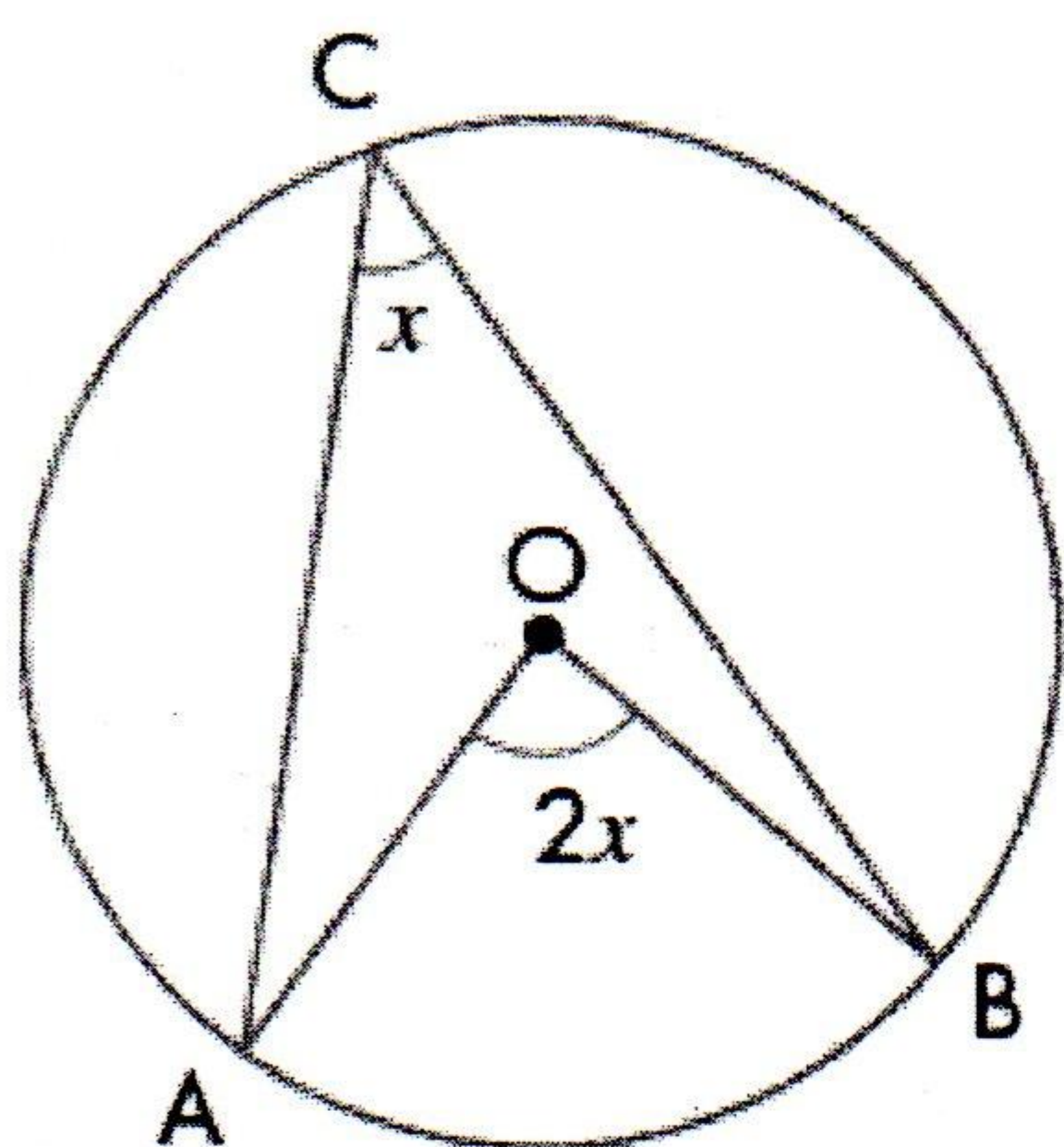


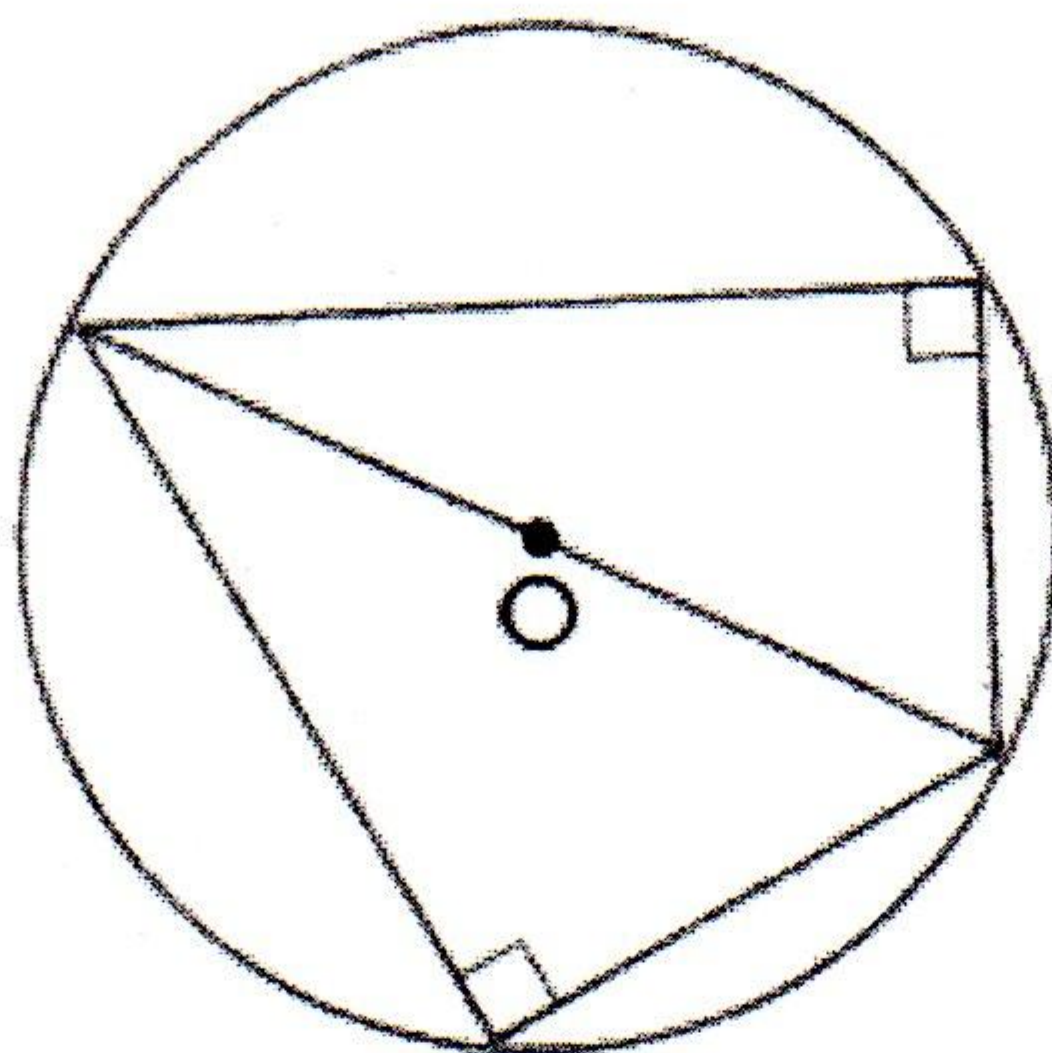
Circle theorem

Theorem 1



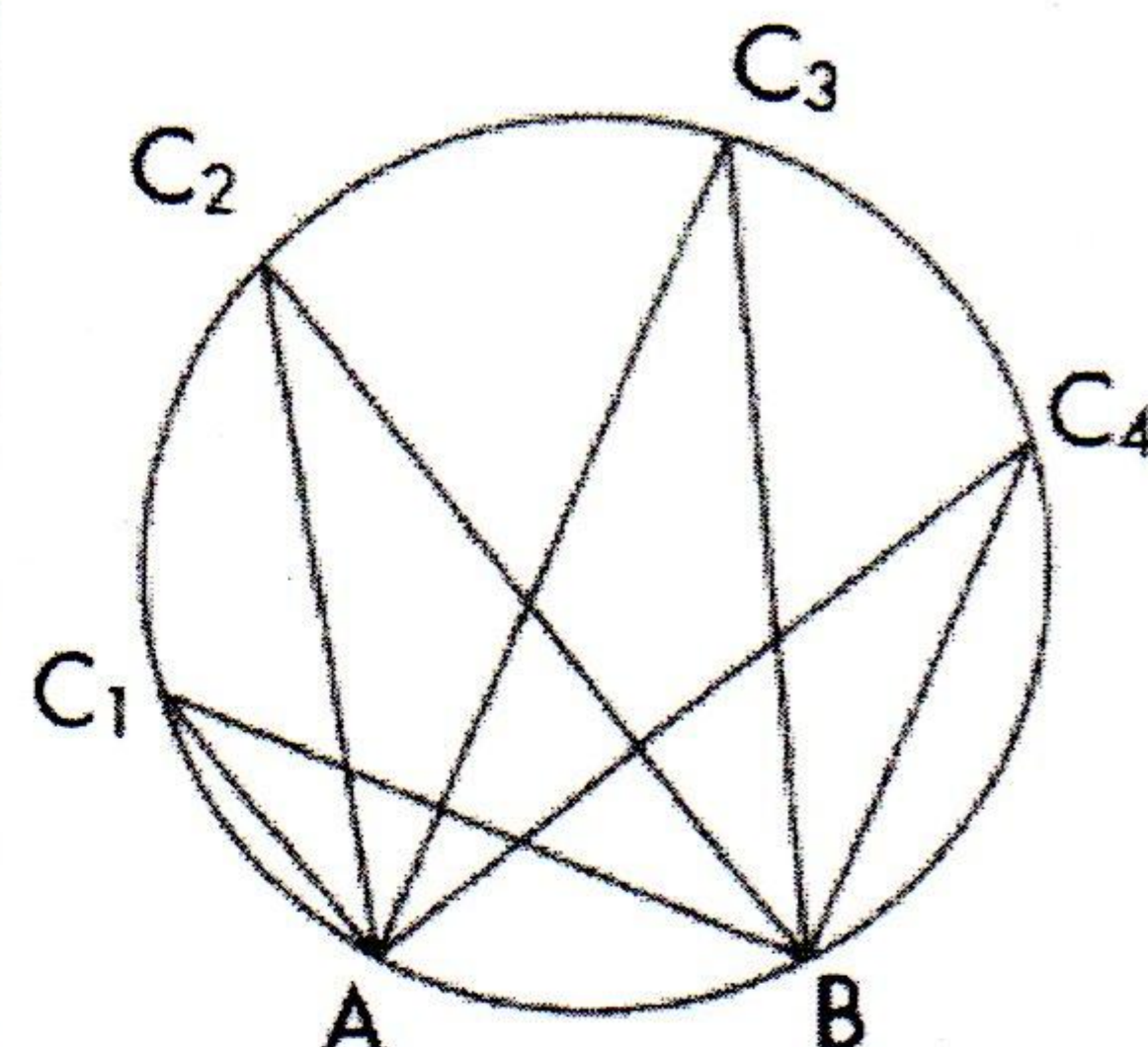
The angle at the centre of a circle is twice the angle at the **circumference** subtended by the same **arc**. $\angle AOB = 2\angle ACB$

Theorem 2



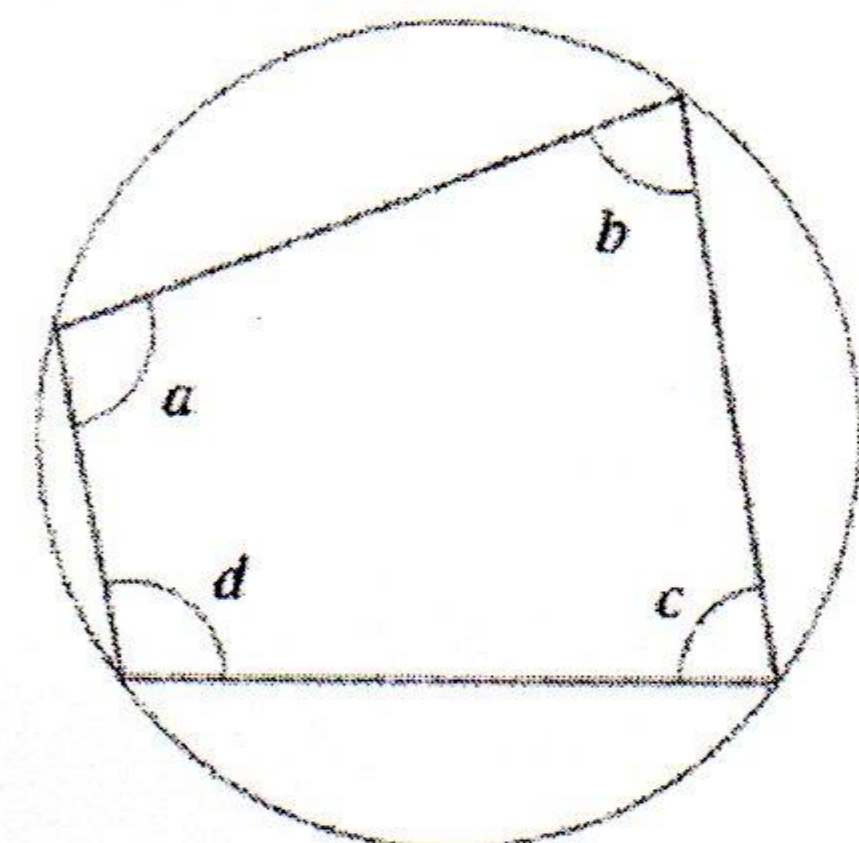
Every angle at the circumference of a **semicircle** that is subtended by the **diameter** of the semicircle is a right angle.

Theorem 3



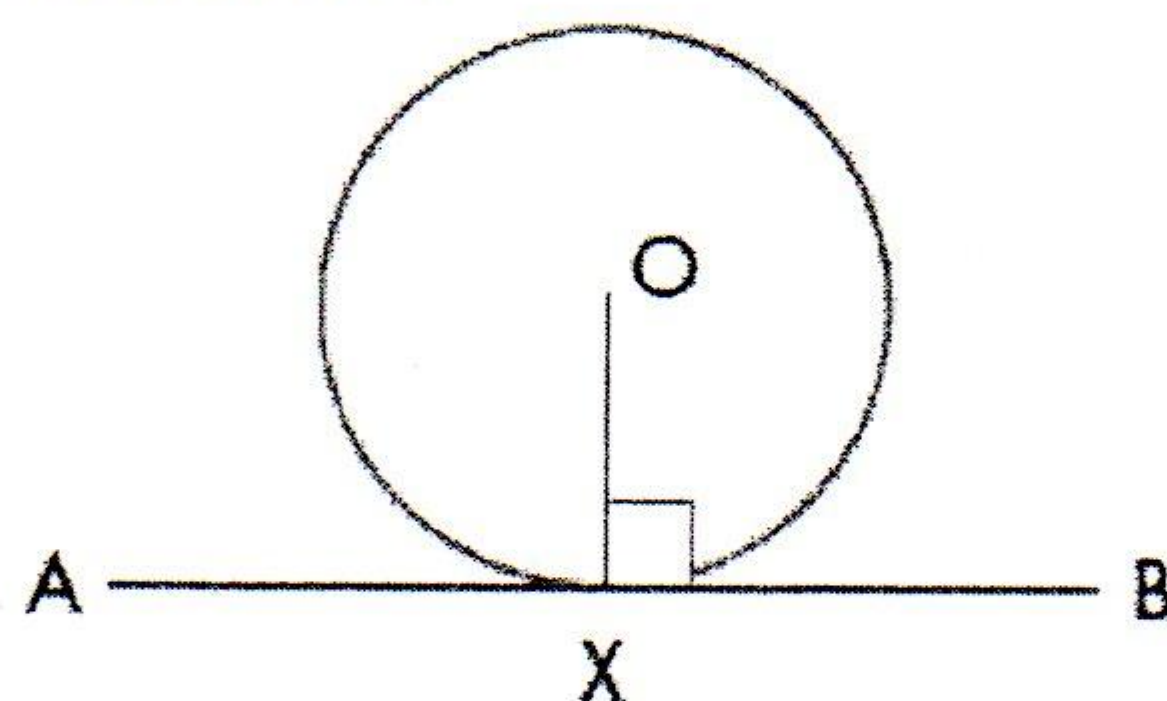
Angles at the circumference in the same **segment** of a circle are equal. Points C1, C2, C3 and C4 on the circumference are subtended by the same arc AB. So $\angle AC1B = \angle AC2B = \angle AC3B = \angle AC4B$

Theorem 4



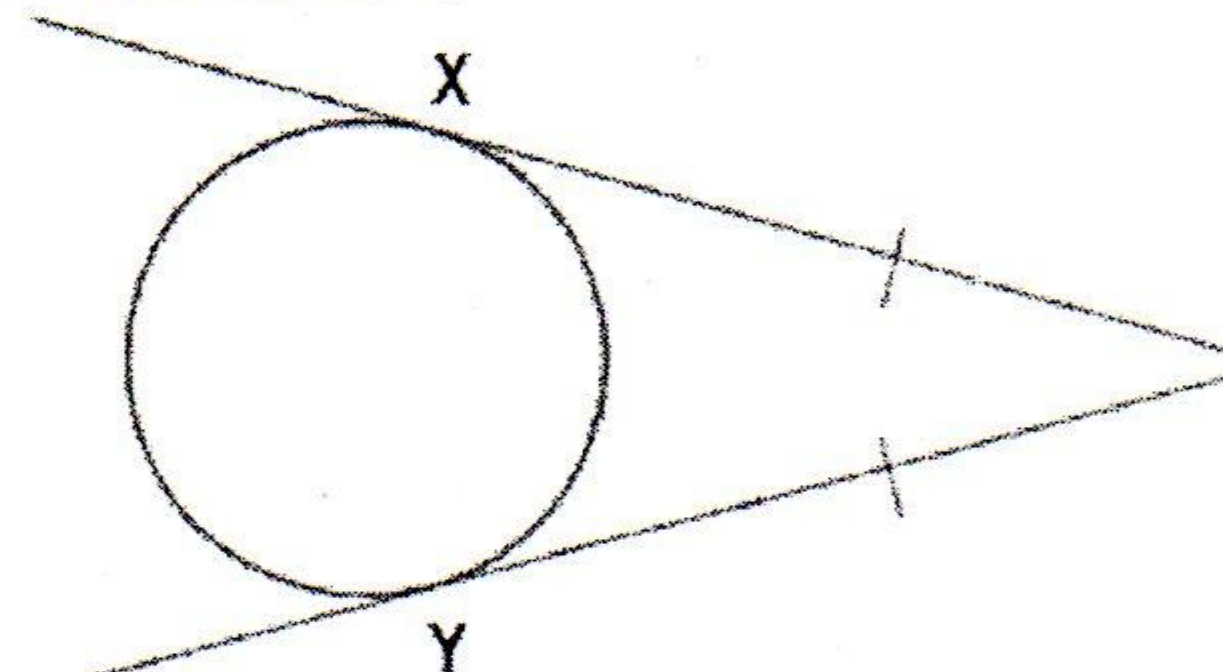
The sum of the opposite angles of a cyclic quadrilateral is 180° .
 $a + c = 180^\circ$ and $b + d = 180^\circ$

Theorem 5



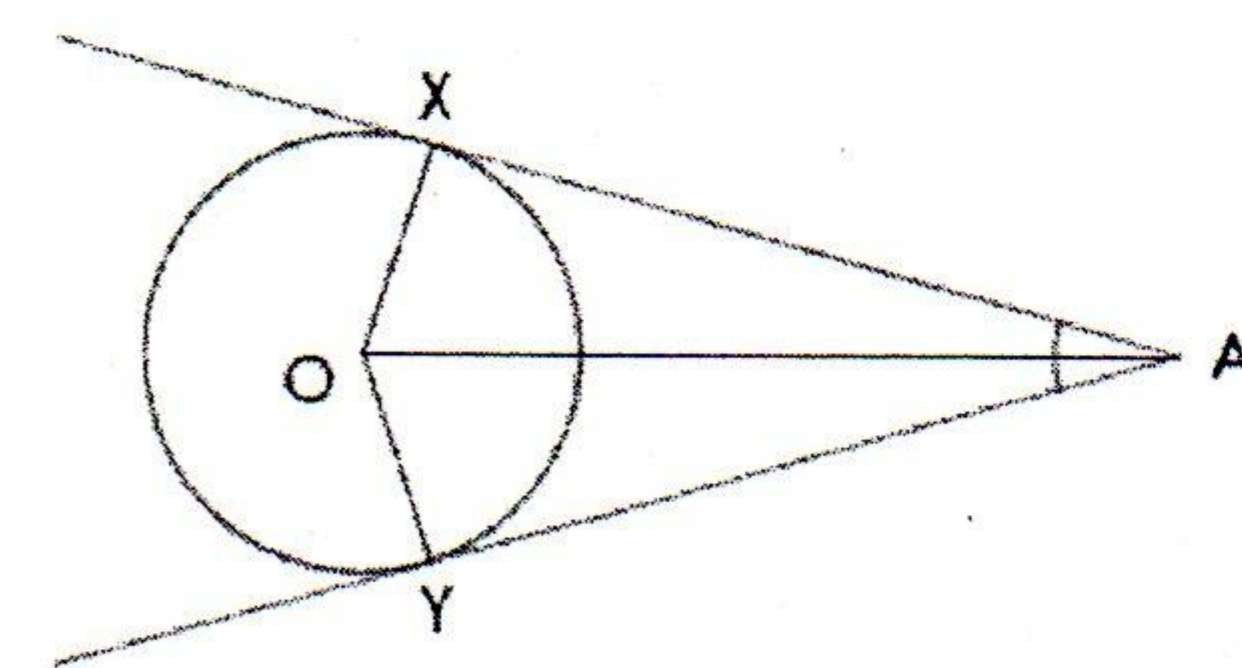
A tangent to a circle is perpendicular to the **radius** drawn to the point of contact. The radius OX is perpendicular to the tangent AB.

