tangent to the circle at point *C*.

Angle *AOC* = 120°

Calculate the area of the shaded region.
Give your answer correct to 3 significant figures.

..... m^2

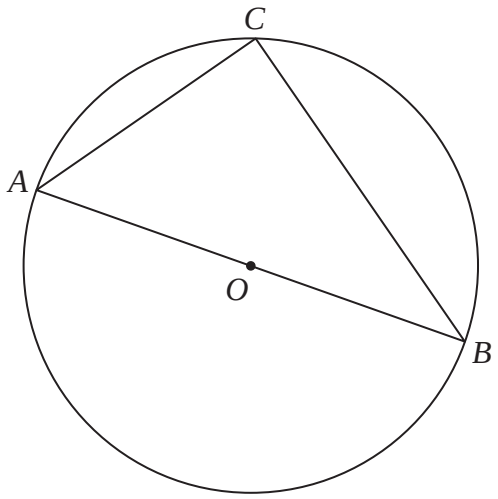
(Total for Question 20 is 5 marks)

Question 61

19 Prove algebraically that the straight line with equation $x - 2y = 10$ is a tangent to the circle with equation $x^2 + y^2 = 20$

(Total for Question 19 is 5 marks)

20

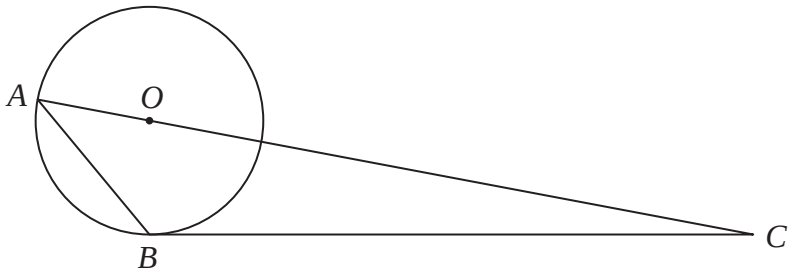


A, *B* and *C* are points on the circumference of a circle, centre *O*.
AOB is a diameter of the circle.

Prove that angle *ACB* is 90°
You must **not** use any circle theorems in your proof.

(Total for Question 20 is 4 marks)

11



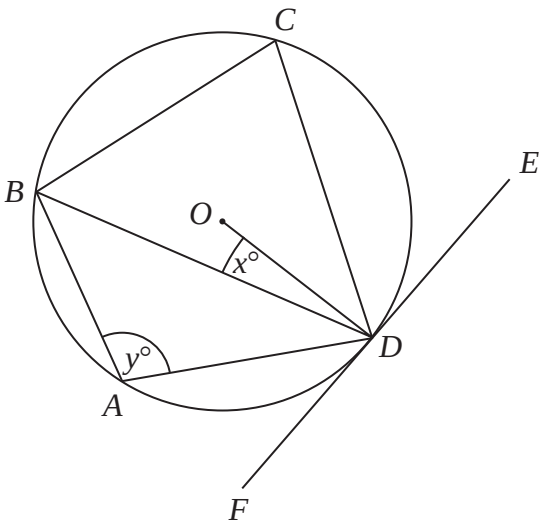
A and *B* are points on a circle, centre *O*.

BC is a tangent to the circle.
AOC is a straight line.
Angle *ABO* = $x°$.

Find the size of angle *ACB*, in terms of *x*.
Give your answer in its simplest form.
Give reasons for each stage of your working.

(Total for Question 11 is 5 marks)

13



A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
FDE is a tangent to the circle.

(a) Show that $y - x = 90$
You must give a reason for each stage of your working.

(3)

Dylan was asked to give some possible values for *x* and *y*.

He said,

"*y* could be 200 and *x* could be 110, because 200 – 110 = 90"

(b) Is Dylan correct?
You must give a reason for your answer.

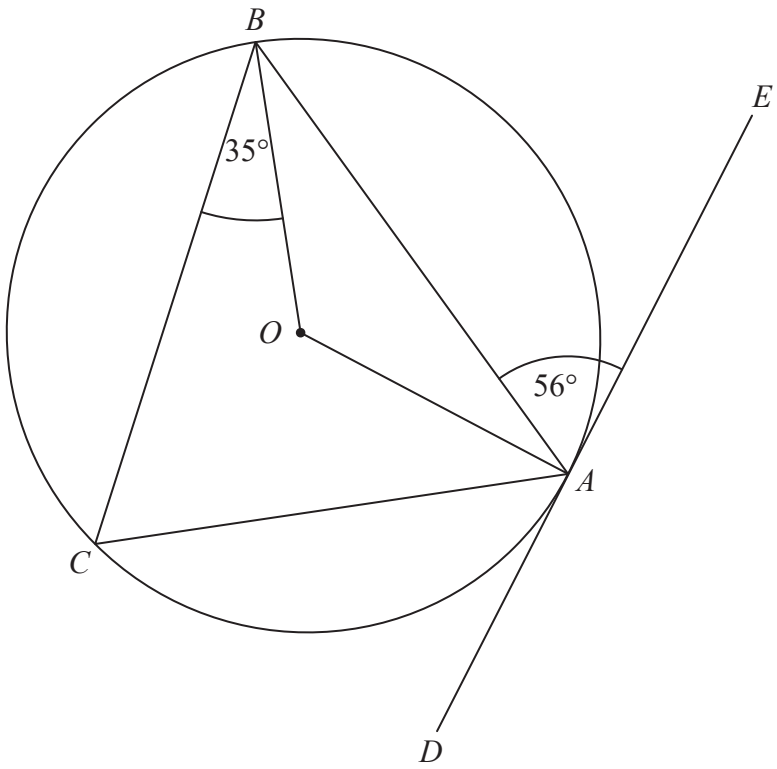
.....

