CIRCLE THEOREM WORKSHEET

Exercise 1 – Introductory Questions

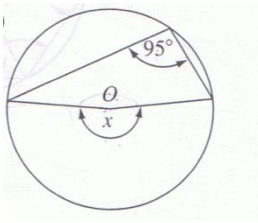
Theorem 1: Angles Standing on the Same Arc (Chord) are Equal

Theorem 2: Angle at the Centre is Twice the Angle at the Circumference

Theorem 3: Angles Standing on a Diameter/ Angles in a Semicircle = 90°

1.Find, the marked angles, giving reason:

a)



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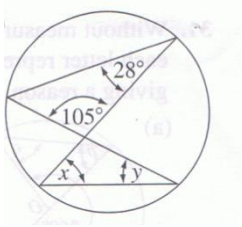

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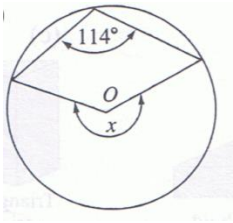

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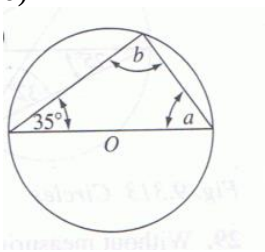
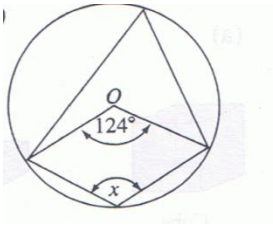
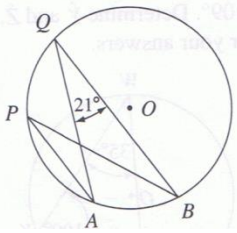


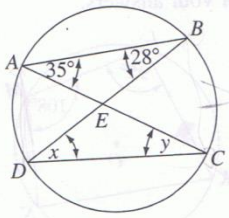
e)



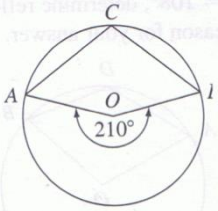
If $\angle AQB = 21°$, determine the magnitude of $\angle APB$, stating a reason for your answer.



Evaluate the angles x and y shown, giving reasons for your answers.



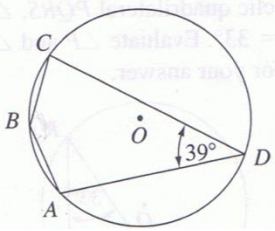
If reflex $\angle AOB = 210°$, calculate $\angle ACB$, giving a reason for your answer.



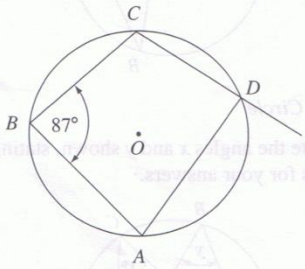
Theorem 4: Opposite Angles in a Cyclic Quadrilateral are Supplementary (sum is 180°)

Theorem 5: Exterior Angle in a Cyclic Quadrilateral = Interior Angle Opposite

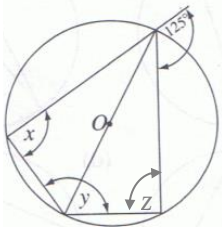
In the cyclic quadrilateral $ABCD$, angle $ADC = 39°$. Calculate angle ABC, giving a reason for your answer.



In the cyclic quadrilateral $ABCD$, $\angle ABC = 87°$. Evaluate angle ADE, giving a reason for your answer.



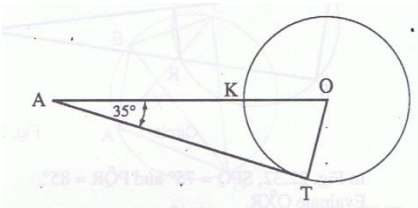
Without measuring, evaluate the magnitude of each letter representing an angle in the circles, giving a reason for each of your answers.