Theorem 6



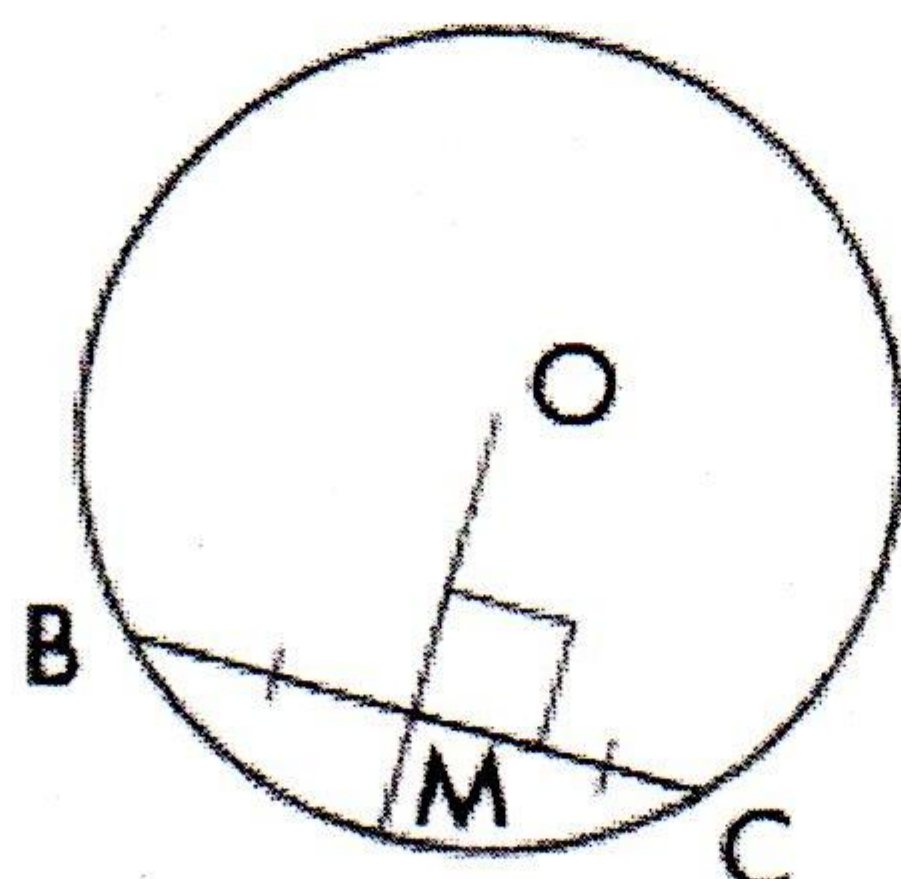
Tangents to a circle from an external point to the points of contact are equal in length.
 $AX = AY$

Theorem 7



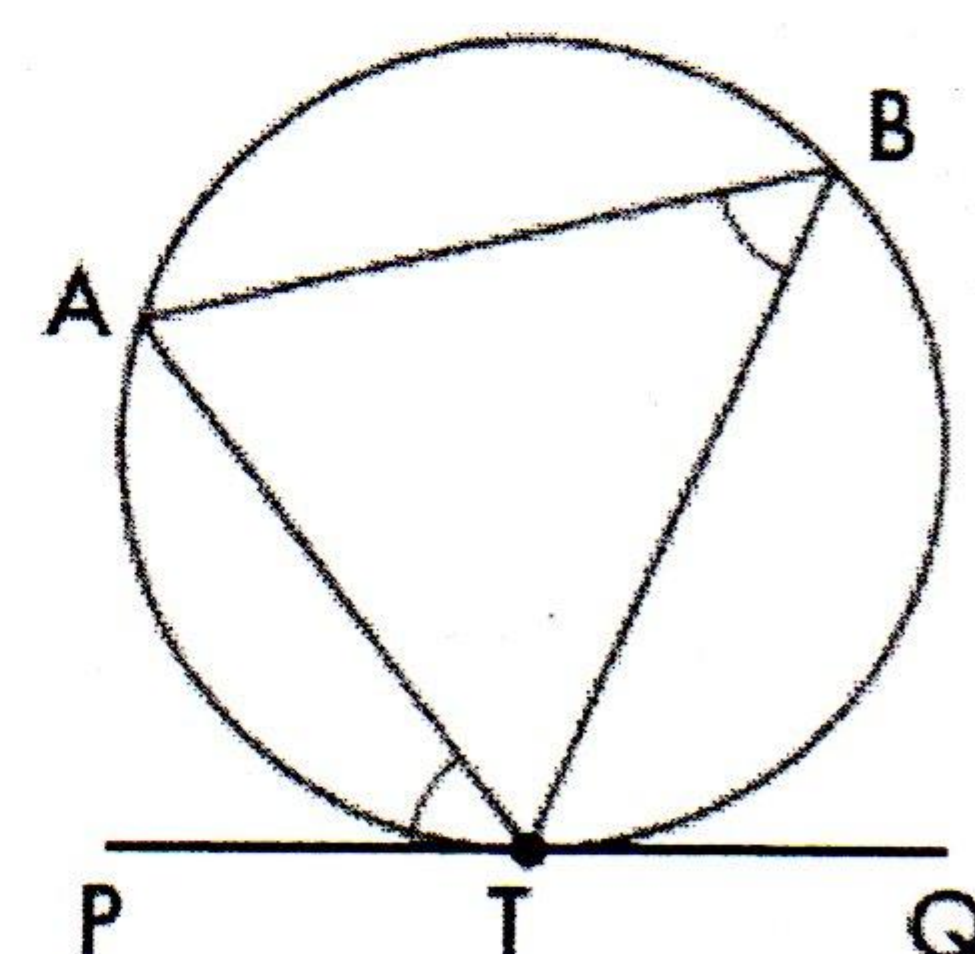
The line joining an external point to the centre of the circle bisects the angle between the tangents.
 $\angle OAX = \angle OAY$

Theorem 8



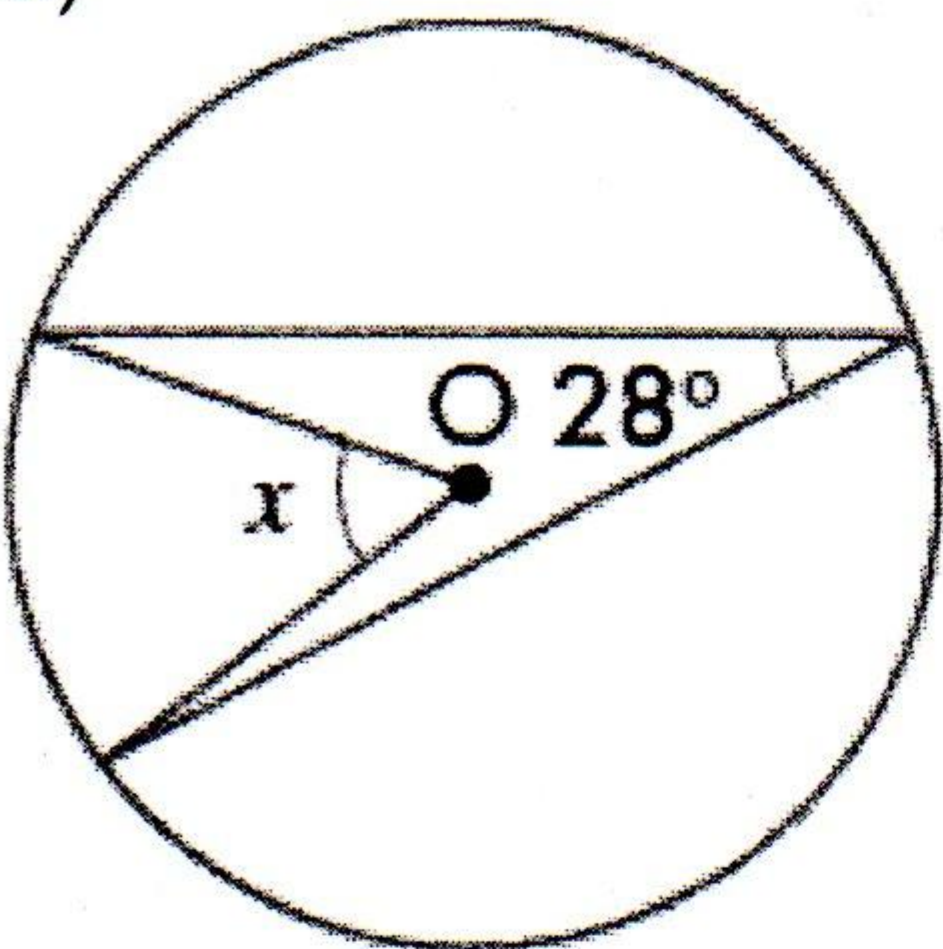
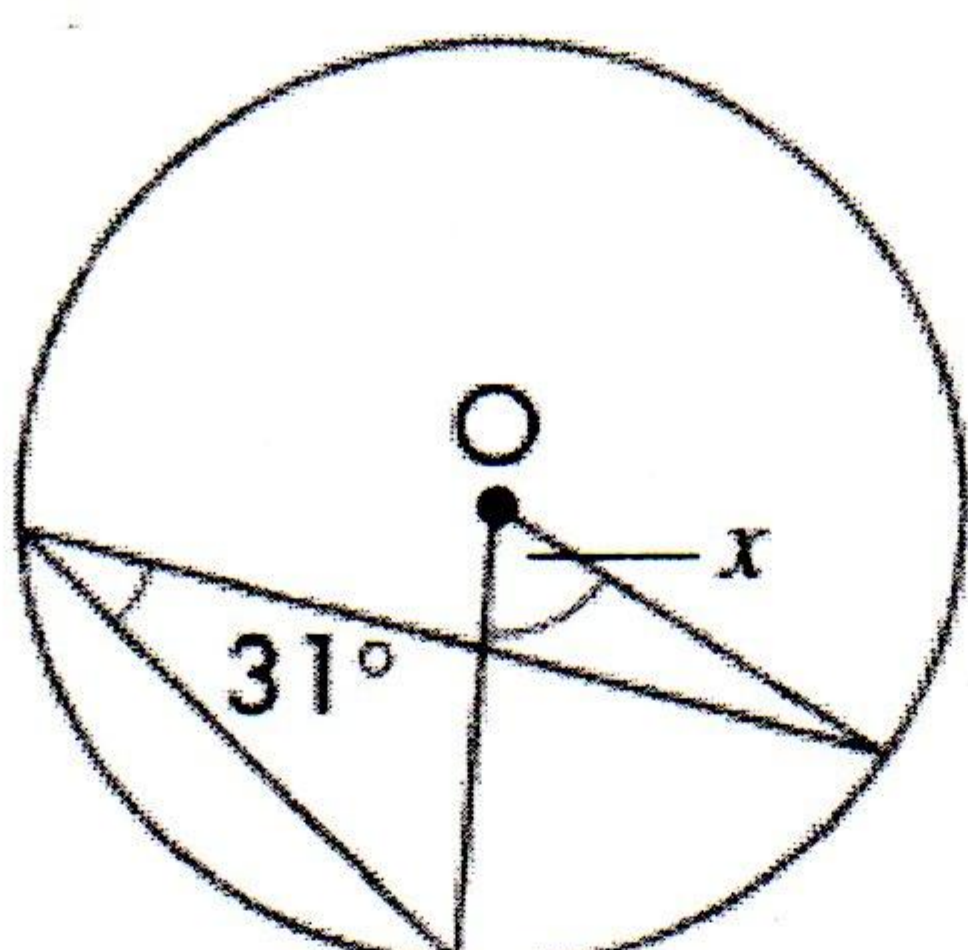
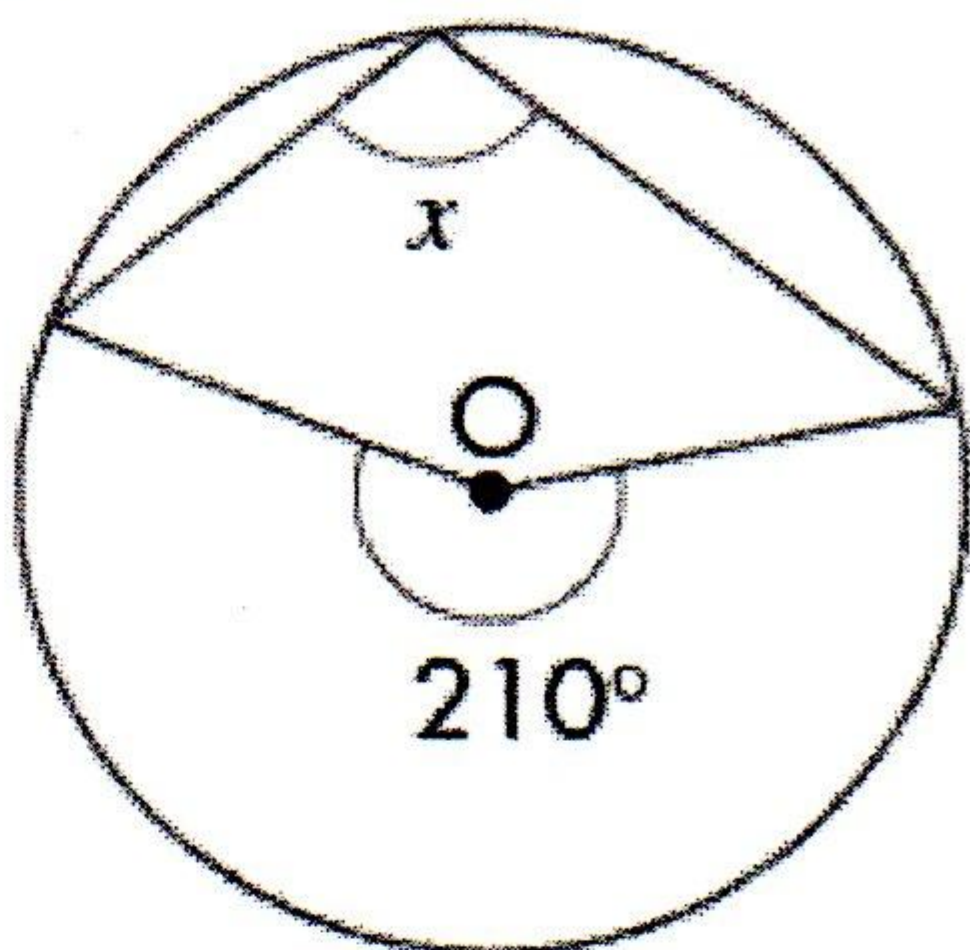
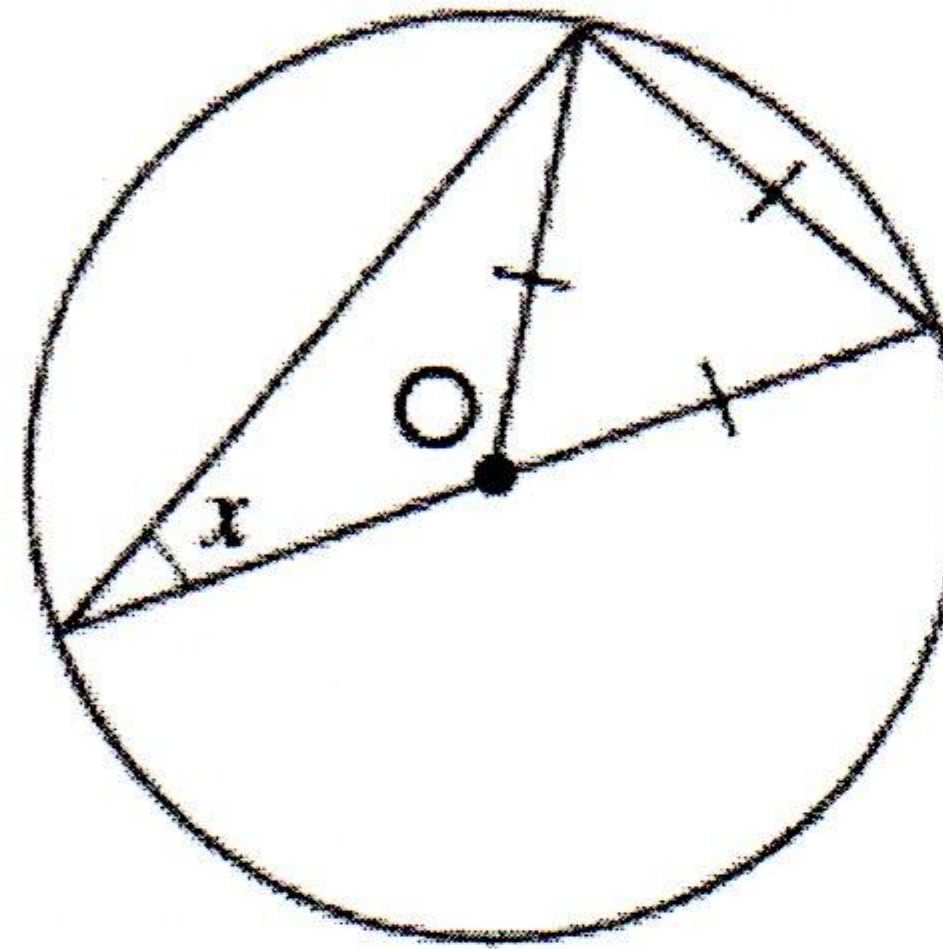
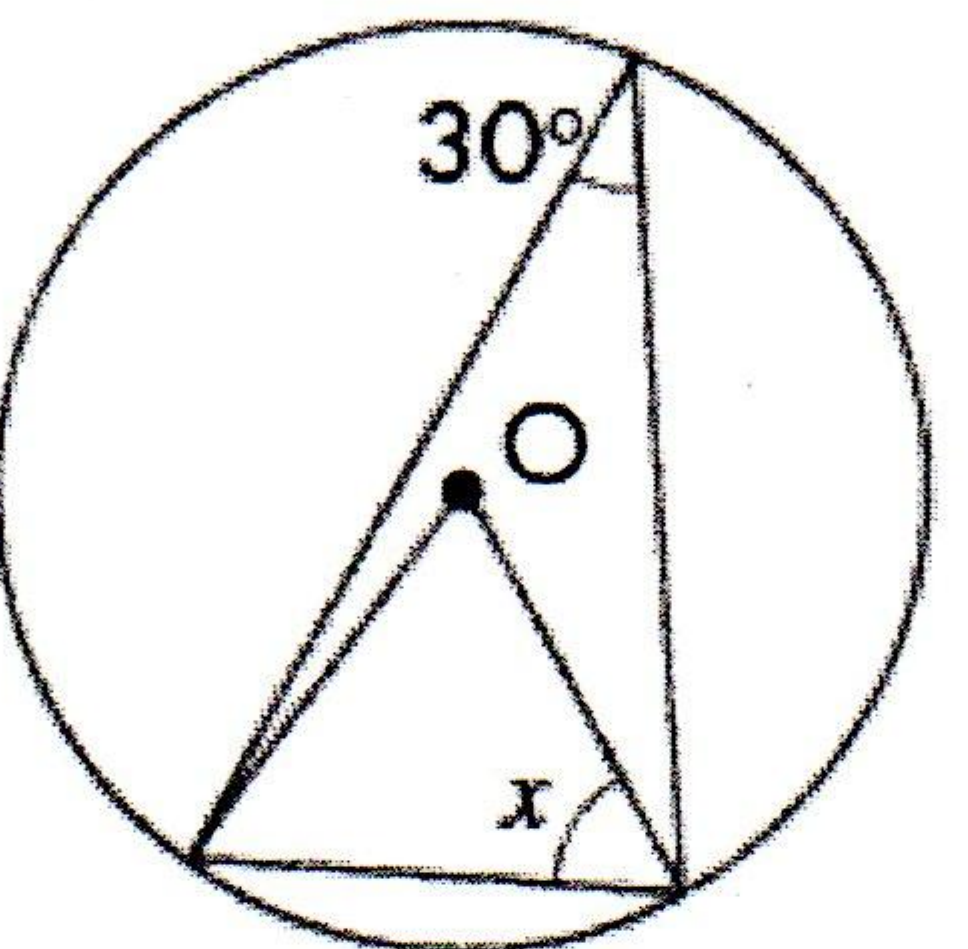
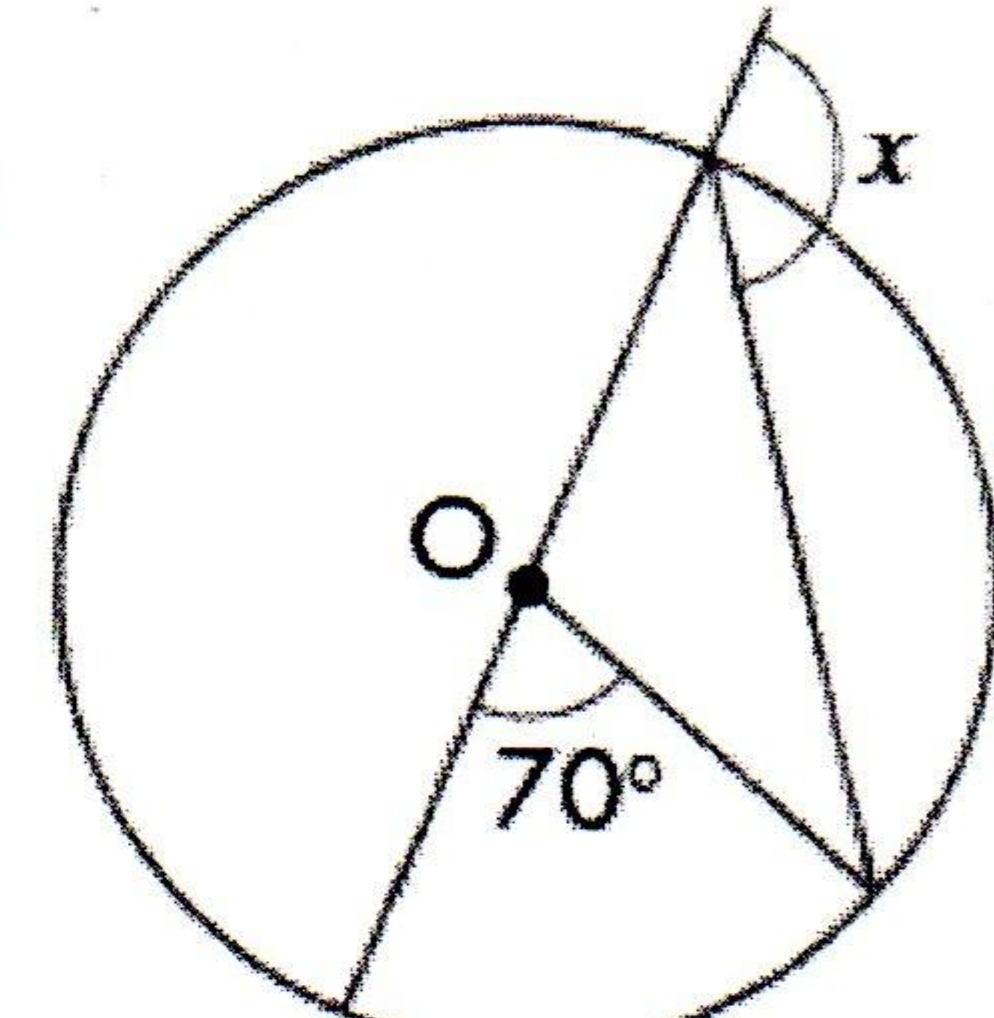
A radius bisects a chord at 90° . If O is the centre of the circle $\angle BMO = 90^\circ$ and $BM = CM$.