.....

(1)

(Total for Question 13 is 4 marks)

12



A, *B* and *C* are points on the circumference of a circle, centre *O*.
DAE is the tangent to the circle at *A*.

Angle *BAE* = 56°
Angle *CBO* = 35°

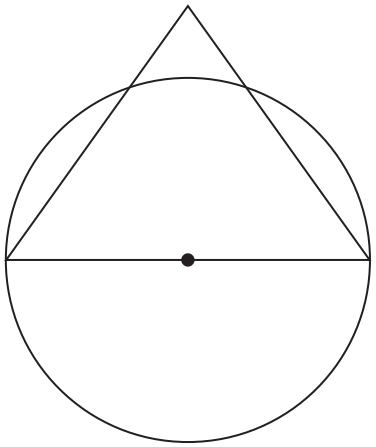
Work out the size of angle *CAO*.
You must show all your working.

.....°

(Total for Question 12 is 3 marks)

Question 66

13 The diagram shows a circle and an equilateral triangle.



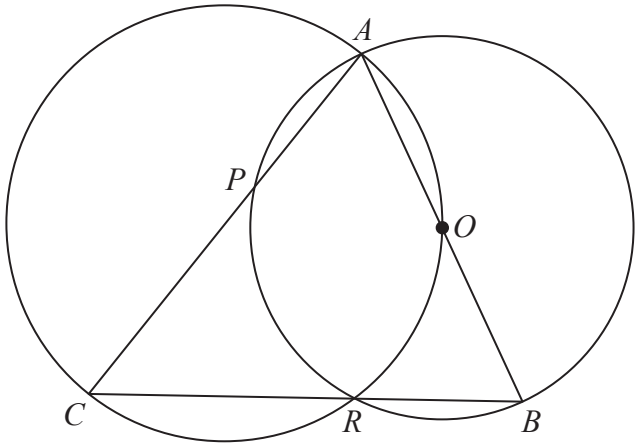
One side of the equilateral triangle is a diameter of the circle.
The circle has a circumference of 44 cm.

Work out the area of the triangle.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 13 is 3 marks)

21



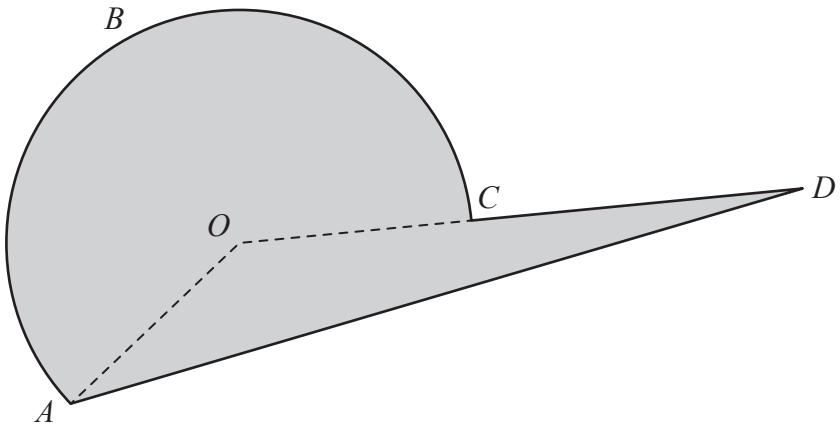
A, *B*, *R* and *P* are four points on a circle with centre *O*.
A, *O*, *R* and *C* are four points on a different circle.
The two circles intersect at the points *A* and *R*.

CPA, *CRB* and *AOB* are straight lines.

Prove that angle *CAB* = angle *ABC*.

(Total for Question 21 is 4 marks)

16 Here is a shaded shape $ABCD$.



The shape is made from a triangle and a sector of a circle, centre O and radius 6 cm.
OCD is a straight line.

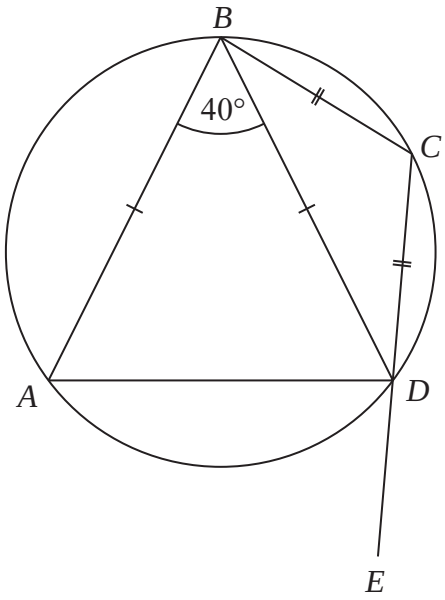
$AD = 14$ cm
Angle $AOD = 140°$
Angle $OAD = 24°$

Calculate the perimeter of the shape.
Give your answer correct to 3 significant figures.

