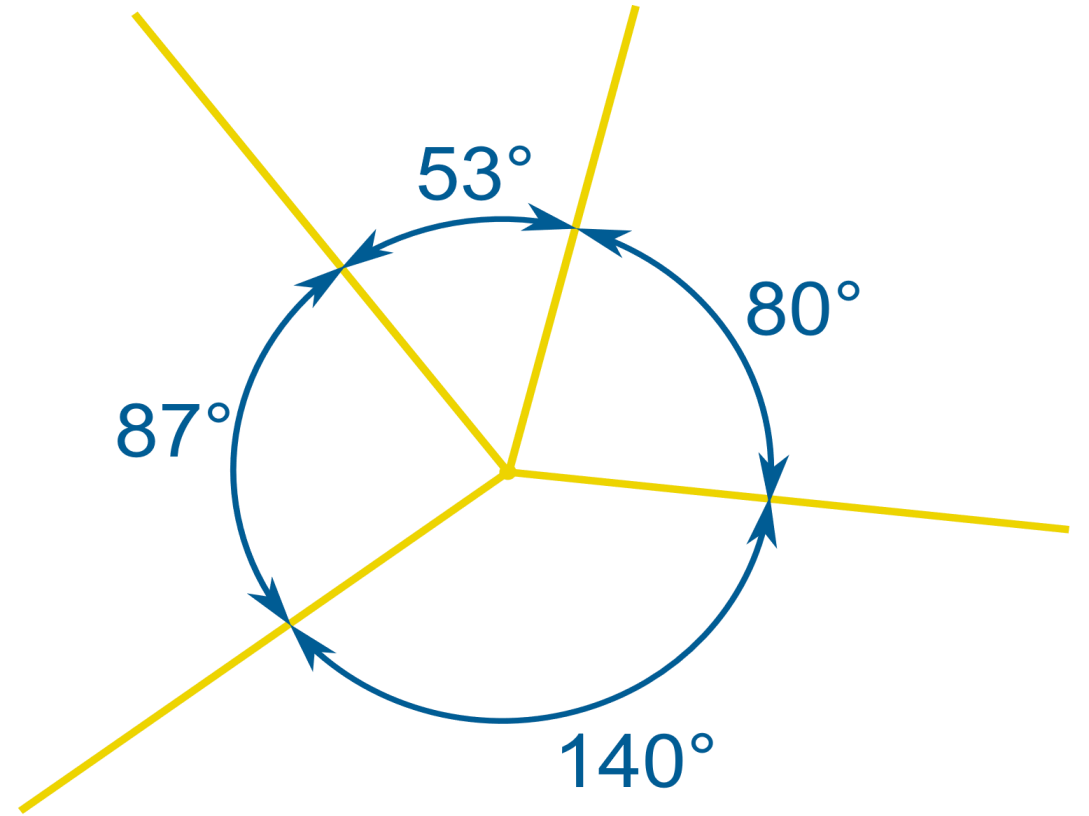
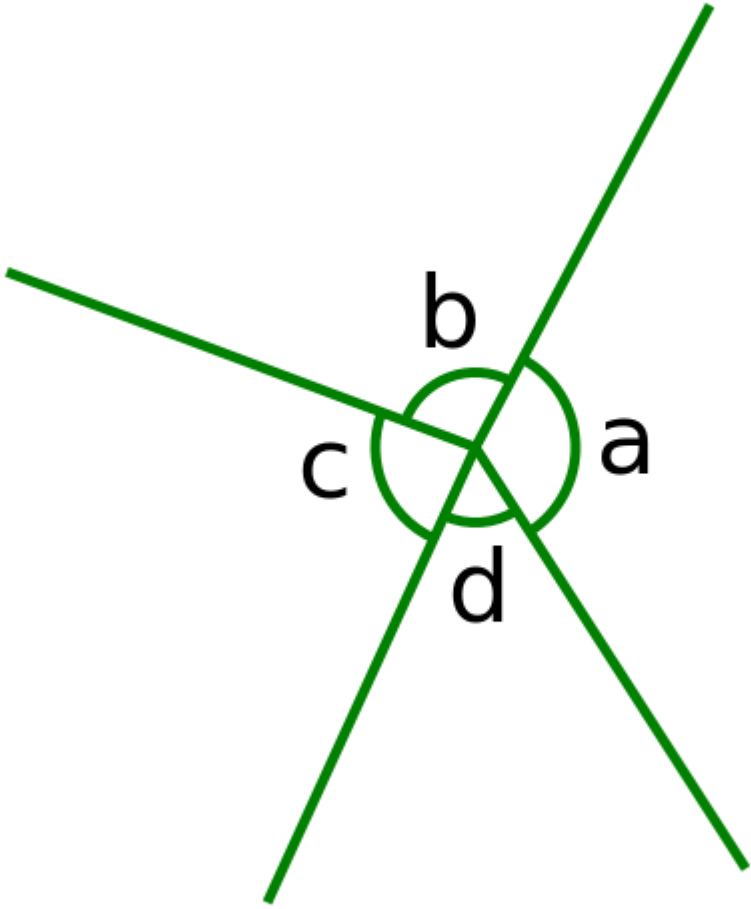


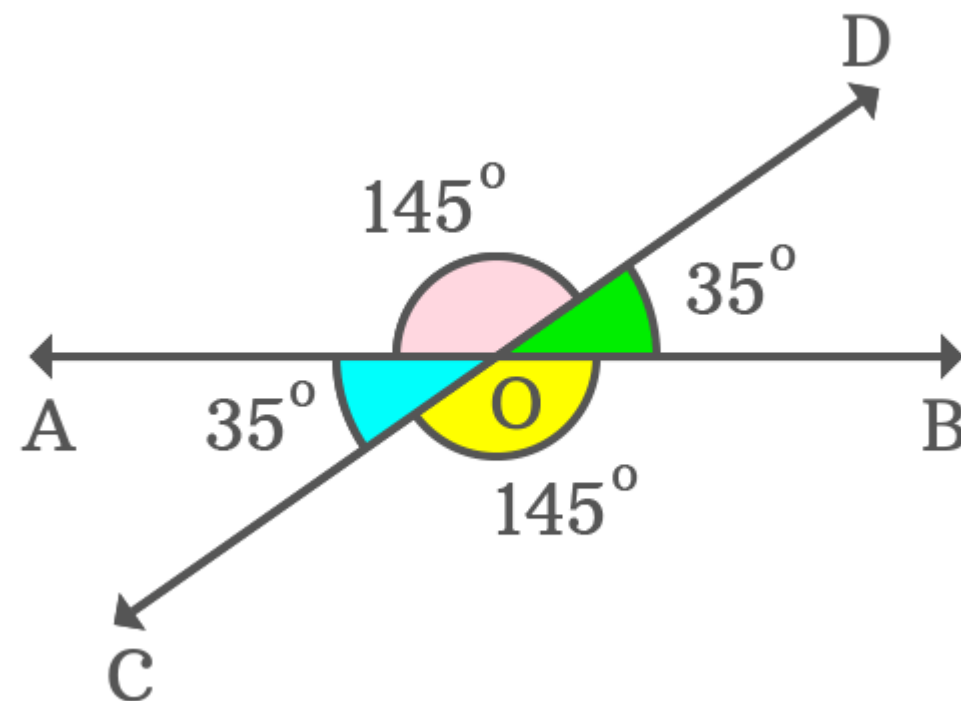
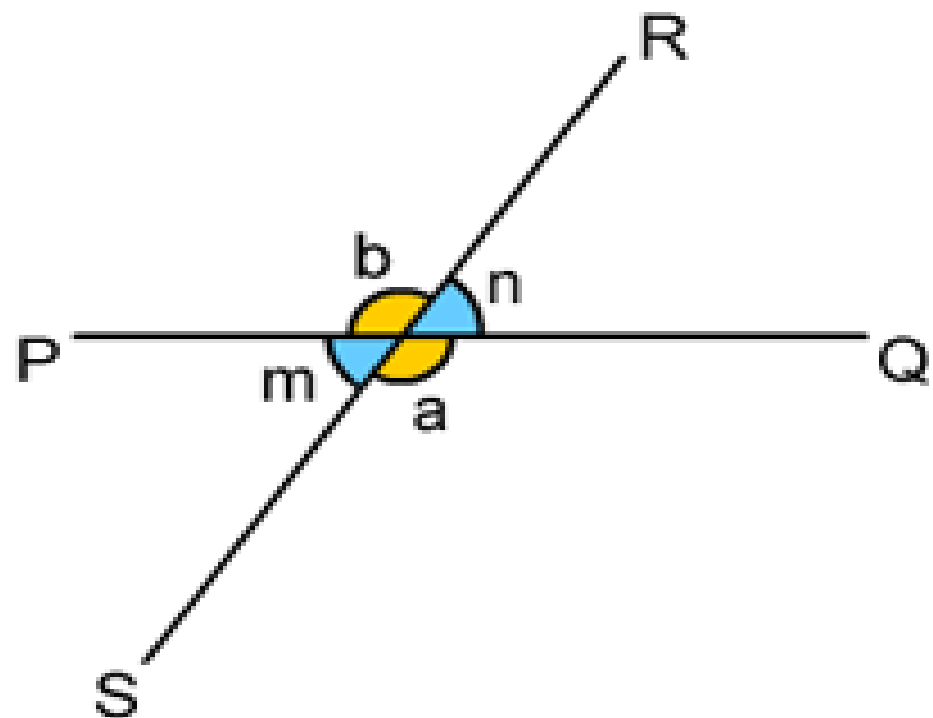
EUCLIDEAN GEOMETRY GRADE 11 PART ONE

THE BASICS

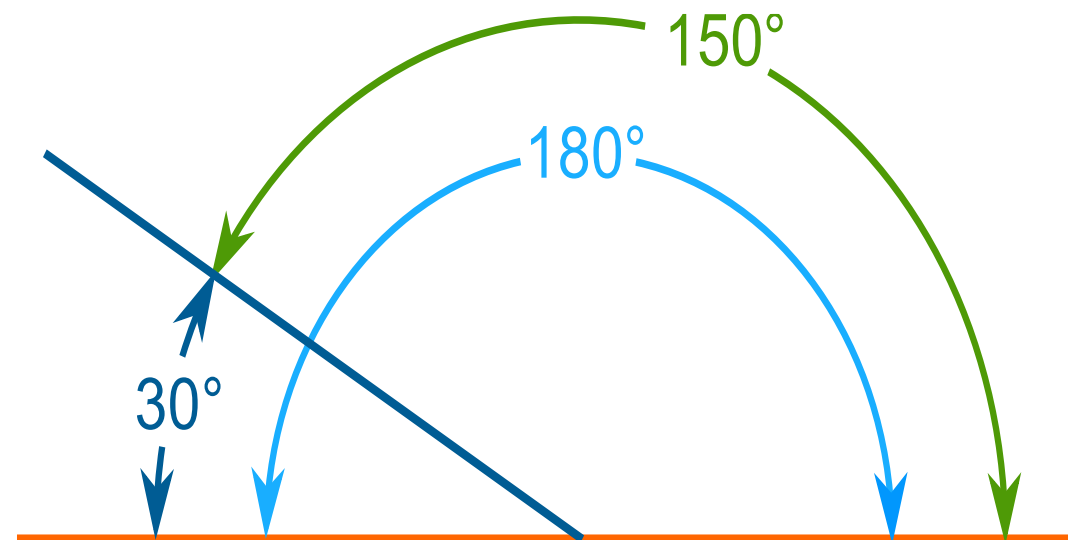
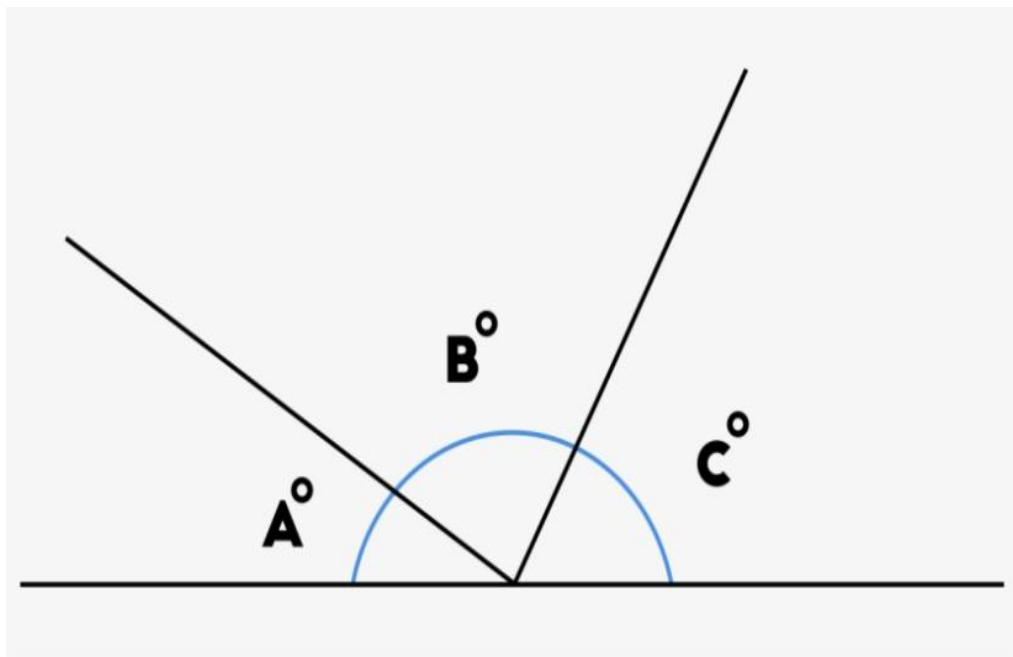
Angles around a point add up to 360°



Vertically opposite angles are equal

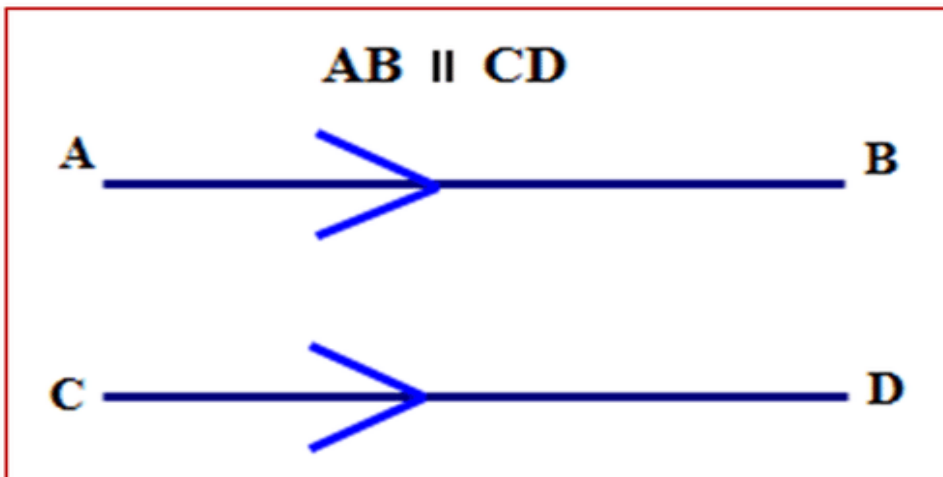
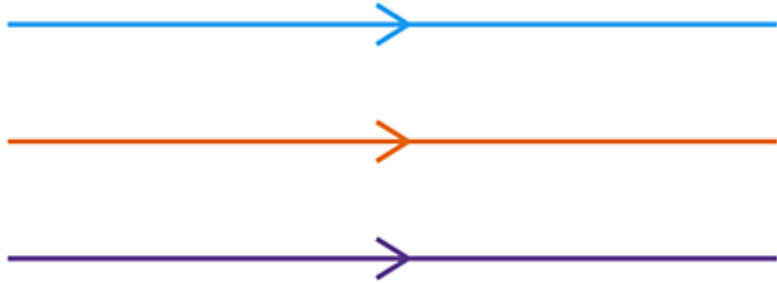


Angles on a straight line add up to 180°

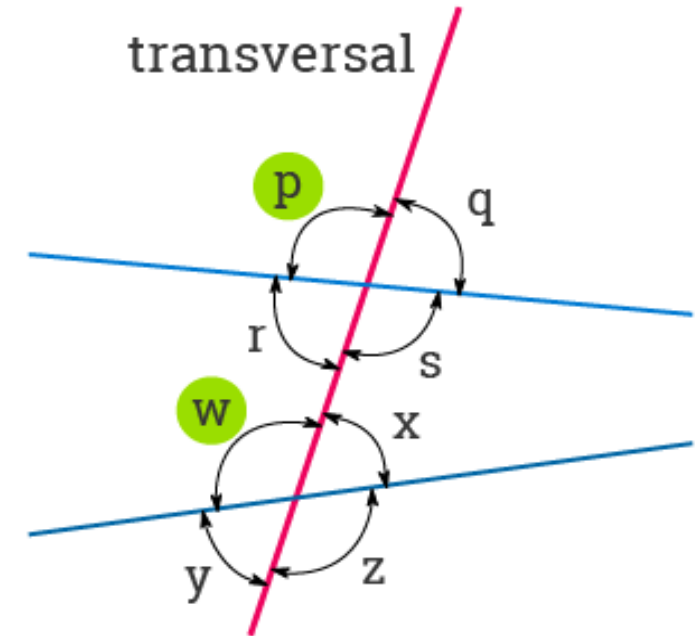


Parallel Lines

- ❖ These are two or more lines that lie in the same plane and never intersect each other are known as **parallel lines**.

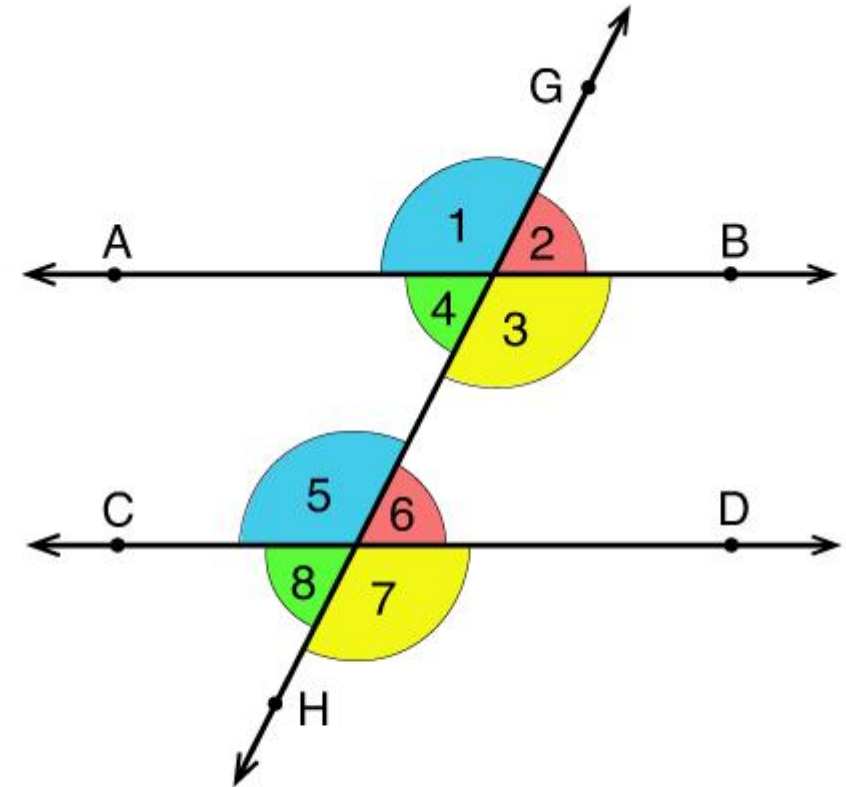
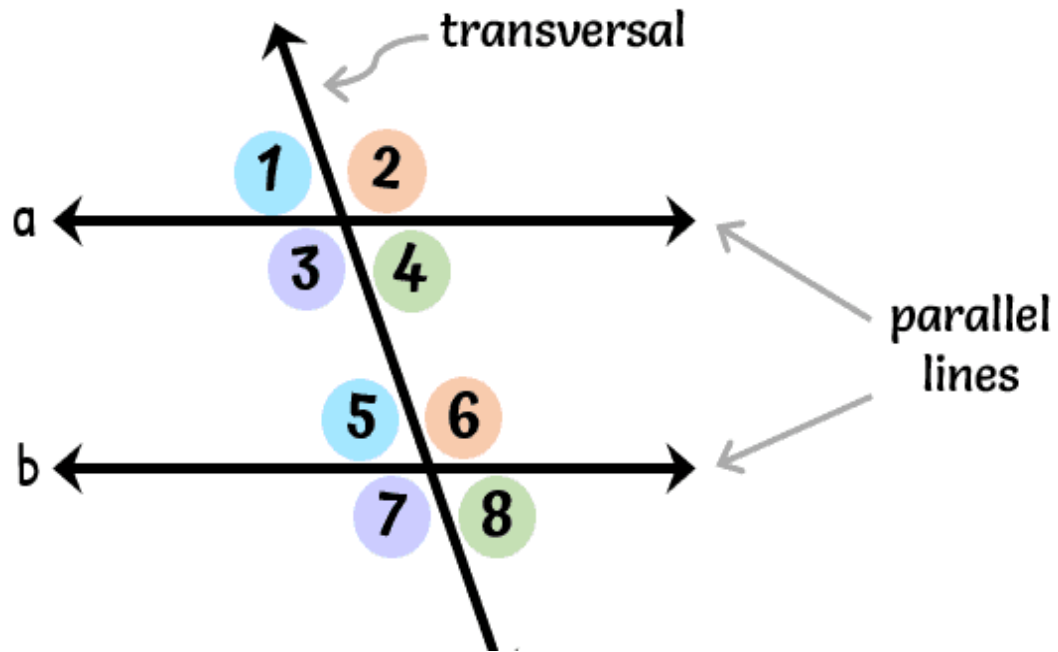


- ❖ When any two parallel lines are intersected by another line called a transversal, many pairs of angles are formed. While some angles are congruent (equal), the others are supplementary



Corresponding Angles

- Corresponding angles are the angles which are formed in matching corners or corresponding corners with the transversal when two parallel lines are intersected by any other line (i.e. the transversal)



$\angle 1$ corresponds to $\angle 5$

$\angle 2$ corresponds to $\angle 6$

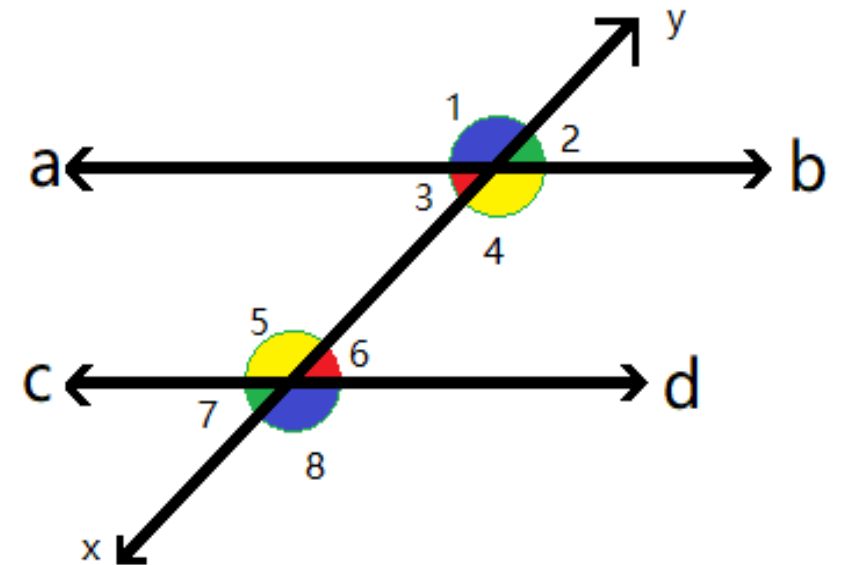
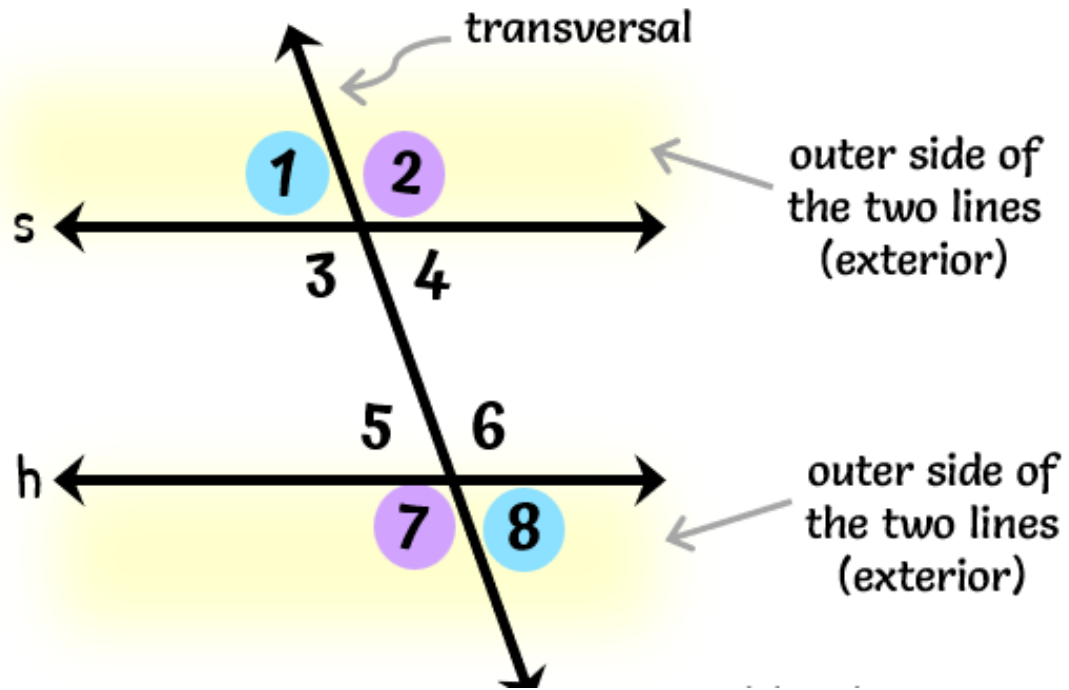
$\angle 3$ corresponds to $\angle 7$

$\angle 4$ corresponds to $\angle 8$

Alternate angles

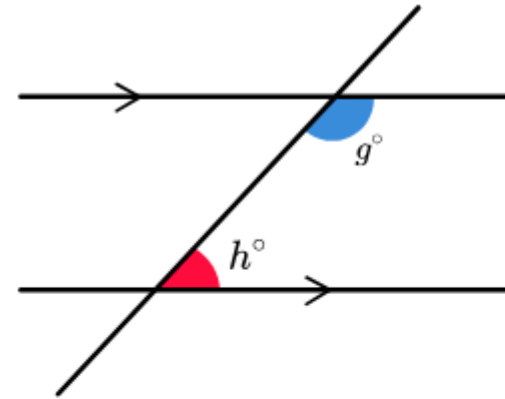
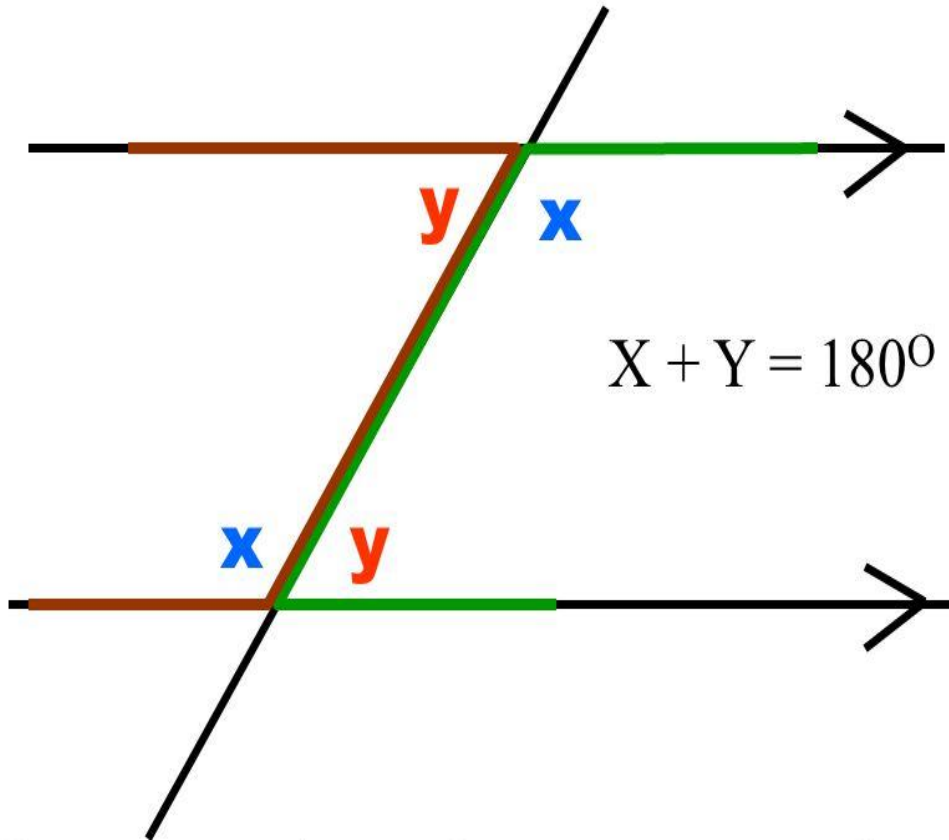
☐ These are angles that occur on opposite sides of the transversal line and have the **same size**.