Theorem 9

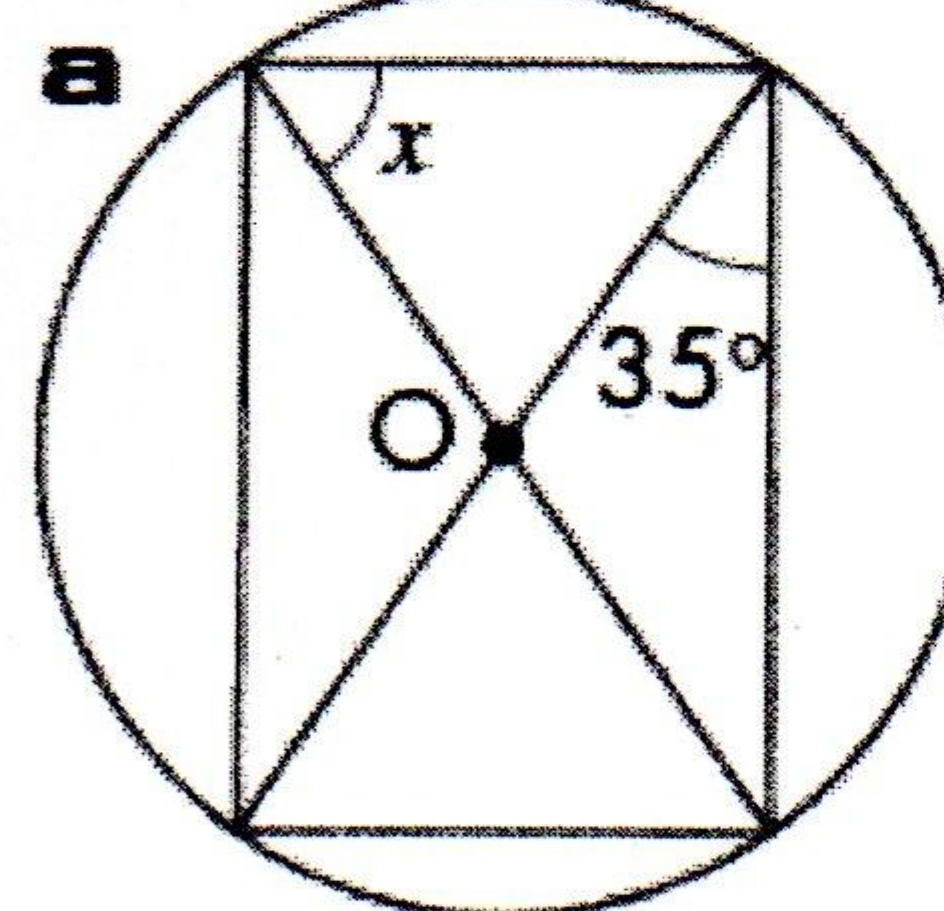
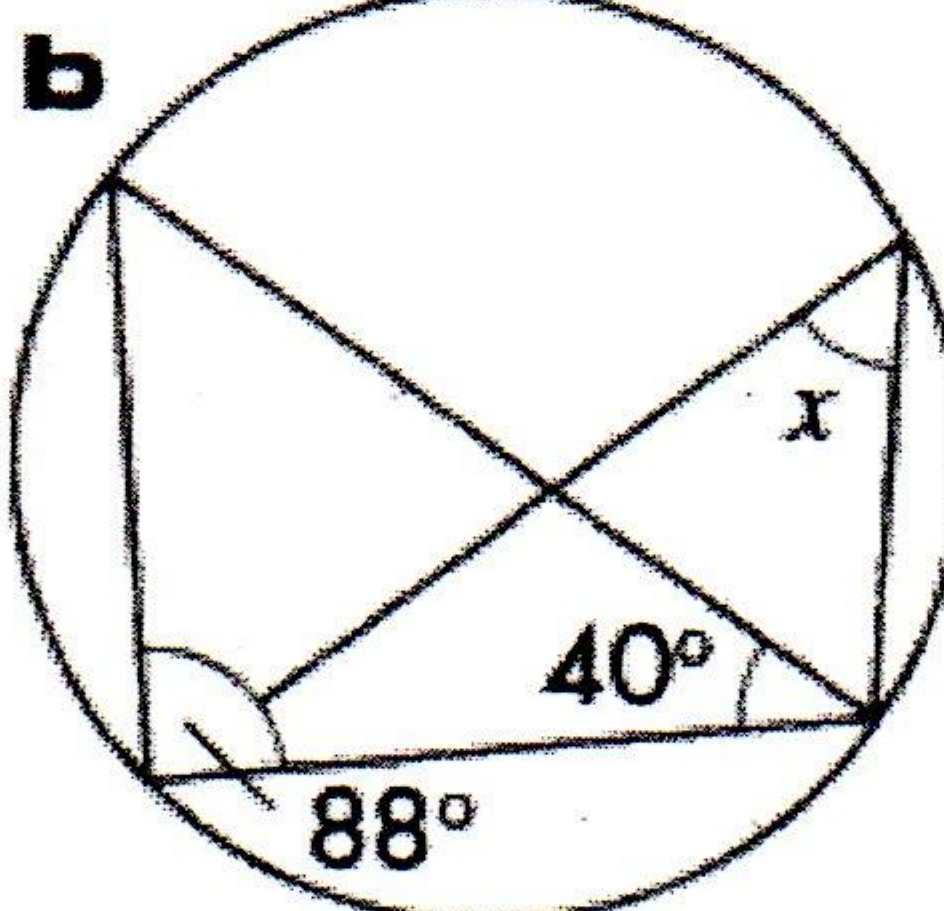
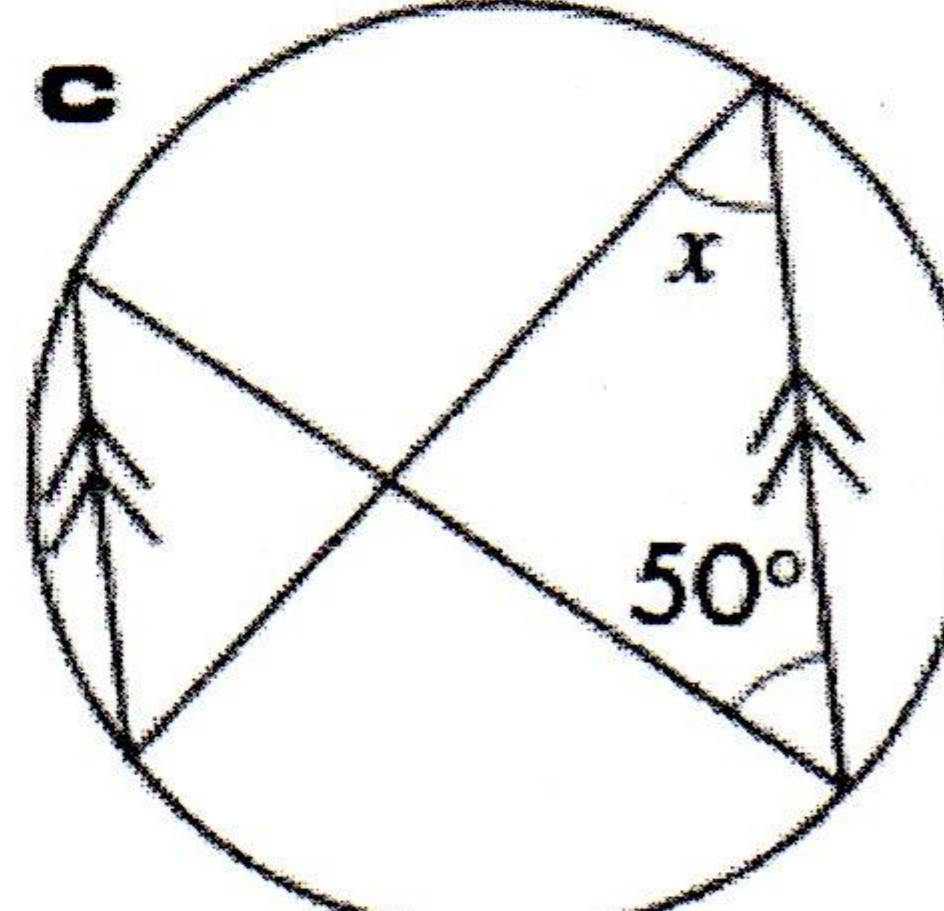
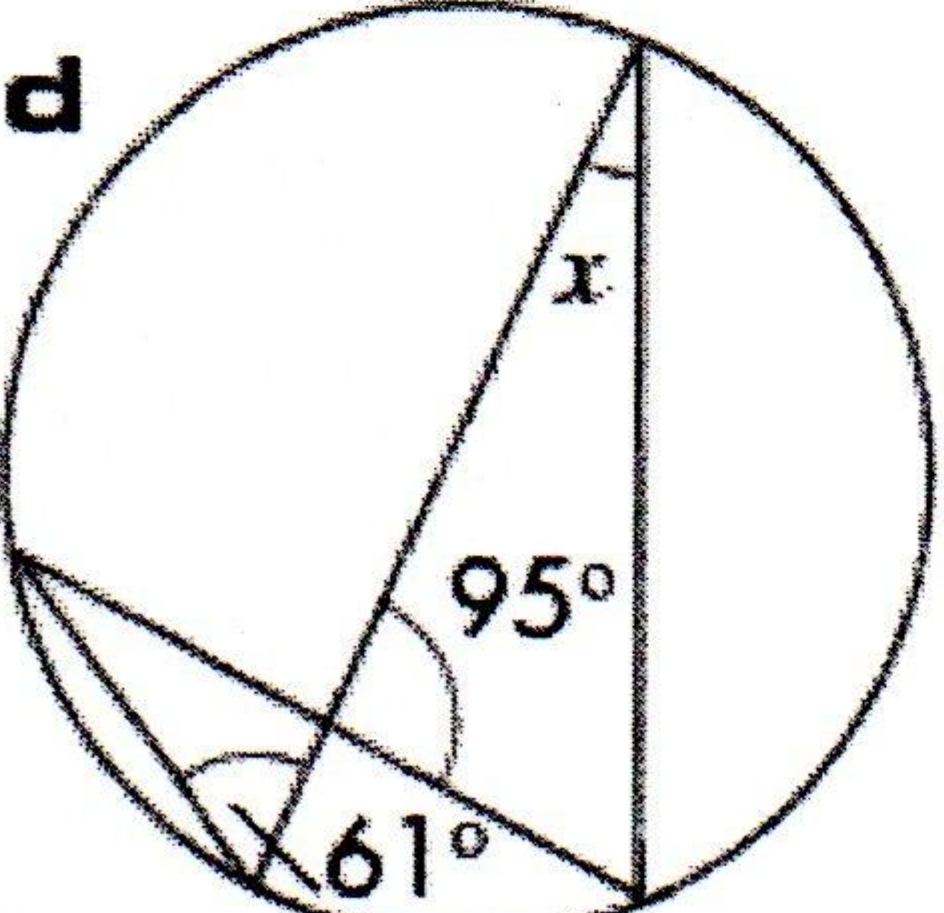
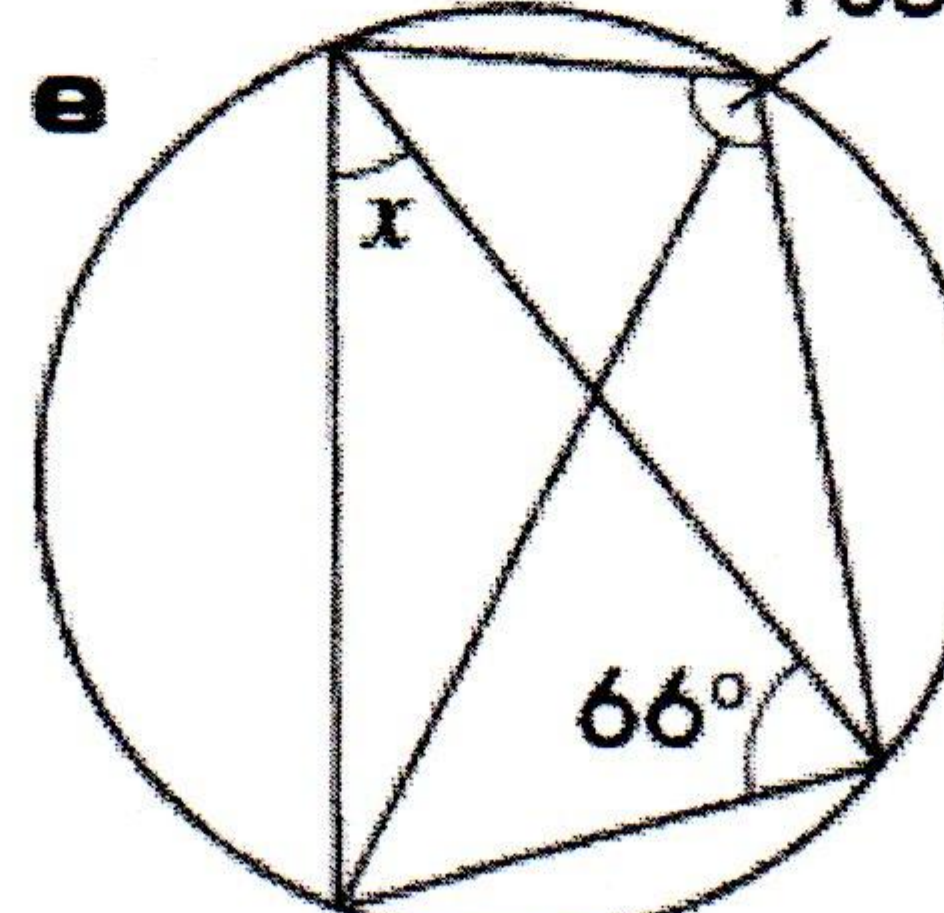
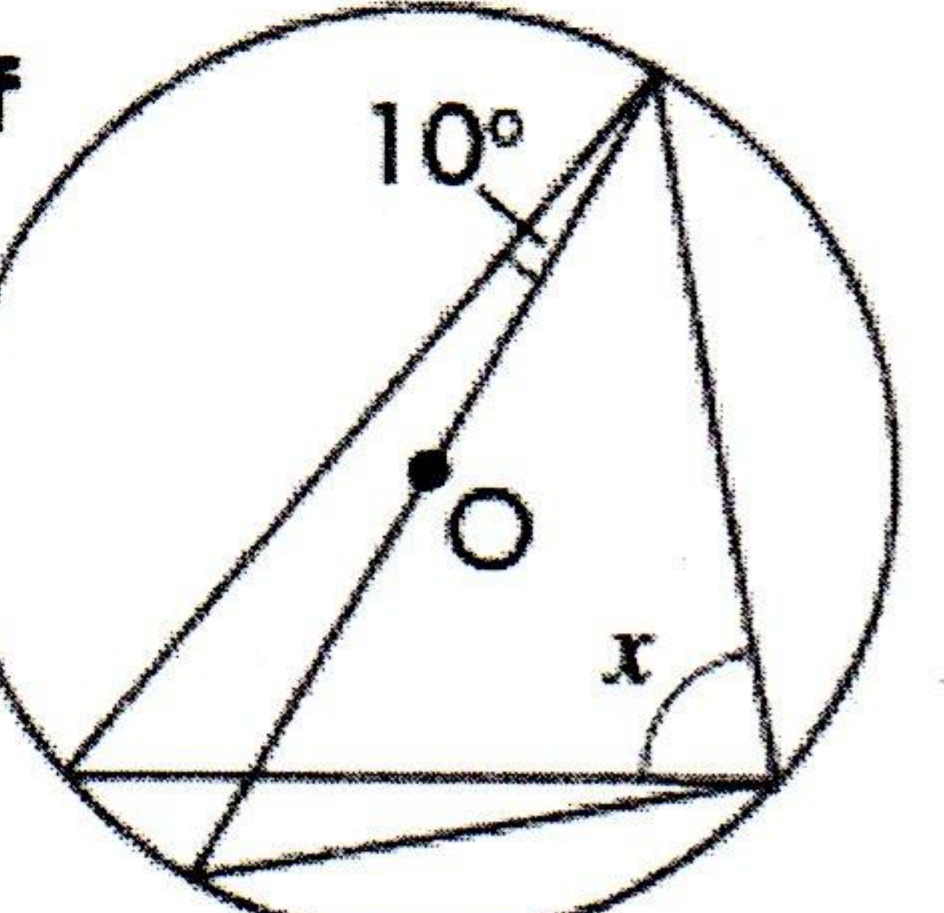


The angle between a tangent and a chord through the point of contact is equal to the angle in the alternate segment.
 $\angle PTA = \angle TBA$

Q1. Find the angle marked x in each of these circles with centre O .