.....cm

(Total for Question 16 is 5 marks)

18 The points A, B, C and D lie on a circle.
CDE is a straight line.

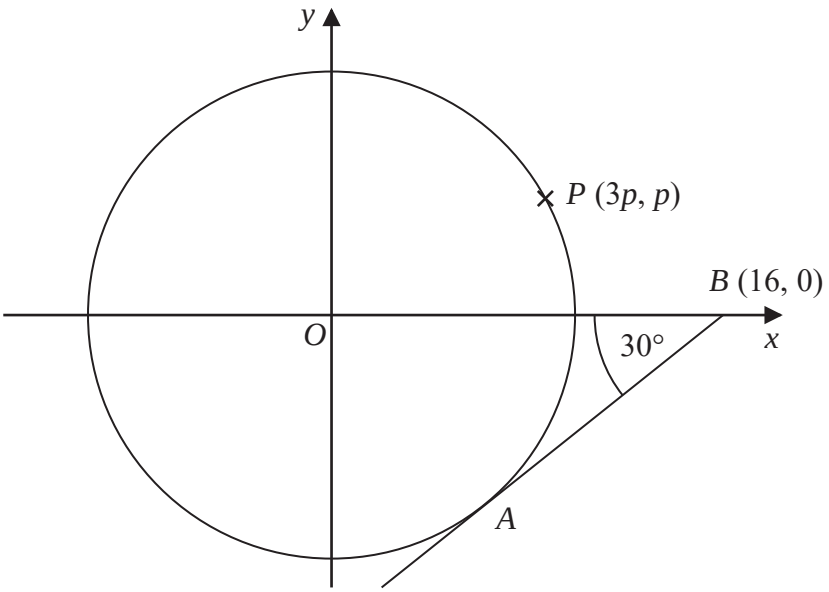


$BA = BD$
$CB = CD$
Angle $ABD = 40°$

Work out the size of angle ADE.
You must give a reason for each stage of your working.

(Total for Question 18 is 5 marks)

22 The diagram shows a circle, centre O.



AB is the tangent to the circle at the point A.
Angle $OBA = 30°$

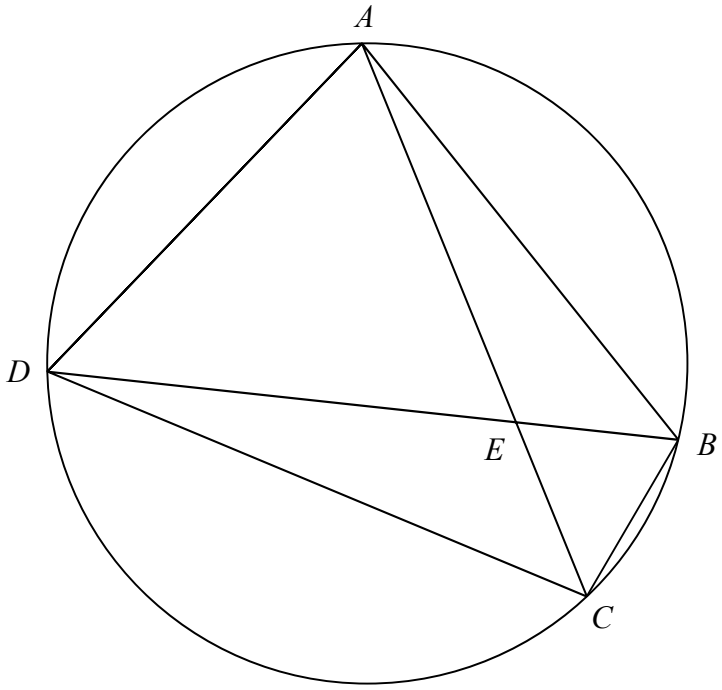
Point B has coordinates $(16, 0)$
Point P has coordinates $(3p, p)$

Find the value of p.
Give your answer correct to 1 decimal place.
You must show all your working.

$p =$ .....

(Total for Question 22 is 4 marks)

22 A, B, C and D are four points on a circle.



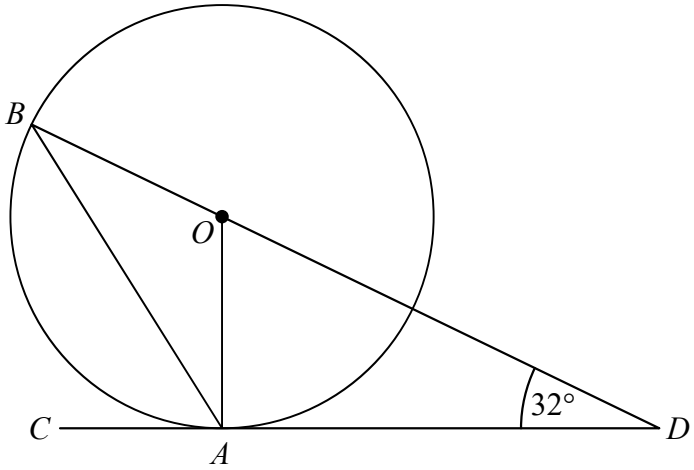
AEC and DEB are straight lines.

Triangle AED is an equilateral triangle.

Prove that triangle ABC is congruent to triangle DCB.

(Total for Question 22 is 4 marks)

17



A and *B* are points on a circle with centre *O*.
CAD is the tangent to the circle at *A*.
BOD is a straight line.