☐ Alternate angles are equal:

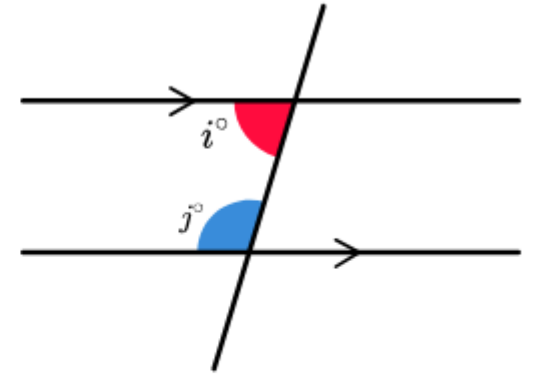


Co-interior angles

- Co-interior angles in parallel lines occur in between two parallel lines when they are intersected by a transversal.
- The two angles that occur on the same side of the transversal always add up to 180°



$$g + h = 180^\circ$$



$$i + j = 180^\circ$$

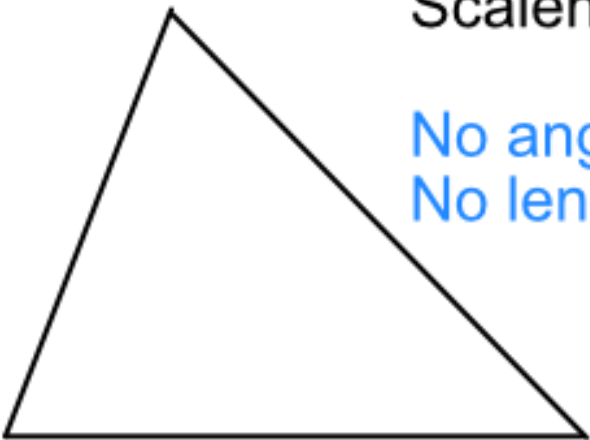
Properties of triangles

Right-angled Triangle



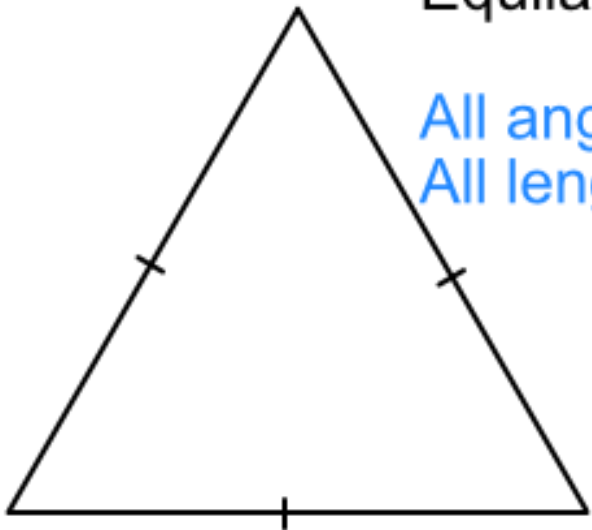
One angle is 90°

Scalene Triangle



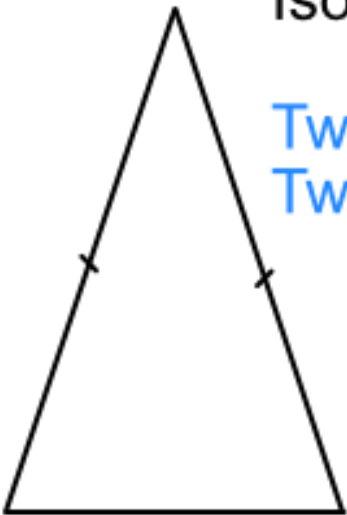
No angles are the same
No lengths are the same

Equilateral Triangle



All angles are the same
All lengths are the same

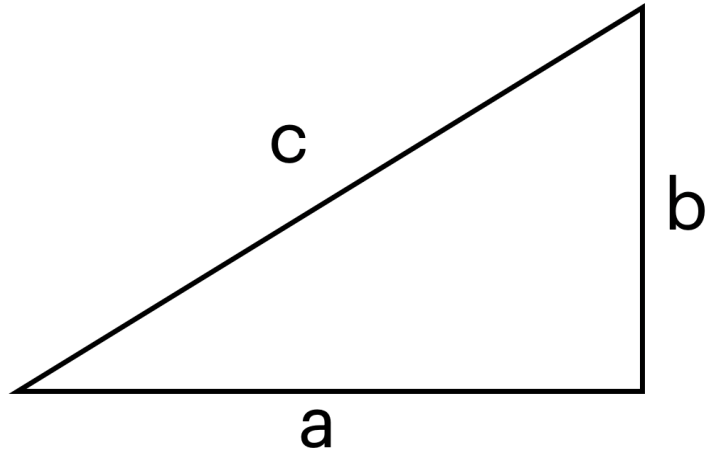
Isosceles Triangle



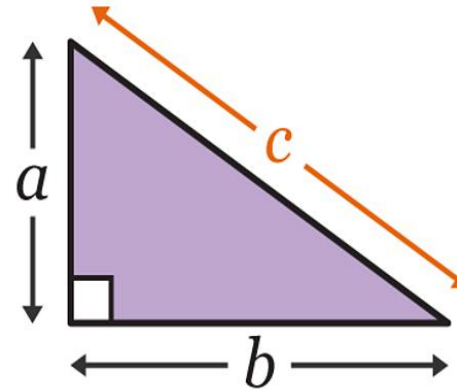
Two angles are the same
Two lengths are the same

Pythagoras Theorem

- ❖ The Pythagoras theorem explains the relationship between the three sides of a right-angled triangle.
- ❖ According to the Pythagorean theorem, the square of the hypotenuse is equal to the sum of the squares of the other two sides of a triangle.



$$c^2 = a^2 + b^2$$

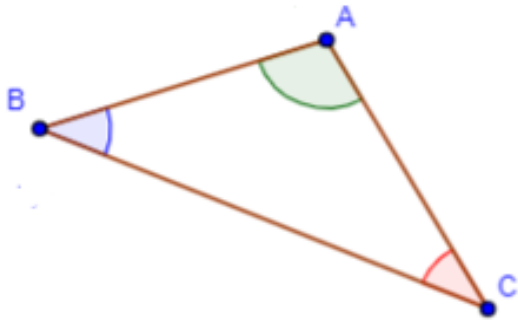


$$a^2 + b^2 = c^2$$

Sum of interior angles of a triangle

This fundamental concept in geometry states that the three interior angles of a triangle always add up to 180 degrees

Sum of Angles in a Triangle



$$\angle A + \angle B + \angle C = 180^\circ$$

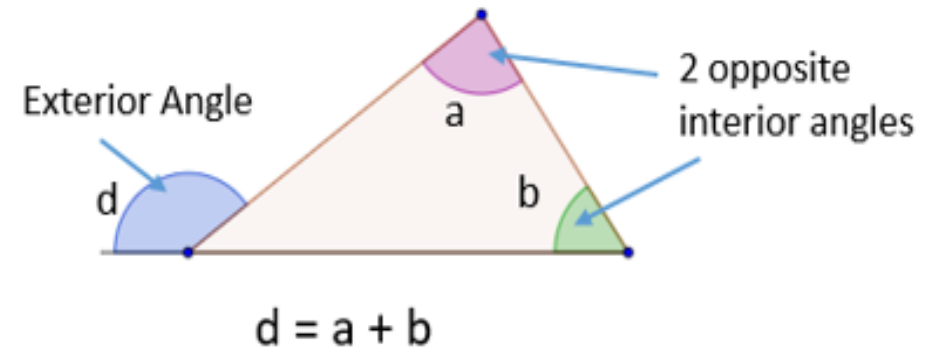
The sum of the angles in a triangle is always 180°

Exterior angle of triangle

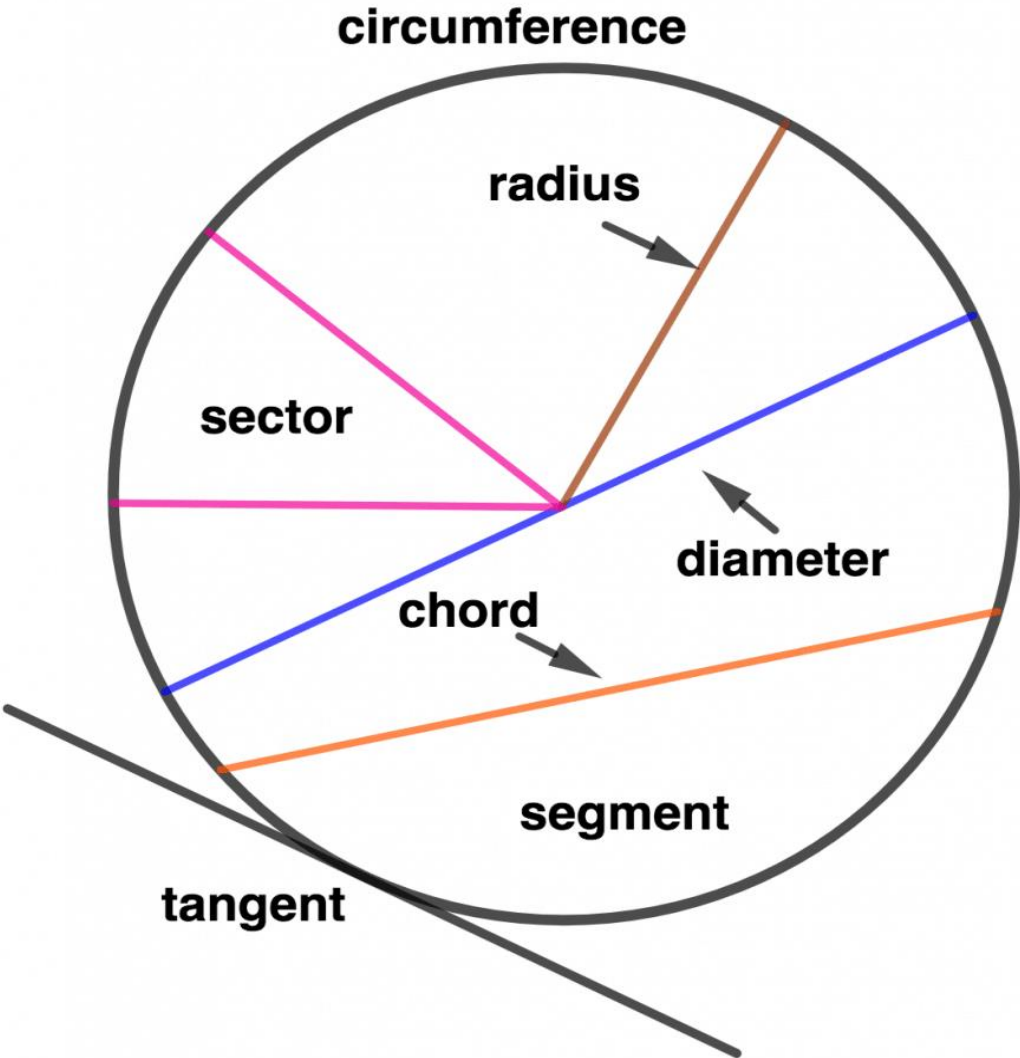
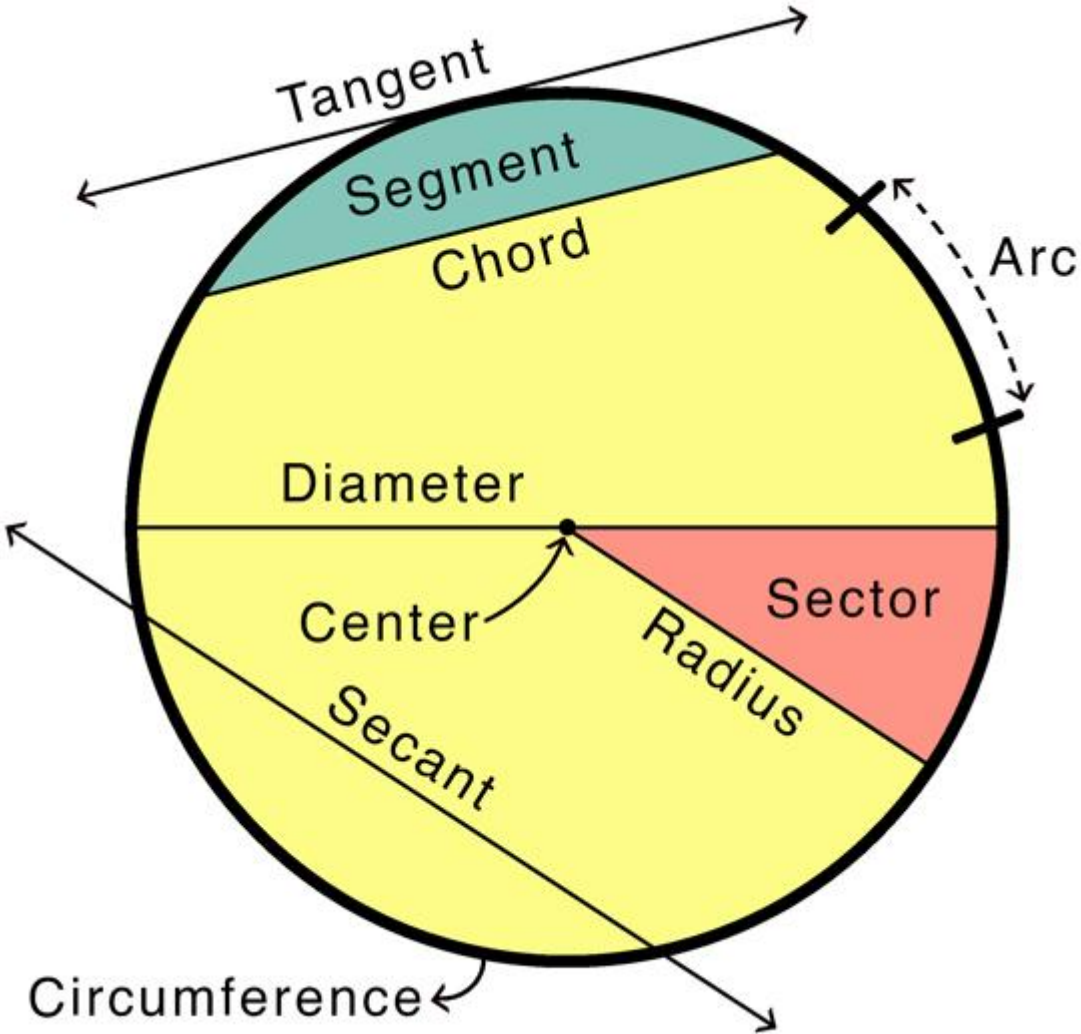
An exterior angle of a triangle is formed by extending one of its sides, and its measure equals the sum of the two non-adjacent interior angles (also known as remote interior angles)

Exterior Angle Theorem

The exterior angle of a triangle is equal to the sum of the two opposite interior angles.



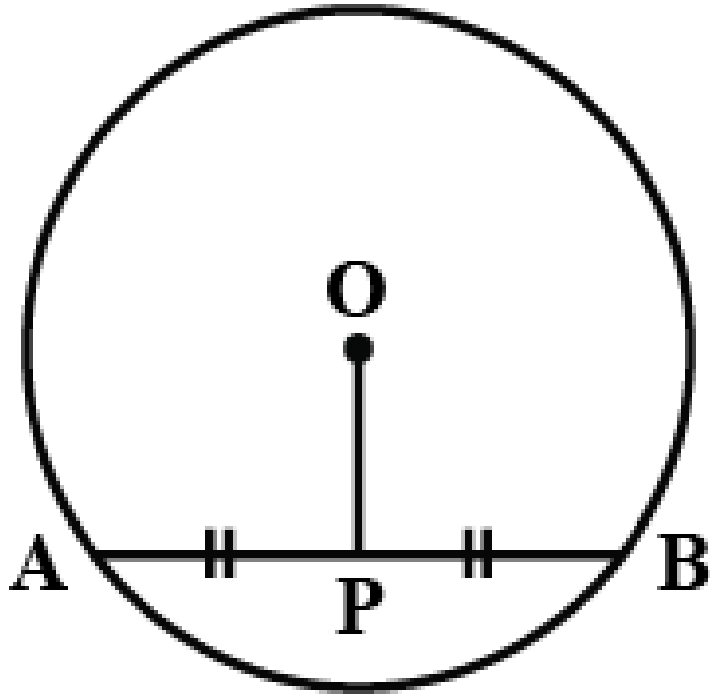
Parts of a circle



THE THEOREMS

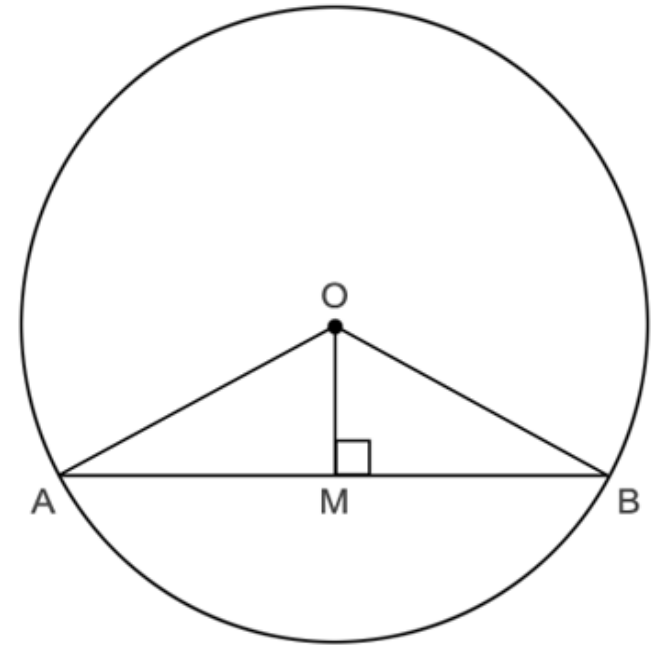
Theorem 1

The line drawn from the center of a circle to the midpoint of the chord is perpendicular to the chord



Converse of Theorem 1

The line drawn from the center of a circle perpendicular to a chord bisects the chord

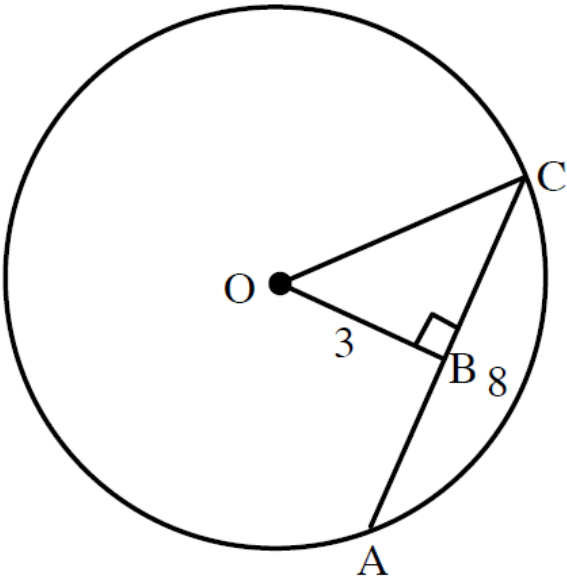


Practice Questions on Theorem 1

Question 1

In the diagram below, O is the center.
OB = 3 cm, AC = 8 cm and $OB \perp AC$. Calculate the length

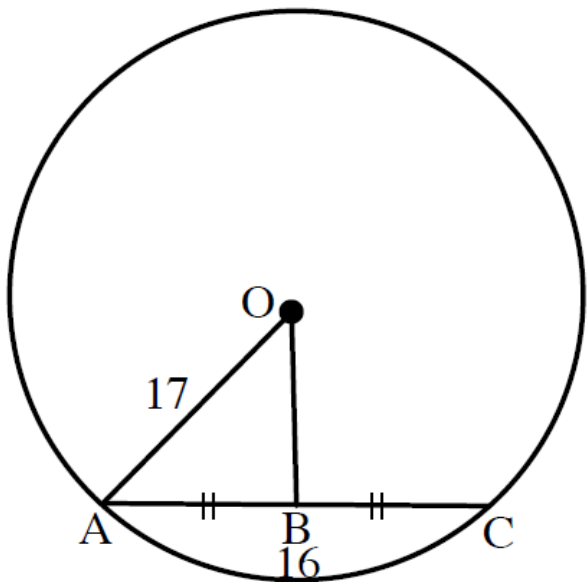
- a) AB
- b) OC



Statement		Reason
(a)	$AB = BC = 4$	Perp from centre to chord.
(b)	$BC = 4$ $OC^2 = (3)^2 + (4)^2$ $\therefore OC^2 = 25$ $\therefore OC = 5$	Proved

Question 2

In the diagram below ,O is the centre.
AC = 16 units, AB = BC and AO = 17 units
Calculate the length of OB.