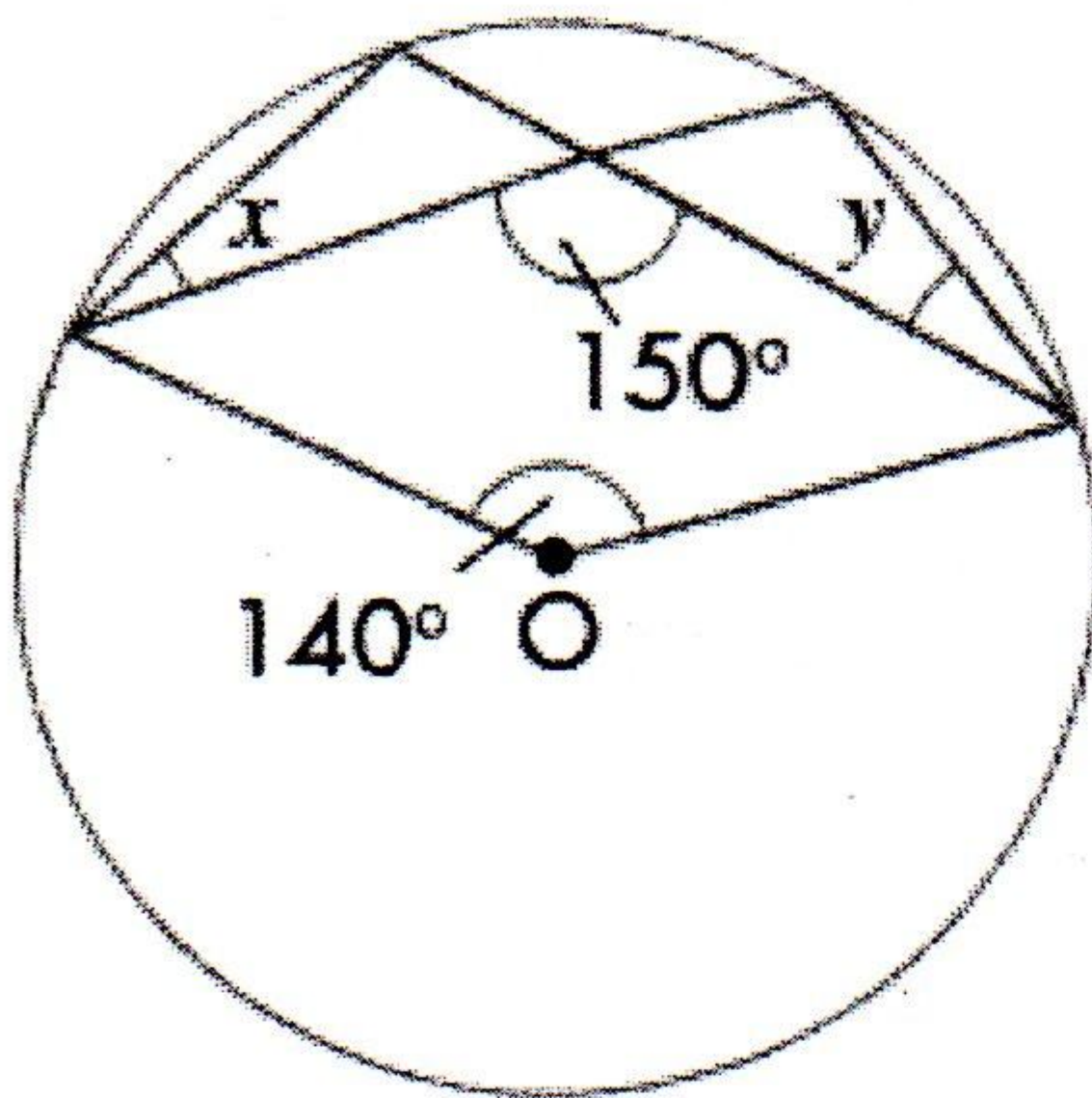
<p>a)</p>  <p>$x =$ _____</p>	<p>b)</p>  <p>$x =$ _____</p>	<p>c)</p>  <p>$x =$ _____</p>
<p>d)</p>  <p>$x =$ _____</p>	<p>e)</p>  <p>$x =$ _____</p>	<p>f)</p>  <p>$x =$ _____</p>

Q2. Find the angle marked x in each of these circles with centre O .

<p>a</p>  <p>$x =$ _____</p>	<p>b</p>  <p>$x =$ _____</p>	<p>c</p>  <p>$x =$ _____</p>
<p>d</p>  <p>$x =$ _____</p>	<p>e</p>  <p>$x =$ _____</p>	<p>f</p>  <p>$x =$ _____</p>

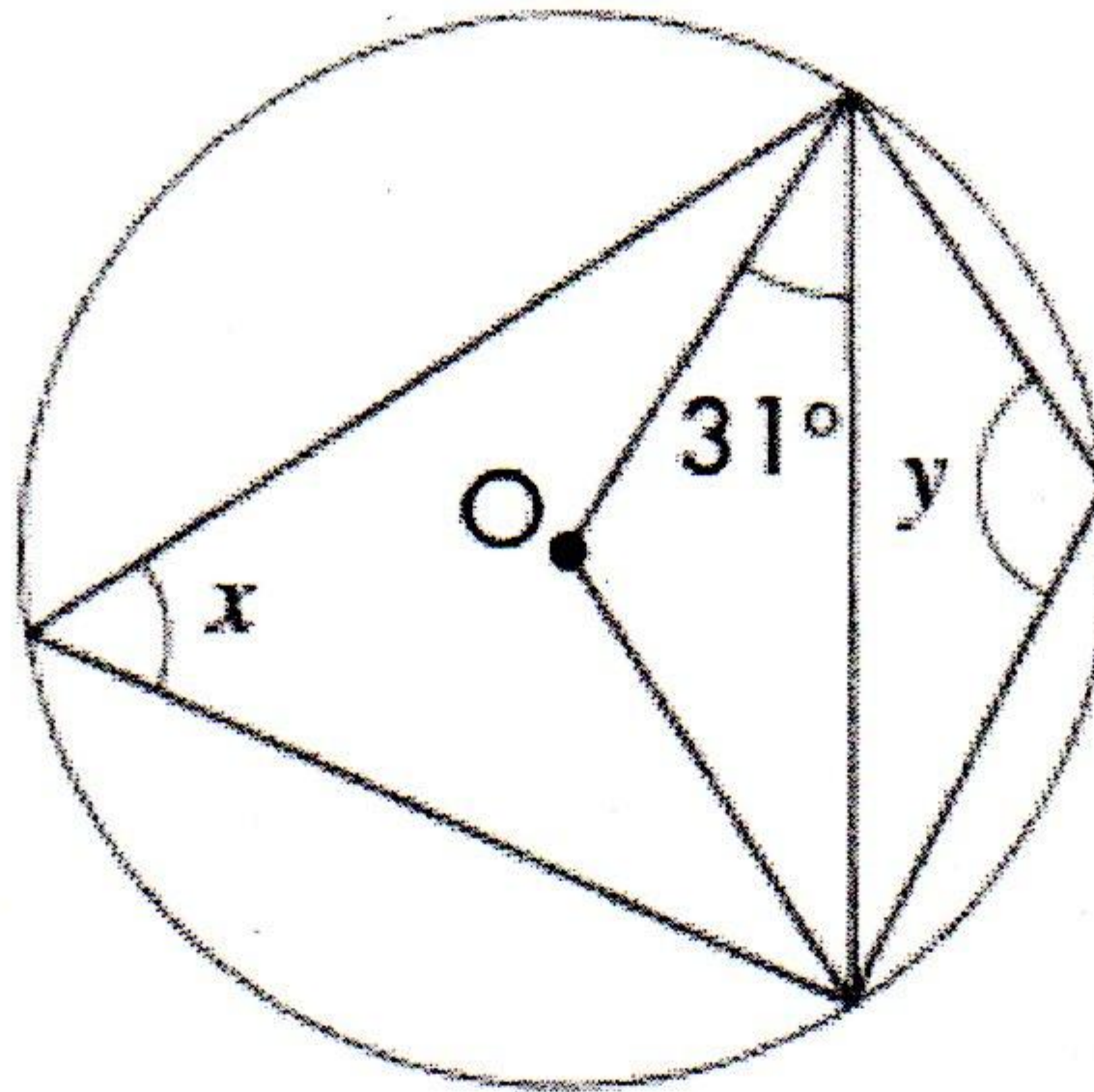
Q3. Find the angles marked x and y in each of these circles. O is the centre where shown.

a)



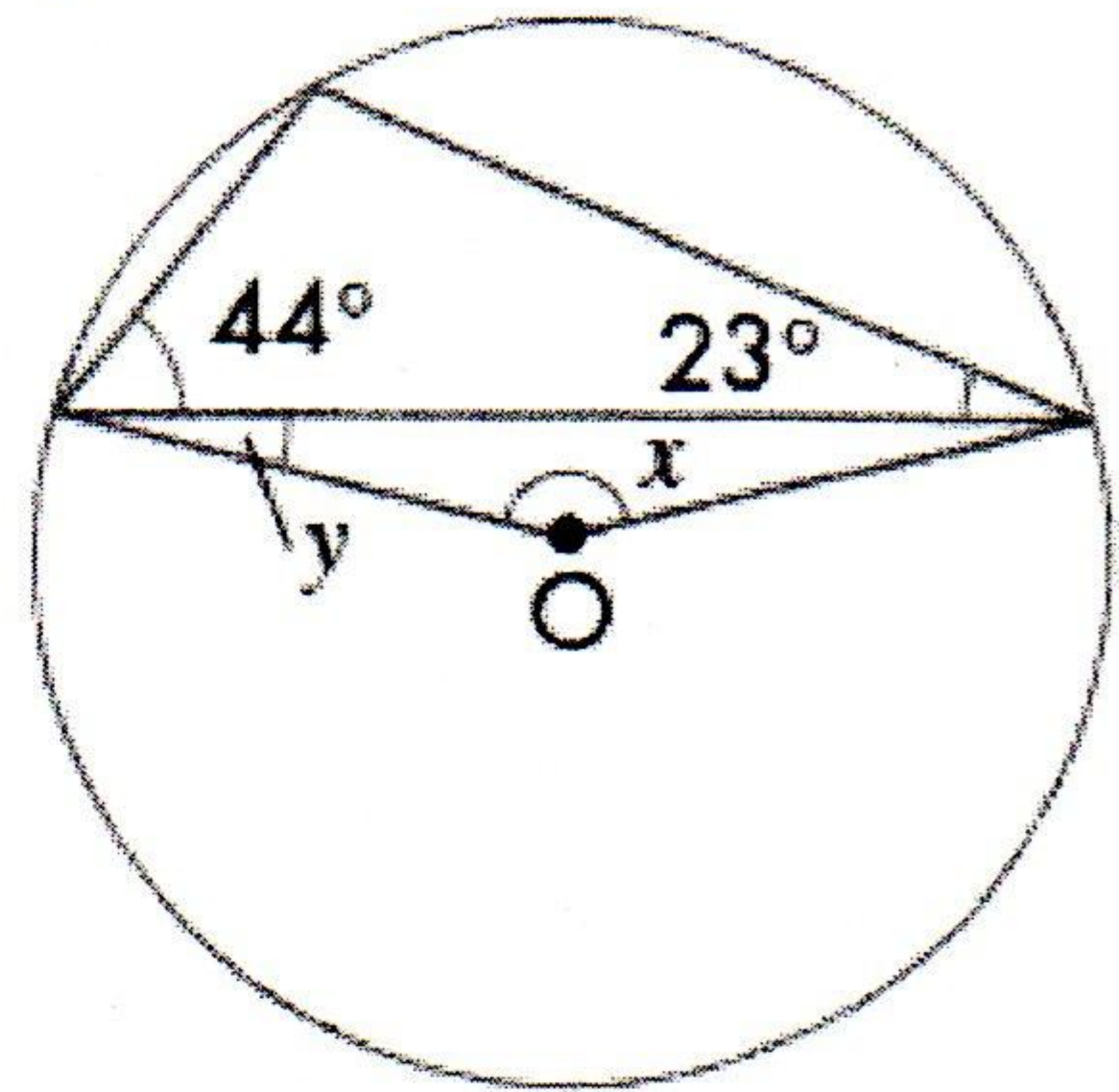
$x = \underline{\hspace{2cm}}, y = \underline{\hspace{2cm}}$

b)



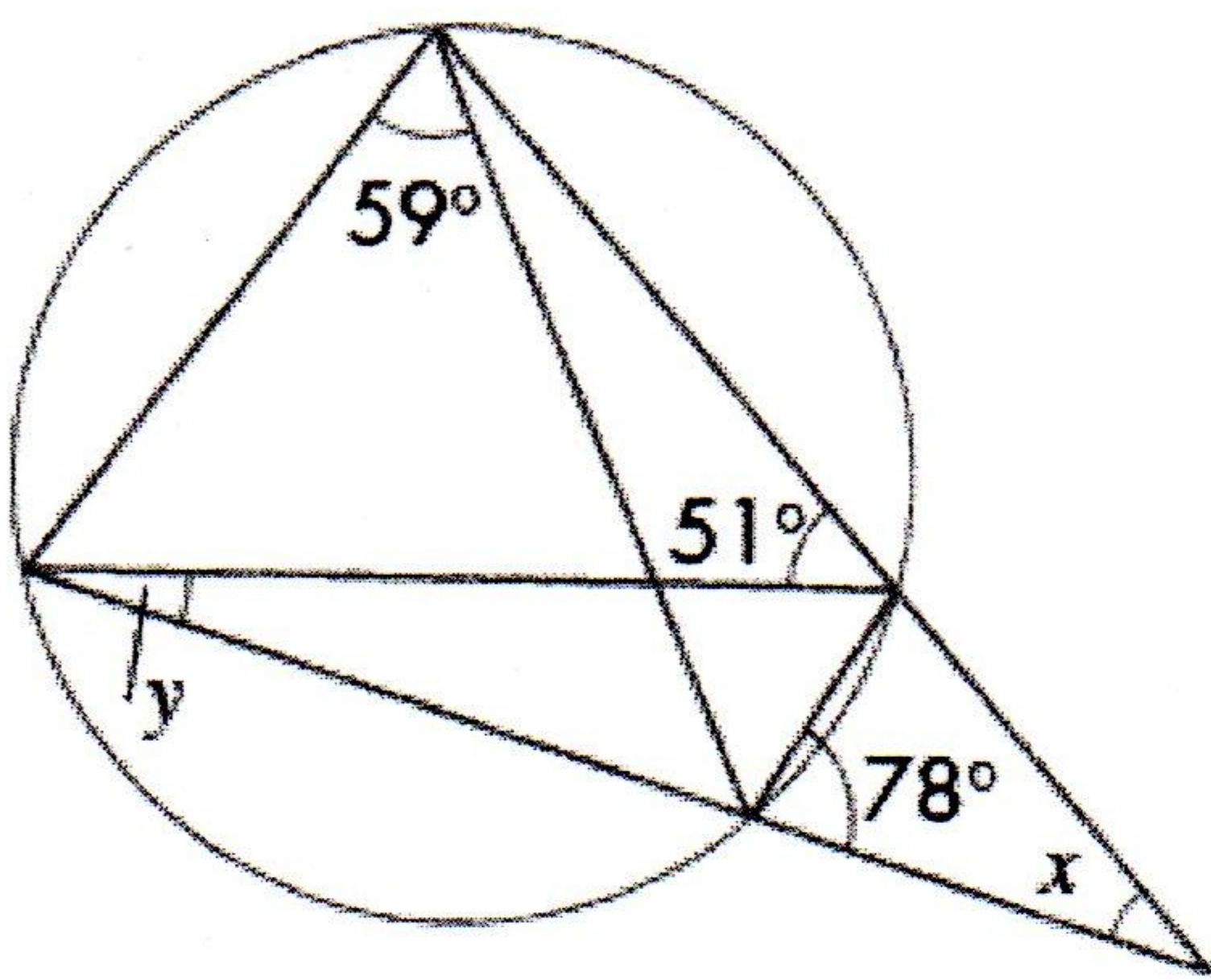
$x = \underline{\hspace{2cm}}, y = \underline{\hspace{2cm}}$

c)



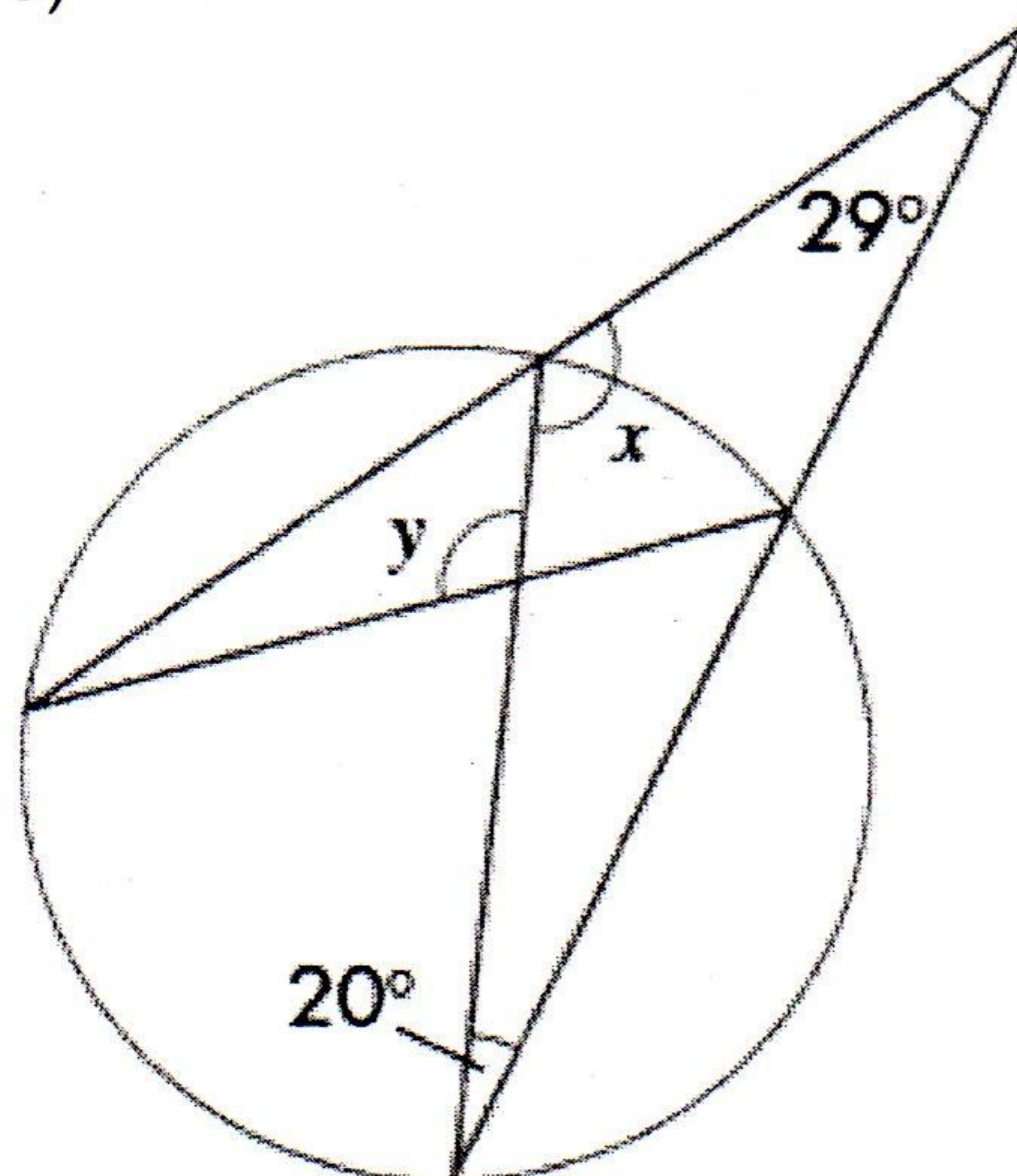
$x = \underline{\hspace{2cm}}, y = \underline{\hspace{2cm}}$

d)