Theorem 6: Angle between Radius and Tangent = 90°

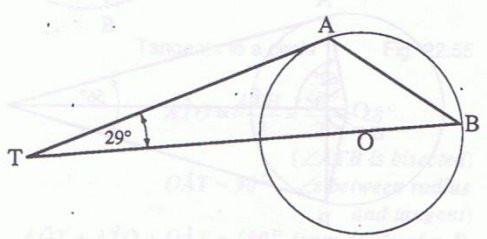
Theorem 7: Tangents from an External Point are Equal in Length

Theorem 8: Angle between Chord and Tangent Equal Angle in Opposite Segment



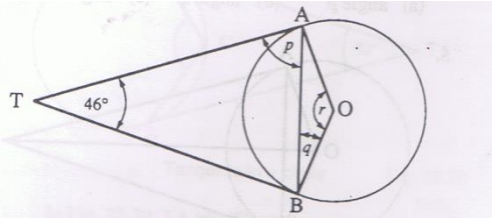
Tangent to a circle Fig. 22.41

In Fig. 22.41, AT is a tangent to the circle and AKO is a straight line.
Given that $O\hat{A}T = 35°$, estimate:
(a) $A\hat{K}T$ (b) $A\hat{T}K$



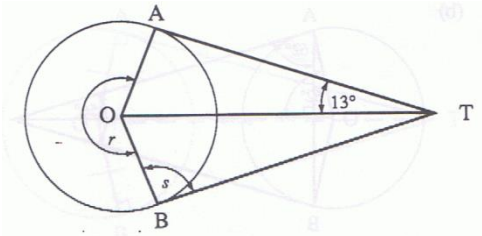
Tangent to a circle Fig. 22.45

In Fig. 22.45, TA is a tangent to the circle, centre O.
Given that $A\hat{T}B = 29°$, calculate $A\hat{B}T$.



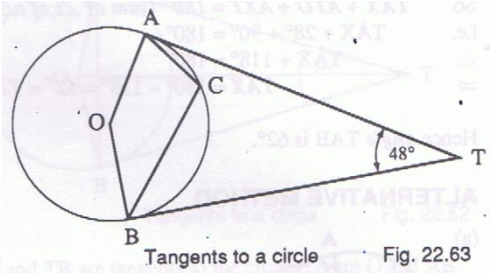
Tangents to a circle Fig. 22.58

In Fig. 22.58, TA and TB are tangents to a circle with centre O.
Given that angle ATB = 46°, estimate angle:
(a) p (b) q (c) r



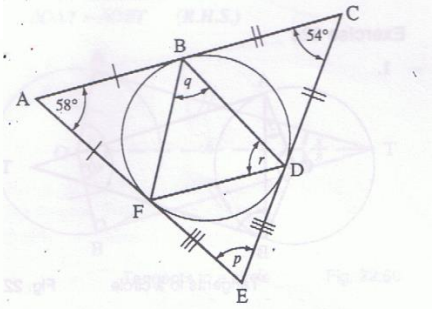
Tangents to a circle Fig. 22.59

In Fig. 22.59, TA and TB are tangents to a circle with centre O.
Given that angle ATO = 13°, evaluate angle:
(a) r (b) s



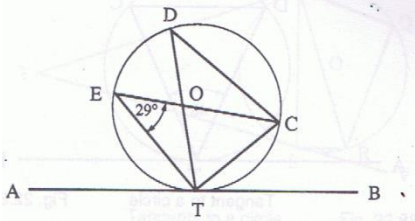
Tangents to a circle Fig. 22.63

In Fig. 22.63, TA and TB are tangents to the circle with centre O.
Given that angle ATB = 48°, calculate:
(a) angle AOB (b) angle ACB



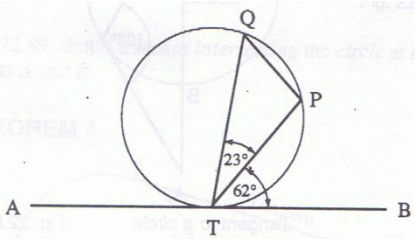
Tangents to a circle Fig. 22.60

In Fig. 22.60, B, D and F are the points of contact of the tangents AC, CE and AE respectively.
Given that $\hat{A} = 58°$ and $\hat{C} = 54°$, determine:
(a) angle p (b) angle q (c) angle r



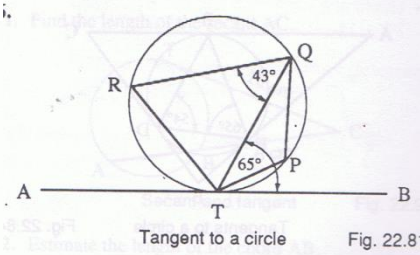
Tangent to a circle Fig. 22.76

In Fig. 22.76, ATB is a tangent at T to a circle with centre O.
Given that $T\hat{E}C = 29°$, calculate:
(a) $T\hat{D}C$ (b) $C\hat{T}B$ (c) $E\hat{T}A$



Tangent to a circle Fig. 22.78

In Fig. 22.78, ATB is a tangent to a circle and PT is a chord.
Given that $Q\hat{T}P = 23°$ and $P\hat{T}B = 62°$, evaluate $Q\hat{P}T$.