Statement	Reason
$AB = 8$	Given
$\angle OBA = 90^\circ$	Line from centre to midpoint of chord
$OB^2 = (17)^2 - (8)^2$	Pythagoras
$\therefore OB^2 = 225$	
$\therefore OB = 15$	

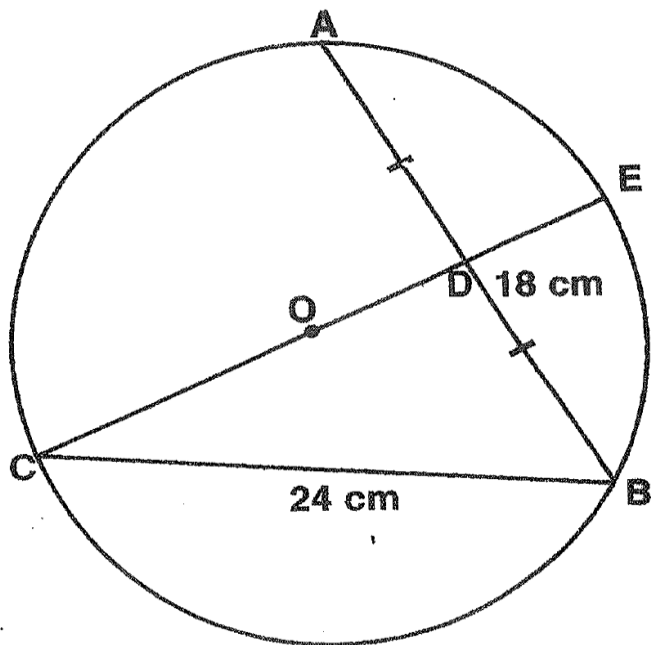
$$+ DB^2 = CB^2$$

2014 Gauteng Preliminary Paper 2 Q 9

9.1 Complete the following so that the Euclidean Geometry statement is true:

A line drawn from the centre of a circle to the midpoint of the chord is to the chord (1)

9.2 In the circle with centre O, chord AB = 18cm and AD = DB. Chord CB = 24 cm.

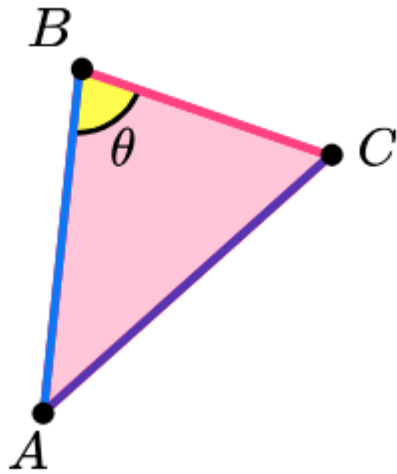


9.2.1 Calculate the length of CD. Leave the answer in the simplest surd form. (4)

9.2.2. If $\frac{CD}{DE} = 3$ calculate the length of DE (2)

Subtended Angle

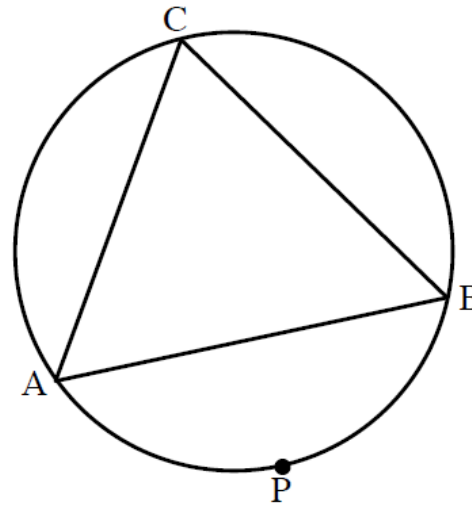
- A subtended angle is the angle between two lines at a point. For example in the triangle below, the side AC subtends the angle θ



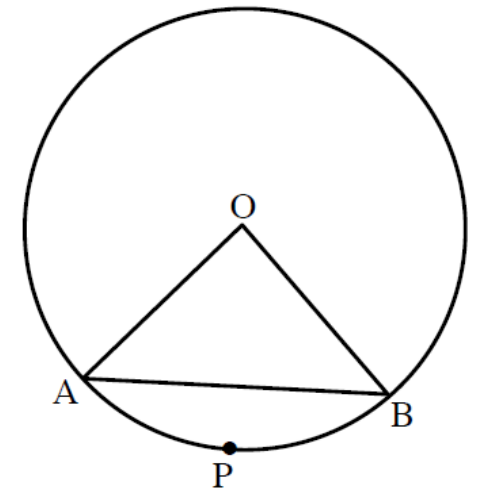
We can, therefore, describe a subtended angle as the angle made from a given point.

- ❖ For circle theorems, a subtended angle is an angle within a circle that is created by two chords or arcs meeting at a point on the circumference of a circle.

Arc APB or chord AB **subtends** angle C at the circumference

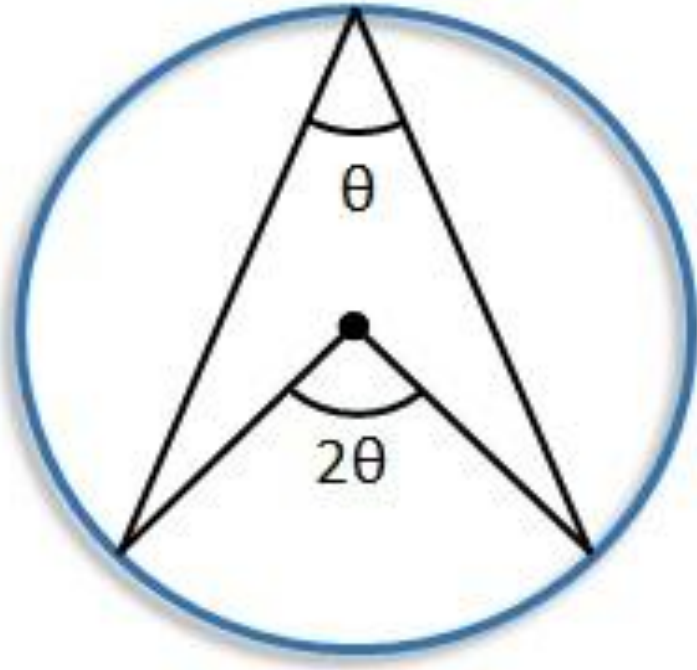


Arc APB or chord AB **subtends** Angle AOB at the centre of the circle

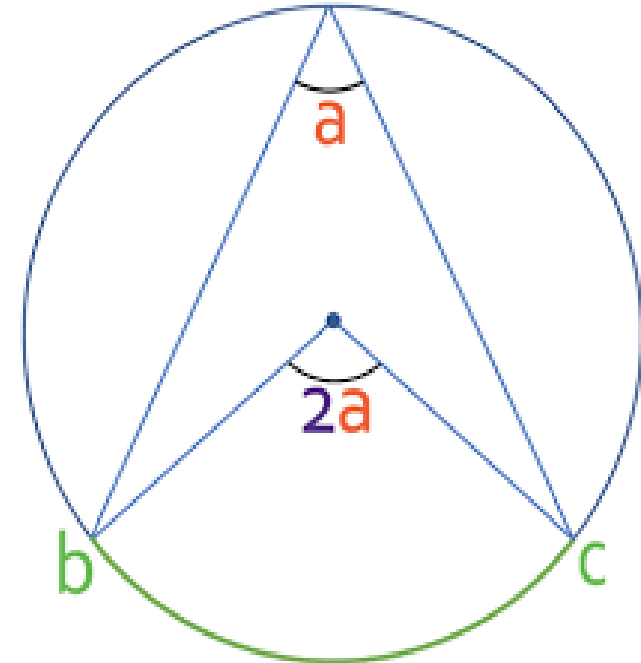


Theorem 2

- ❖ The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (on the same side of the chord as the centre)



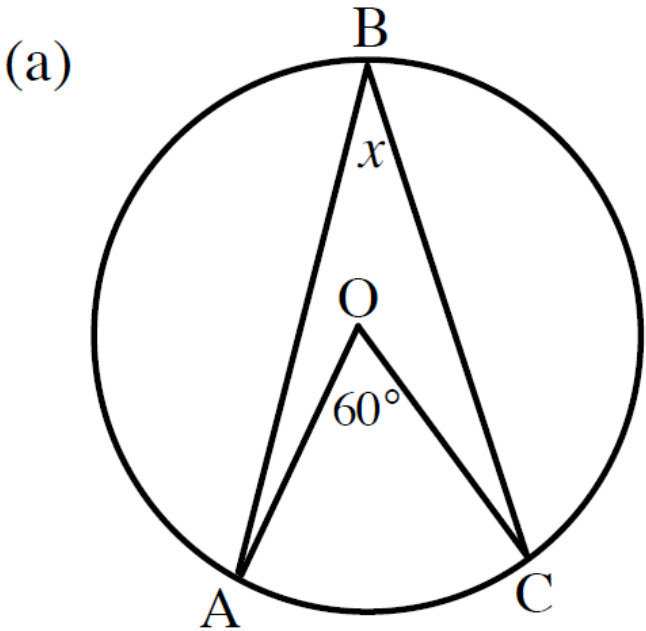
- ❖ If an arc or chord subtends an angle at the centre of a circle and also at any point on the circumference, then the angle at the centre is twice angle at the circumference



Questions on Theorem 2

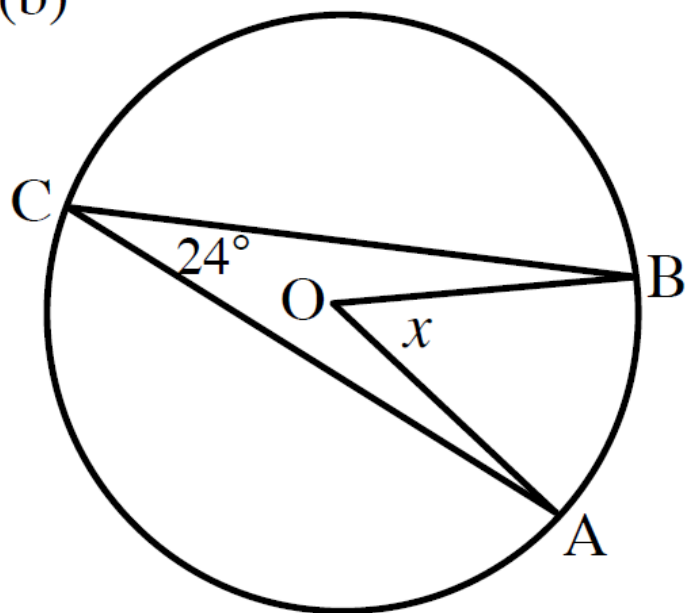
Question 1

Calculate the value of the unknown variables in each case.
O is the center in each case



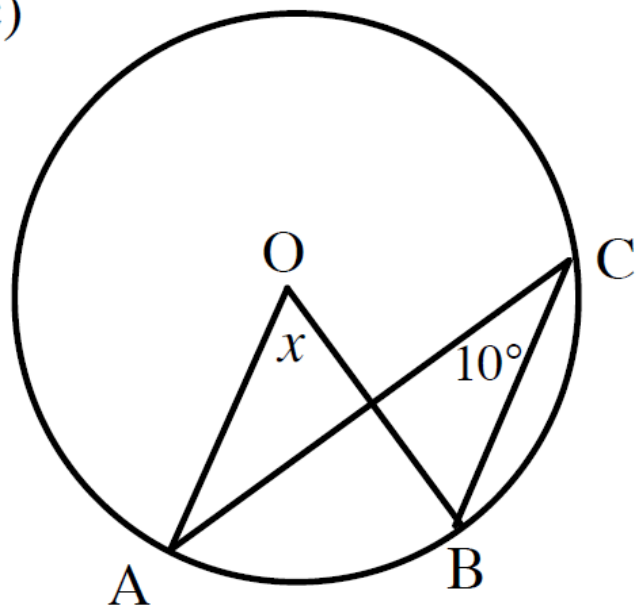
STATEMENT	REASON
$x = 30^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference

(b)

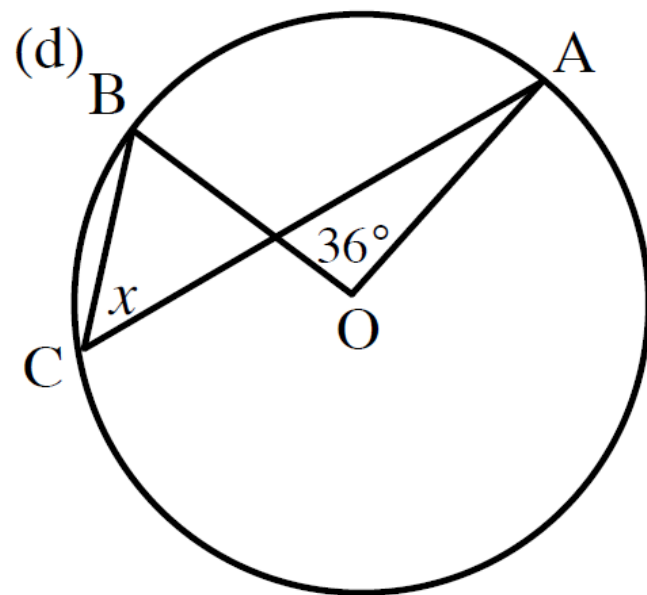


STATEMENT	REASON
$x = 48^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference

(c)

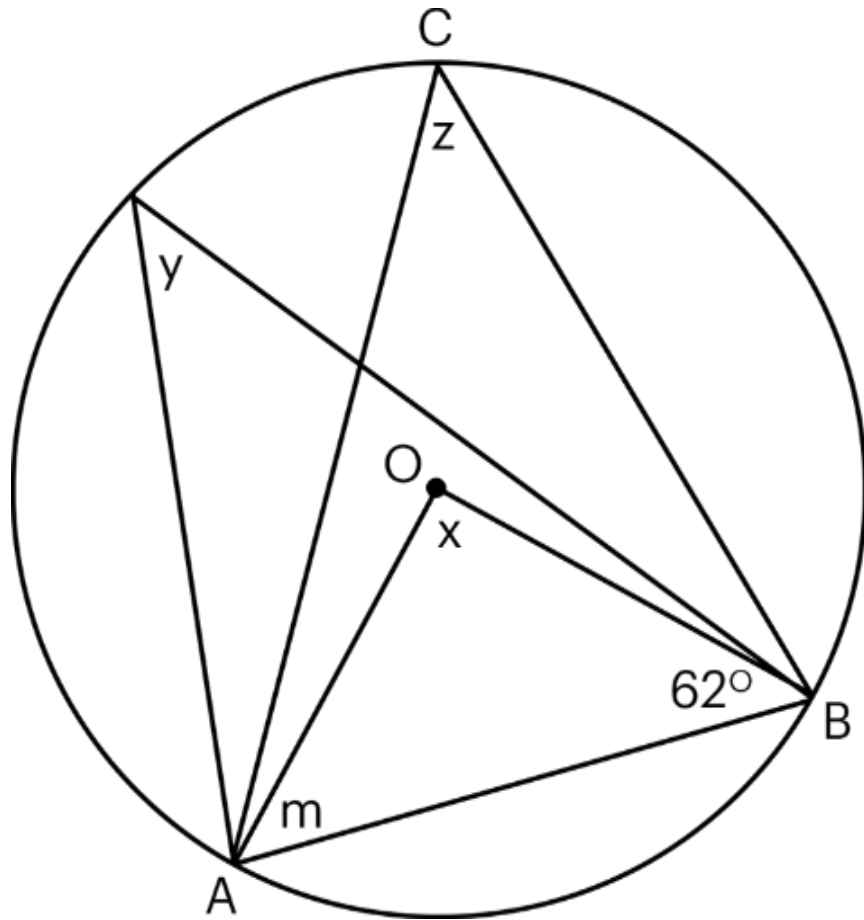


STATEMENT	REASON
$x = 20^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference



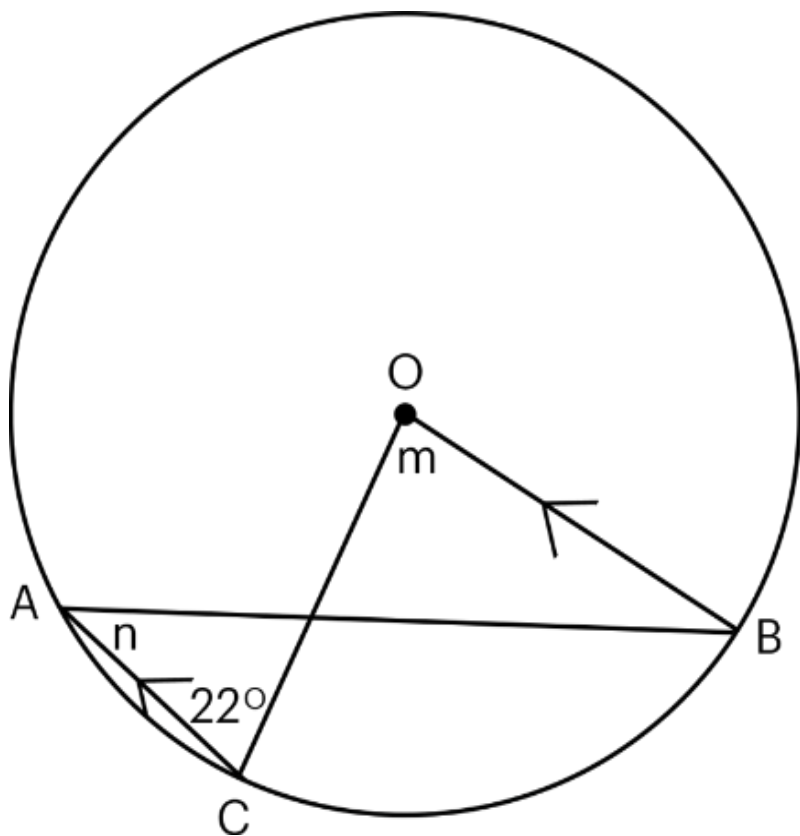
STATEMENT	REASON
$x = 18^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference

(e)



STATEMENT	REASON
$m = 62^\circ$	$\angle$ opp equal sides
$62^\circ + 62^\circ + x = 180^\circ$ $x = 56^\circ$	Sum of $\angle$ in a Δ
$y = z = 28^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference

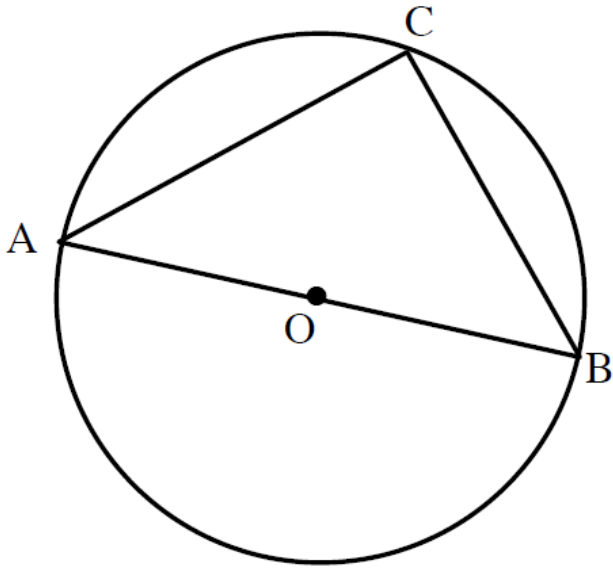
(f)



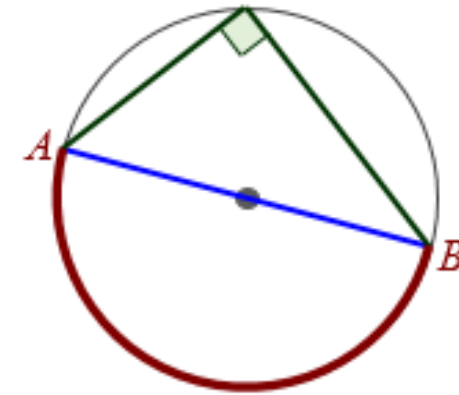
STATEMENT	REASON
$m = 22^\circ$	Alt $\angle$ s $AC \parallel OB$
$n = 11^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference

Theorem 3

- ❑ The angle subtended at the circle by a diameter is a right angle.
- ❑ We say that the angle in a semi-circle is 90° ($\angle$ in a semi-circle)
- ❑ In the diagram below, $\angle C$ is 90°



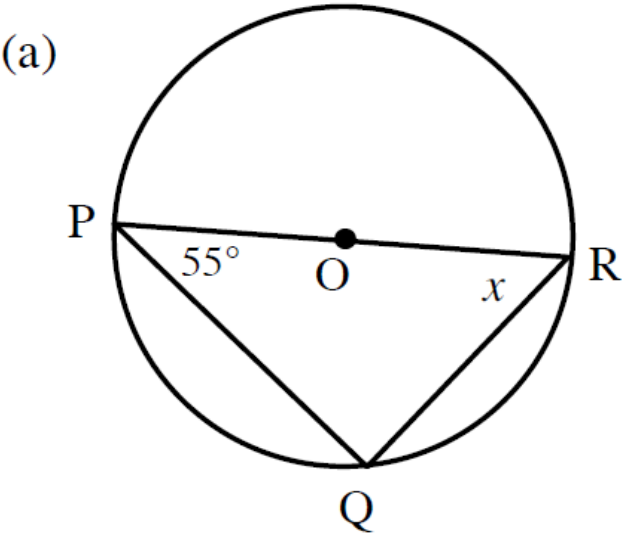
Angles in a Semi-Circle



Angles in a semi-circle (or subtended by the diameter) are 90° .

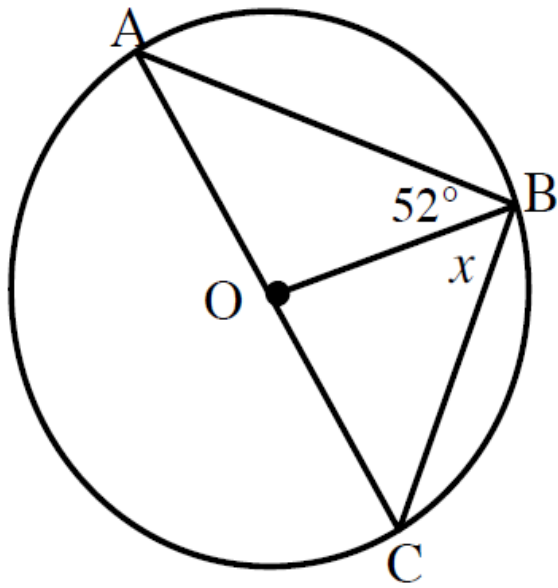
Questions on Theorem 3

Calculate the value of the unknown variables.
O is the centre in each case



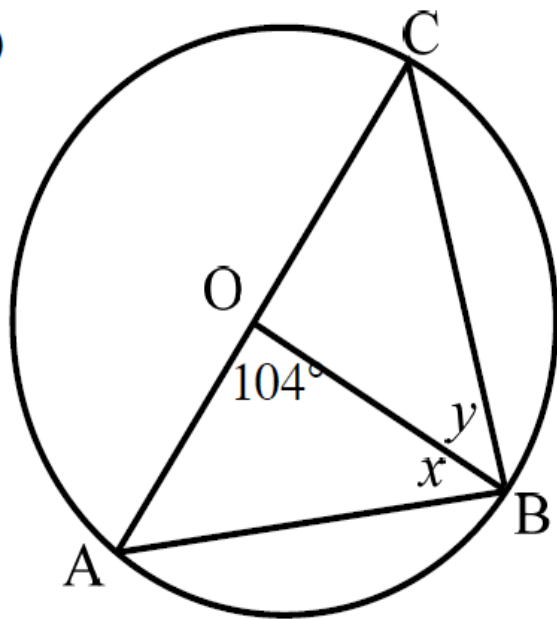
STATEMENT	REASON
$Q = 90^\circ$	$\angle$ s in a semi circle
$55^\circ + 90^\circ + x = 180^\circ$	Sum of $\angle$ s in a triangle
$x = 35^\circ$	

(b)



STATEMENT	REASON
$B = 90^\circ$	$\angle$ s in a semi circle
$52^\circ + x = 90^\circ$	
$x = 38^\circ$	

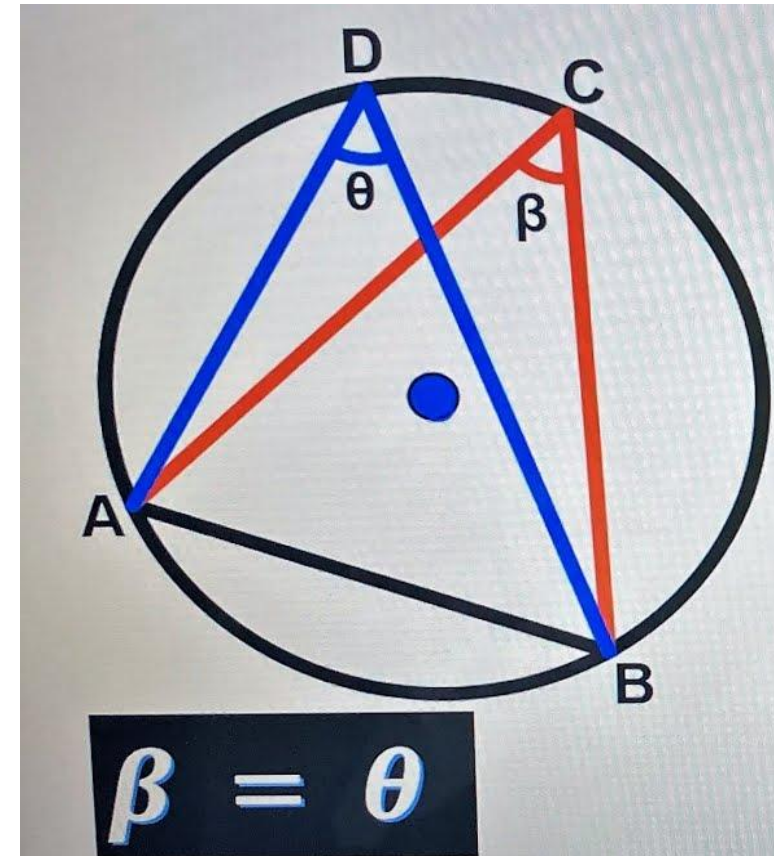
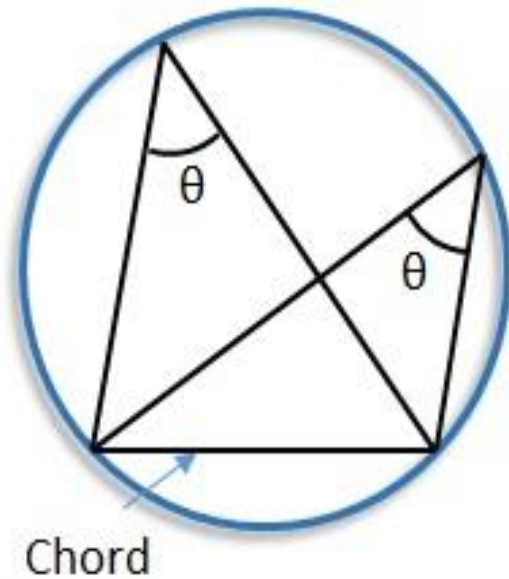
(c)