$x = \underline{\hspace{2cm}}, y = \underline{\hspace{2cm}}$

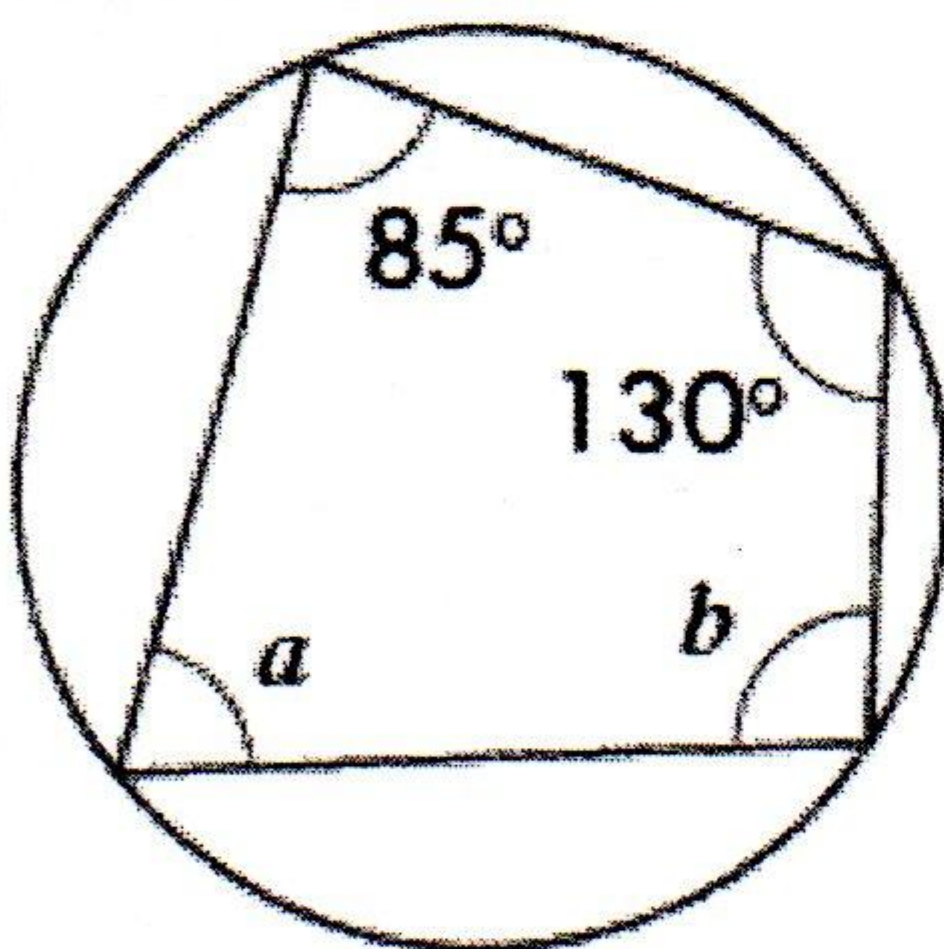
e)



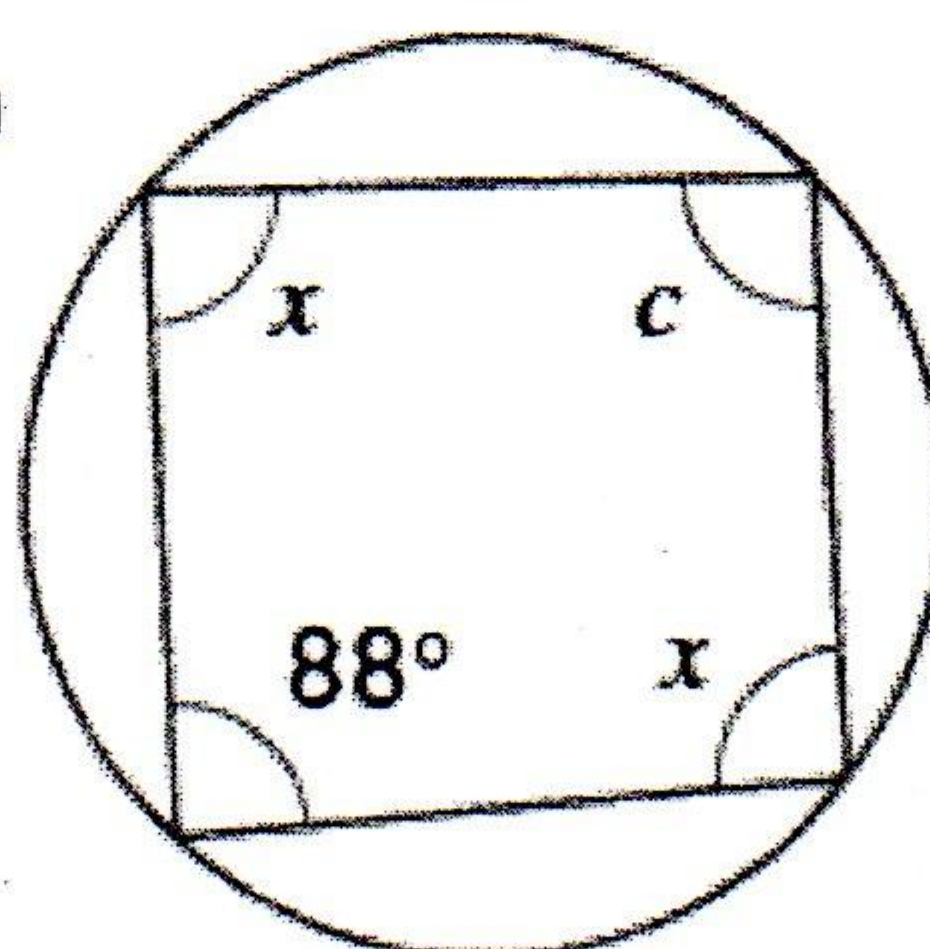
$x = \underline{\hspace{2cm}}, y = \underline{\hspace{2cm}}$

Q4. Find the sizes of the lettered angles in each of these circles.