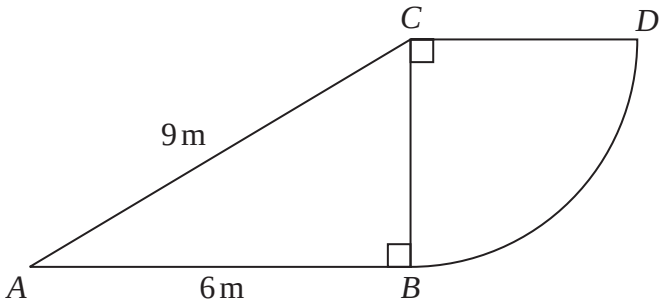
Angle *ODA* = 32°

Work out the size of angle *CAB*.
You must show all your working.

.....°

(Total for Question 17 is 3 marks)

7 The diagram shows a right-angled triangle and a quarter circle.



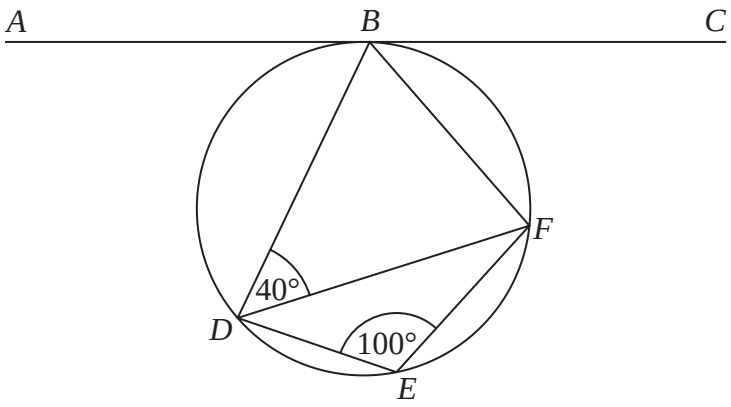
The right-angled triangle *ABC* has angle *ABC* = 90°
The quarter circle has centre *C* and radius *CB*.

Work out the area of the quarter circle.
Give your answer correct to 3 significant figures.
You must show all your working.

..... m^2

(Total for Question 7 is 4 marks)

14

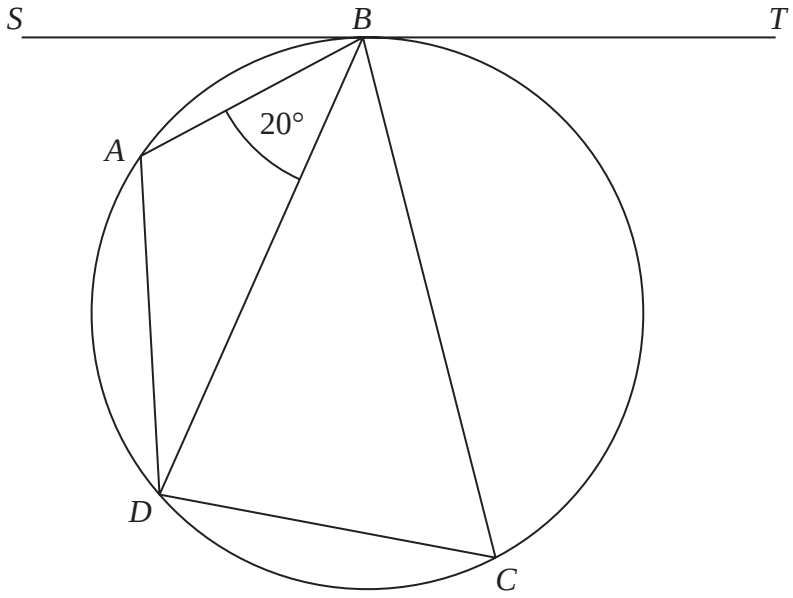


Points *B*, *D*, *E* and *F* lie on a circle.
ABC is the tangent to the circle at *B*.

Find the size of angle *ABD*.
You must give a reason for each stage of your working.

(Total for Question 14 is 4 marks)

14



A, *B*, *C* and *D* are four points on a circle.
SBT is a tangent to the circle.
Angle *ABD* = 20°

the size of angle *BAD* : the size of angle *BCD* = 3 : 1

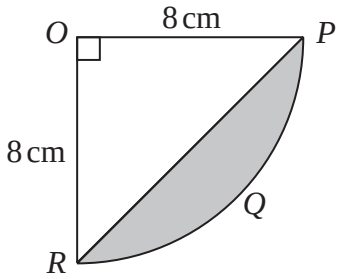
Find the size of angle *SBA*.
Give a reason for each stage of your working.

.....°

.....

(Total for Question 14 is 4 marks)