STATEMENT	REASON
$A = x$	$\angle$ s opp equal sides (equal radii)
$A + x + 104 = 180^\circ$ $2x + 104 = 180$ $2x = 76^\circ$ $x = 38^\circ$	sum of $\angle$ s in a triangle
$y + x = 90^\circ$ $y + 38^\circ = 90^\circ$ $y = 52^\circ$	$\angle$ s in a semi circle

Theorem 4

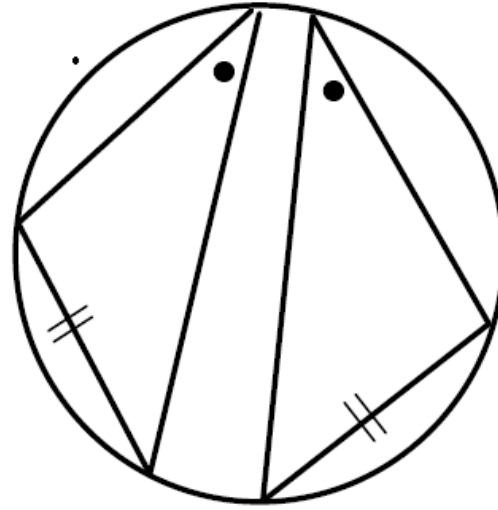
- ❑ An arc or chord of a circle subtends equal angles at the circumference of the circle.
- ❑ We say that the angles in the same segment of the circle are equal. (arc / chord subtends equal $\angle$ s)



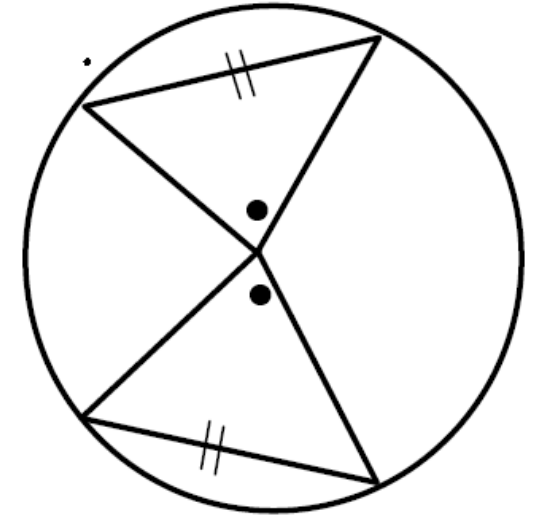
Corollaries of Theorem 4

- ❖ A corollary is a result that can be readily deduced from another theorem or proposition, typically with a short or obvious proof
- ❖ Corollaries are used to make theorems easier to apply and understand, by providing simpler or more specific versions of the main result

1. Equal chords subtend equal angles at the circumference



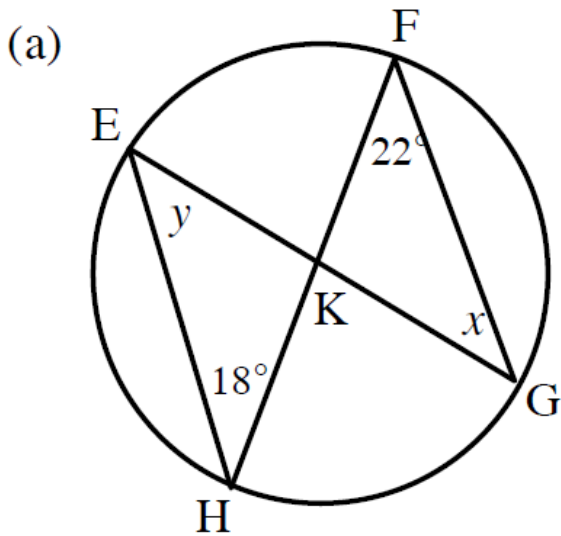
2. Equal chords subtend equal angles at the centre



Questions on Theorem 4

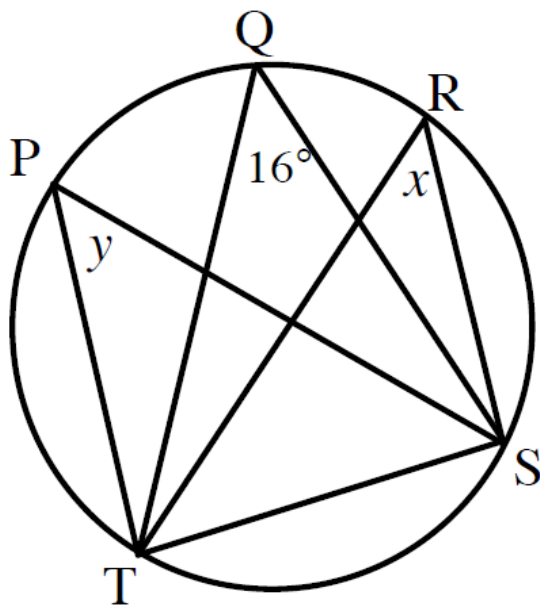
Calculate the value of the unknown variables.

O is the center in each case



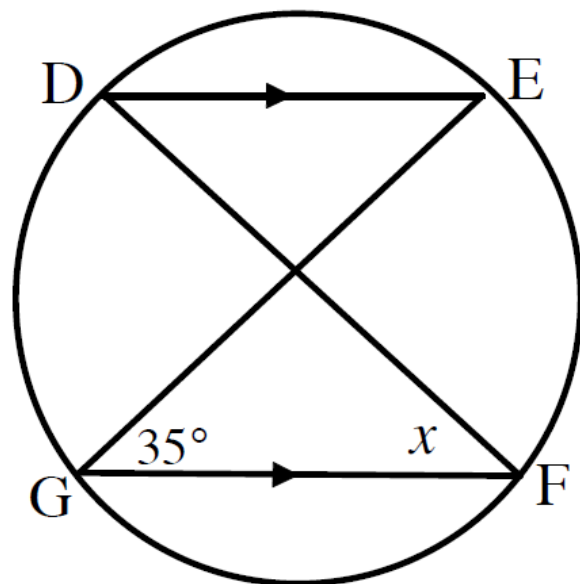
STATEMENT	REASON
$y = 22^\circ$	$\angle$ s in the same segment
$x = 18^\circ$	$\angle$ s in the same segment

(b)



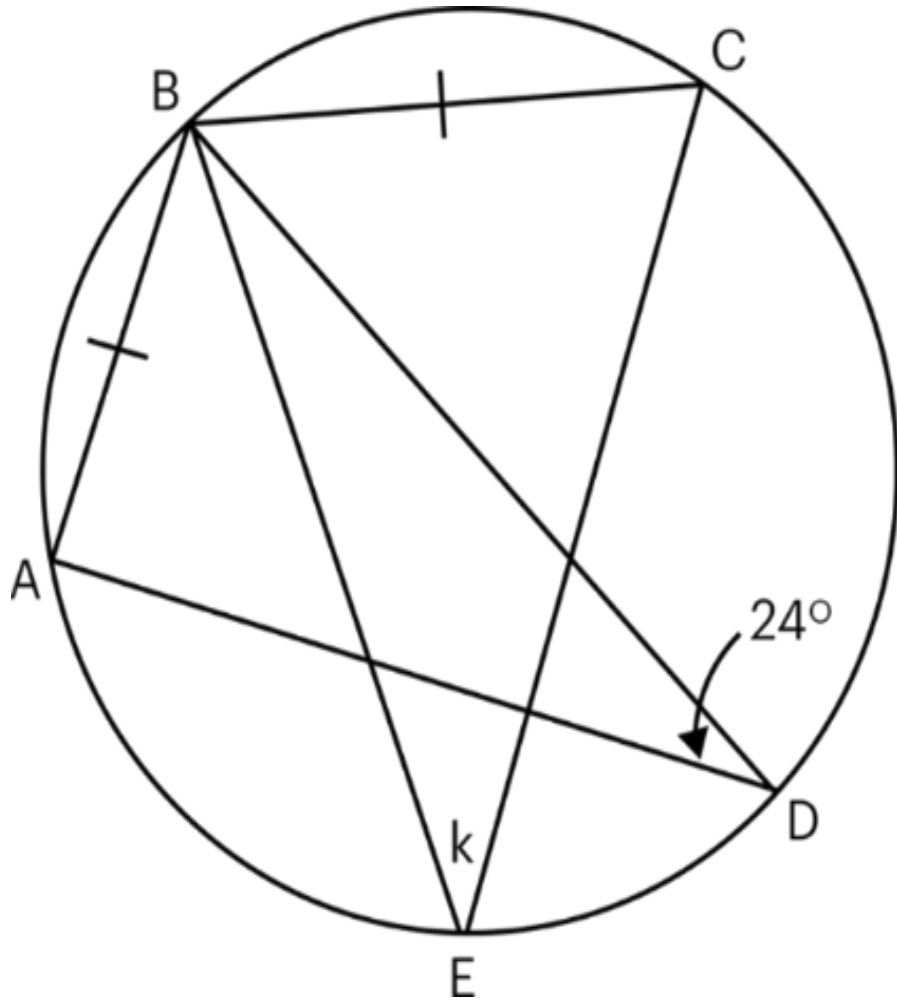
STATEMENT	REASON
$y = x = 16^\circ$	$\angle$ s in the same segment

(c)



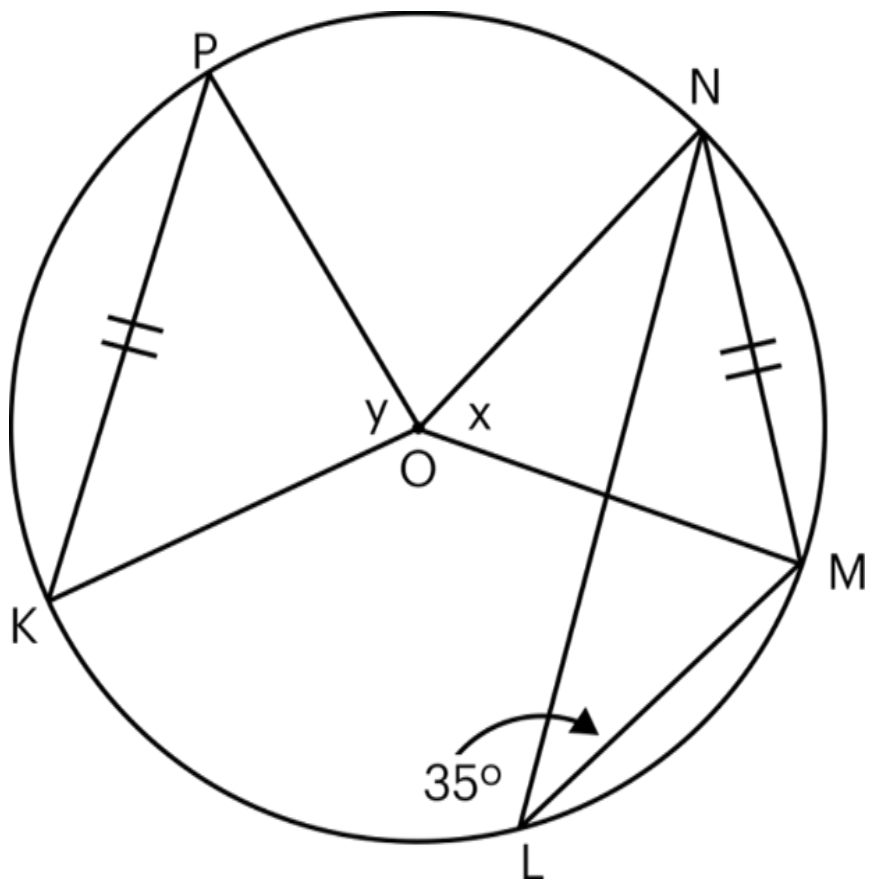
STATEMENT	REASON
$\angle DGE = 35^\circ$	Alt $\angle$ s $DE \parallel GF$
$x = 35^\circ$	$\angle$ s in the same segment

(d)



STATEMENT	REASON
$k = 24^\circ$	Equal chords subtend equal angles

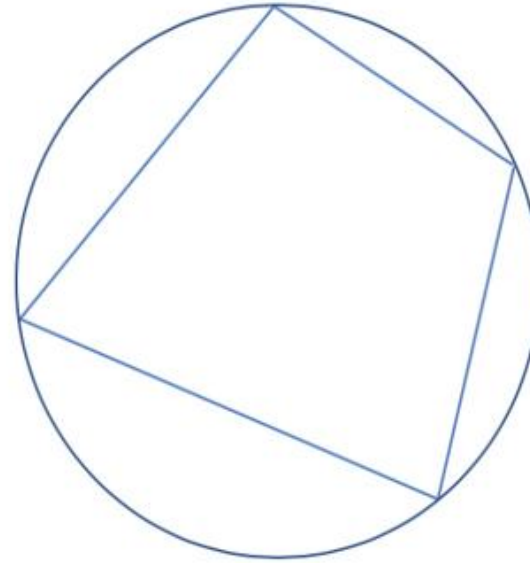
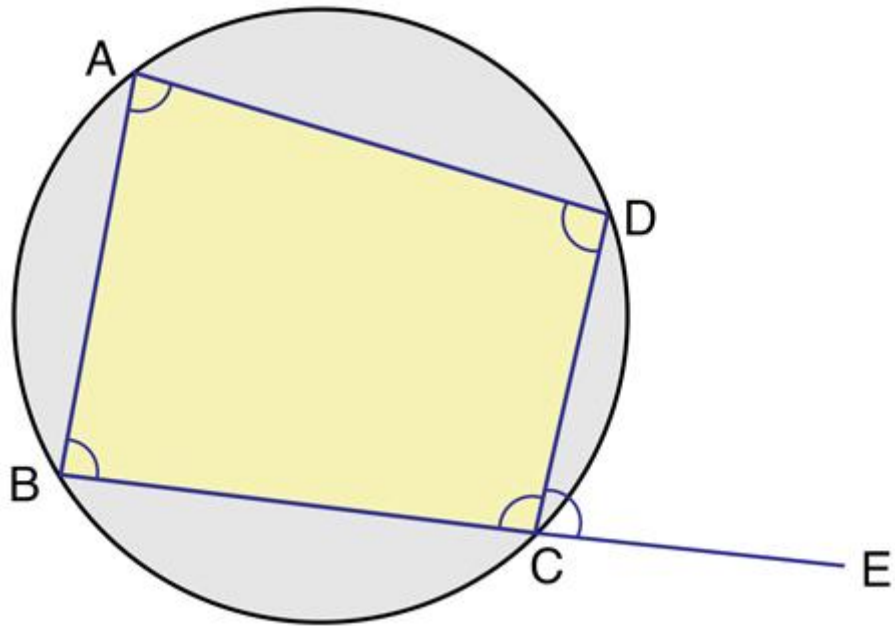
(f)



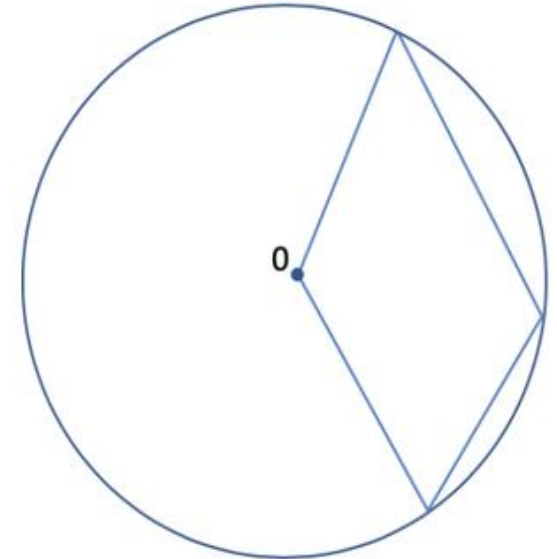
STATEMENT	REASON
$x = 70^\circ$	$\angle$ at centre = $2 \times \angle$ at circumference
$y = x = 70^\circ$	Equal chords subtend equal angles

A cyclic quadrilateral

- ❑ A cyclic quadrilateral is a quadrilateral which has all its four vertices lying on a circle.
- ❑ It is also sometimes called inscribed quadrilateral
- ❑ ABCD is a cyclic quadrilateral because A, B, C and D are concyclic.



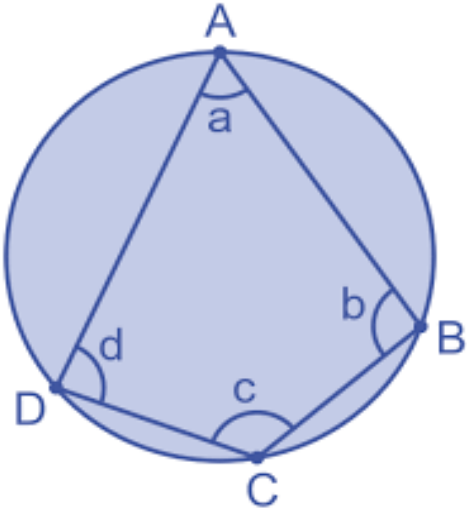
Cyclic
Quadrilateral



Not a Cyclic
Quadrilateral

Theorem 5

- The opposite angles of a cyclic quadrilateral are supplementary (add up to 180°) (opp $\angle$ s cyclic quad)



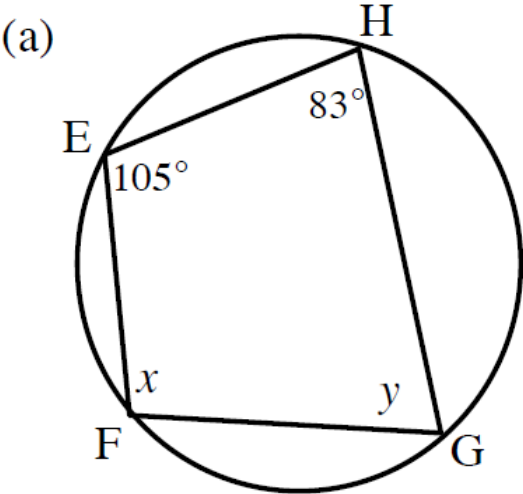
$$a + c = 180^\circ$$

$$d + b = 180^\circ$$

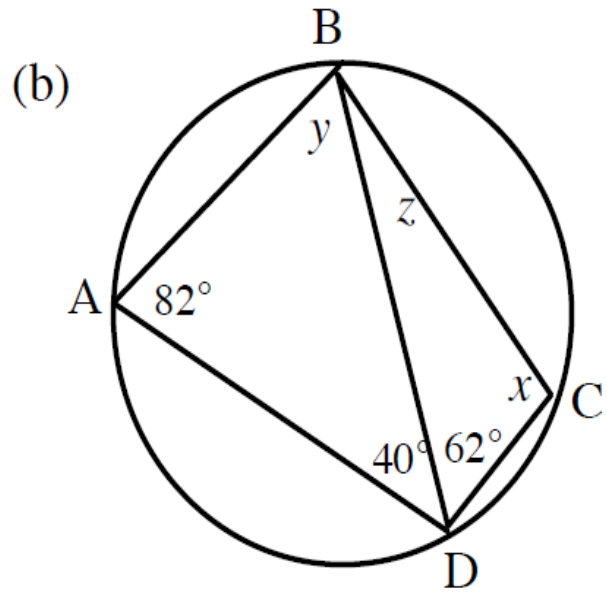
Questions on Theorem 5

Question 5

Calculate the value of the unknown variables in the following questions

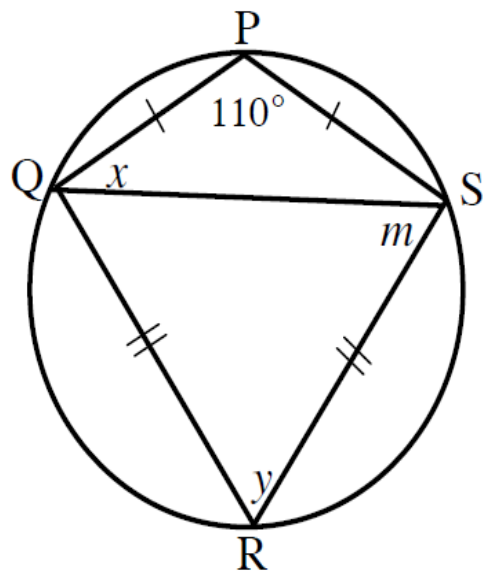


STATEMENT	REASON
$x + 83^\circ = 180^\circ$ $x = 97^\circ$	opp $\angle$ s of a cyclic quad
$y + 105^\circ = 180^\circ$ $y = 75^\circ$	opp $\angle$ s of a cyclic quad



STATEMENT	REASON
$x + 82^\circ = 180^\circ$ $x = 98^\circ$	opp $\angle$ s of a cyclic quad
$z + 98^\circ + 62^\circ = 180^\circ$ $z = 20^\circ$	Sum of $\angle$ s in a triangle
$y + 82^\circ + 40^\circ = 180^\circ$ $y = 58^\circ$	Sum of $\angle$ s in a triangle

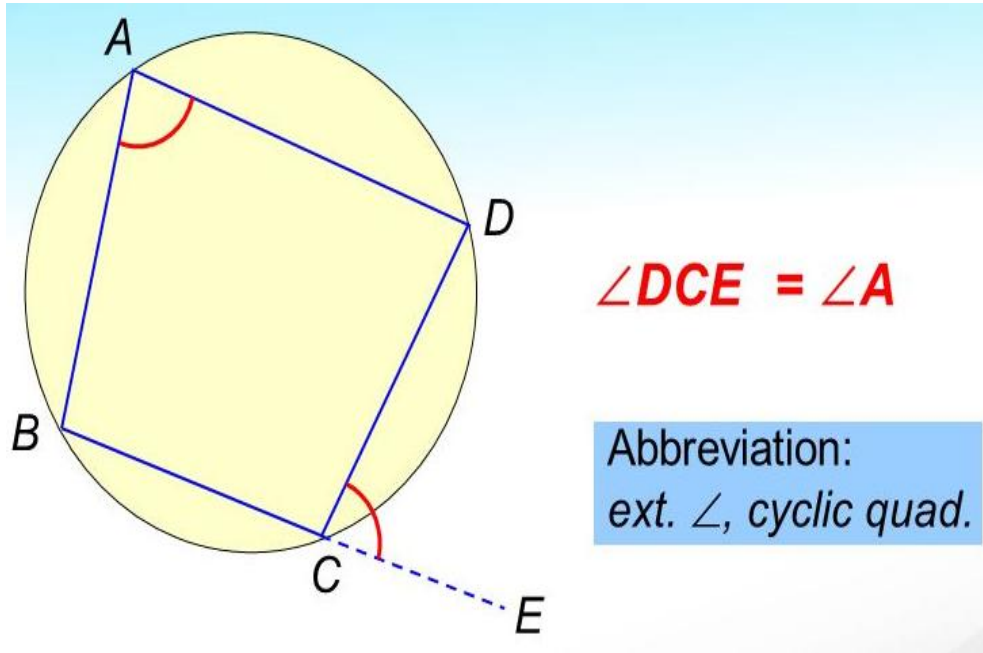
(c)



STATEMENT	REASON
$y + 110^\circ = 180^\circ$ $y = 70^\circ$	opp $\angle$ s of a cyclic quad
$\angle PSQ = x$ $x + \angle PSQ + 110^\circ = 180^\circ$ $2x = 70^\circ$ $x = 35^\circ$	$\angle$ s opp equal sides Sum of $\angle$ s in a triangle
$\angle RQQ = m$ $m + \angle RQQ + 70^\circ = 180^\circ$ $2m = 110^\circ$ $m = 55^\circ$	$\angle$ s opp equal sides Sum of $\angle$ s in a triangle

Theorem 6

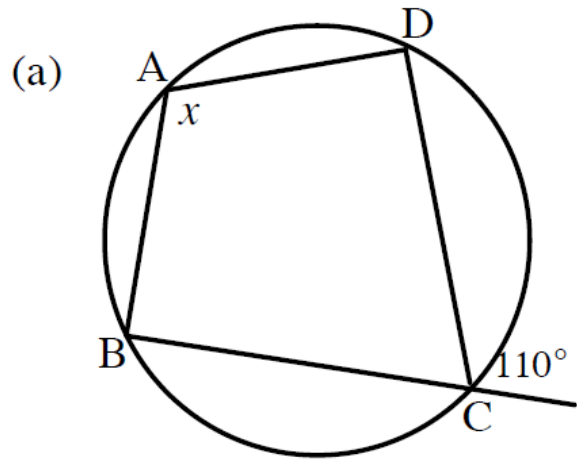
- An exterior angle of a cyclic quadrilateral is equal to the interior opposite angle. (ext $\angle$ of cyclic quad)



Questions on Theorem 6

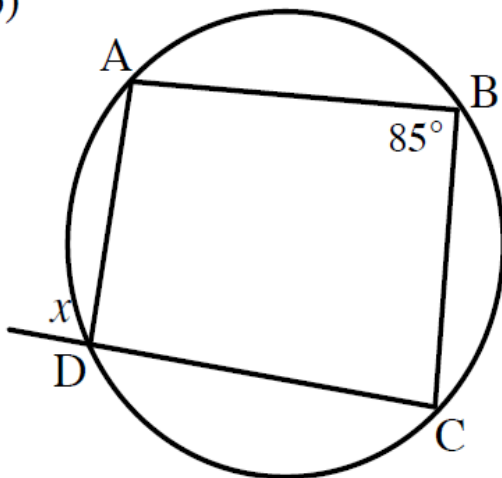
Question 6

Calculate the value of the unknown variables in the following questions



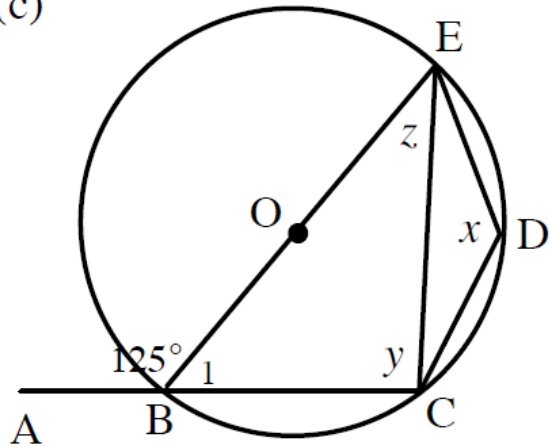
STATEMENT	REASON
$x = 110^\circ$	Ext $\angle$ of a cyclic quad equal to the interior opp angle