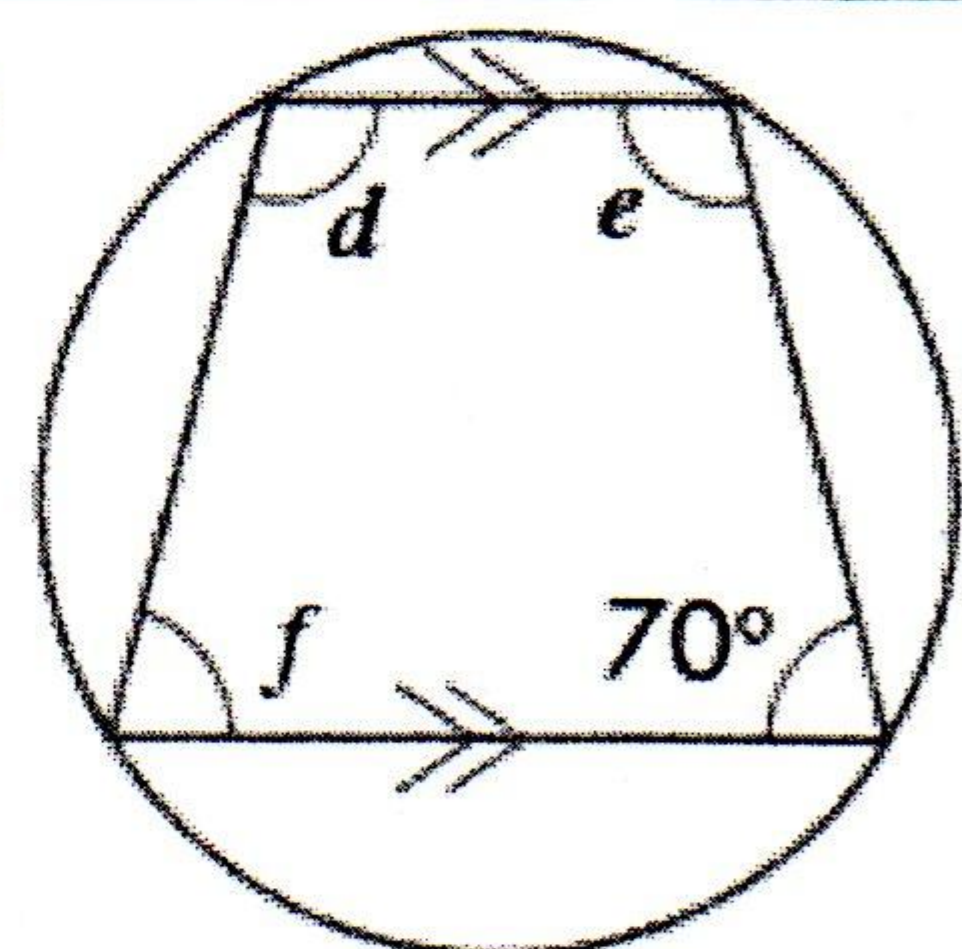
a



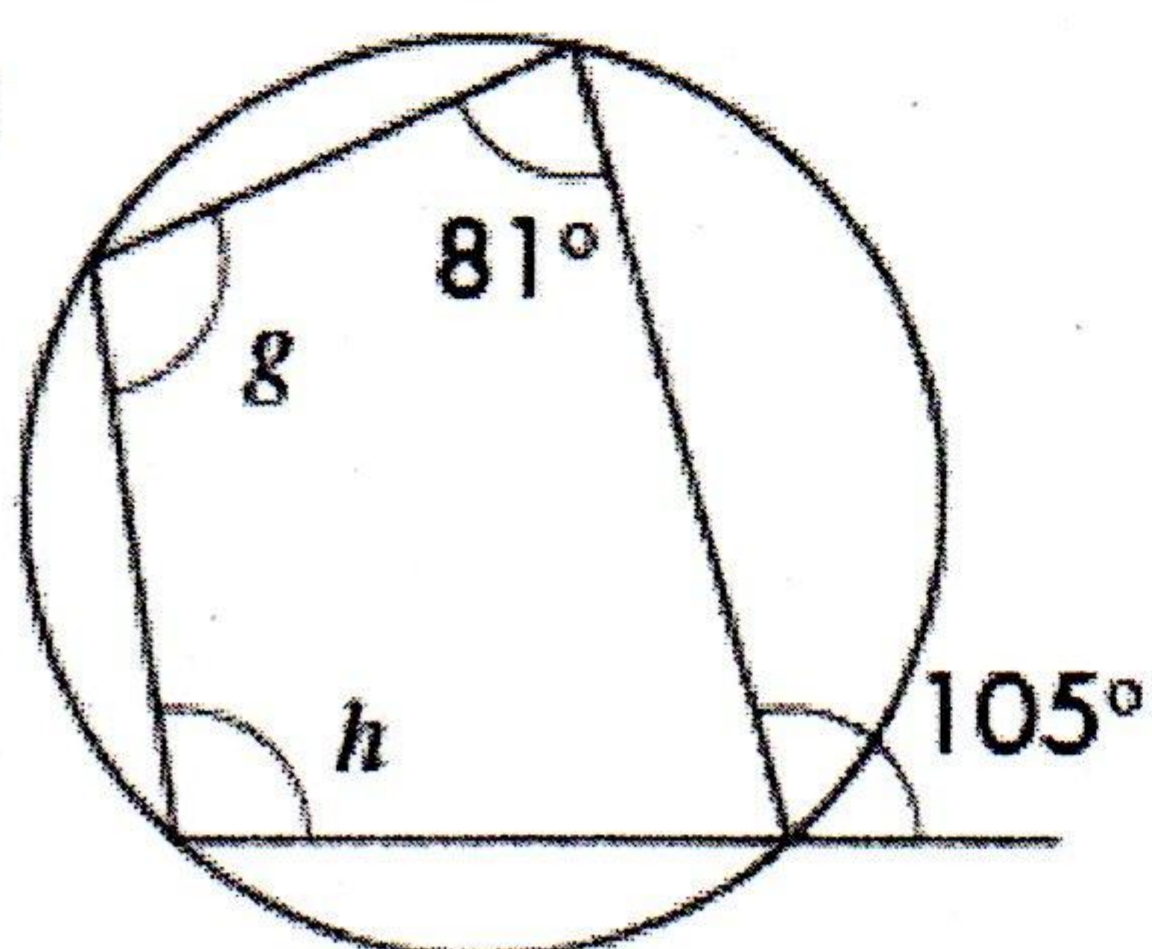
b



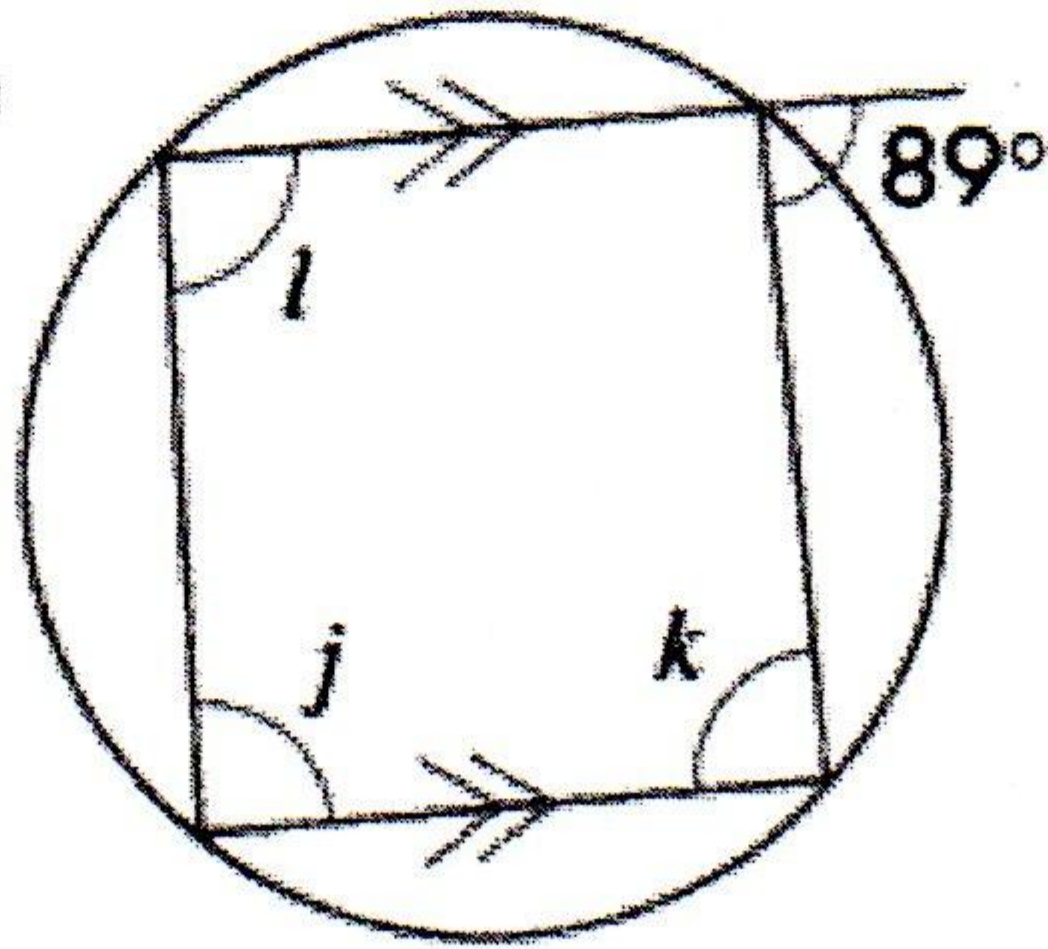
c



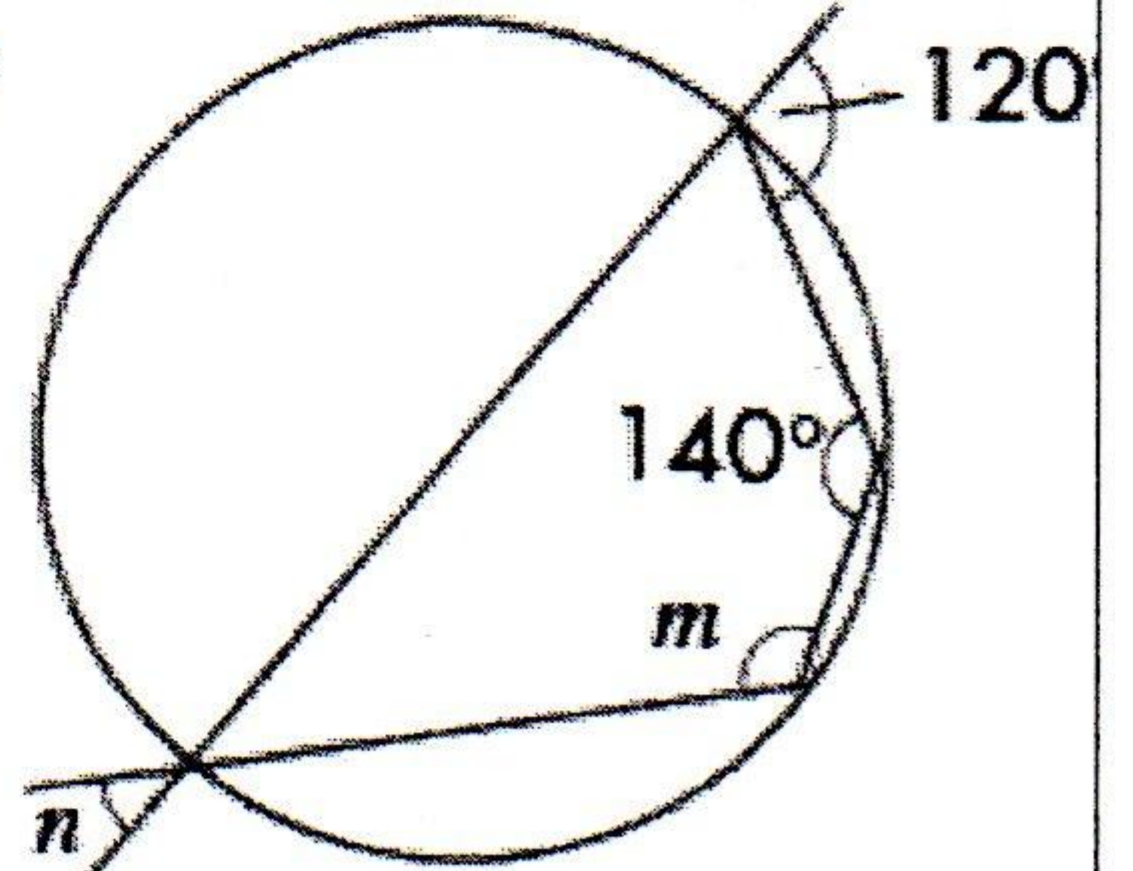
d



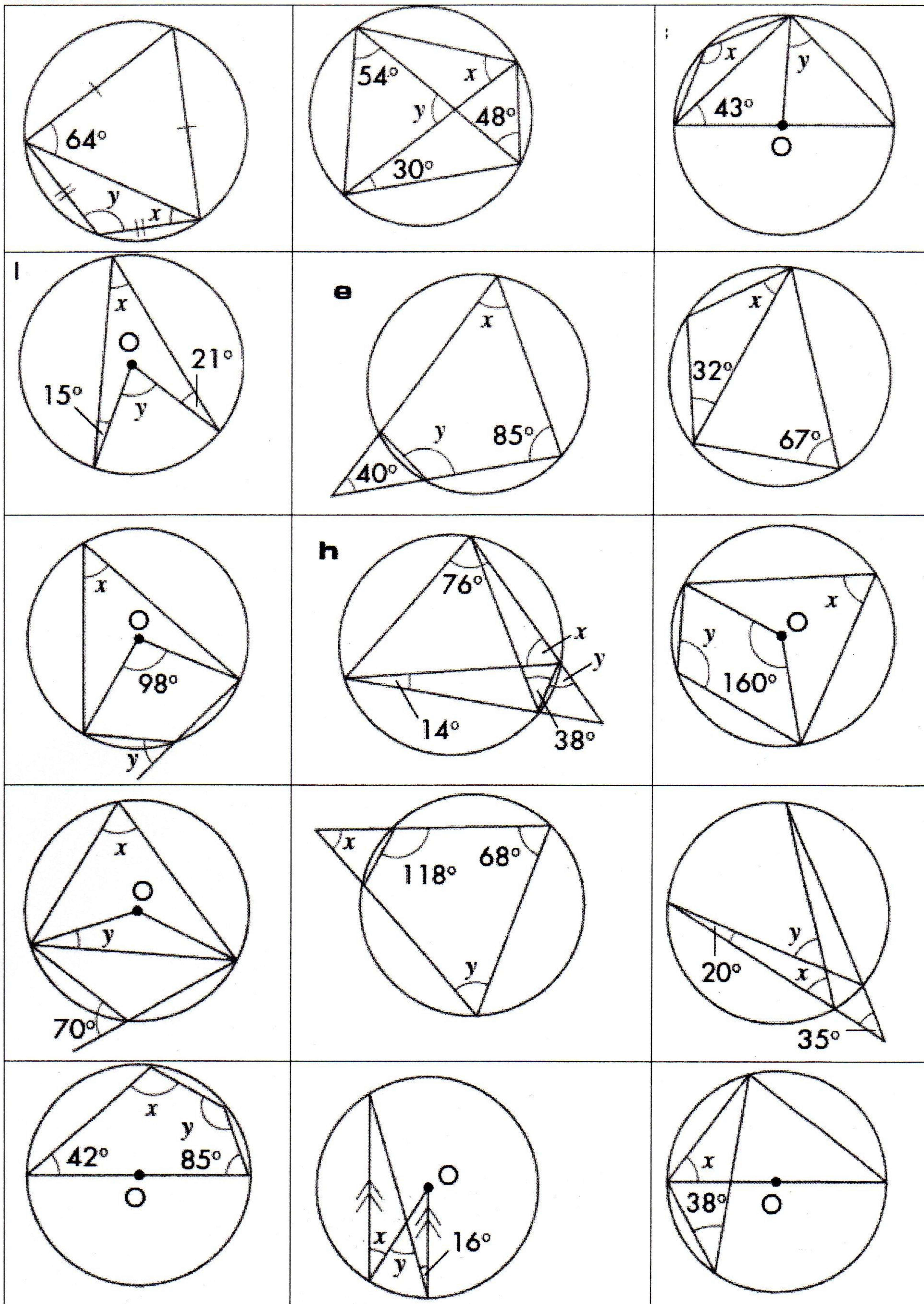
e



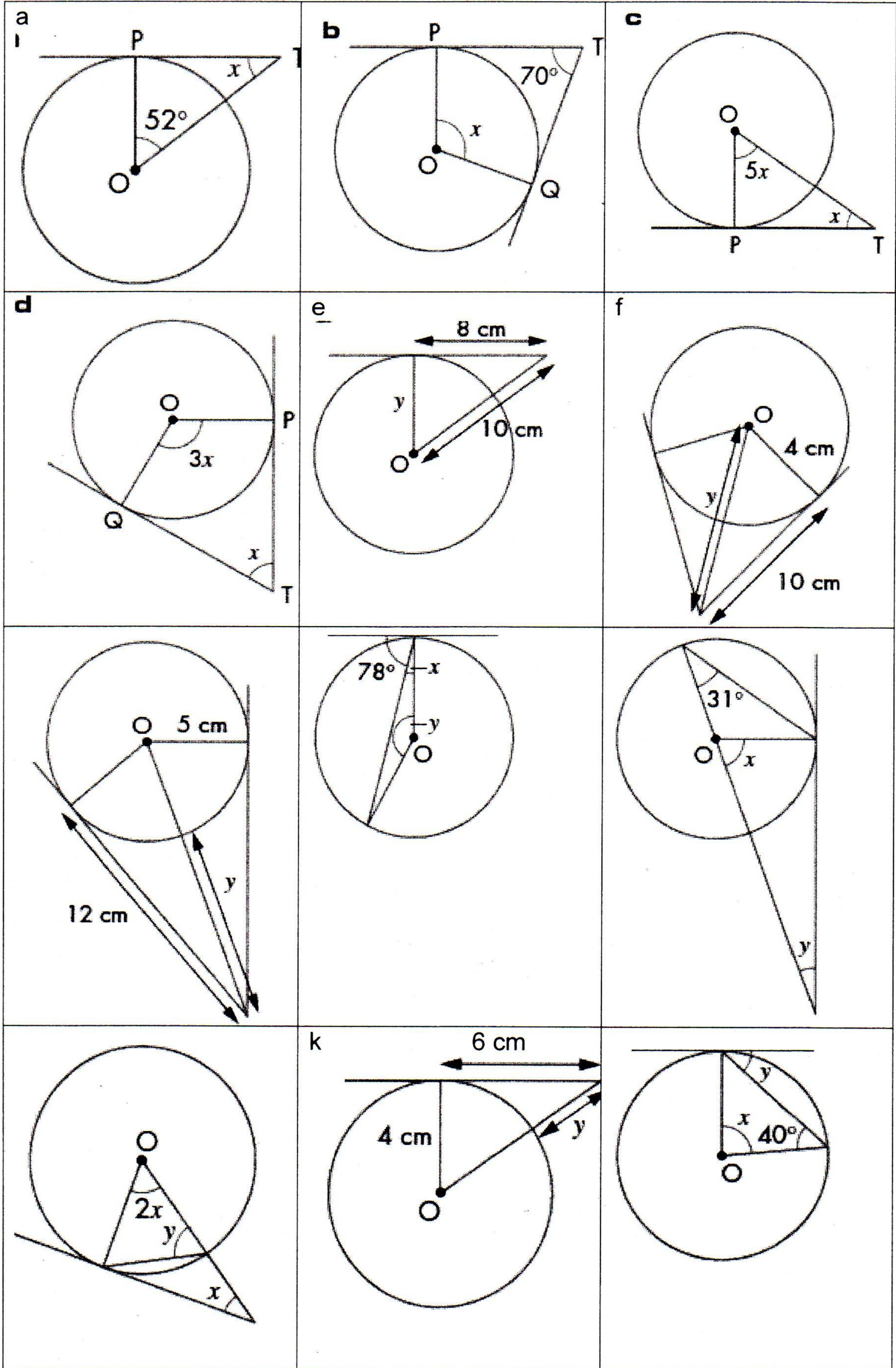
f

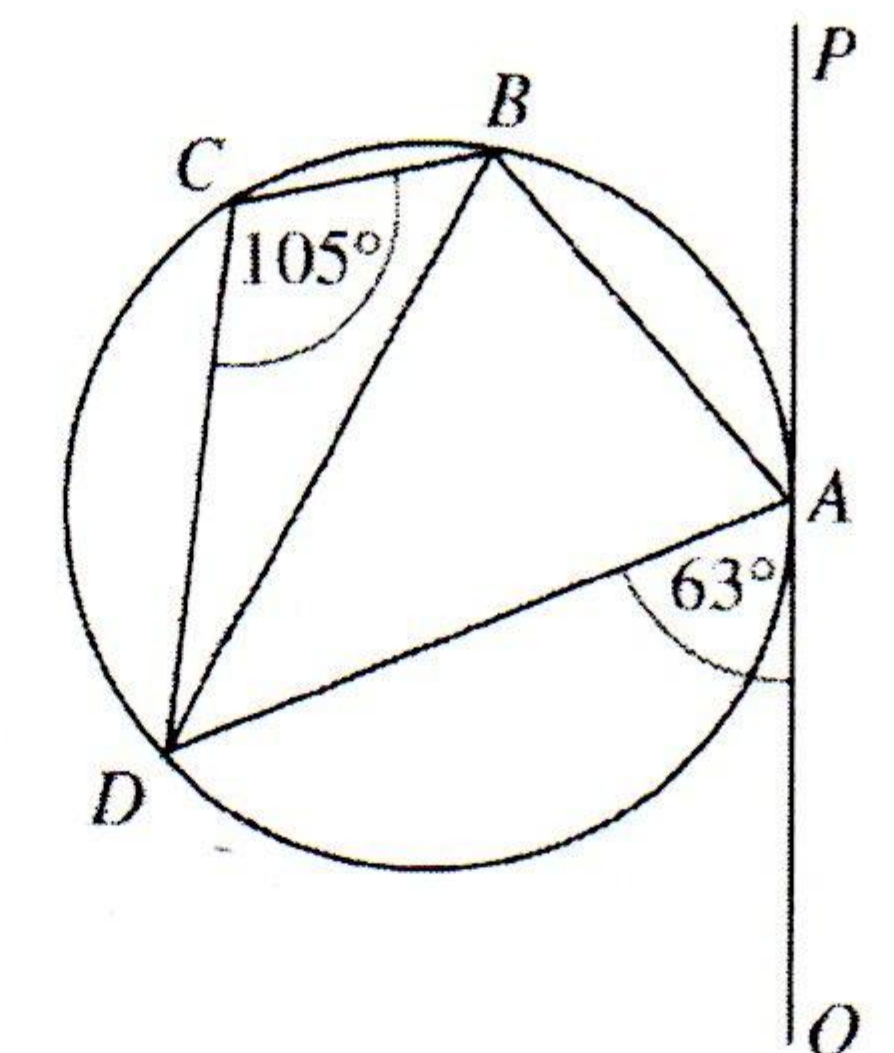
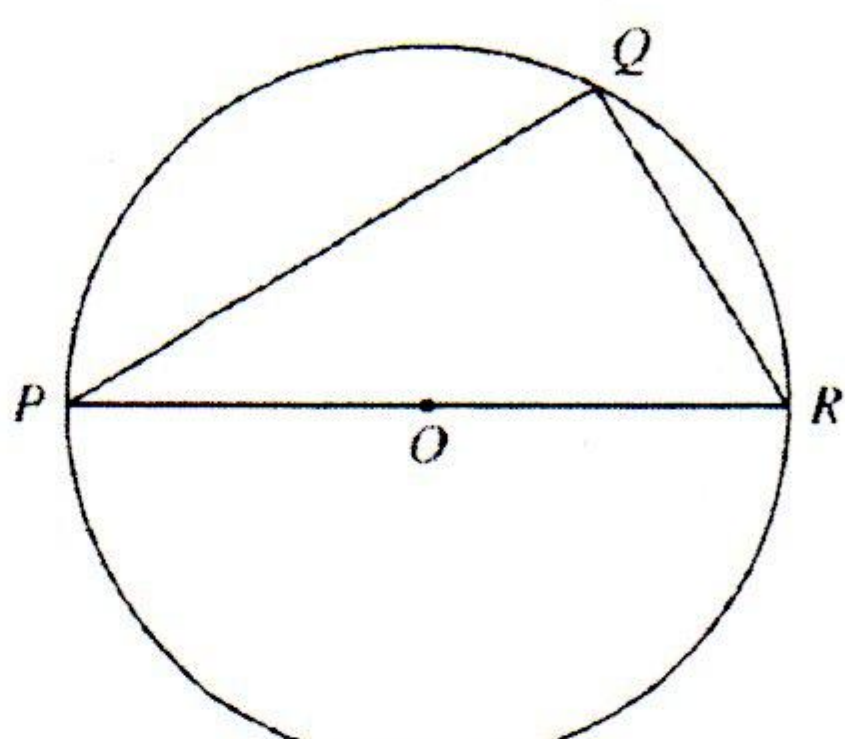
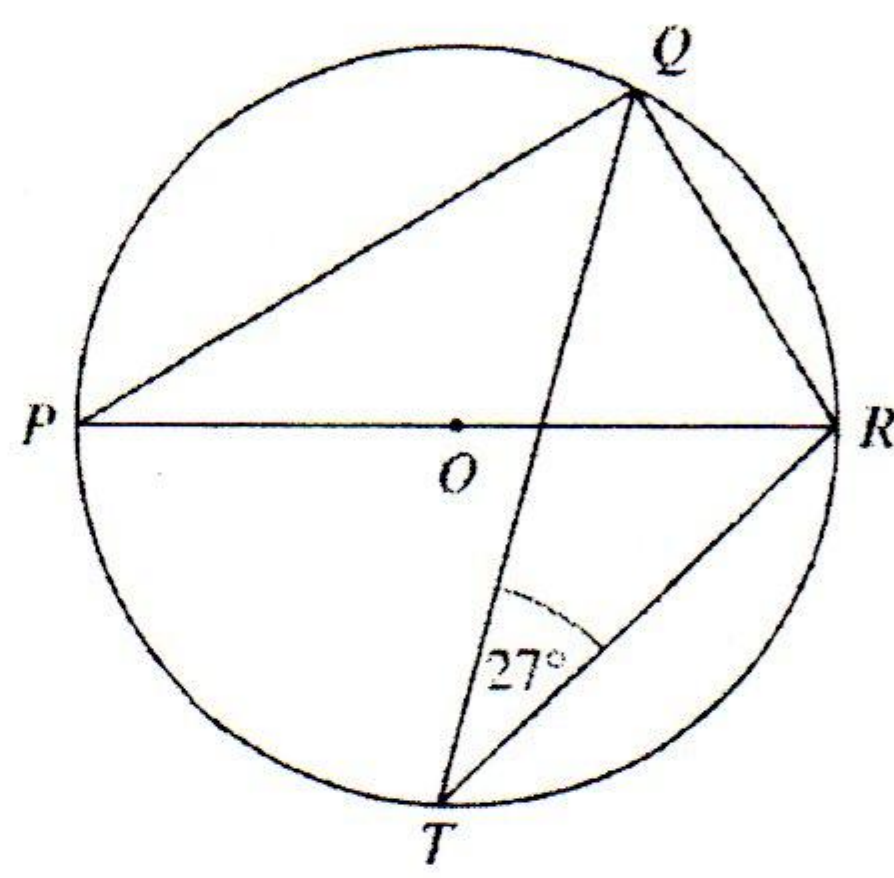
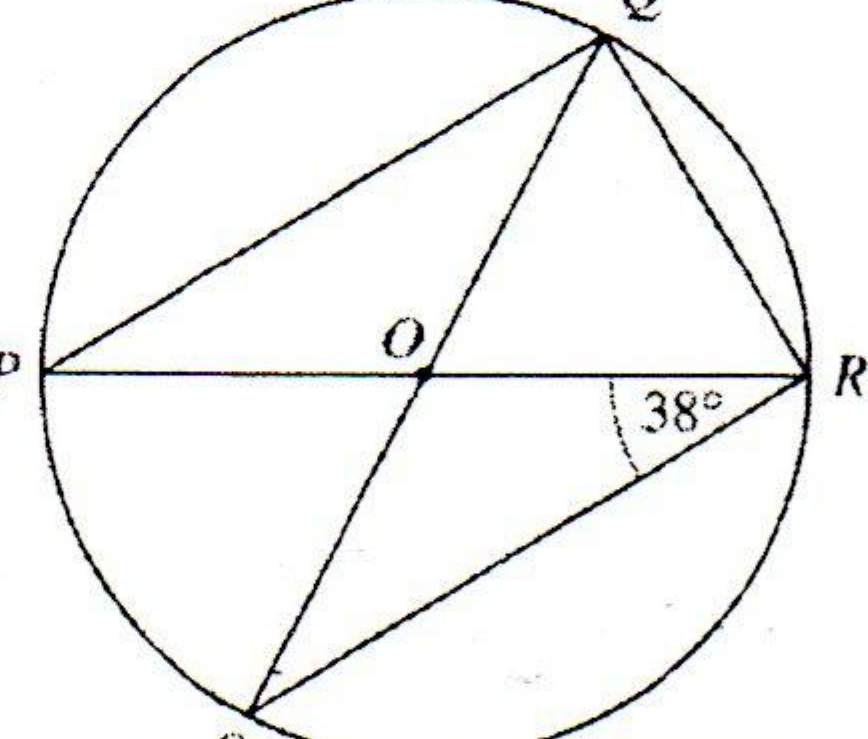
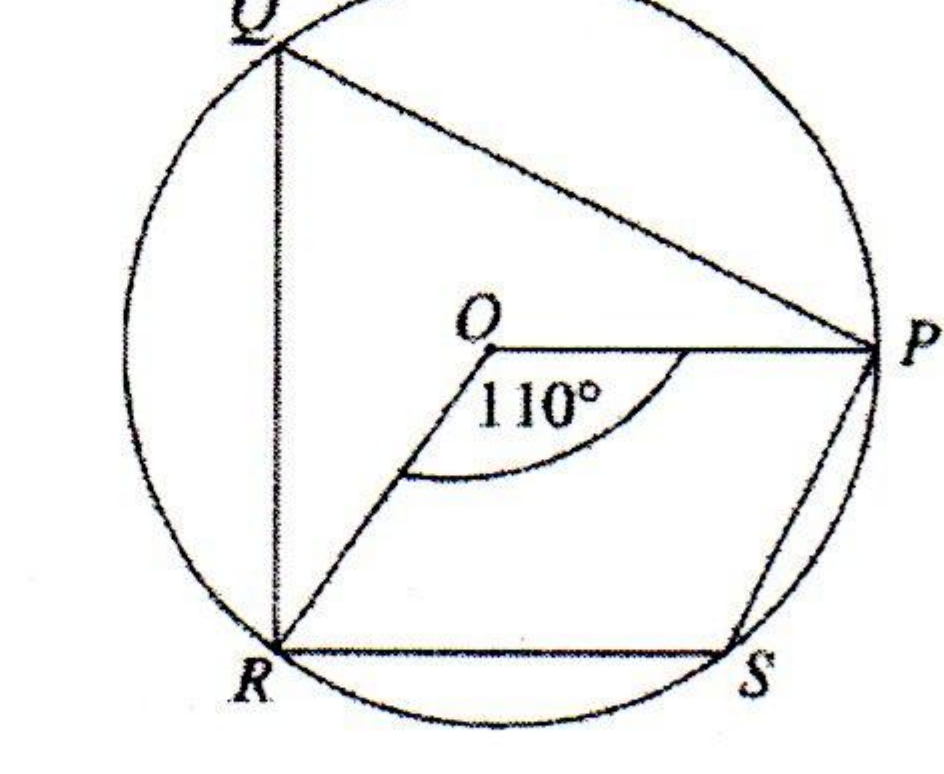
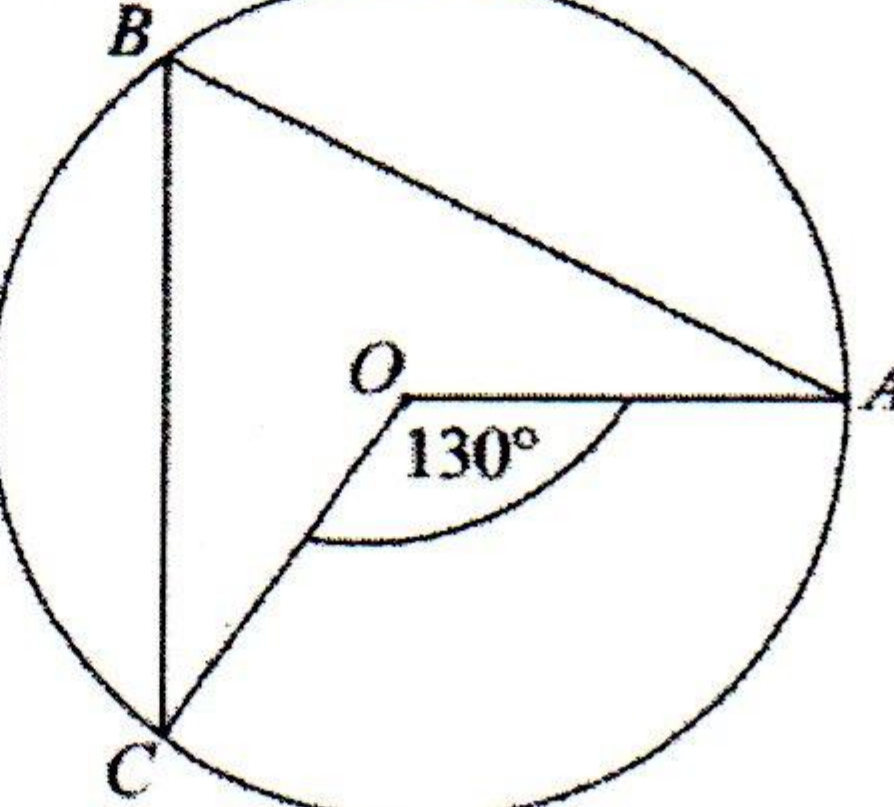