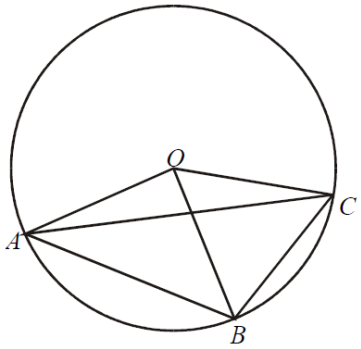


Tangent to a circle Fig. 22.81

In Fig. 22.81, ATB is a tangent to a circle and PQRT is a cyclic quadrilateral.
Given that $R\hat{Q}T = 43°$ and $Q\hat{T}B = 65°$, estimate:
(a) $Q\hat{R}T$ (b) $Q\hat{P}T$ (c) $R\hat{T}A$

Exercise 2 – Mixed Questions

1. In the diagram, O is the centre of the circle.
Angle $OAC = 12°$ and angle $BOC = 80°$.



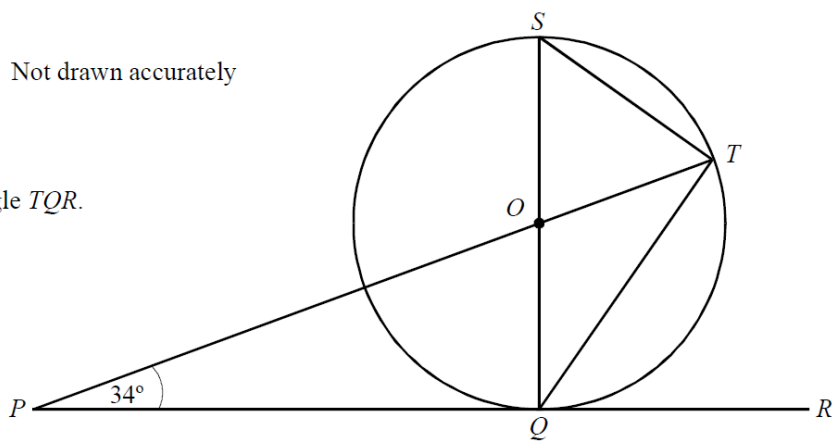
Calculate the size of the following angles, giving a geometrical reason for each of your answers.

(a) Angle OCA (b) Angle AOC

(c) Angle ACB (d) Angle ABC

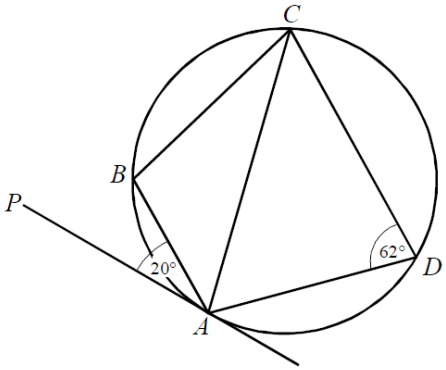
2. The line PQR is a tangent to a circle with centre O.
QS is a diameter of the circle.
T is a point on the circumference of the circle such that POT is a straight line.
The angle OPQ is 34°.

Not drawn accurately



Calculate the size of angle TQR.

3. $ABCD$ is a cyclic quadrilateral and PA is a tangent to the circle at A.
Angle $BAP = 20°$ and angle $ADC = 62°$.

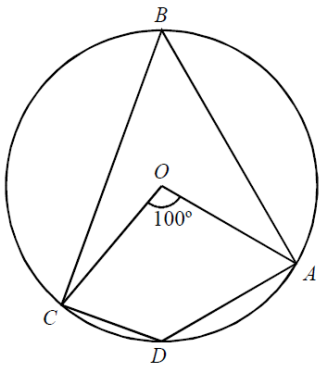


Not to scale

Find angles ABC and BAC.