(b)



STATEMENT	REASON
$x = 85^\circ$	Ext $\angle$ of a cyclic quad equal to the interior opp angle

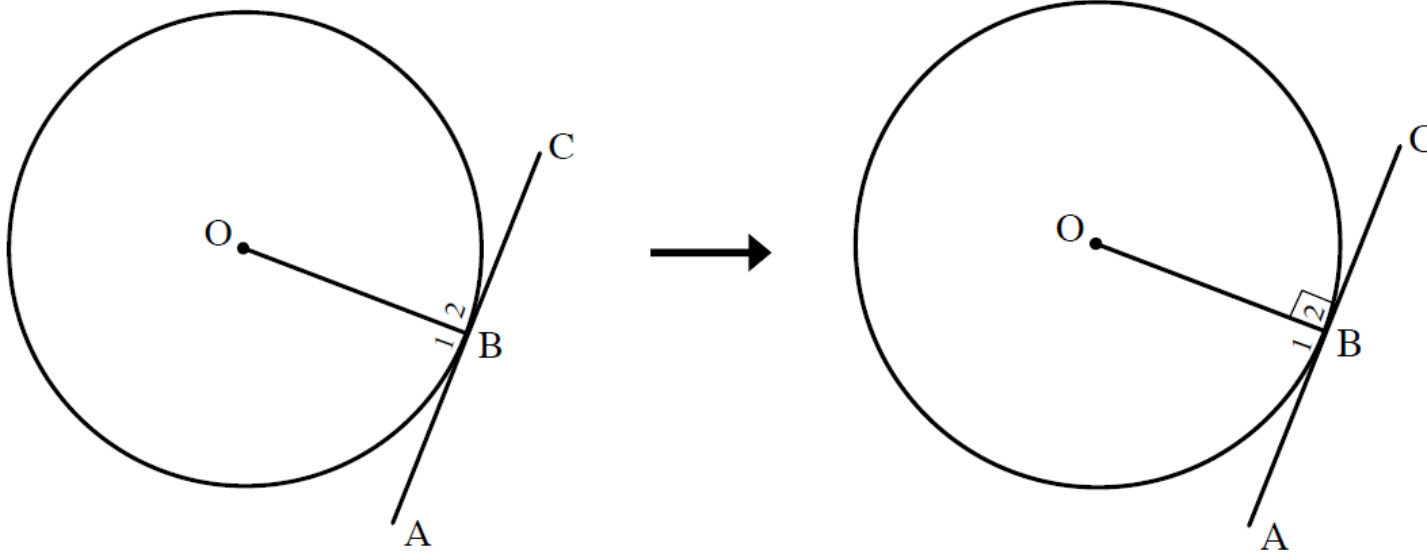
(c)



STATEMENT	REASON
$x = 125^\circ$	Ext $\angle$ of a cyclic quad equal to the interior opp angle
$y = 90^\circ$	$\angle$ s in a semi circle
$B_1 + 125^\circ = 180$ $B_1 = 55^\circ$	opp $\angle$ s of a cyclic quad
$90^\circ + 55^\circ + z = 180^\circ$ $z = 35^\circ$	Sum of $\angle$ s in a triangle

Theorem 7

- ❑ The tangent to a circle is perpendicular to the radius or diameter at their point of contact
- ❑ In the diagram below, If ABC is a tangent to the circle at B, then the radius $OB \perp ABC$ i.e. $\angle B_1 = \angle B_2$



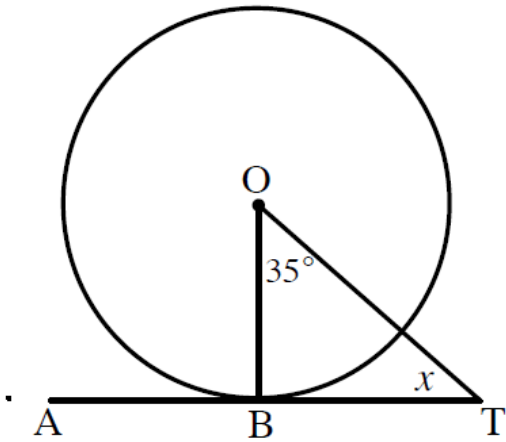
Questions on Theorem 7

Find the values of the angles indicated with a letter in the following diagrams.

O always represents the centre of the circle, and radii do indeed meet the tangent at the point of contact

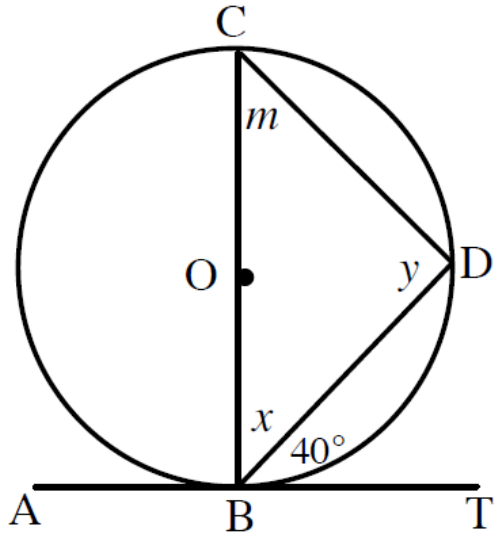
Question 7

(a)



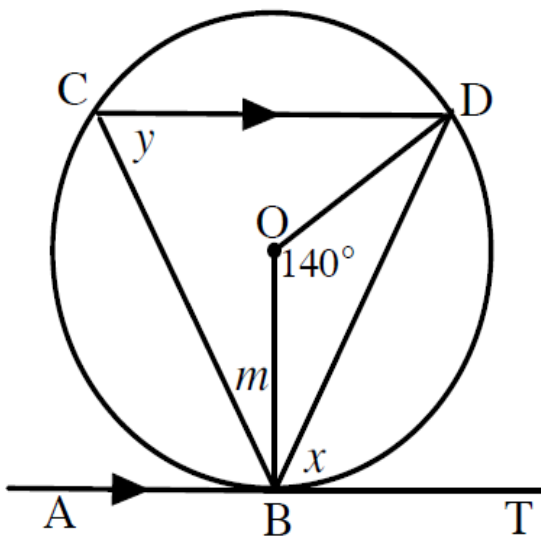
STATEMENT	REASON
$\angle OBT = 90^\circ$	Rad perp to tangent
$x + 35^\circ + 90^\circ = 180^\circ$ $x = 55^\circ$	Sum of $\angle$ s in a triangle

b)



STATEMENT	REASON
$x + 40^\circ = 90^\circ$ $x = 50^\circ$	Diameter perp to tangent
$y = 90^\circ$	$\angle$ s in a semi circle
$50^\circ + 90^\circ + m = 180^\circ$ $m = 40^\circ$	Sum of $\angle$ s in a triangle

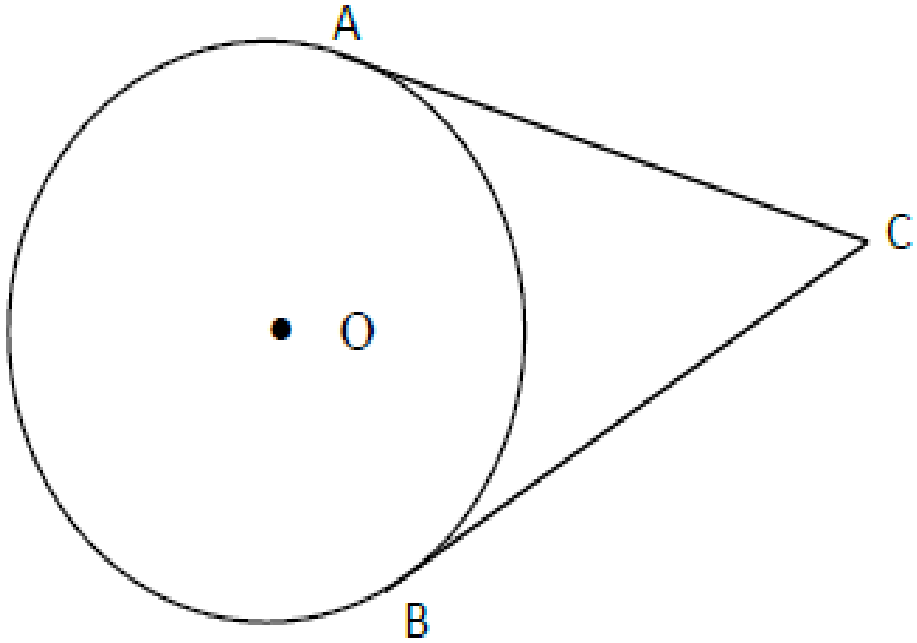
c)



STATEMENT	REASON
$y = 70^\circ$	$\angle$ at center = $2 \times \angle$ at circum
$\angle CBA = 70^\circ$	Alt $\angle$ s $CD \parallel AT$
$\angle CBA + m = 90^\circ$ $70^\circ + m = 90^\circ$ $m = 20^\circ$	Rad perp to tangent
$\angle OBD = \angle ODB$	$\angle$ s opp equal radii
$\angle OBD + \angle ODB + 140^\circ = 180^\circ$ $2\angle OBD = 40^\circ$ $\angle OBD = 20^\circ$	Sum of $\angle$ s in triangle
$x + \angle OBD = 90^\circ$ $x + 20^\circ = 90^\circ$ $x = 70^\circ$	Rad perp to tangent

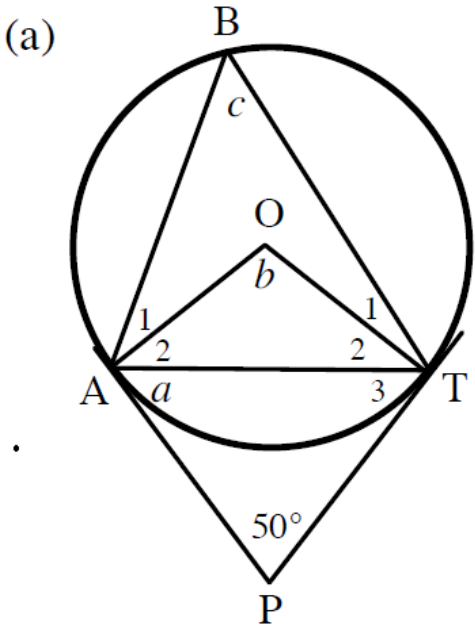
Theorem 8

Two tangents drawn to a circle from the same point outside the circle are equal in length i.e. $AC = BC$



Questions on Theorem 8

Find the values of the angles indicated with a letter in the following diagrams. O always represents the centre of the circle, and radii do indeed meet the tangent at the point of contact.



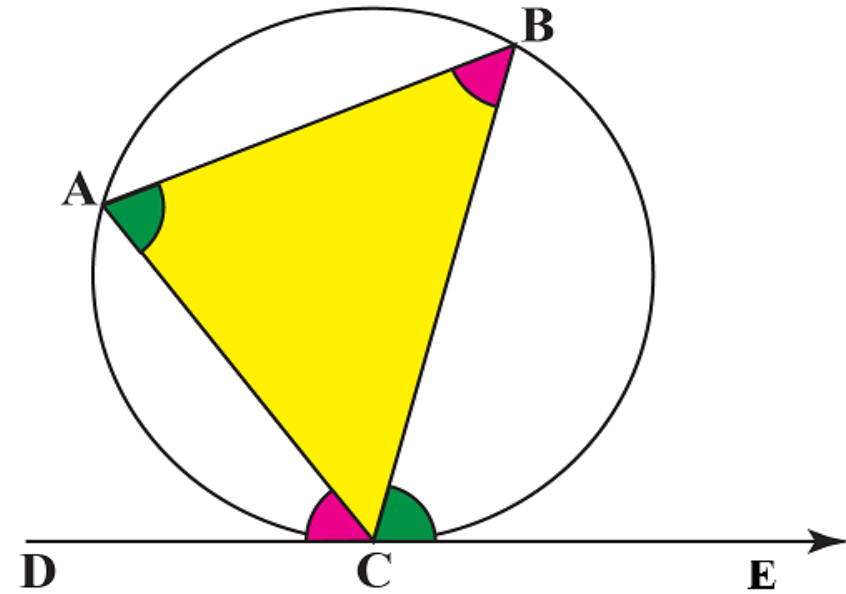
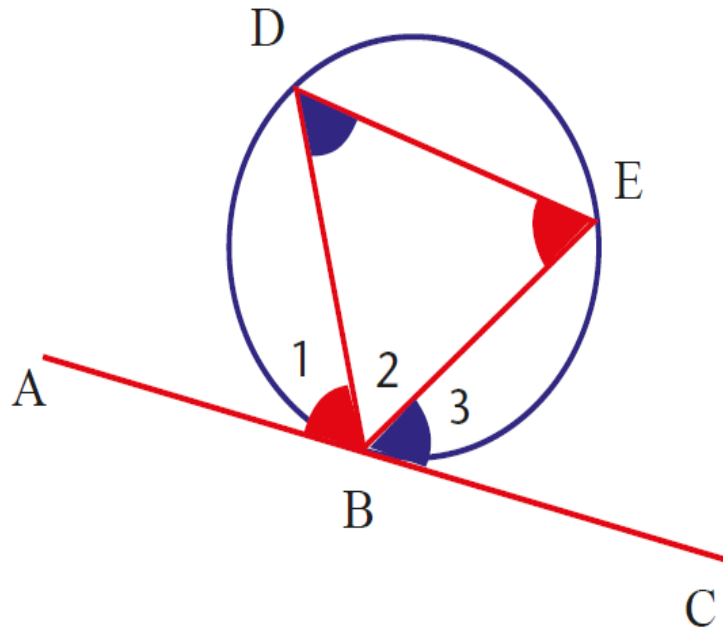
STATEMENT	REASON
$PA = PT$	Tangents drawn from same point
$a = T_3$	$\angle$ s opp equal sides
$a + T_3 + 50^\circ = 180^\circ$ $2a = 130$ $a = 65^\circ$	Sum of $\angle$ s in a triangle
$A_2 + a = 90^\circ$ $A_2 + 65^\circ = 90^\circ$ $A_2 = 25^\circ$ $A_2 = T_2$	Rad perp tang $\angle$ s opp equal sides
$A_2 + T_2 + b = 180^\circ$ $25^\circ + 25^\circ + b = 180^\circ$ $b = 130^\circ$	Sum of $\angle$ s in a triangle
$c = 65^\circ$	$\angle$ at center = $2 \times \angle$ at circum

Theorem 9

- ❖ The angle between a tangent to a circle and a chord drawn at the point of contact, is equal to the angle which the chord subtends in the alternate segment
- ❖ We usually say it is the tan-chord theorem
- ❖ In the diagram below:

$$\angle B_1 = \angle E$$

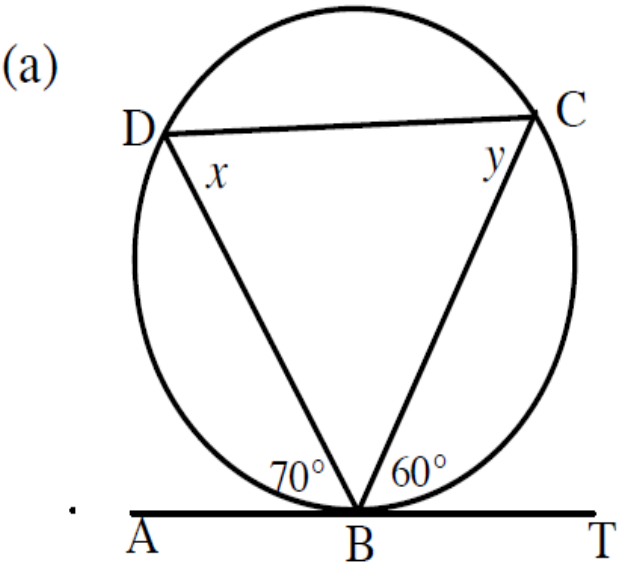
$$\angle B_3 = \angle D$$



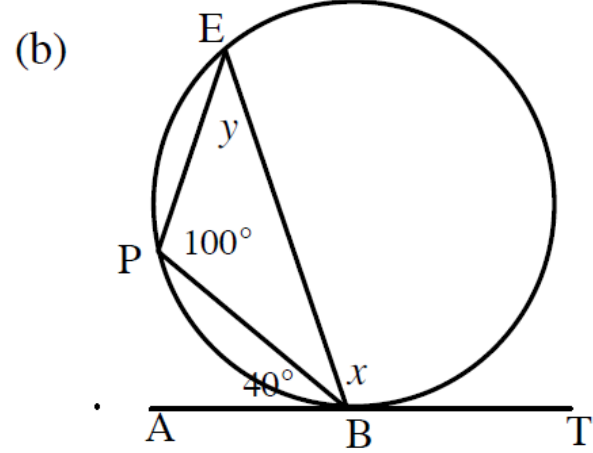
Questions on Theorem 9

Calculate the value of the unknown angles.

O is the centre and ABT is a tangent to the circle.

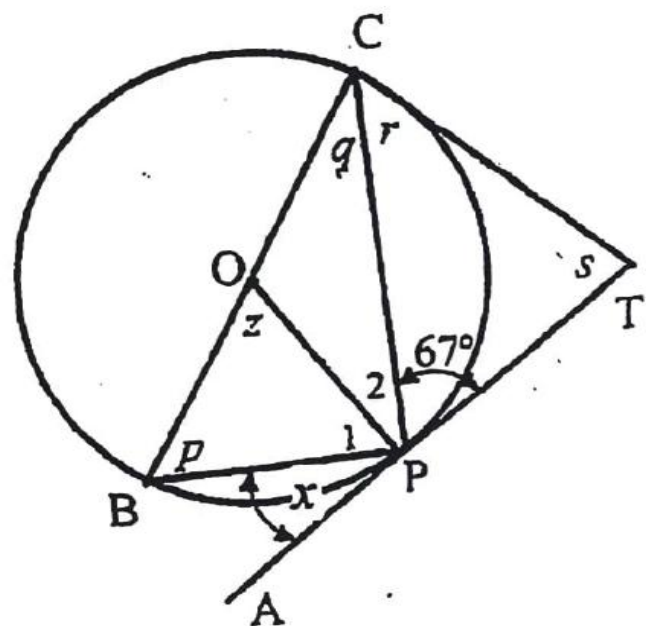


STATEMENT	REASON
$y = 70^\circ$	Tan chord
$x = 60^\circ$	Tan chord



STATEMENT	REASON
$y = 40^\circ$	Tan chord theorem
$x = 100^\circ$	Tan chord theorem

(c)



STATEMENT	REASON
$CT = PT$	Tangents drawn from same point
$r = 67^\circ$	$\angle$ s opp equal sides
$67^\circ + 67^\circ + s = 180^\circ$ $s = 46^\circ$	Sum of $\angle$ s in a triangle
$p = 67^\circ$	Tan-chord theorem
$p = P_1 = 67^\circ$ $67^\circ + 67^\circ + z = 180^\circ$ $z = 46^\circ$	$\angle$ s opp equal radii/equal sides Sum of $\angle$ s in a triangle
$q = 23^\circ$	$\angle$ at center = $2 \times \angle$ at circum
$x = 23^\circ$	Tan-chord theorem

EUCLIDEAN GEOMETRY GRADE 11 PART TWO

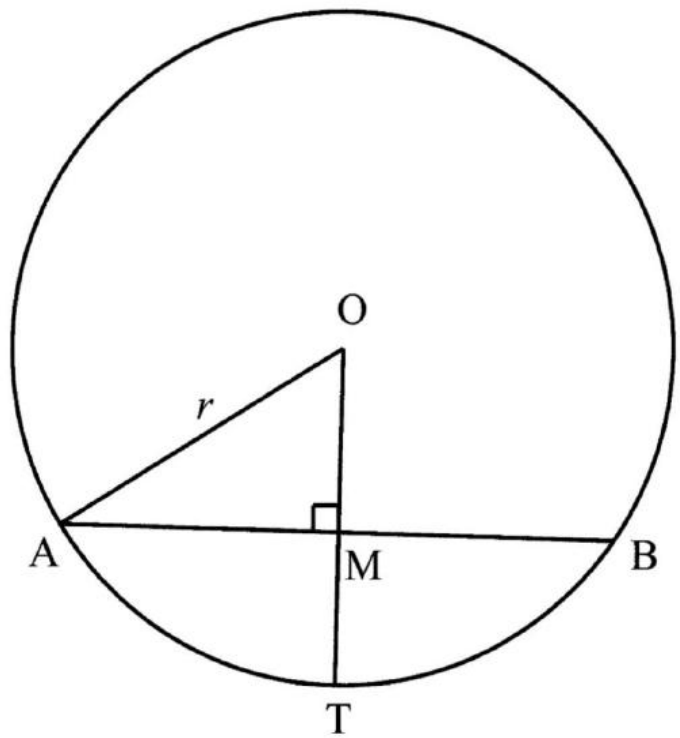


PAST EXAM PAPERS

2022 KwaZulu Natal Preliminary Paper 2 Q 8

8.1 Complete the following statement:
The line drawn from the center of a circle perpendicular to the chord..... (1)

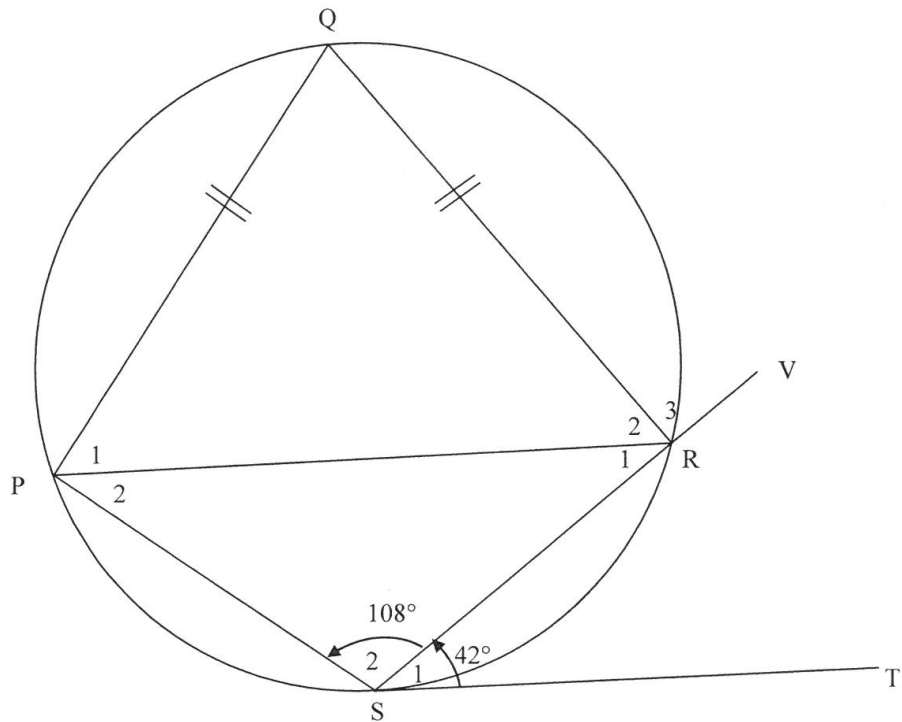
8.2 The circle below with centre O has chord $AB = 8\text{cm}$.
 $OMT \perp AB$ with $MT = 2\text{cm}$. The radius of the circle is r .



- 8.2.1 Write down, with a reason the value of AM (2)
- 8.2.2 Calculate the length of the radius of the circle (4)

2017 March Paper 2 Q 8

In the diagram, PQRS is a cyclic quadrilateral. ST is a tangent to the circle at S and chord SR is produced to V. $PQ = QR$ and $\angle S_1 = 42^\circ$ and $\angle S_2 = 108^\circ$.

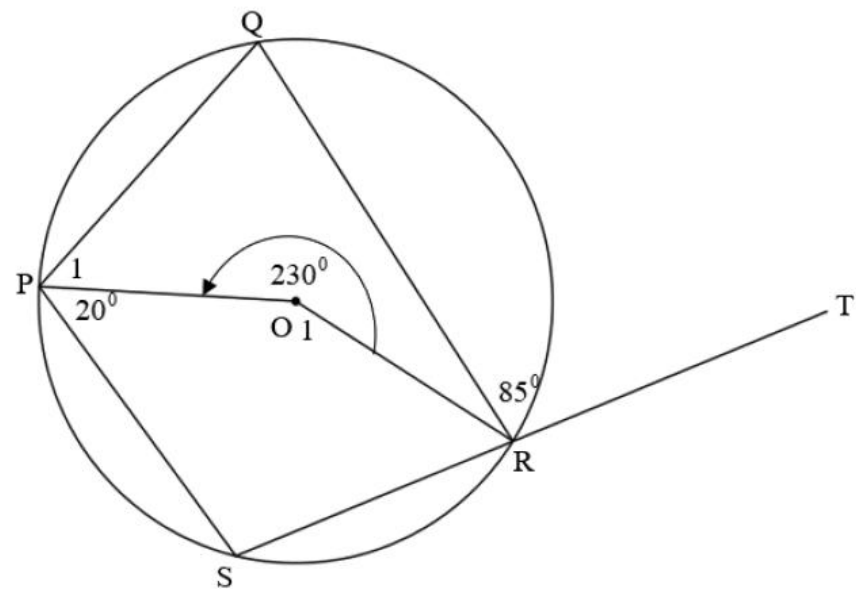


Determine with reasons the size of the following angles

- 8.1 $\angle Q$ (2)
- 8.2 $\angle R_2$ (2)
- 8.3 $\angle P_2$ (2)
- 8.4 $\angle R_3$ (2)

2024 Eastern Cape November Paper 2 Q 9.2-9.3

In the diagram, O is the center of the circle with a reflex angle of 230° . P, Q, R and S are points on the circumference of the circle with chord SR extended to point T. $\angle QRT = 85^\circ$ and $\angle OPS = 20^\circ$.