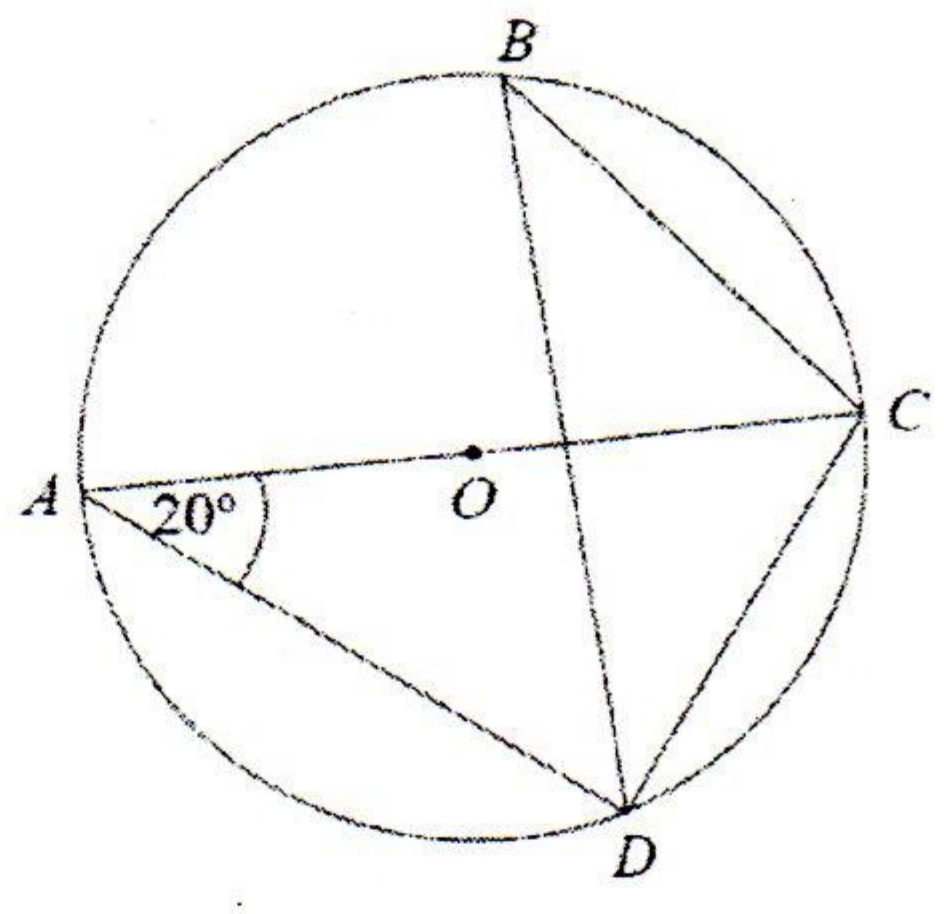
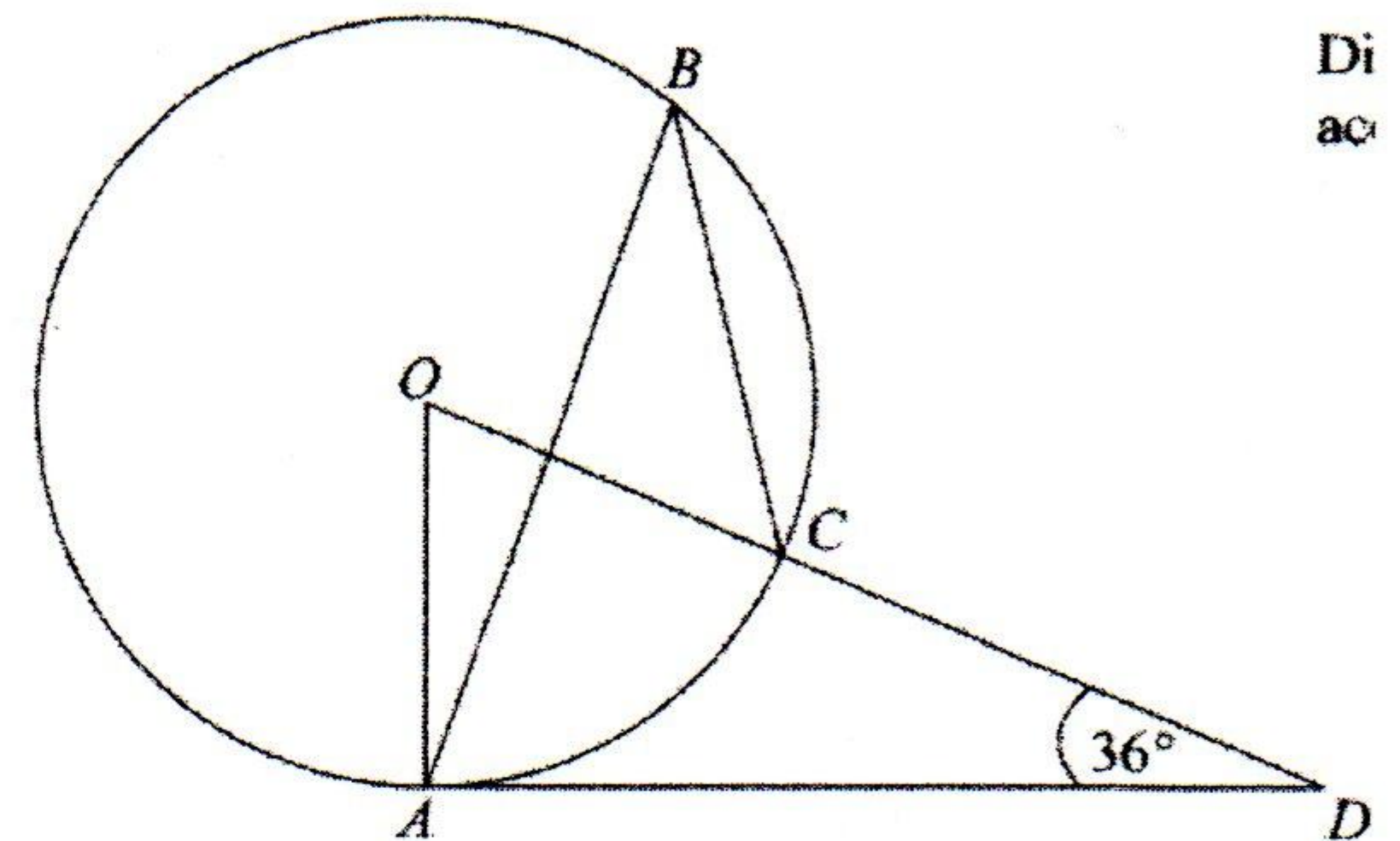
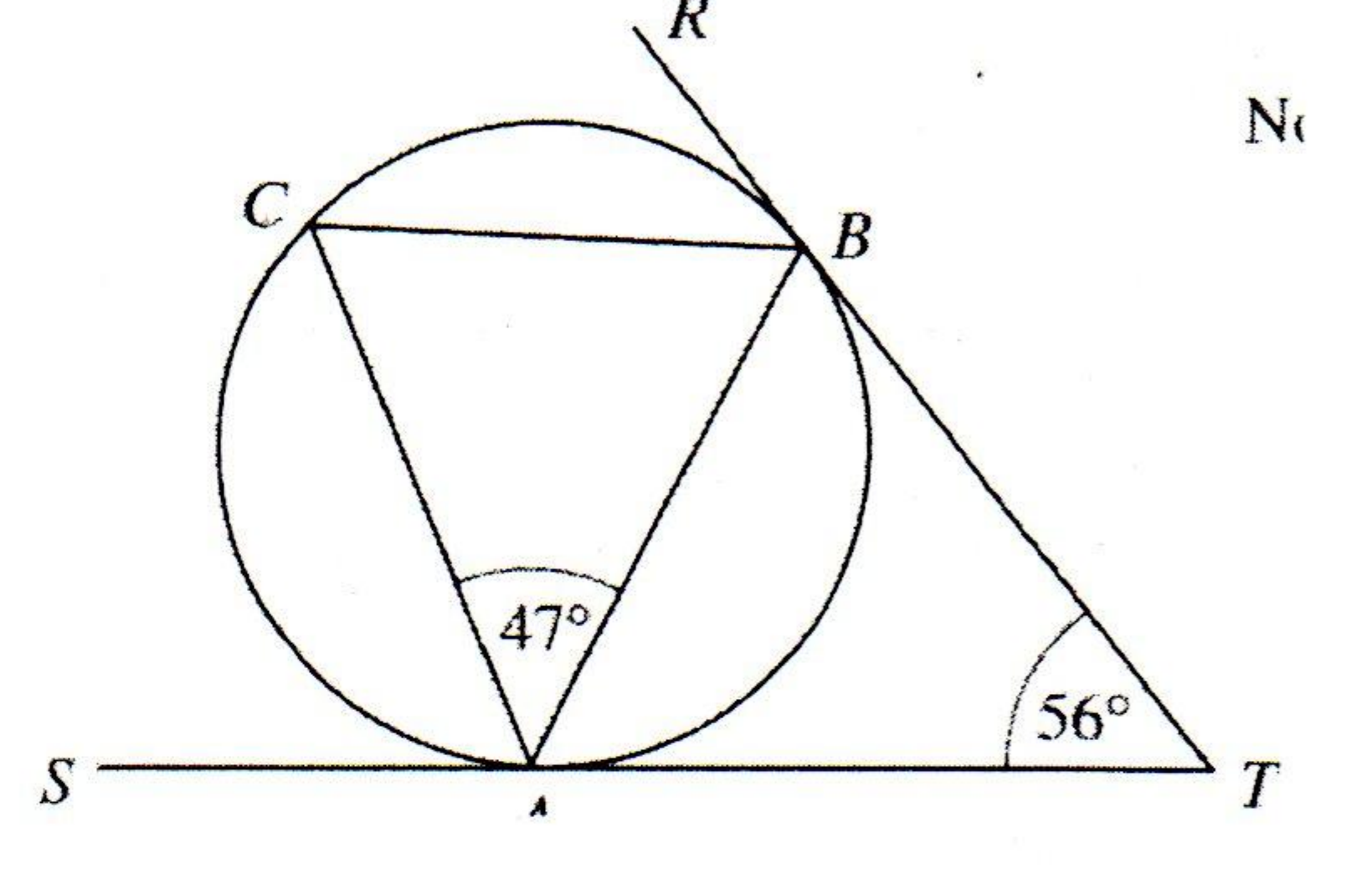
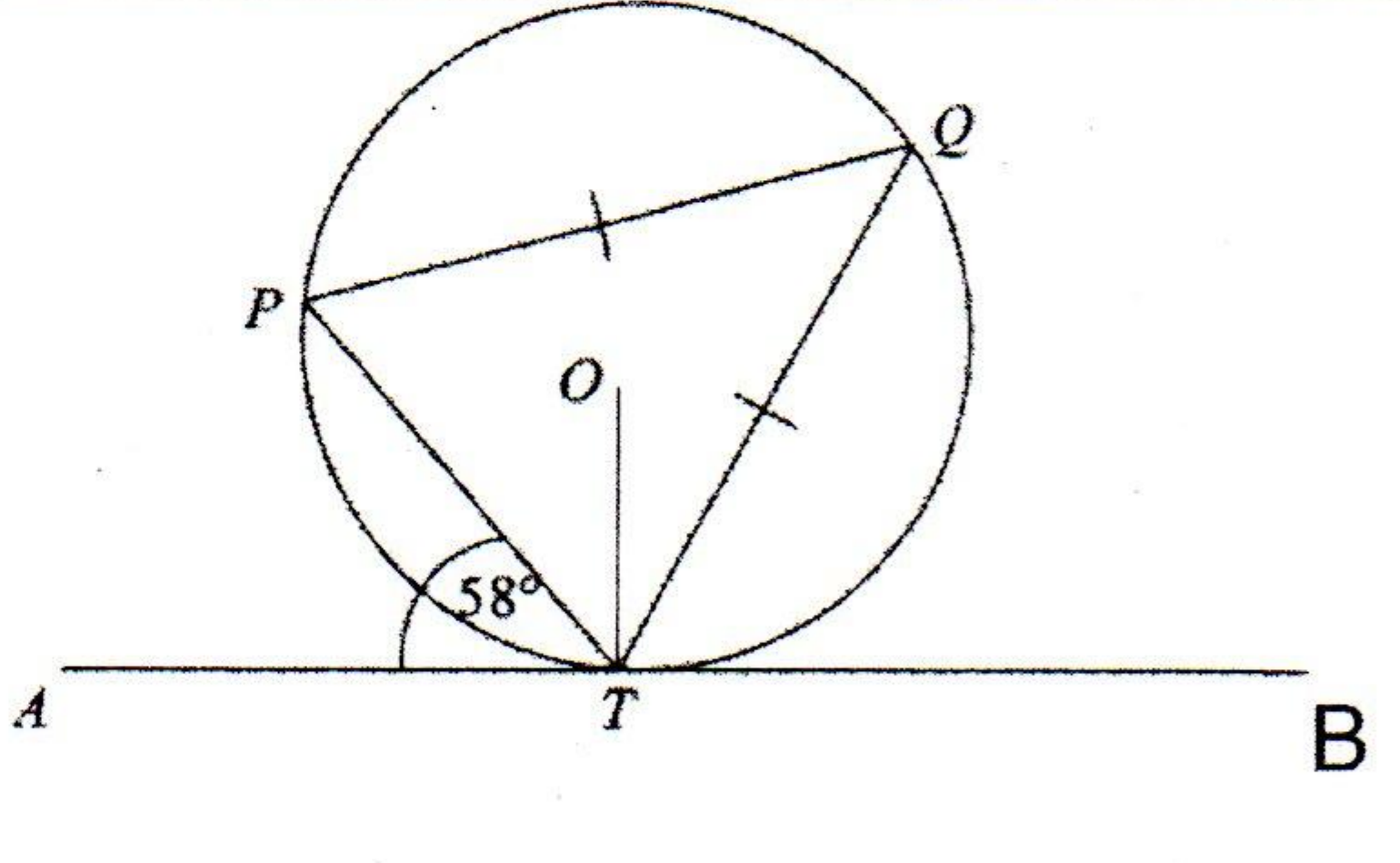
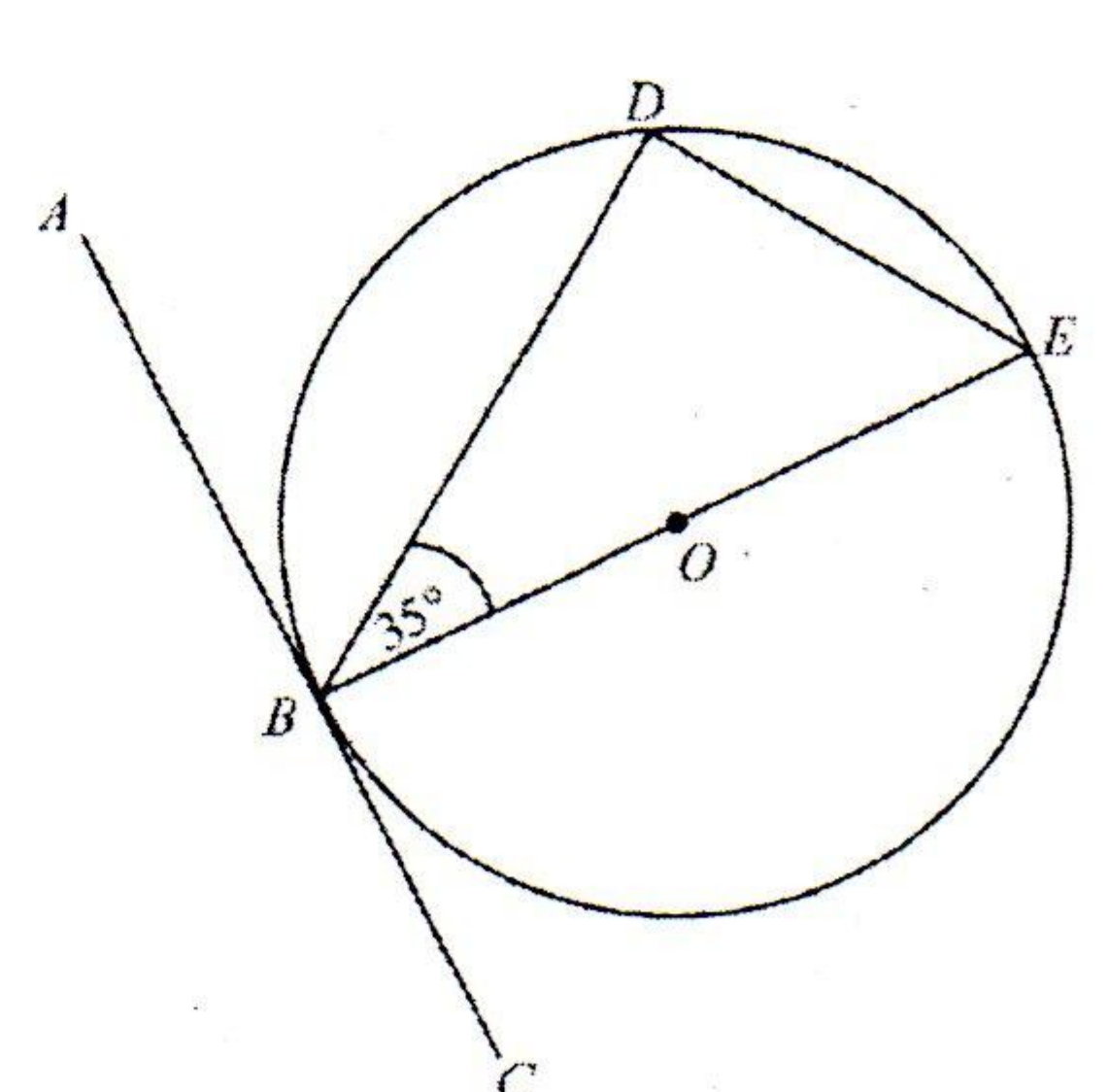
Q5. Find the values of x and y in each of these circles. Where shown, O marks the centre of the circle.