4. In the diagram, O is the centre of the circle.
Angle $COA = 100°$

Not drawn accurately



Calculate

(a) angle CBA,

(b) angle CDA

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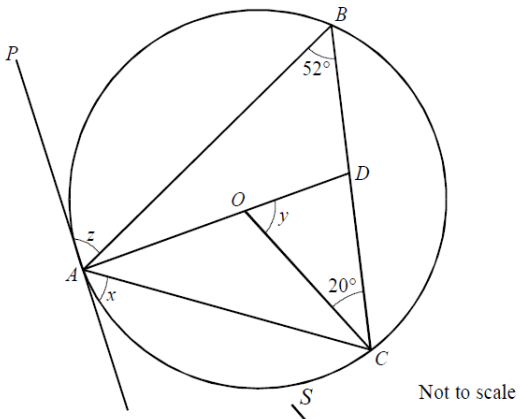
5. A, B and C are points on the circumference of a circle centre O.

D is a point on BC such that AOD is a straight line.
PA is a tangent to the circle at A.

Calculate angles x, y and z.

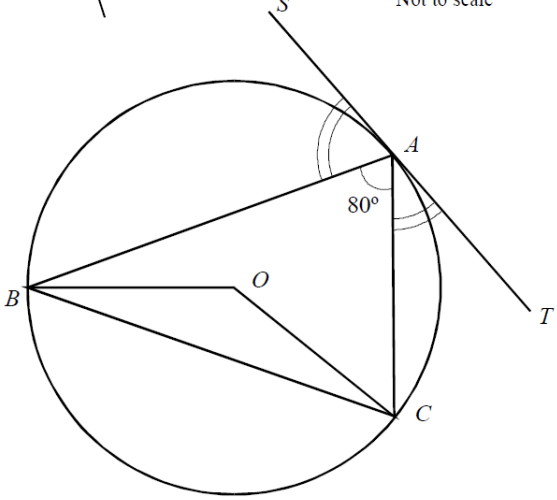


Not to scale

6. In the diagram, O is the centre of the circle.
SAT is a tangent to the circle at A.
Angle $BAC = 80°$ and angle SAB = angle TAC.

(a) Calculate
(i) angle BOC (ii) angle OBC
(iii) angle ABO (iv) angle ACO.

(b) Explain why triangles OAB and OAC are congruent (identical).

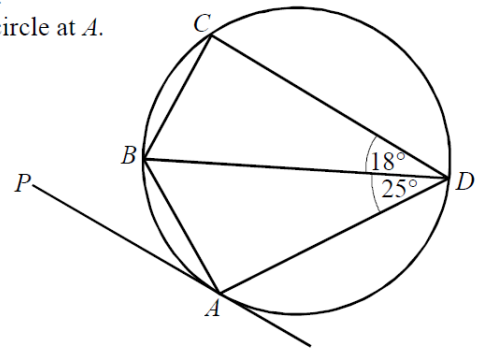


7. A, B, C and D are points on the circumference of a circle.
BD is a diameter of the circle and PA is a tangent to the circle at A.
Angle $ADB = 25°$ and angle $CDB = 18°$.

(a) Write down the value of angle

(i) BCD (ii) PAB.

(b) Calculate angle ABC.



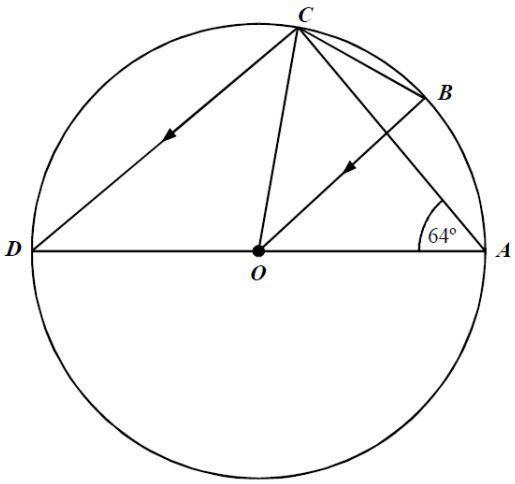
8. AD is a diameter of a circle centre O.
B and C are points on the circumference such that DC is parallel to OB. The angle $OAC = 64°$.