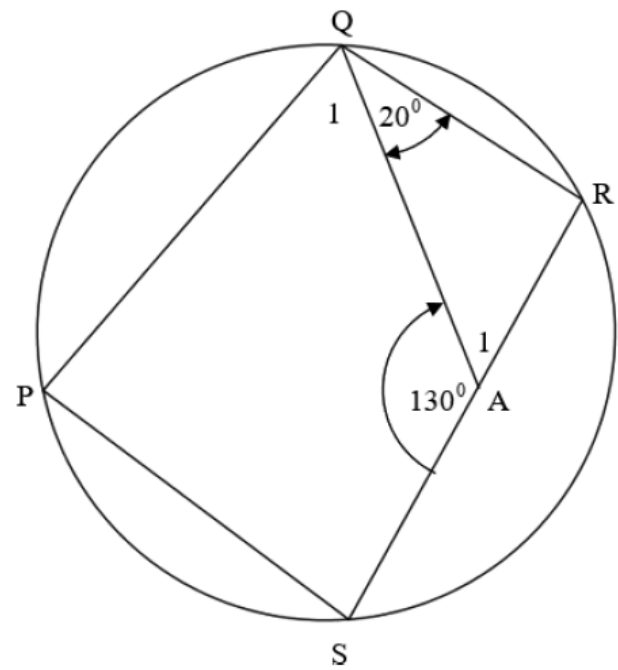


Calculate, with reasons the value of the following angles

- 9.2.2. $\angle S$ (2)
- 9.2.2 $\angle Q$ (2)
- 9.2.3 $\angle P_1$ (2)

CONTINUED.....

9.3 In the diagram, PQRS is a cyclic quadrilateral. QA intersects SR at point A. $\angle SAQ = 130^\circ$ and $\angle AQR = 20^\circ$



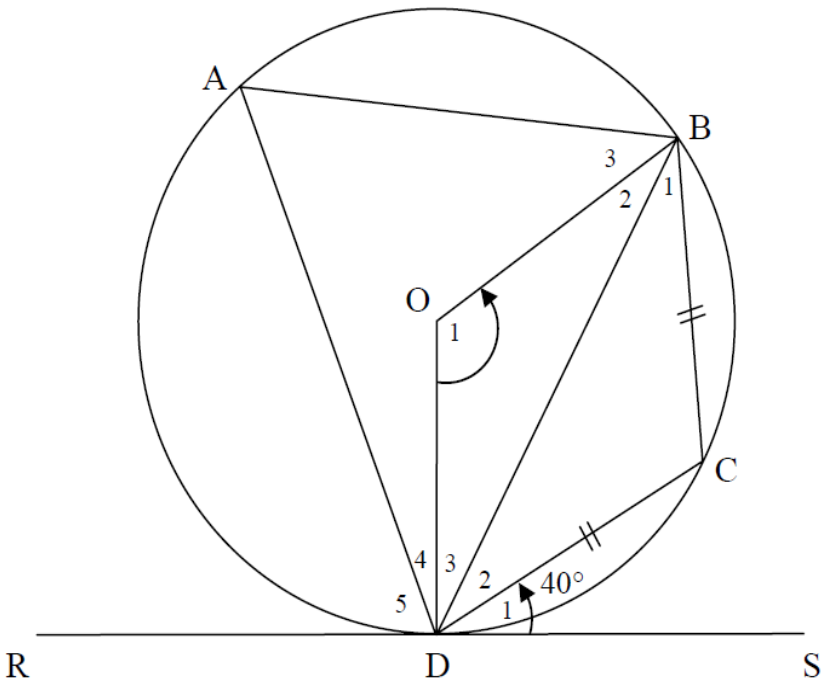
Calculate, giving reasons the size of $\angle P$ (4)

2008 November Paper 3 Q 7

Complete the statements below by filling in the missing word(s) so that the statements are CORRECT:

- 7.1.1 The angle subtended by a chord at the centre of a circle is (1)
- 7.1.2 The angle between the tangent and a chord is (1)
- 7.1.3 The opposite angles of a cyclic quadrilateral are (1)

In the figure below, RDS is a tangent to circle O at D.

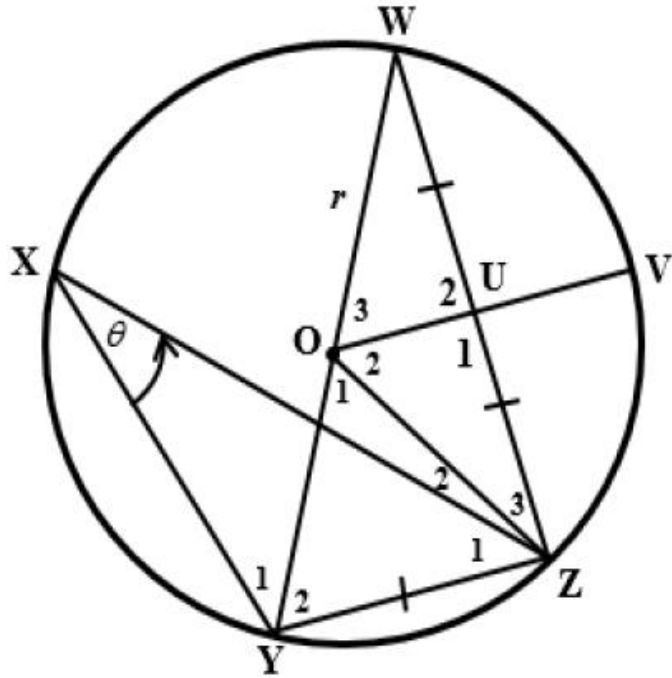


If $BC = DC$ and $\angle CDS = 40^\circ$ calculate, with reasons, the measures of:

- 7.2.1 $\angle BDC$ (2)
- 7.2.2 $\angle C$ (1)
- 7.2.3 $\angle A$ (1)
- 7.2.4 $\angle O_1$ (2)

O is the centre of the circle VWXYZ and U is the midpoint of chord WZ as indicated in the diagram. WOY is a straight line. $OW = \text{radius} = r$

WOY is a straight line. $OW = \text{radius} = r$



10.1.1 $\angle O_1$

10.1.2 W

10.1.3 $\angle Y_2$

(2)

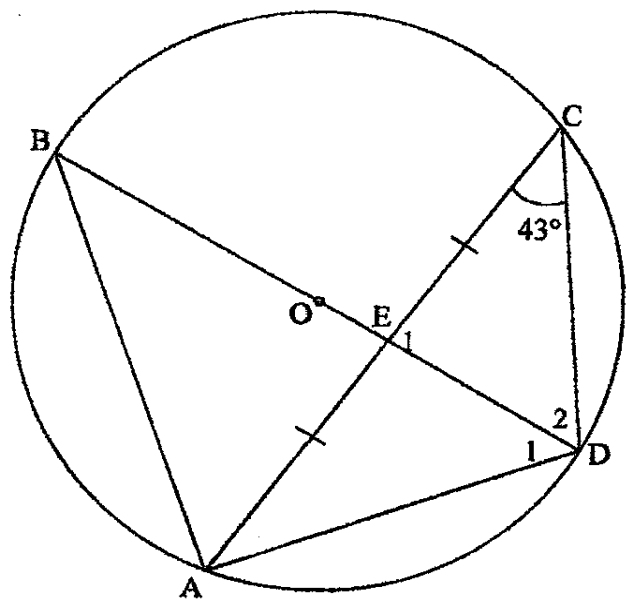
(2)

(2)

10.3 Hence or otherwise, calculate the value of UV if it is further given that $OU = 3 \text{ cm}$ and $UW = 4 \text{ cm}$ (2)

2015 Western Cape Preliminary Paper 2 Q 8

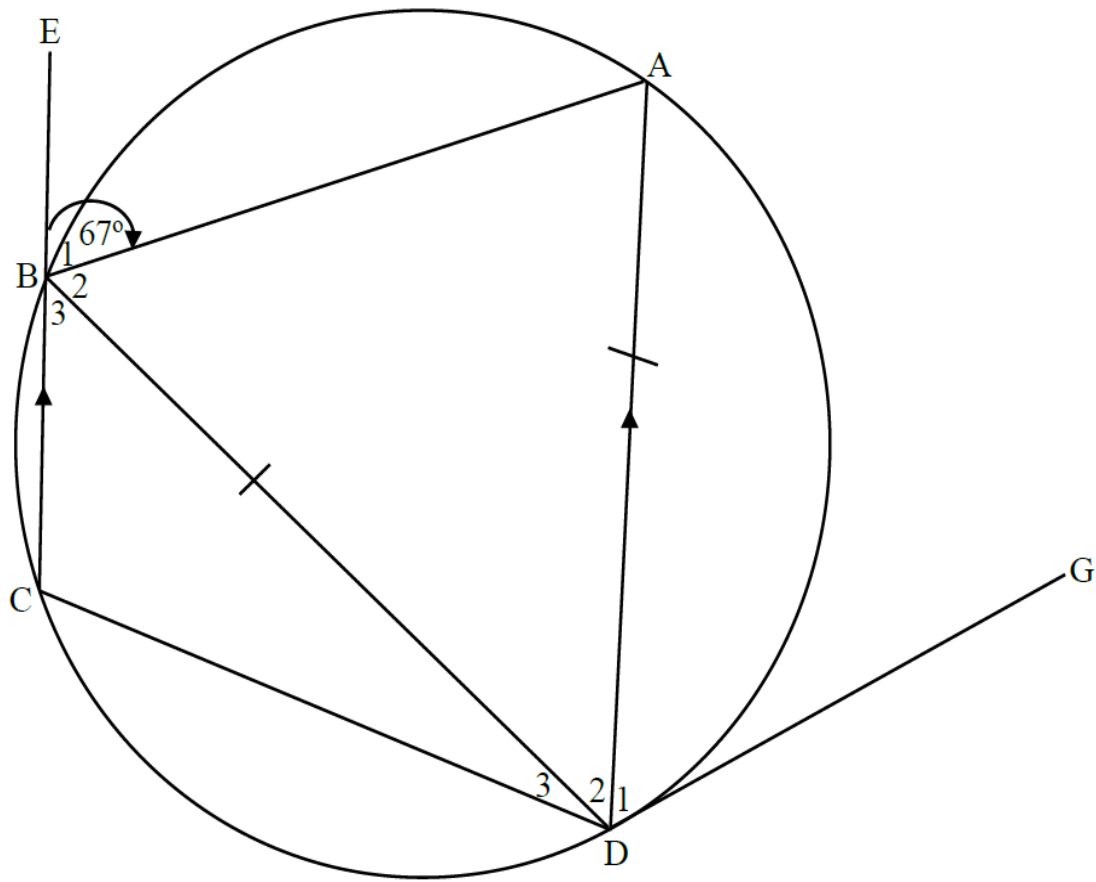
In the diagram, O is the centre of the circle. A, B, C and D are points on the circumference of the circle. Diameter BD bisects chord AC at E. Chords AB, CD and AD are drawn. $\angle C = 43^\circ$.



- 8.1 Give a reason for $DE \perp AC$. (1)
- 8.2 Calculate, giving reasons, the sizes of $\angle B$. (2)
- 8.3 Prove that $\angle E_1 = \angle BAD$. (2)
- 8.4 The length of the diameter of the circle is 28 units.
Calculate the length of AB. (2)

2020 Gauteng Preliminary Paper 2 Q 8

In the diagram below, points A, B, C and D lie on the circumference of a circle with $AD \parallel BC$.
CB is produced to E. GD is a tangent to the circle at D and $DB = AD$. $\angle EBA = 67^\circ$



8.1 Calculate, with reasons, the size of the following angles:

8.1.1 $\angle ADC$ (2)

8.1.2 $\angle C$ (1)

8.1.3 $\angle A$ (1)

8.1.4 $\angle D_2$ (3)

8.1.5 $\angle BDG$ (2)

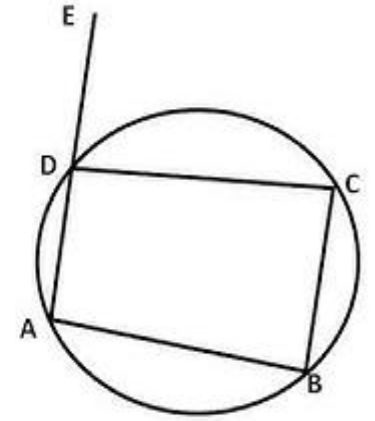
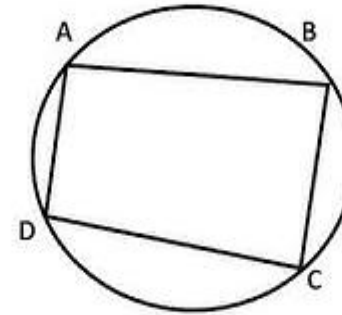
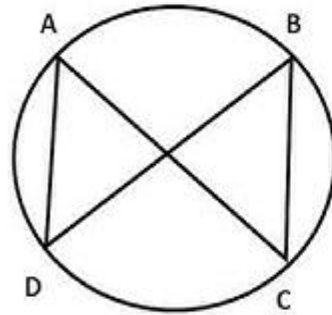
8.2 Prove that $AB = CD$. (2)

EUCLIDEAN GEOMETRY GRADE 11 PART 3

Proving a quadrilateral is a cyclic quadrilateral

- ❑ There are **THREE WAYS** to prove that a shape is a cyclic quadrilateral and there are as follows:
- ❑ Prove that the opposite interior angles of the quadrilateral are supplementary, then the quadrilateral is cyclic.
- ❑ Prove that the exterior angle of the quadrilateral is equal to the opposite interior angle, then the quadrilateral is cyclic.
- ❑ If the angles in the same segment of a circle are equal, then the quadrilateral made by the chord and the two angles must be a cyclic quadrilateral.

How to prove if a quadrilateral is cyclic



2010 March Paper 3 Q 9

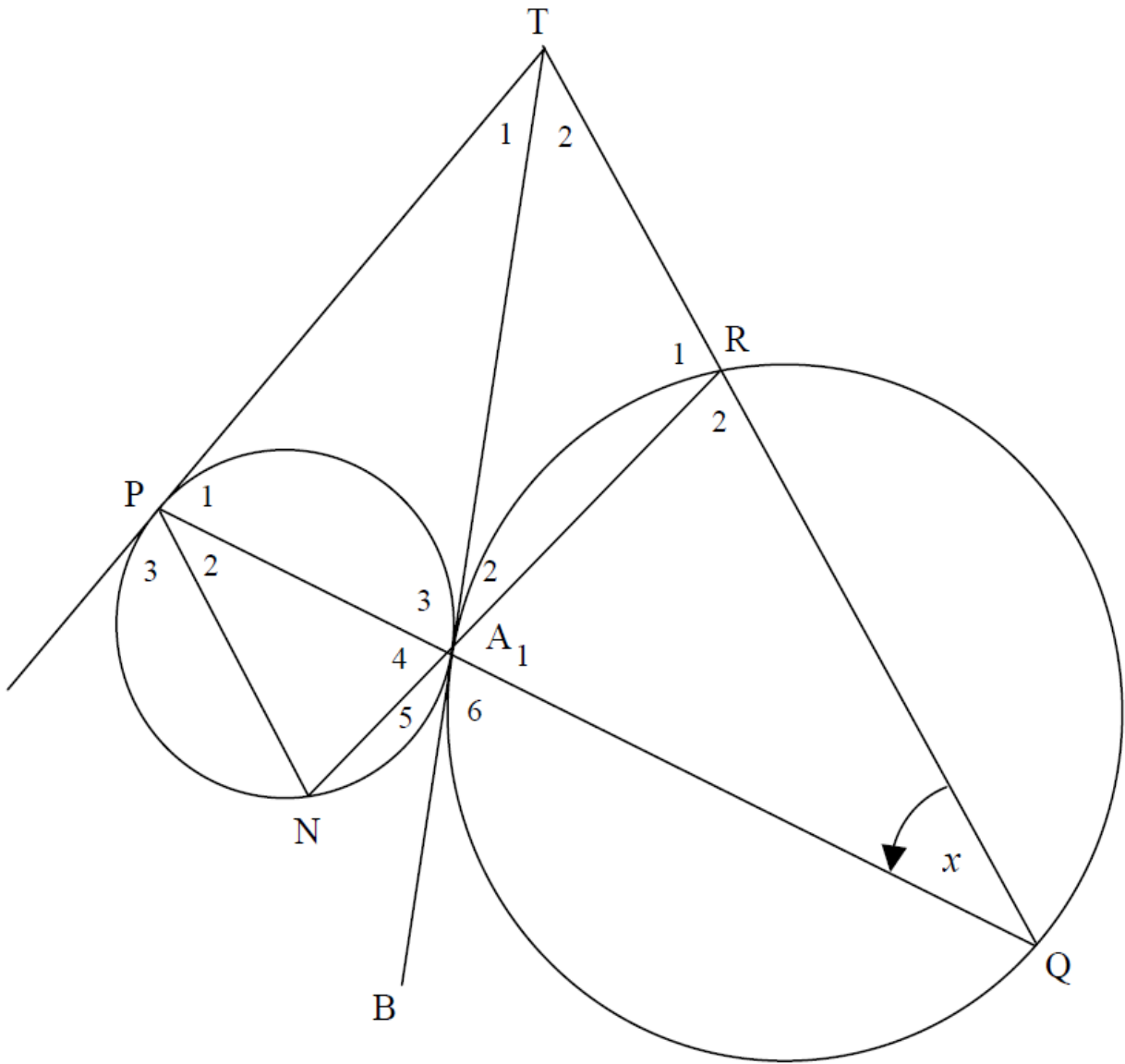
Complete the following statement:

9.1 The angle between the tangent and the chord (1)

9.2 In the diagram below, two circles have a common tangent TAB. PT is a tangent to the smaller circle. PAQ; QRT and NAR are straight lines. Let $\angle Q = x$.

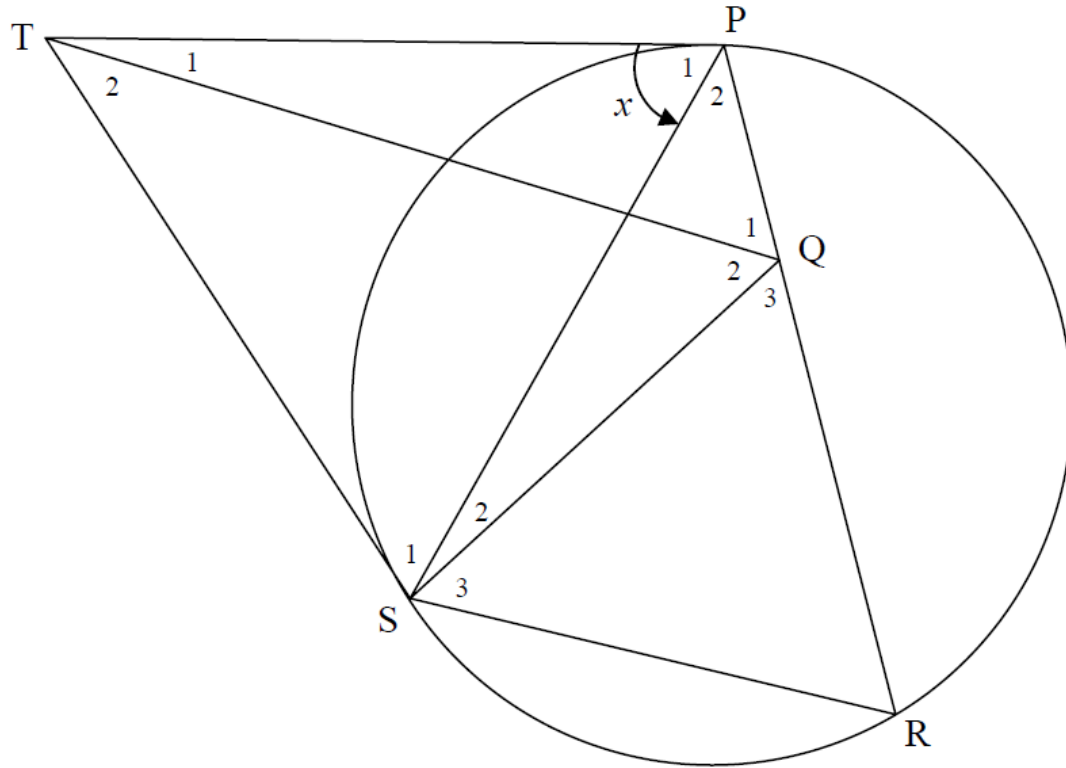
9.2.1 Name, with reasons, THREE other angles equal to x . (5)

9.2.2 Prove that APTR is a cyclic quadrilateral. (5)



2009 March Paper 3 Q 7

In the figure TP and TS are tangents to the given circle. R is a point on the circumference. Q is a point on PR such that $\angle Q_1 = \angle P_1$. SQ is drawn. Let $\angle P_1 = x$.



Prove that:

7.1 $TQ \parallel SR$

(4)

7.2 QPTS is a cyclic quadrilateral.

(4)

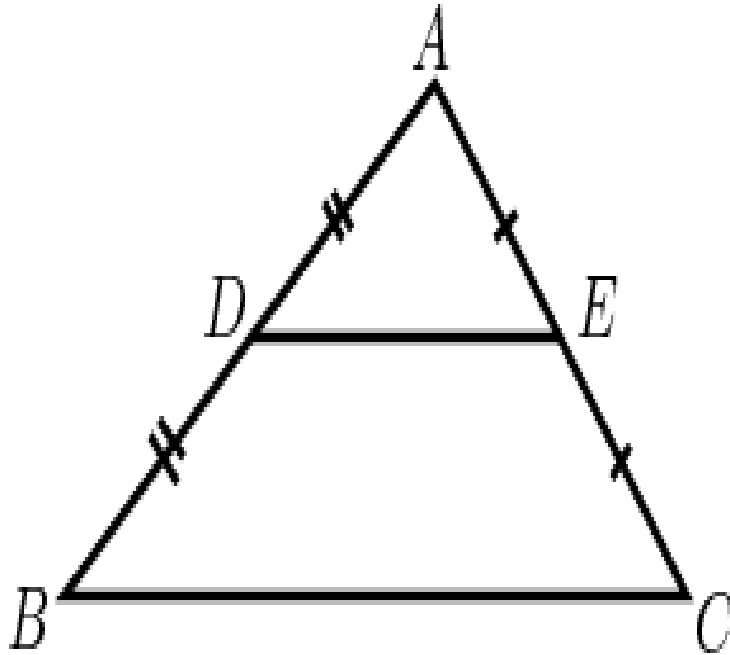
7.3 TQ bisects $\angle SQP$.

(3)

Mid-point Theorem

It states that the line segment connecting the midpoints of two sides of a triangle is parallel to the third side and is half the length of the third side.

Converse: The line drawn through the midpoint of one side of a triangle and parallel to another side bisects the third side.

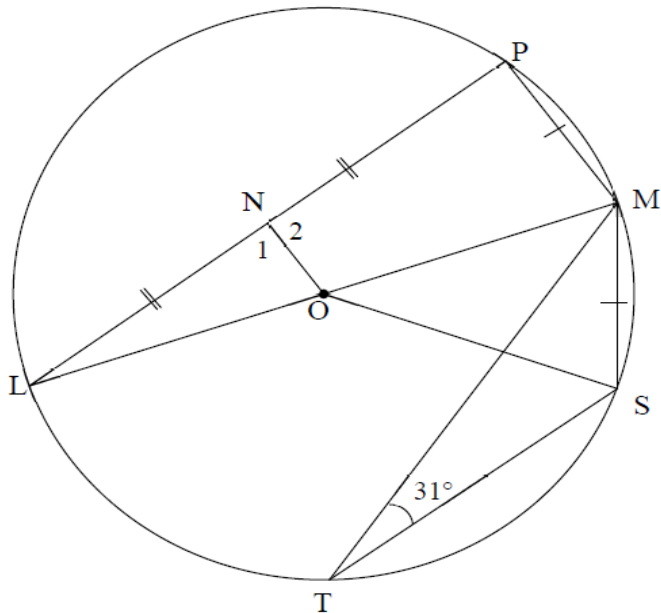


Given that $DE \parallel BC$, D as the midpoint of AB and E as the midpoint of AC then:

$$DE = \frac{1}{2}BC$$

2022 Limpopo Preliminary Paper 2 Q 8.1

8.1 In the diagram, O is the centre of the circle and LOM is a diameter of the circle. ON bisects chord LP at N. T and S are points on the circle on the other side of LM with respect to P. Chords PM, MS, MT and ST are drawn. $PM = MS$ and $\angle MTS = 59^\circ$.