7 The diagram shows a sector $OPQR$ of a circle, centre O and radius 8 cm.



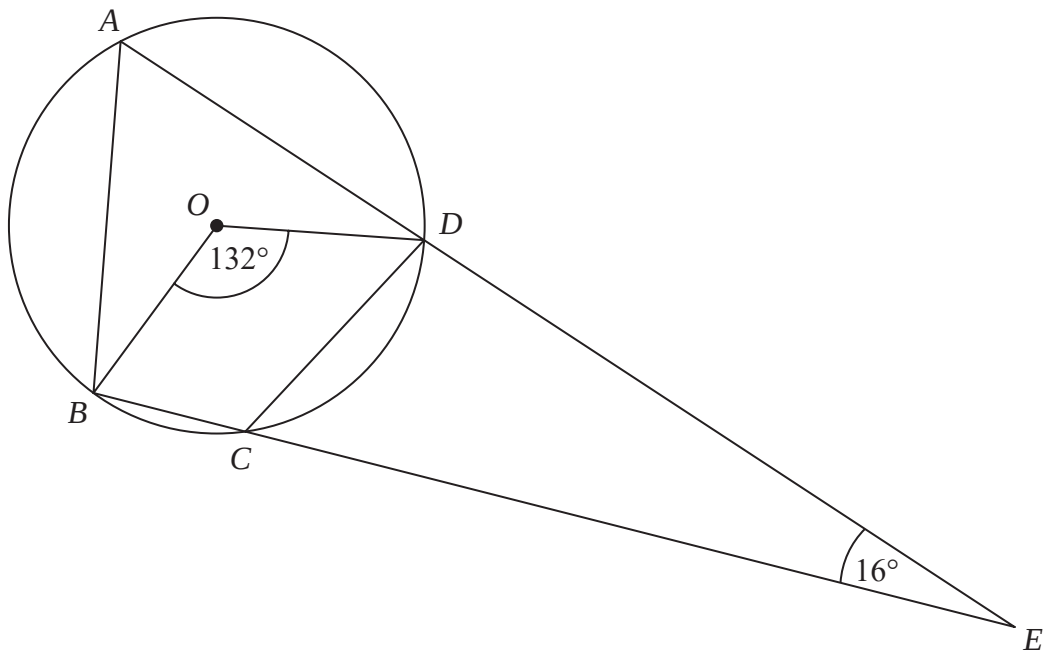
OPR is a triangle.

Work out the area of the shaded segment PQR.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 7 is 4 marks)

20 *A*, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
ADE and *BCE* are straight lines.

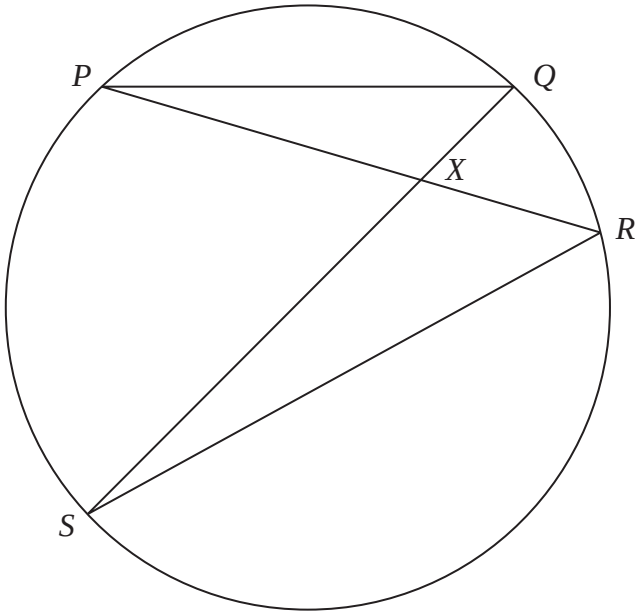


Work out the size of angle *CDE*.
Give a reason for each stage of your working.

.....°

(Total for Question 20 is 4 marks)

15 P, Q, R and S are four points on a circle.

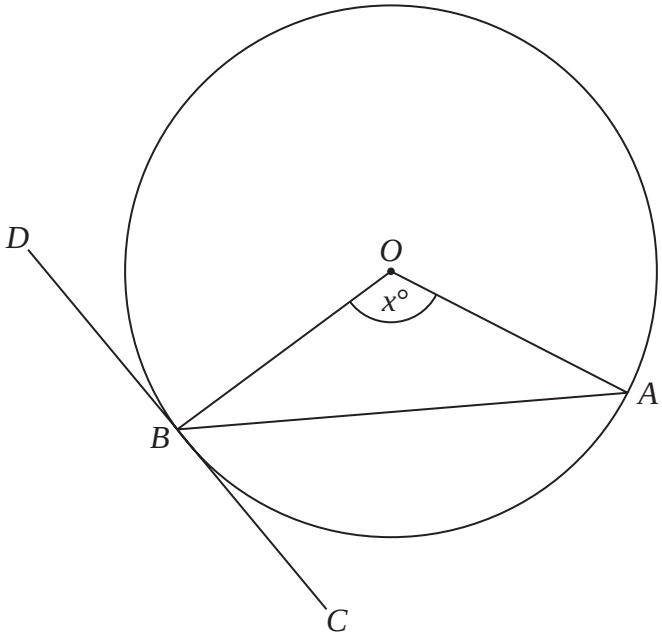


PXR and SXQ are straight lines.

Prove that triangle PQX and triangle SRX are similar.

(Total for Question 15 is 3 marks)

18



A and *B* are points on a circle, centre *O*.
DBC is the tangent to the circle at *B*.
Angle *AOB* = *x*°

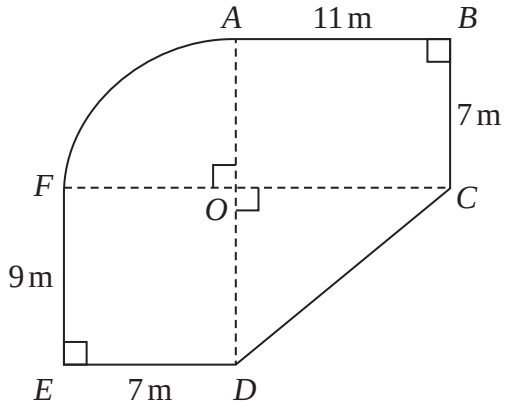
Show that angle *ABC* = $\frac{1}{2}x°$

You must give a reason for each stage of your working.