(a) Calculate the size of angle ODC.

(b) Calculate the size of angle AOB.

(c) Calculate the size of angle ACB.

(d) Calculate the size of angle OBC.



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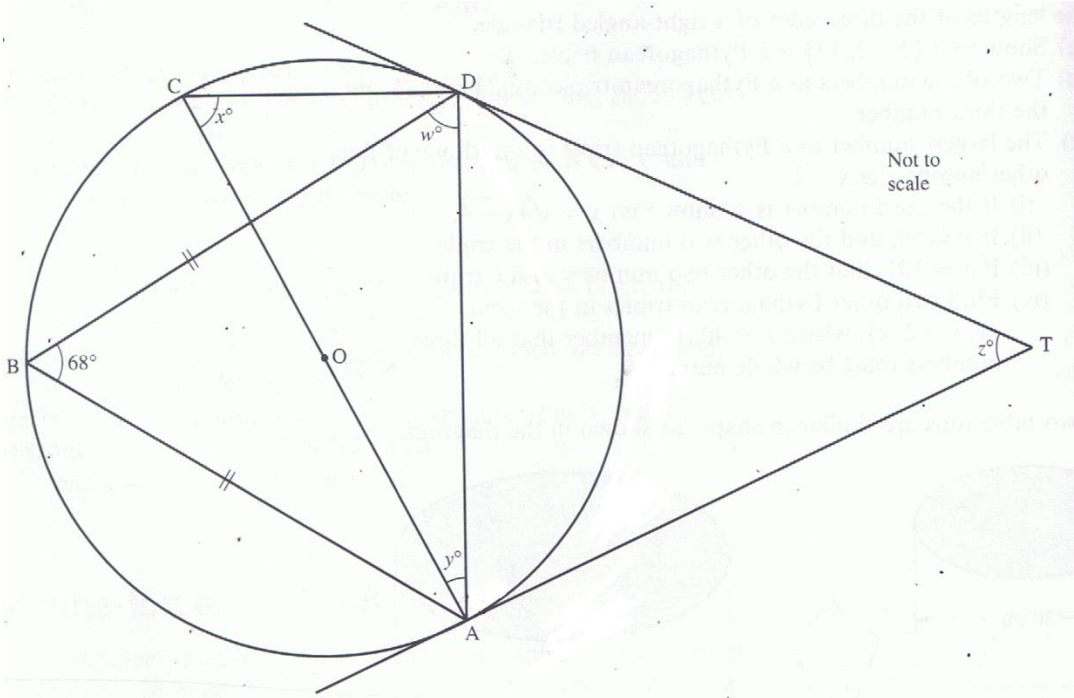
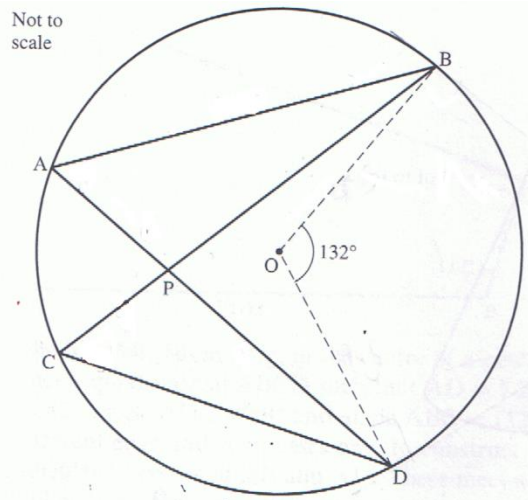
Exercise 3 - Exam Style Questions



AOC is the diameter of circle ABCD.
AT and DT are tangents. BD = BA and angle DBA = 68°.
Find the angles marked w, x, y and z.

J 97 2

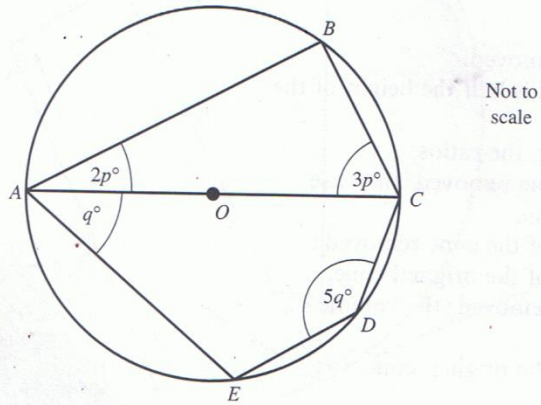


O is the centre of the circle. Angle BOD = 132°. The chords AD and BC meet at P.