8.1.1 Determine with reasons, the size of each of the following angles

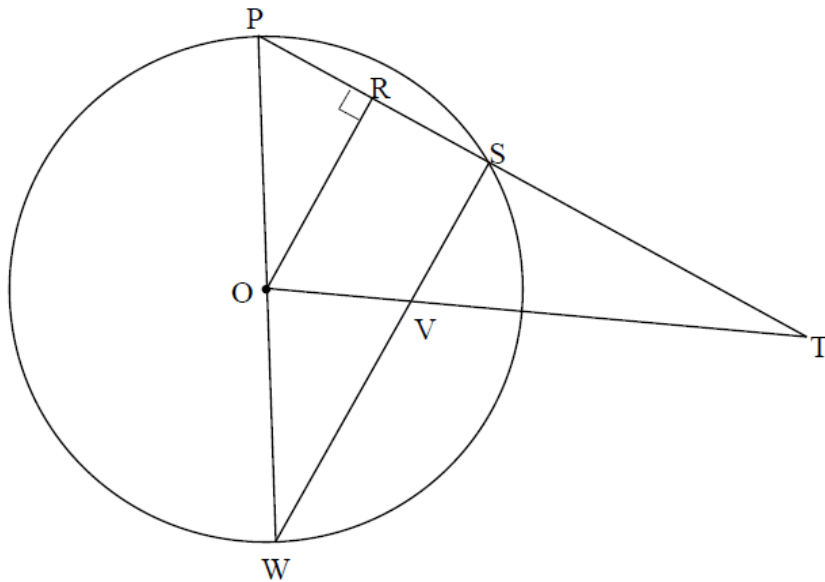
a) $\angle MOS$ (2)

b) $\angle L$ (2)

8.1.2 Prove that $ON = \frac{1}{2} MS$ (4)

2024 November Paper 2 Q 10.2.1

In the diagram below, O is the centre of the circle. $\triangle PWS$ is drawn with P, W and S on the circle. $OR \perp PS$. PRS is produced to T. SW and OT intersect at V. $OV:OT = 1:4$

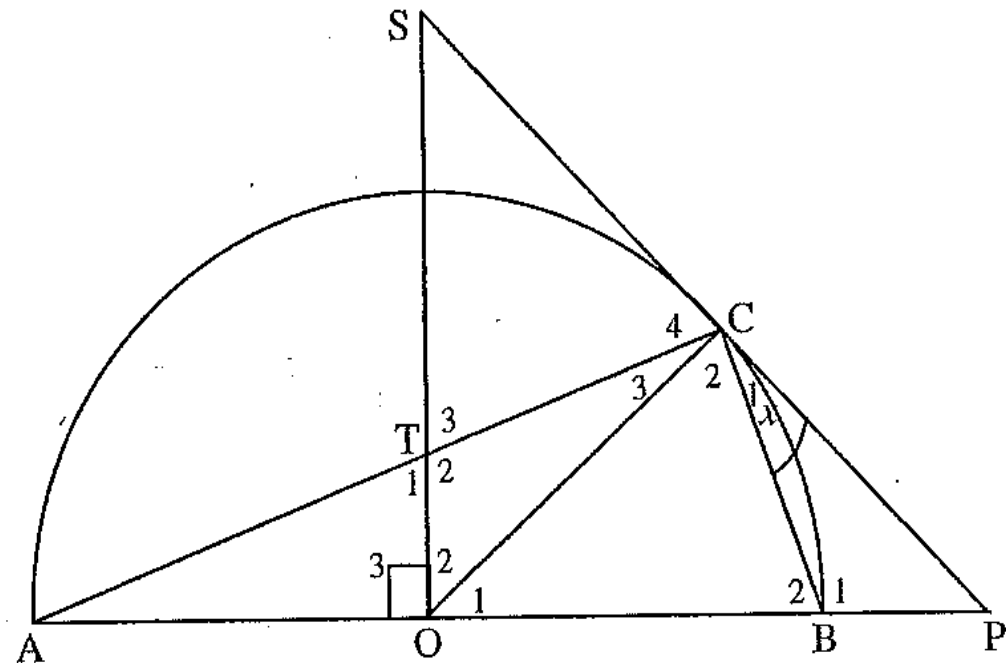


10.2.1 Prove, with reasons that $OR:WS = 1:2$ (5)

2015 Mpumalanga Preliminary Paper 2 Q 9

9.1 Complete: The exterior angle of a triangle is equal to (1)

9.2 In the figure below, AB is the diameter of a semicircle with centre O. AB is produced to P. PCS is a tangent to the circle at C, and SO is perpendicular to AB. SO and AC intersect at T. BC and OC are drawn.



9.2.1 If $\angle C_1 = x$, write down, with reasons, TWO other angles each of which is equal to x . (4)

9.2.2 Prove that $\angle PCT = \angle T_2$ (5)

9.2.3 Calculate, with reasons, the magnitudes of the following angles in terms of x :

(a) $\angle CST$ (4)

(b) $\angle COB$ (2)

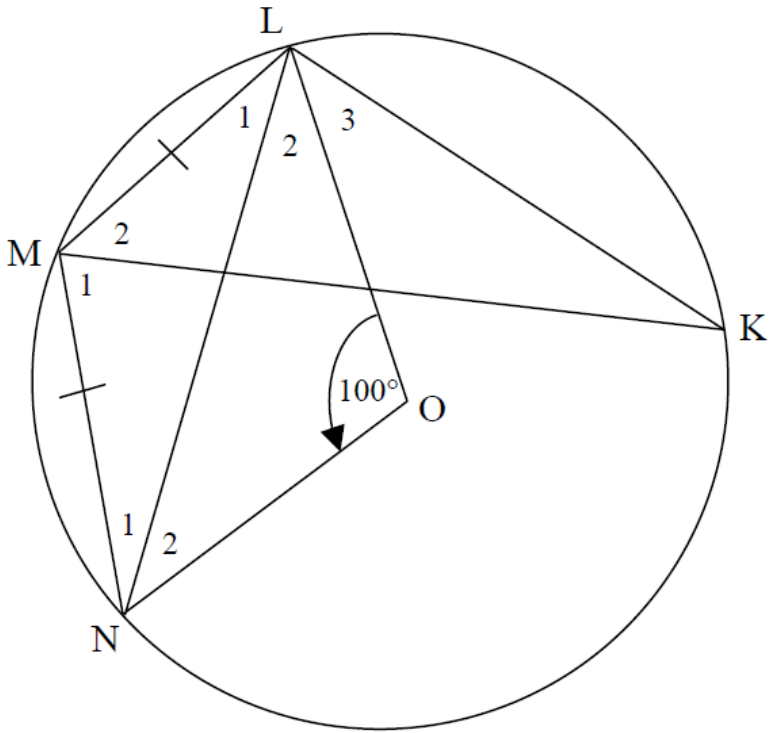
(c) $\angle P$ (2)

2010 March Paper 3 Q 8

8.1 Complete the statement:

The sum of the angles around a point is(1)

8.2 In the figure below, O is the centre of the circle.
K, L, M and N are points on the circumference of the circle such that $LM = MN$. $\angle LON = 100^\circ$



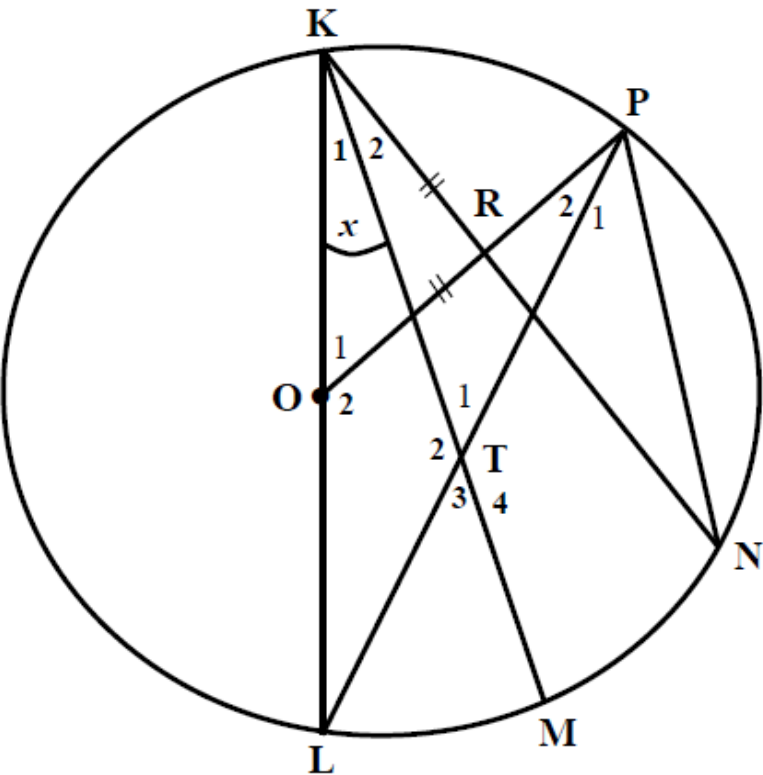
Determine, with reasons, the values of the following:

8.2.1 $\angle LMN$ (3)

8.2.2 $\angle LKM$ (3)

2018 KwaZulu Natal Preliminary Paper 2 Q 9.2

KOL is the diameter of the circle KPNML having centre O. R is the point on chord KN, such that $KR = RO$. OR is produced to P. Chord KM bisects $\angle LKN$ and cuts LP in T. $\angle K_1 = x$.



- Prove with reasons that:
- 9.2.1 $TK = TL$.

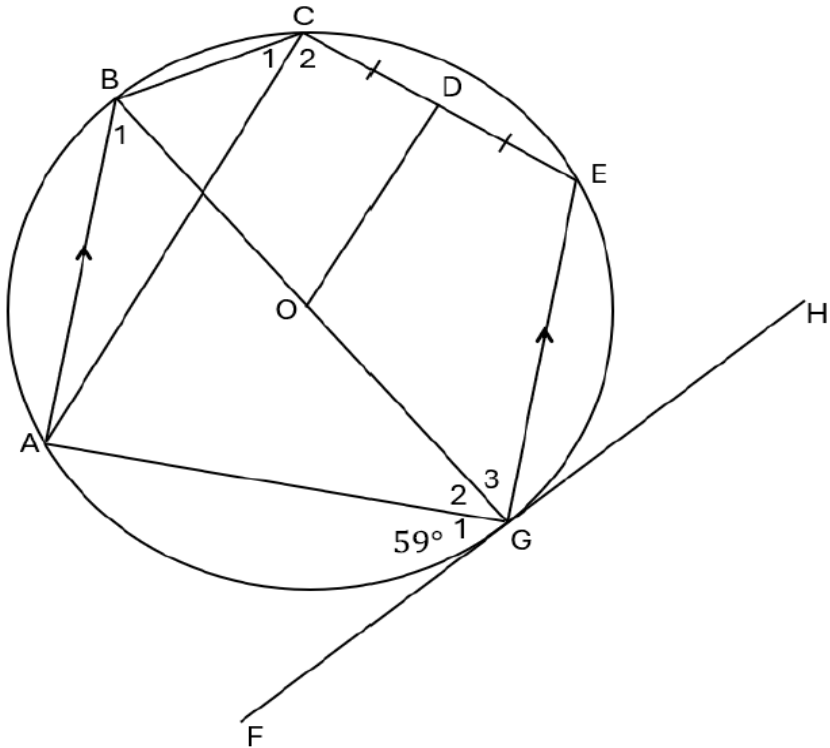
(5)
- 9.2.2 KOTP is a cyclic quadrilateral.

(3)
- 9.2.3 $PN \parallel MK$

(3)

2025 Western Cape Preliminary Paper 2 Q 9.3

In the diagram below, FGH is a tangent to the circle with centre O. BOG is a diameter , $AB \parallel EG$. $\angle G_1 = 59^\circ$. $CD = DE$.

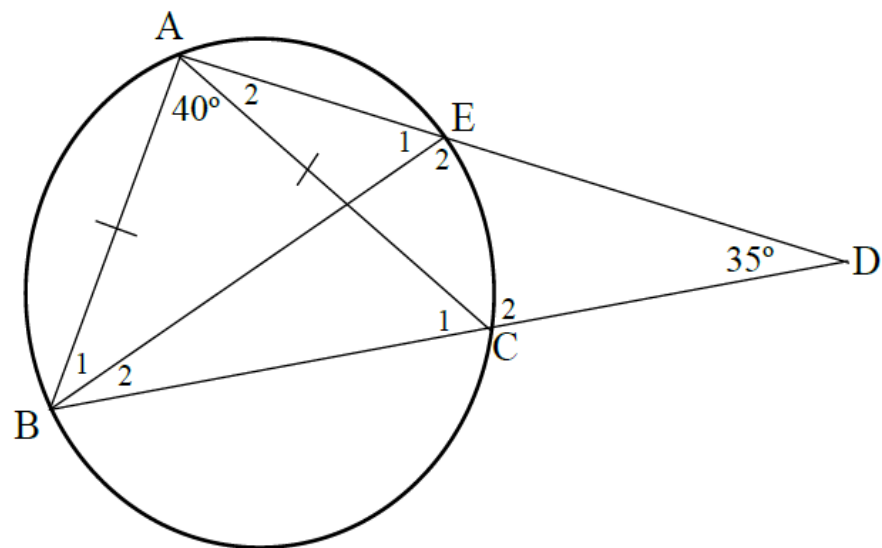


Determine, with reasons, the size of :

- 9.3.1 $\angle CDO$ (2)
- 9.3.2 $\angle B_1$ (2)
- 9.3.3 $\angle G_2$ (4)
- 9.3.4 $\angle G_3$ (2)
- 9.3.5 $\angle C_1$ (2)
- 9.4 Prove that $AC \parallel OD$. (3)

2019 Eastern Cape Exemplar Paper 2 Q 8.2

In the diagram below, A, B, C and E are points on the circumference of a circle. BC produced meets AE produced at point D. $AB = AC$, $\angle D = 35^\circ$ and $\angle A_1 = 40^\circ$



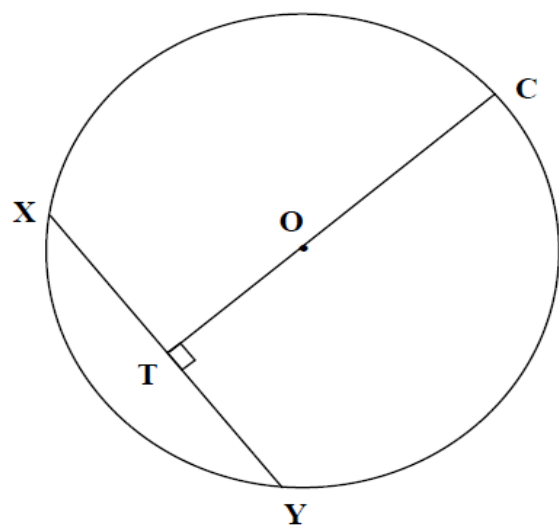
8.2.1 Determine, with reasons:

- (a) $\angle C_1$ (2)
- (b) $\angle A_2$ (2)
- (c) $\angle B_2$ (2)

8.2.2 Hence prove that BE bisects $\angle ABC$ (3)

2014 June Higher Grade Paper 2 Q 7

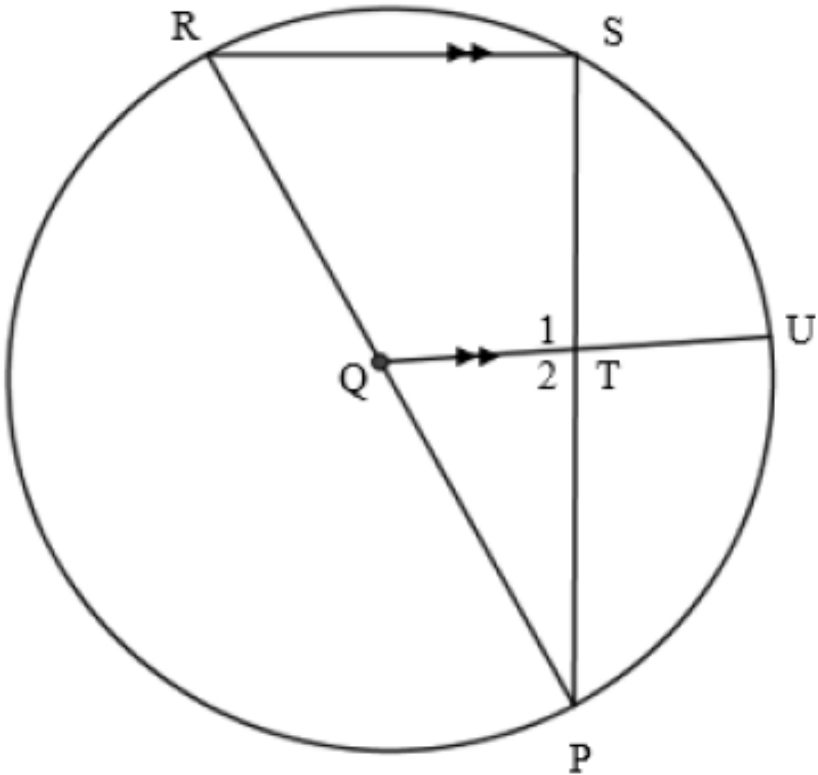
In the diagram drawn below, O is the center of circle XCY. COT is perpendicular to chord XY with T on XY. $OC = r$ and $XY = \frac{3}{2}r$.



Prove, stating reasons, that $CT = \frac{(4+\sqrt{7})}{4}r$ (6)

2017 Eastern Cape Preliminary Paper 2 Q 8

8.1 PR is a diameter of the circle PRSU. QU is drawn parallel to RS and meets SP in T.

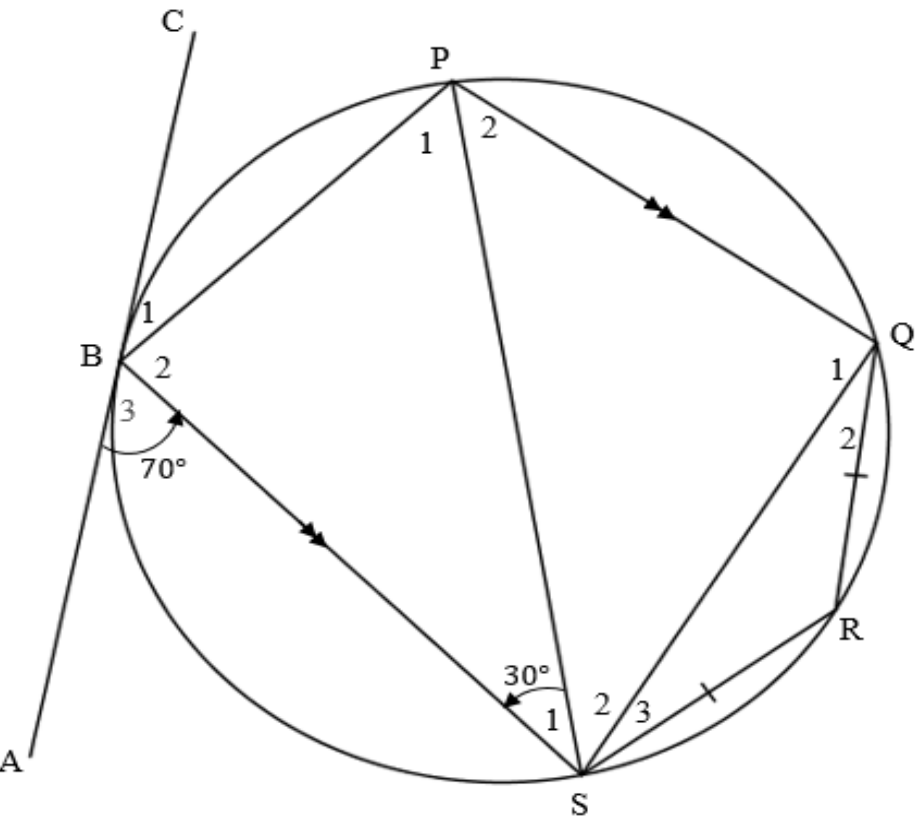


8.1.1 Write down, with a reason, the size of $\angle S$. (2)

8.1.2 If the diameter is 20cm and $SP = 16\text{cm}$, calculate the length of TU. (6)

CONTINUED :

8.2 ABC is a tangent to circle BPQRS at B. $PQ \parallel BS$.
 $QR = RS$. $\angle S_1 = 30^\circ$ and $\angle B_3 = 70^\circ$.

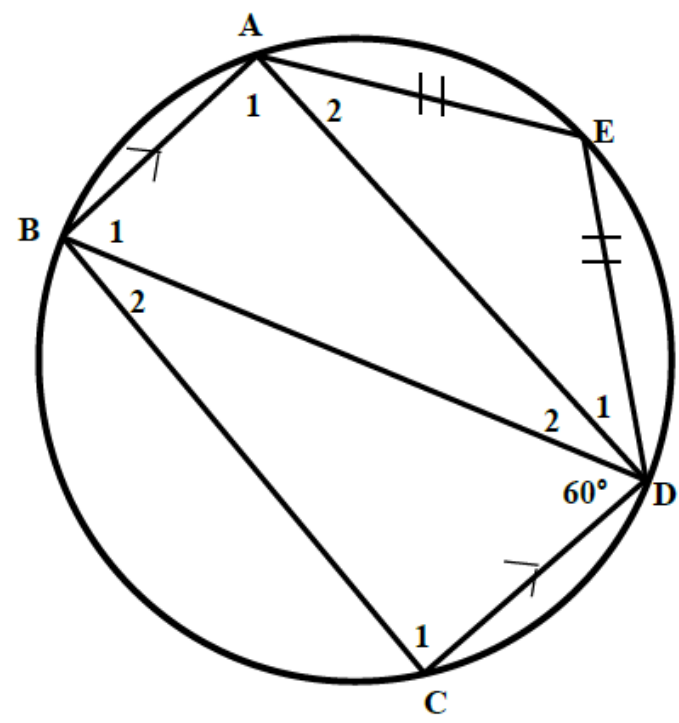


Calculate, with reasons, the size of the following angles:

- 8.2.1 $\angle B_1$ (2)
- 8.2.2 $\angle P_2$ (2)
- 8.2.3 $\angle R$ (2)
- 8.2.4 $\angle Q_2$ (3)

2015 Western Cape June Paper 2 Q 8.2

8.2 In the diagram below BD is a diameter of the circle.
BA || CD, AE = ED and $\angle BDC = 60^\circ$. Calculate, stating reasons, the size of the following angles:

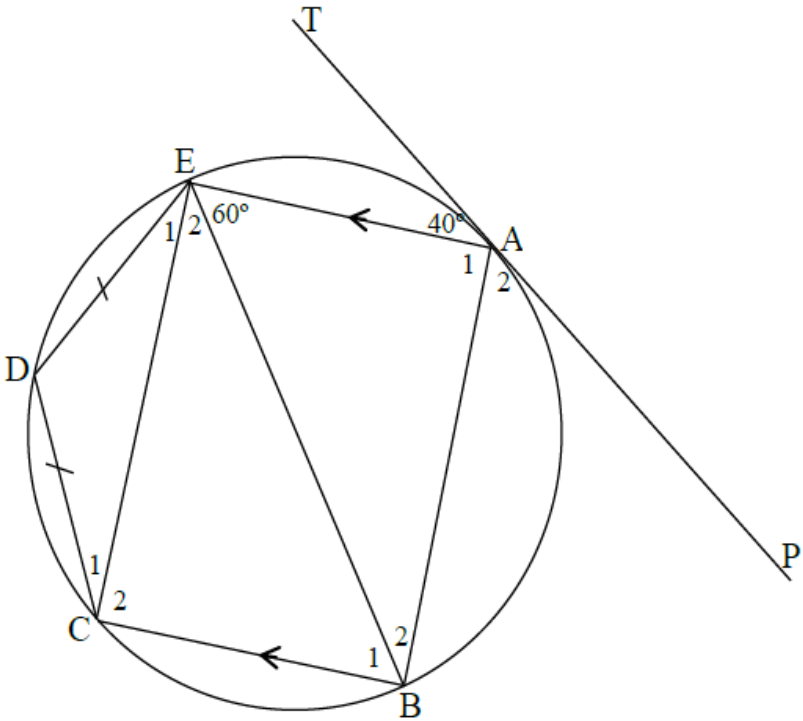


- 8.2.1 $\angle C_1$ (2)
- 8.2.2 $\angle B_1$ (2)
- 8.2.3 $\angle E$ (2)
- 8.2.4 $\angle D_1$ (2)

2018 Gauteng Preliminary Paper 2 Q 8

In the diagram below, TAP is a tangent to circle ABCDE at A.

AE || BC and DC = DE. $\angle TAE = 40^\circ$ and $\angle AEB = 60^\circ$.



8.1 Identify TWO cyclic quadrilaterals. (2)

8.2 Determine, with reasons, the size of the following angles:

8.2.1 $\angle B_2$ (2)

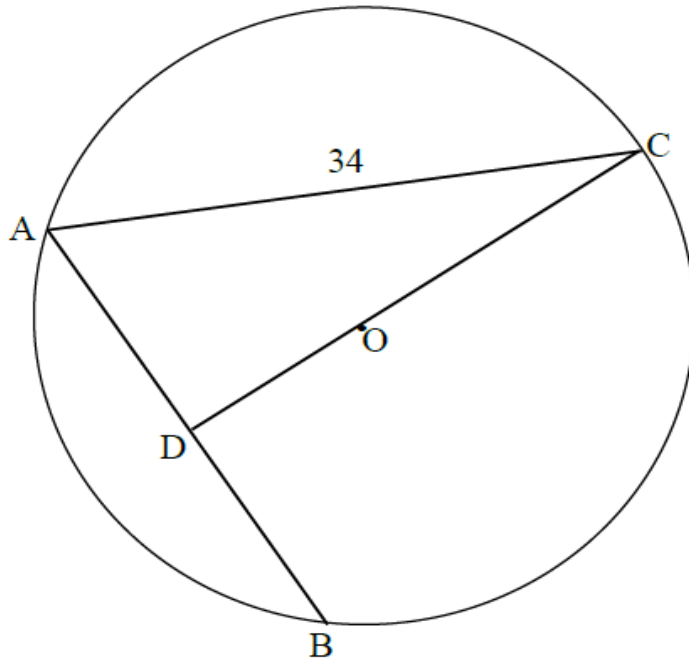
8.2.2 $\angle B_1$ (2)

8.2.3 $\angle D$ (2)

8.2.4 $\angle E_1$ (3)

CONTINUED.....