(Total for Question 18 is 3 marks)

4 The diagram shows a plan of Jason's garden.

ABCO and *DEFO* are rectangles.
CDO is a right-angled triangle.
AFO is a sector of a circle with centre *O* and angle *AOF* = 90°



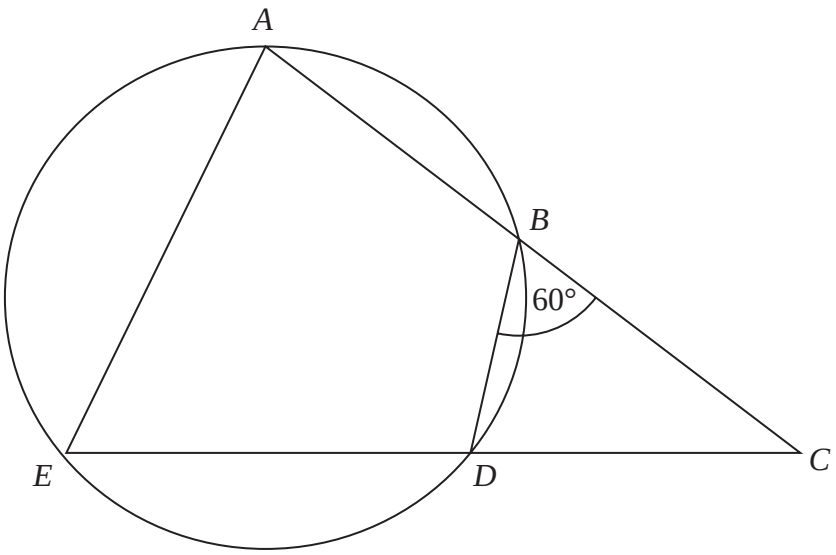
Jason is going to cover his garden with grass seed.
Each bag of grass seed covers 14 m^2 of garden.
Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

£.....

(Total for Question 4 is 5 marks)

16



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

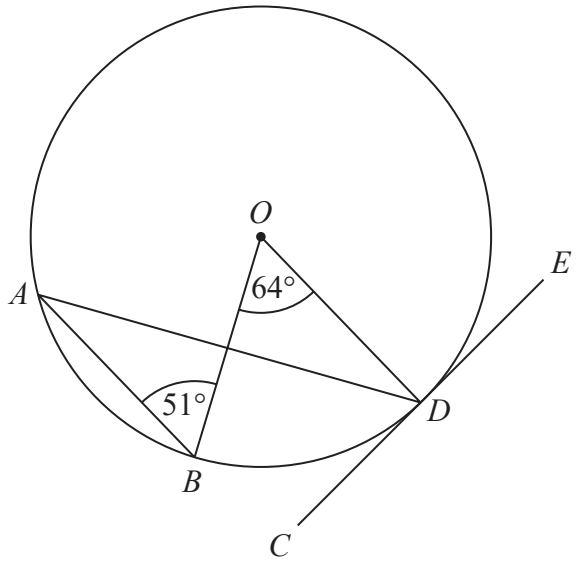
size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

.....°

(Total for Question 16 is 4 marks)

21 A, B and D are points on a circle with centre O.
CDE is the tangent to the circle at D.



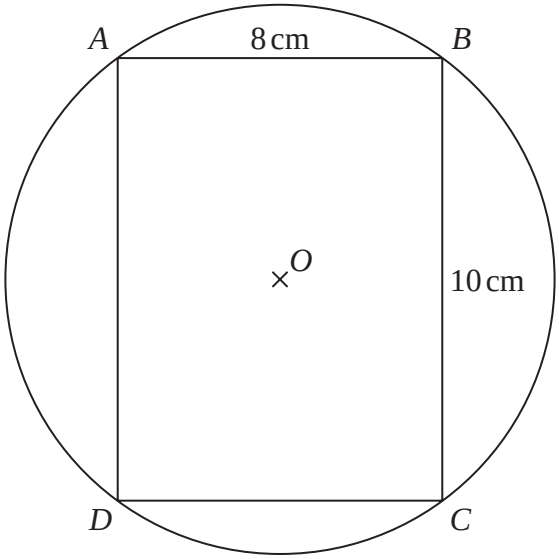
Work out the size of angle ADC.
Write down any circle theorems you use.

.....°

.....

(Total for Question 21 is 4 marks)

12 The points *A*, *B*, *C* and *D* lie on a circle, centre *O*.
ABCD is a rectangle.



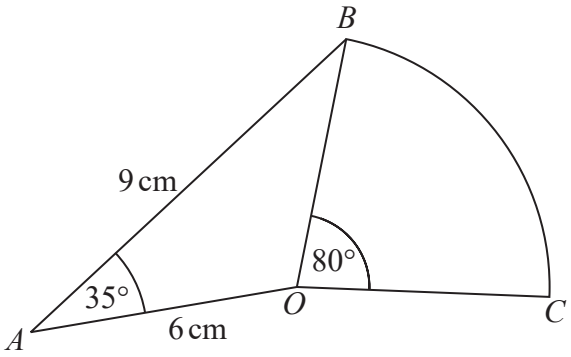
AB = 8 cm *BC* = 10 cm

Work out the circumference of the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 12 is 4 marks)

14 *OAB* is a triangle.
OBC is a sector of a circle, centre *O*.