(a) (i) Calculate angles BAD and BCD.
(ii) Explain why triangles ABP and CDP are similar.
(iii) AP = 6 cm, PD = 8 cm, CP = 3 cm and AB = 17·5 cm. Calculate the lengths of PB and CD.
(iv) If the area of triangle ABP is n cm^2, write down, in terms of n, the area of triangle CPD.

(b) (i) The tangents at B and D meet at T. Calculate angle BTD.
(ii) Use OB = 9·5 cm to calculate the diameter of the circle which passes through O, B, T and D, giving your answer to the nearest centimetre.

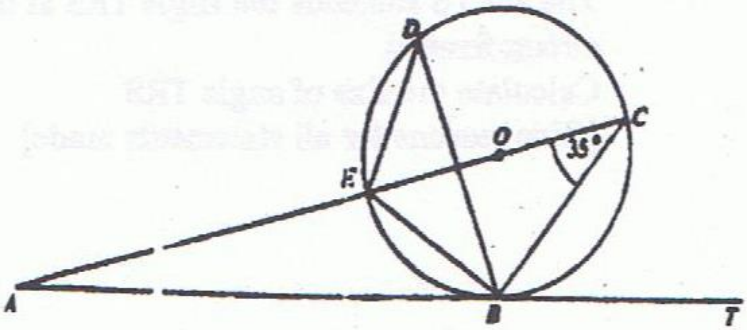
N 95 4



A, B, C, D and E lie on a circle, centre O. AOC is a diameter.
Find the value of:
(a) p,
(b) q.

J 03 2

[Jan/02/12]



In the diagram above, **not drawn to scale**, ABT is a tangent to the circle BEDC, centre O. AEC is a straight line through the centre O, with angle

$E\hat{C}B = 35°$

Calculate, giving reasons for your answers, the sizes of the following angles:

(i) $E\hat{D}B$

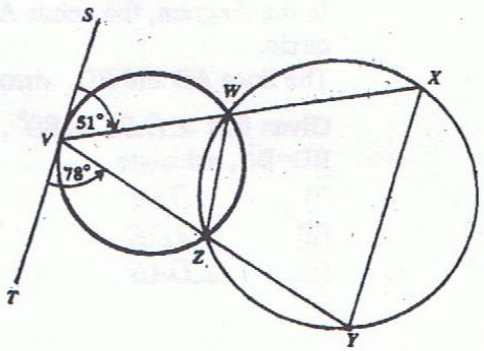
(ii) $B\hat{E}C$

(iii) $C\hat{B}T$

(iv) $B\hat{A}E$ [8 mks]

[Jun/04/11]

In the diagram below, VWZ and WXYZ are two circles intersecting at W and Z. SVT is a tangent to the circle at V, VWX and VZY are straight lines, $T\hat{V}Y = 78^0$ and $S\hat{V}X = 51^0$.



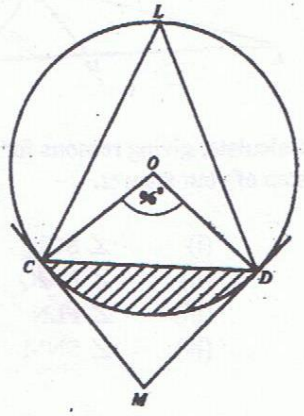
1) Calculate the size of EACH of the following angles, giving reasons for your answer.

1) $V\hat{Z}W$

2) $X\hat{Y}Z$

[Jun/03/10]

In the diagram below **not drawn to scale**, MC and MD are tangents of the circle centre is at O. Angle COD measures $96°$.



(a) Calculate, giving reason for your answer, the size of

(i) angle MCD

(ii) angle CMD [5 mks]

(b) Explain why the quadrilateral OCMD is cyclic. [3 mks]

(c) Given that the radius of the circle shown in the diagram above is 6.5 cm, calculate the area of triangle OCD

(ii) the area of the shaded segment of the circle. [Use $\pi = 3.14$]