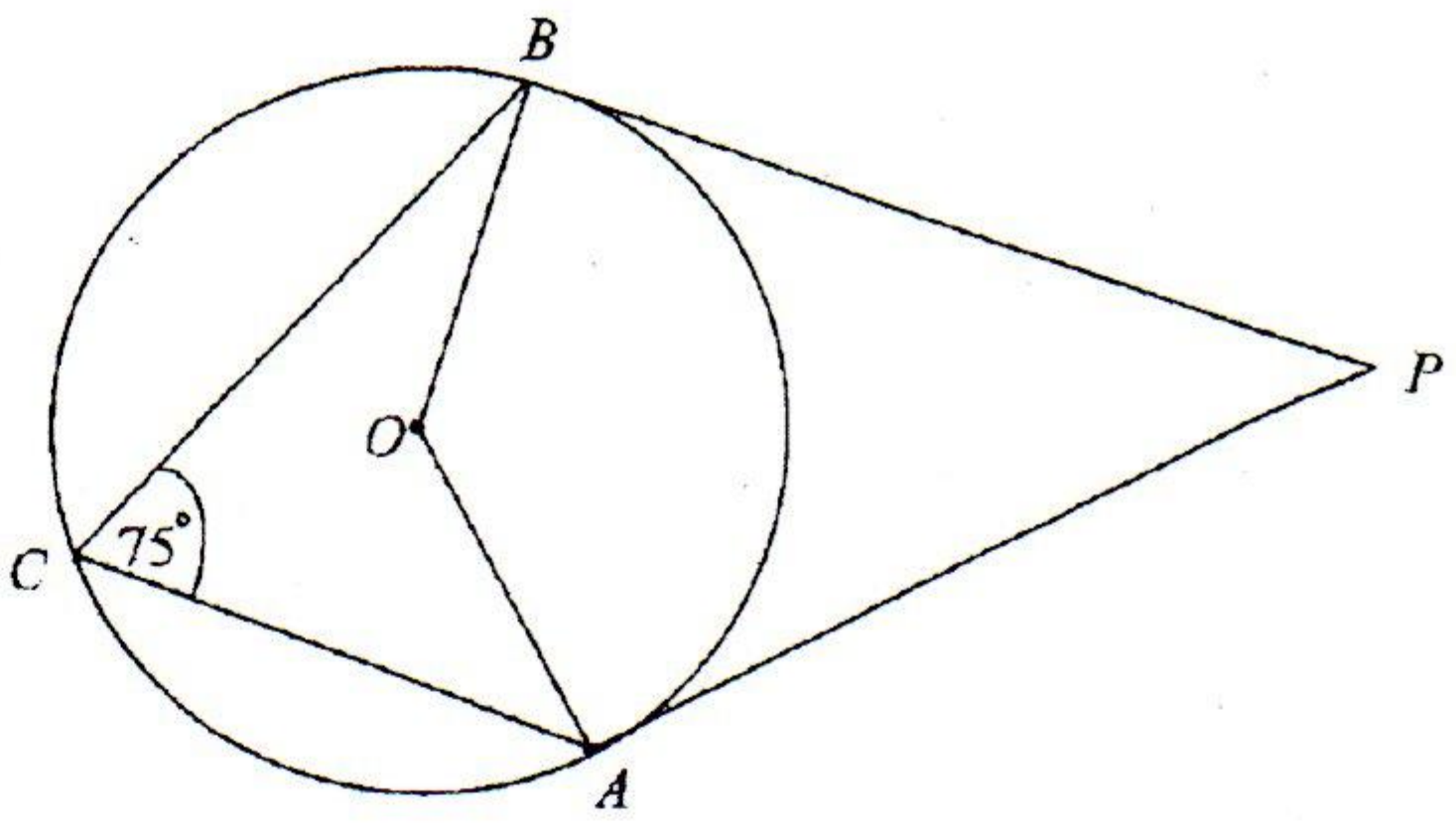
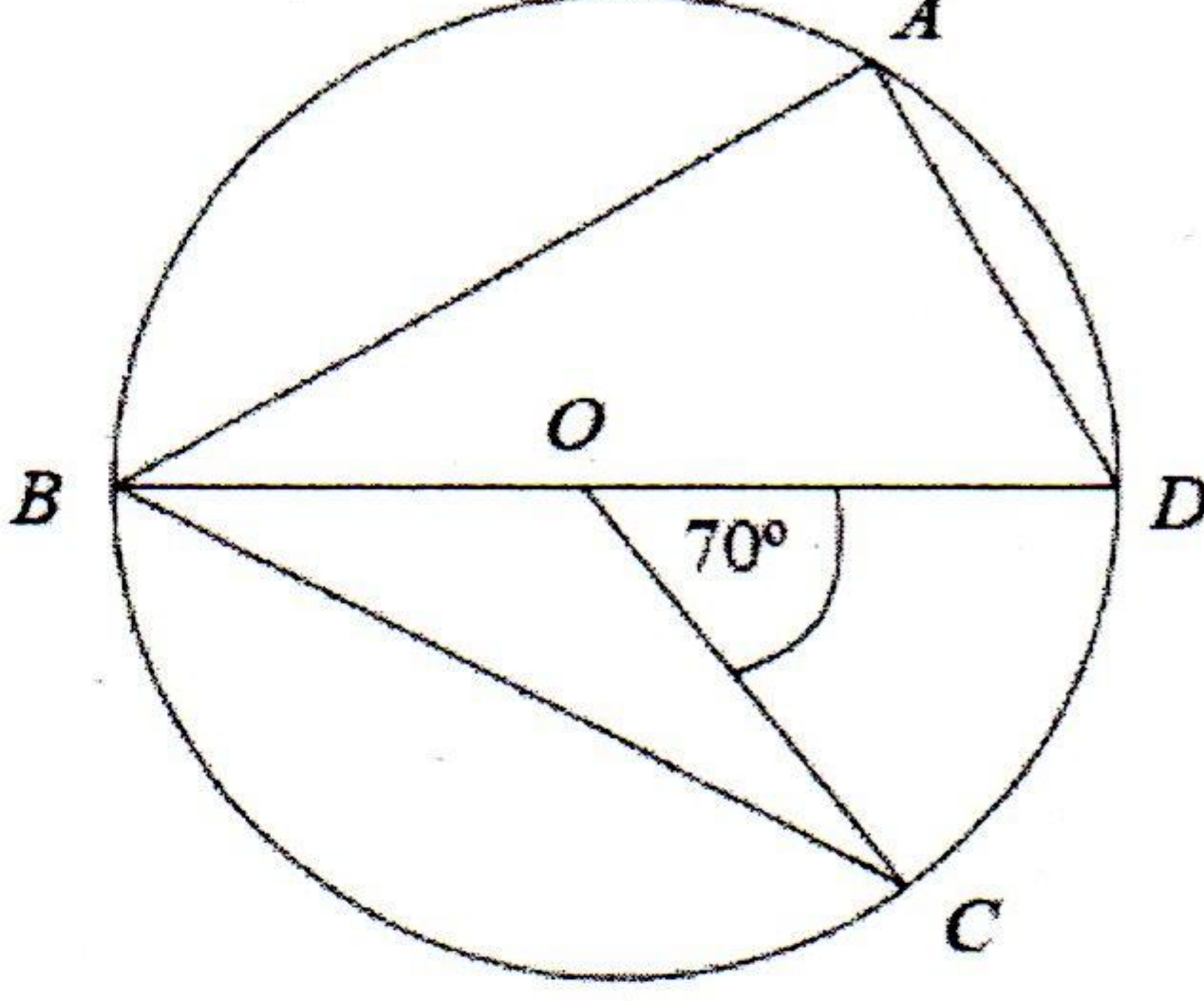
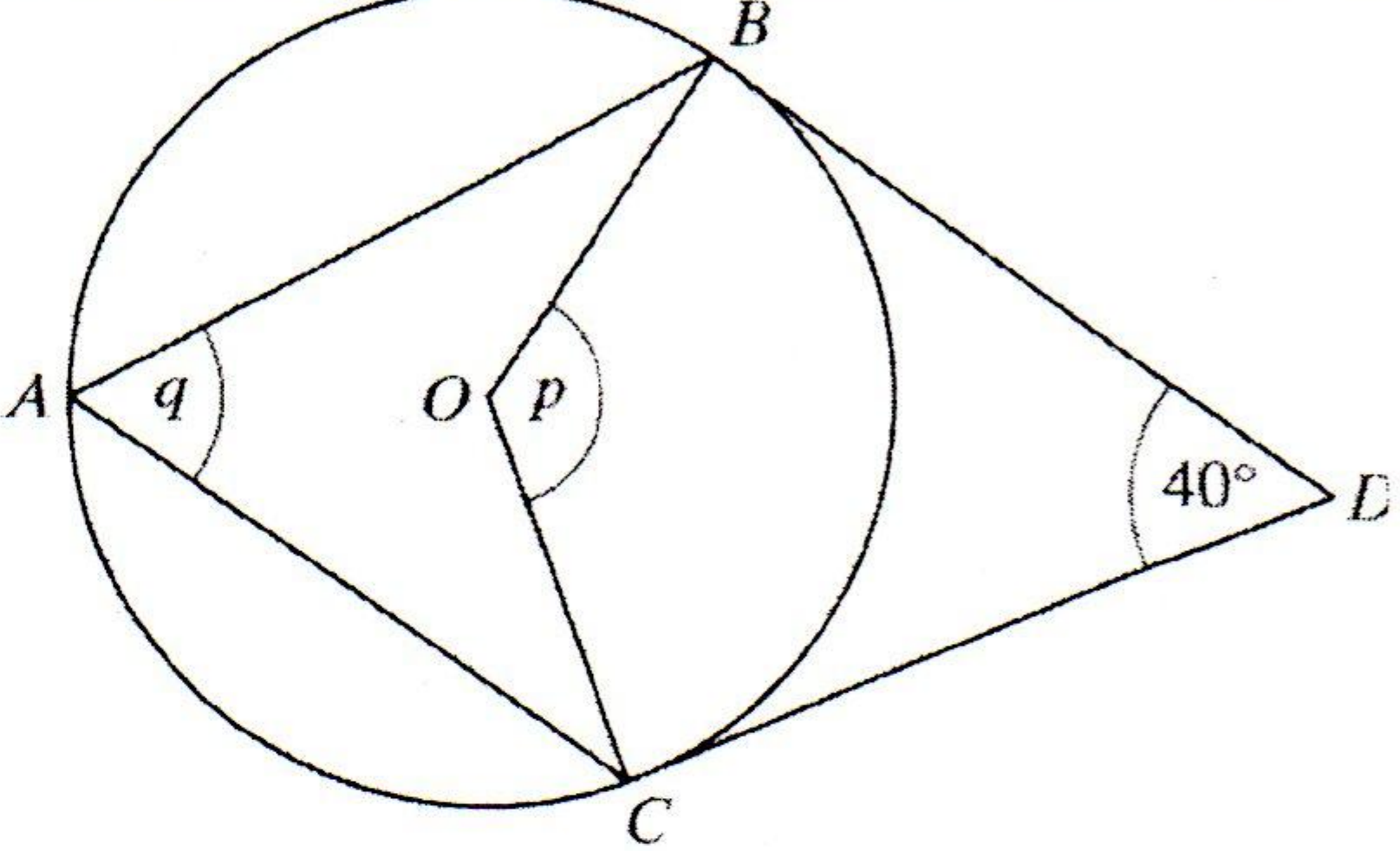
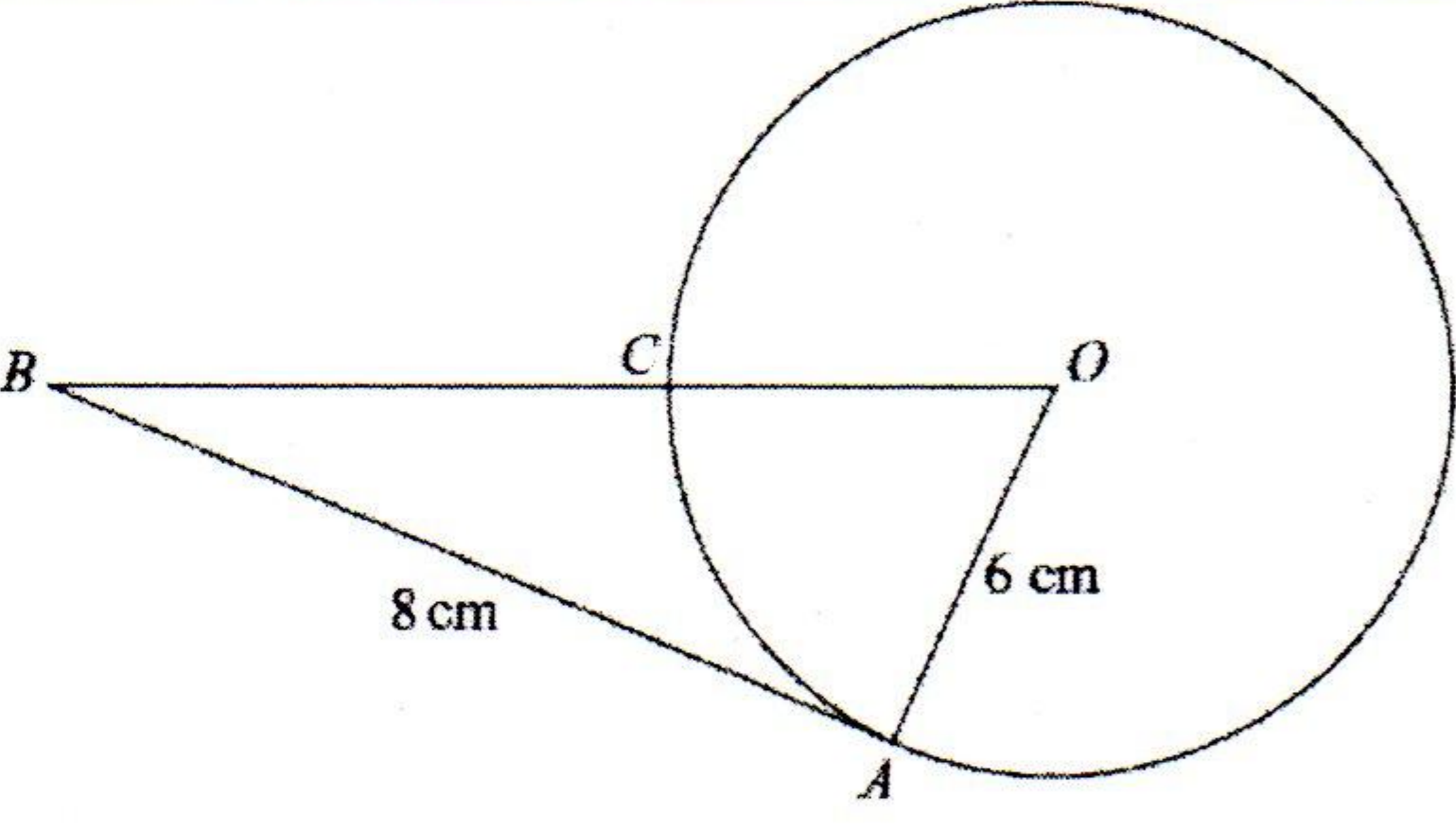
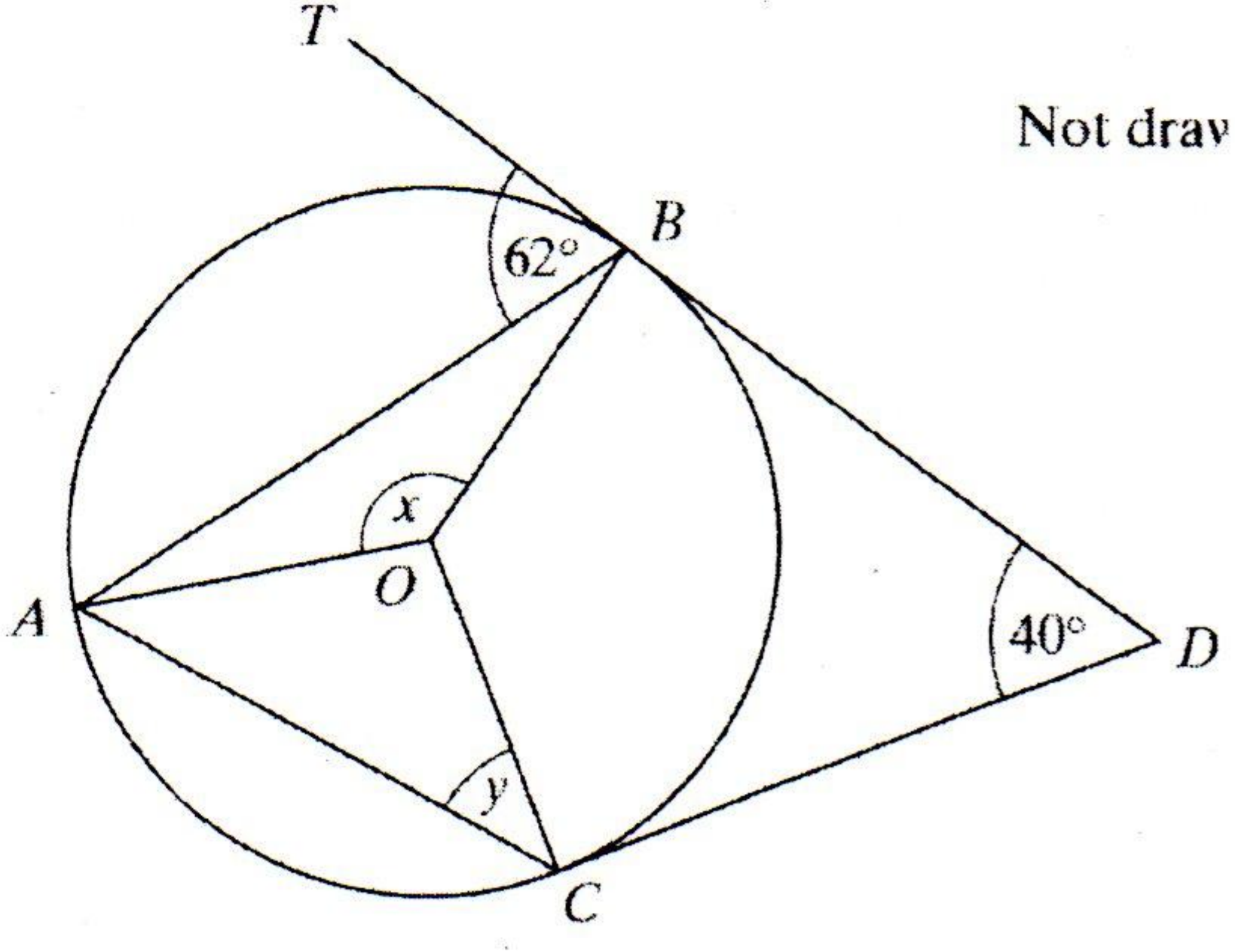


Q6. Each diagram shows a tangent to a circle with centre O. Find x and y in each case.



<p>1. In the diagram, $ABCD$ is a cyclic quadrilateral and PAQ is a tangent to the circle at A. Angle $BCD = 105^\circ$ and angle $DAQ = 63^\circ$.</p> <p>(a) Work out the size of angle BAD. Give a reason for your answer.</p> <p>(b) Work out the size of angle ADB.</p>	
<p>2. P, Q and R are points on the circumference of a circle, centre O. PR is a diameter of the circle.</p> <p>Write down the size of angle PQR.</p>	
<p>3) T is also a point on the circumference of the circle in question (2). Angle $QTR = 27^\circ$</p> <p>(b) (i) Write down the size of angle RPQ. (b) (ii) Work out the size of angle PRQ.</p>	
<p>4) S is another point on the circumference of the circle in question (2). QS is a diameter of the circle. Angle $PRS = 38^\circ$</p> <p>Work out the size of angle SQR.</p>	
<p>5). In the diagram, O is the centre of the circle. P, Q, R and S are points on the circle. Angle $ROP = 110^\circ$ Calculate the size of angle RSP. (ii) Give a reason for your answer.</p>	
<p>6. In the diagram, O is the centre of the circle. Angle $AOC = 130^\circ$ Calculate the size of angle ABC.</p>	

<p>7. A, B, C and D are points on the circumference of a circle, centre O. AC is a diameter of the circle. Angle $DAC = 20^\circ$. (a) Find the size of angle ACD. $^\circ$ (b) Find the size of angle DBC. Give a reason for your answer. $^\circ$</p>	
<p>8. 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 $ADO = 36^\circ$ (a) Work out the size of angle AOD. (b) (i) Work out the size of angle ABC. (ii) Give a reason for your answer.</p>	
<p>9. A, B and C are three points on the circumference of a circle. The line SAT is a tangent to the circle at A. The line RBT is a tangent to the circle at B. These tangents meet at T. Angle $CAB = 47^\circ$ and angle $BTA = 56^\circ$ (a) Calculate the size of angle BAT. (b) Calculate the size of angle ABC.</p>	
<p>10. 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 $ATP = 58^\circ$. Calculate the size of angle OTQ. Give a reason for each stage in your working. $^\circ$</p>	
<p>11. 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 $DBE = 35^\circ$. (a) Find the size of angle ABD. Give a reason for your answer. $^\circ$ (b) Find the size of angle DEB. Give a reason for your answer. $^\circ$</p>	

<p>12. In the diagram , A, B and C are points on the circumference of a circle O. PA and PB are tangents to the circle. Angle $ACB = 75^\circ$</p> <p>a) (i) Work out the size of the angle AOB. (ii) Give a reason for your answer. b) Work out the size of angle APB.</p>	
<p>13. A, B, C and D are points on the circumference of a circle, centre O. BOD is a straight line. Angle $COD = 70^\circ$</p> <p>(a) Find the size of angle BAD. Give a reason for your answer. (b) Find the size of angle CBD. Give a reason for your answer. </p>	
<p>14. A, B and C are points on the circumference of a circle with centre O. BD and CD are tangents.</p> <p>Angle $BDC = 40^\circ$</p> <p>(a) (i) Work out the value of p. (ii) Hence write down the value of q. (b) The tangent DB is extended to T. The line AO is added to the diagram. Angle $TBA = 62^\circ$</p>	
<p>15. 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.</p> <p>BA is a tangent to the circle. $AB = 8\text{ cm}$. $OA = 6\text{ cm}$.</p> <p>(a) Explain why angle OAB is a right angle. (b) Work out the length of BC. cm</p>	
<p>16. From the given figure. Work out the value of x. Work out the value of y.</p>	 <p style="text-align: right;">Not draw</p>