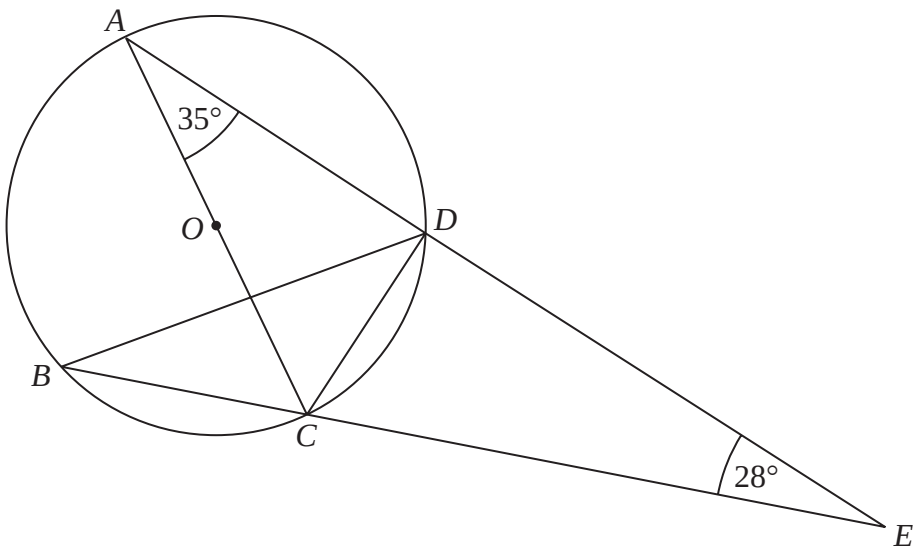


Calculate the area of *OBC*.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 14 is 4 marks)

21



A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
AC is a diameter of the circle.

ADE and *BCE* are straight lines.

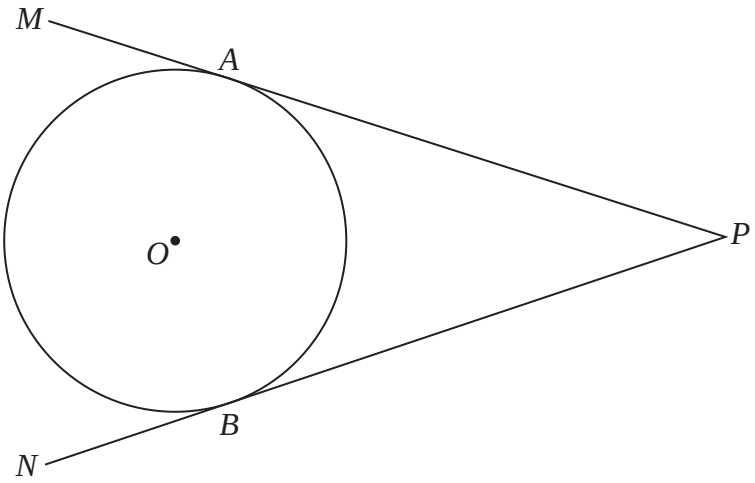
Work out the size of angle *BDC*.
Write down any circle theorems that you use.

.....°

.....

(Total for Question 21 is 4 marks)

22 A and B are points on a circle, centre O.

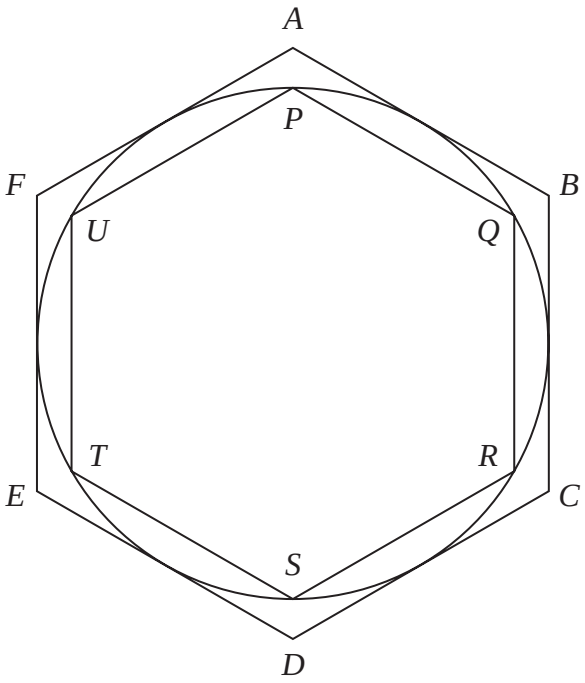


MAP and NBP are tangents to the circle.

Prove that $AP = BP$

(Total for Question 22 is 4 marks)

21 The diagram shows a circle, radius r cm and two regular hexagons.



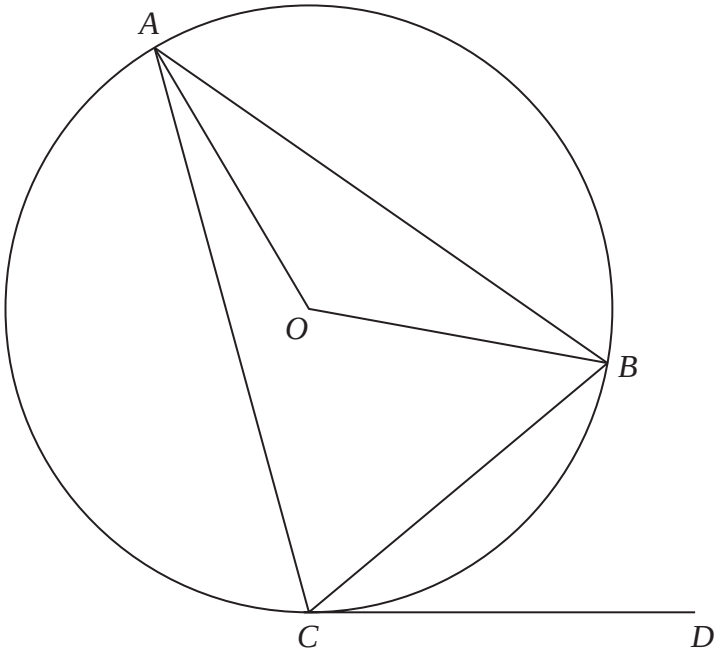
Each side of the larger hexagon *ABCDEF* is a tangent to the circle.
Each side of the smaller hexagon *PQRSTU* is a chord of the circle.

By considering perimeters, show that

$$3 < \pi < 2\sqrt{3}$$

(Total for Question 21 is 4 marks)

17 *A*, *B* and *C* are points on a circle, centre *O*.



CD is a tangent to the circle.

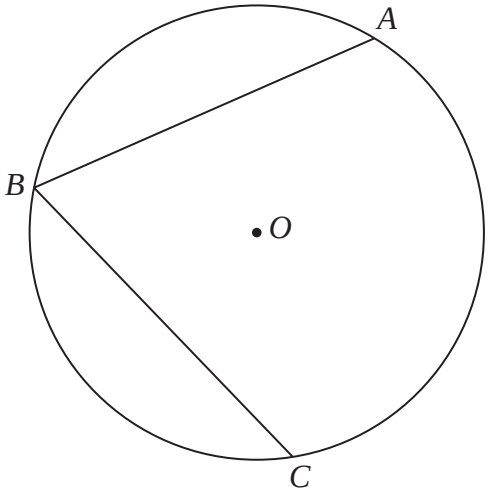
Angle *BCD* = 40°
Angle *OAB* = 3 × angle *OAC*

Work out the size of angle *ACD*.
Write down any circle theorems that you use.

.....°

(Total for Question 17 is 4 marks)

18 *A*, *B* and *C* are three points on a circle, centre *O*.

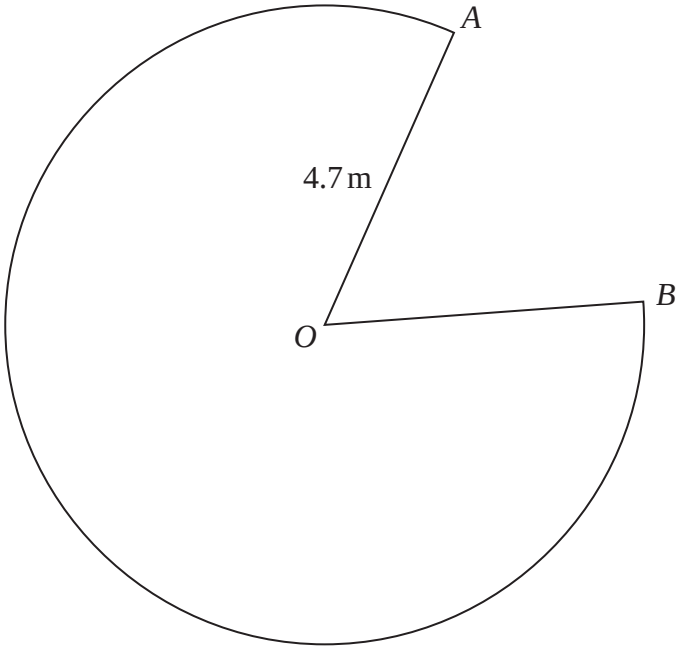


$BA = BC$

Prove that OB bisects angle ABC.

(Total for Question 18 is 3 marks)

11 OAB is a sector of a circle with centre O and radius 4.7 m.



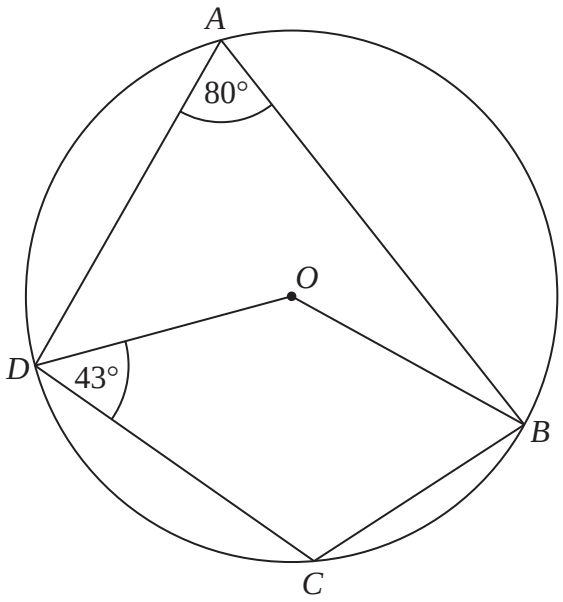
The sector has a perimeter of 34.3 m.

Find the size of the reflex angle AOB.
Give your answer correct to the nearest degree.

.....°

(Total for Question 11 is 3 marks)

20 *A*, *B*, *C* and *D* are points on a circle with centre *O*.



Find the size of angle *OBC*.
Write down any circle theorems that you use.

.....°

(Total for Question 20 is 4 marks)