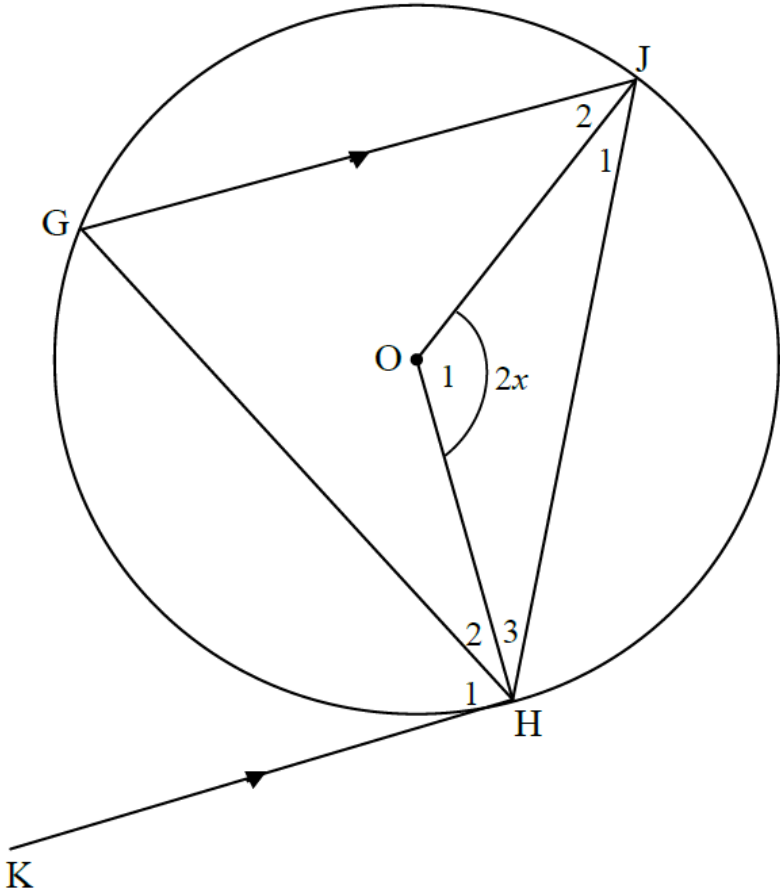
8.3 In the diagram below, radius CO is produced to bisect chord AB at D. $CA = 34\text{mm}$ and $AB = 40\text{mm}$



Calculate the size of $\angle C$. (4)

2018 Senior Certificate Paper 2 Q 8

In the diagram, O is the centre of the circle. Radii OH and OJ are drawn. A tangent is drawn from K to touch the circle at H. $\Delta H G J$ is drawn such that $G J \parallel K H$. $\angle O_1 = 2x$

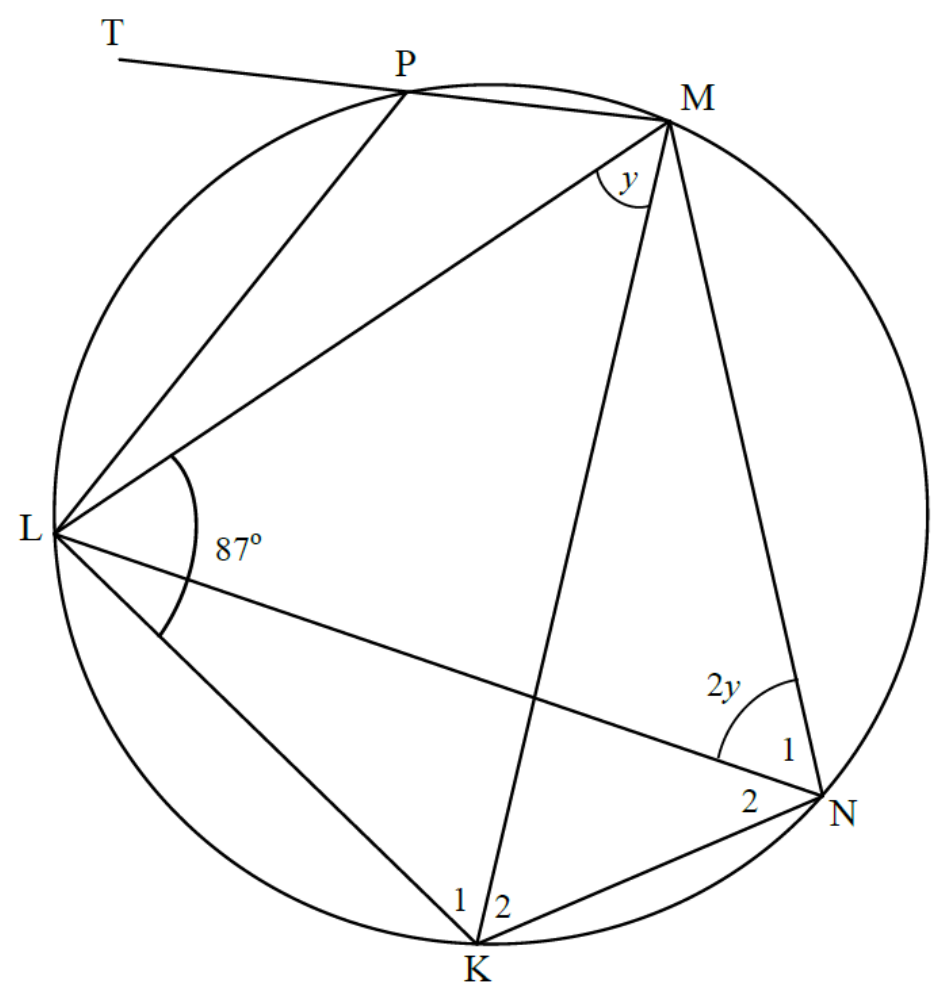


8.1.1 Name, giving reasons, THREE angles, each equal to x . (5)

8.1.2 Prove that $H_2 = H_3$ (3)

CONTINUED.....

8.2 In the diagram, KLMN is a cyclic quadrilateral with $\angle KLM = 87^\circ$. Diagonals LN and MK are drawn. P is a point on the circle and MP is produced to T, a point outside the circle. Chord LP is drawn. $\angle LMK = y$ and $\angle N_1 = 2y$.



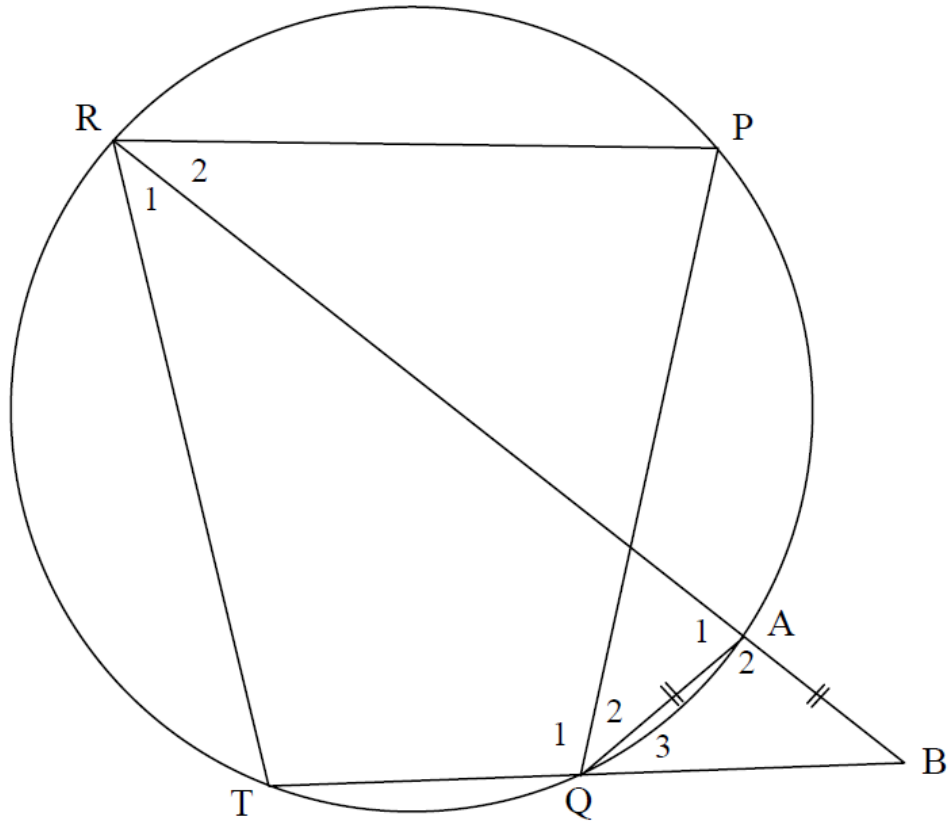
- 8.2.1 Name, giving a reason, another angle equal to y . (2)
- 8.2.2 Calculate, giving reasons, the size of:

(a) y (3)

(b) $\angle TPL$ (2)

2008 November Paper 3 Q 8

In the diagram below, points R, P, A, Q and T lie on a circle. RA bisects $\angle R$ and $AB = AQ$. RA and TQ produced meet at B.



Prove that:

8.1 AQ bisects $\angle PQB$ (3)

8.2 $TR = TB$ (2)

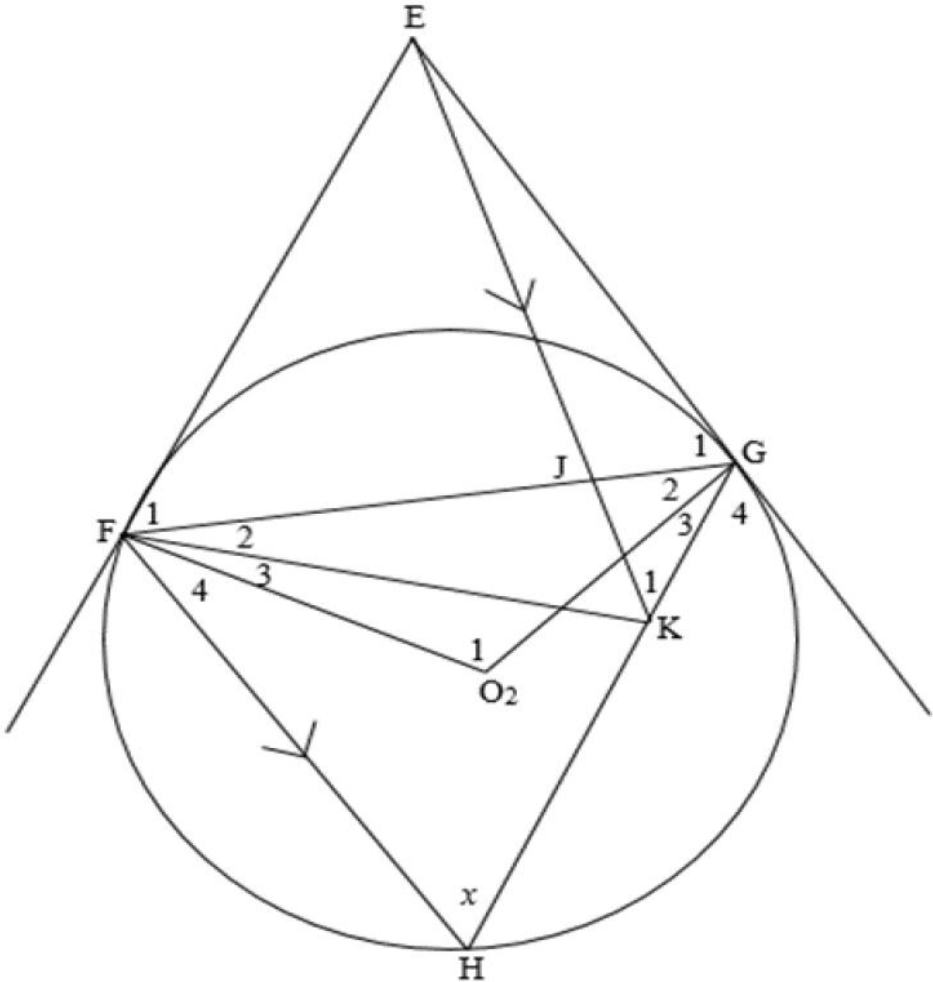
8.3 $\angle P = \angle TRP$ (3)

2016 Overberg District Preliminary Paper 2 Q 8

8.1 Complete the following:

The opposite angles of a cyclic quadrilateral are

8.2 In the diagram, EF and EG are tangents to circle with center O. FH || EK, EK intersects FG at J and meets GH at K. $\angle H = x$.



Prove that ...

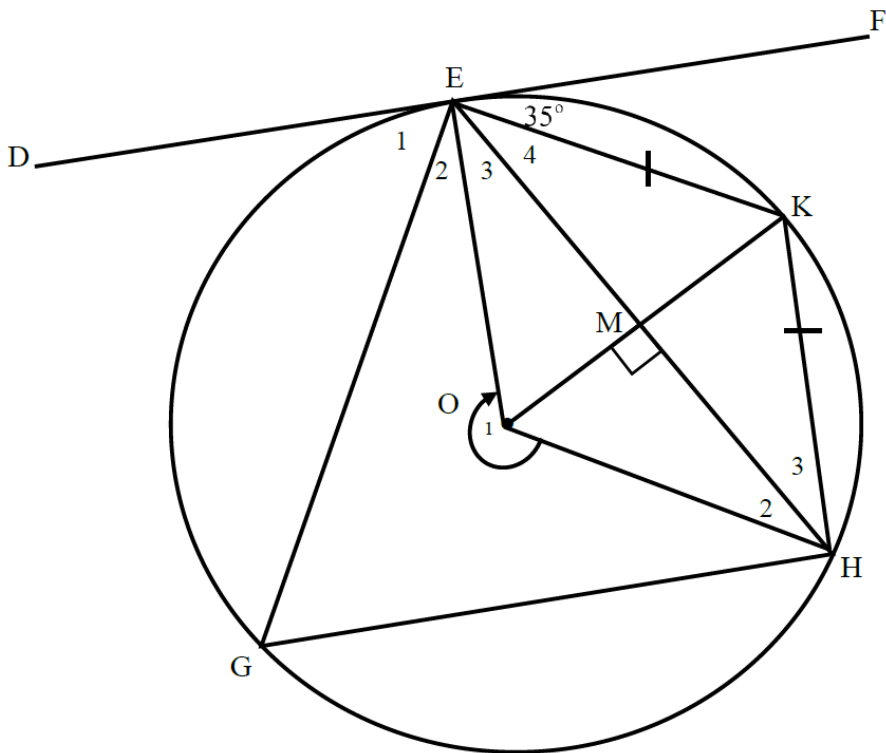
8.2.1 FOG is a cyclic quadrilateral. (5)

8.2.2 EG is a tangent to the circle GJK. (5)

8.2.3 $\angle FEG = 180^\circ - 2x$. (3)

2019 Free State Preliminary Paper 2 Q 8

DF is a tangent to the circle at E. EKHG is a cyclic quadrilateral. O is the centre of the circle. $OK \perp HK$ and $EK = HK$



8.1 Determine, with reasons, the size of each of the following:

8.1.1 $\angle E_4$ (3)

8.1.2 $\angle EKH$ (2)

8.1.3 $\angle G$ (2)

8.1.4 $\angle O_1$ (2)

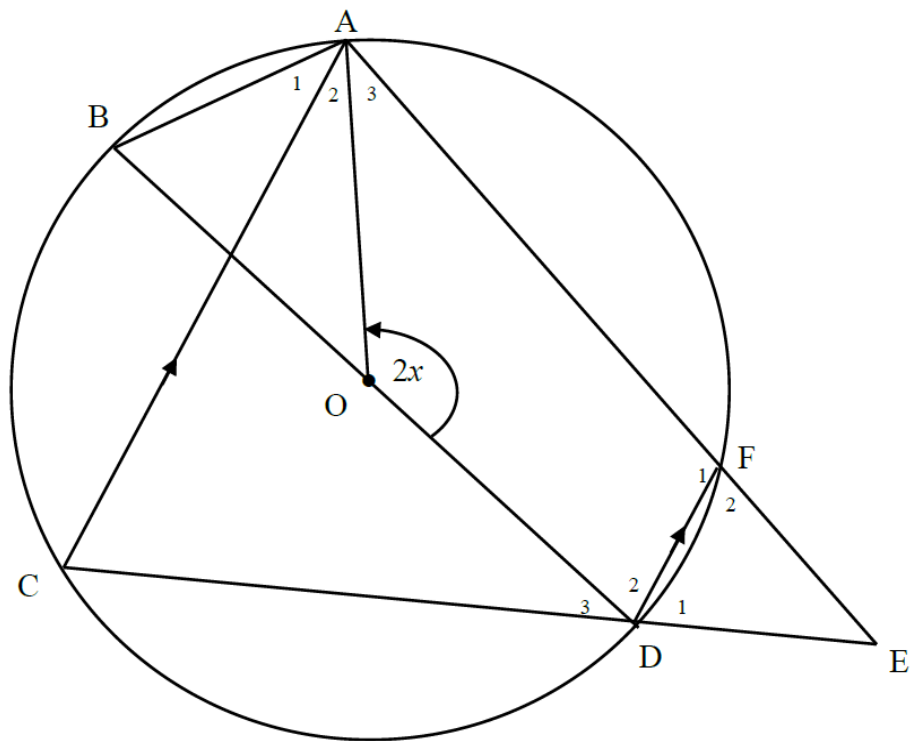
8.2 It is further given that $EH = 24$ units.

KM = 4 units and the radius of the circle EKHG is x . Determine the value of x

(4)

2019 Free State Preliminary Paper 2 Q 9

A circle with centre O is given below. Lines CD and AF are produced to E. $\angle AOD = 2x$ and BD is the diameter. $AC \parallel FD$.



- 9.1.1 Determine, with reasons, four other angles that are each equal to x (6)
- 9.1.2 Express $\angle E$ in terms of x (2)
- 9.1.3 Prove that AODE is a cyclic quadrilateral. (2)
- 9.2 It is further given that $ED : DC = 8 : 12$ and $FE = 10$. Calculate the length of AF. (3)

2016 Eastern Cape Preliminary Paper 2 Q 8

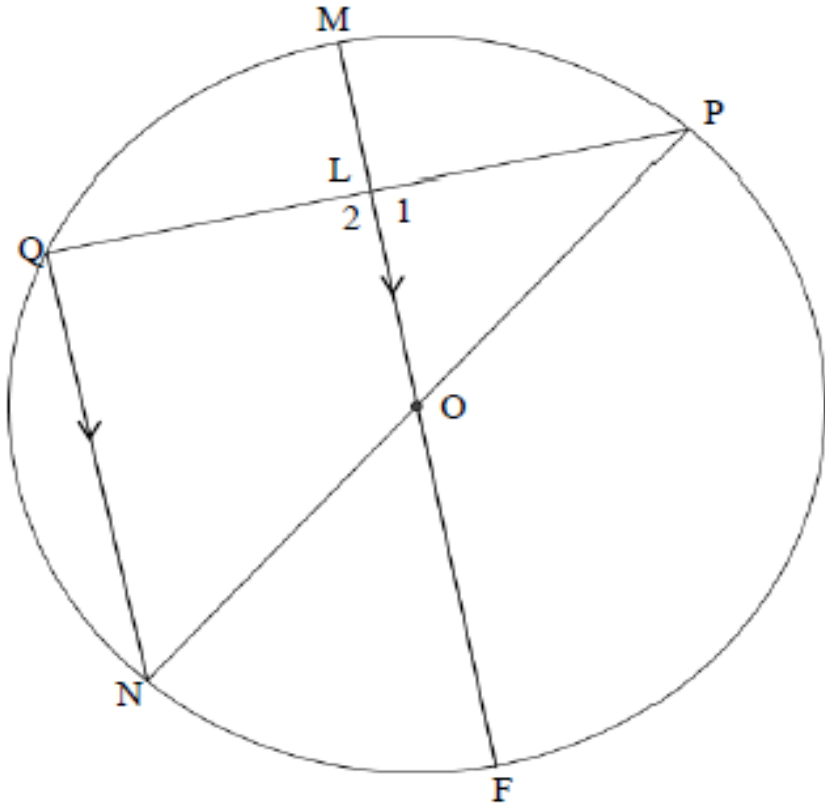
8.1 Complete the following statement: A line drawn from the centre of the circle perpendicular to a chord ...

8.2 In the diagram below O is the centre of circle PMQNF. PN and FM are diameters.

$QN \parallel FM$

$OL = 3ML$

$QP = 14$ units



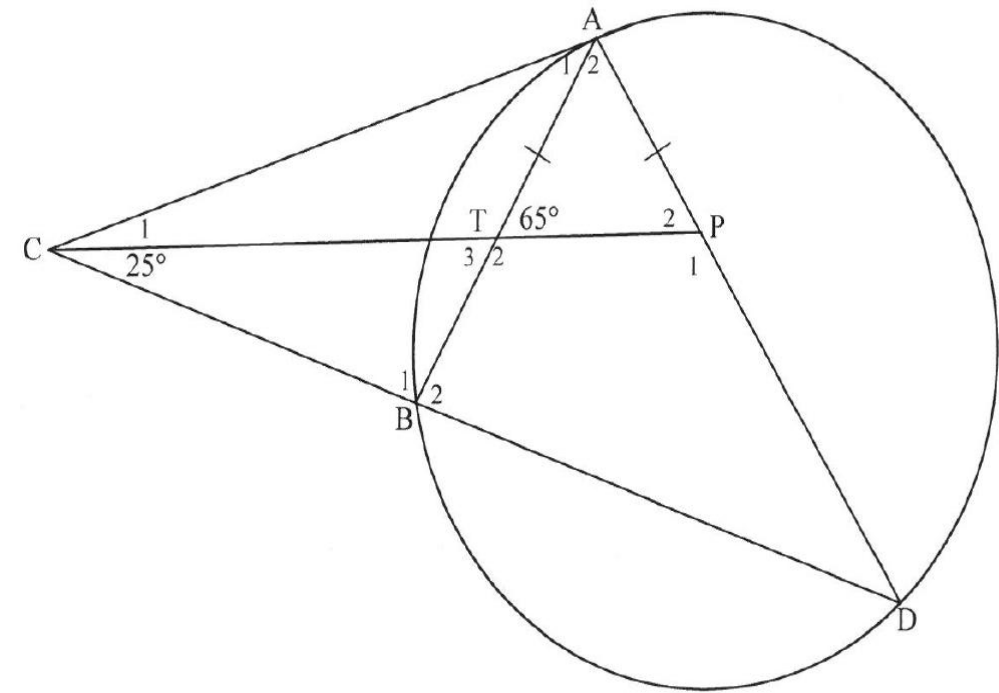
8.2.1 Prove that L is the midpoint of QP. (4)

8.2.2 Write down the length of MF in terms of ML. (1)

8.2.3 Determine the length of ML. Leave your answer in surd form. (3)

2015 Senior Certificate Paper 2 Q 8

In the diagram, $\triangle ACD$ is drawn with points A and D on the circumference of a circle. CD cuts the circle at B. P is a point on AD with CP the bisector of $\angle ACD$. CP cuts the chord AB at T. $AT = AP$, $\angle ATP = 65^\circ$ and $\angle PCD = 25^\circ$.



8.1 Determine the size of each of the following:

8.1.1 $\angle P_2$ (2)

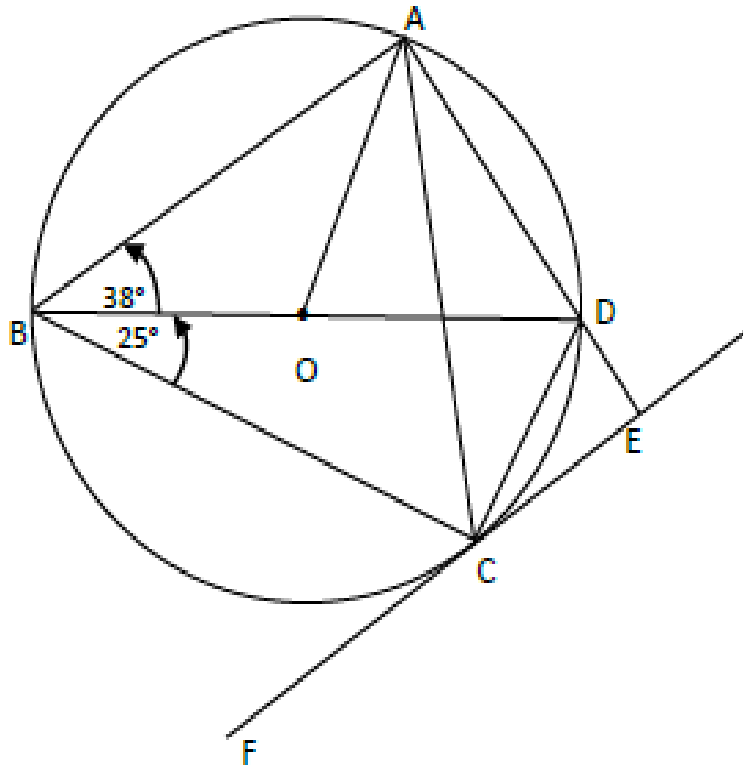
8.1.2 $\angle D$ (2)

8.1.3 $\angle A_1$ (2)

8.2 Is CA a tangent to the circle ABD? Motivate your answer. (2)

2016 Overberg District Preliminary Paper 2 Q 9

In the diagram, ABCD is a cyclic quadrilateral in the circle, having centre O. Tangent FC meets AD produced in E. Radius AO and chord AC are drawn. $\angle ABO = 38^\circ$ and $\angle CBD = 25^\circ$



Calculate, with reasons, the size of each of the following angles:

9.1.1 $\angle BAD$ (2)

9.1.2 $\angle AOD$ (2)

9.1.3 $\angle CDE$ (2)

9.1.4 $\angle DCE$ (2)

9.1.5 $\angle ACD$ (2)

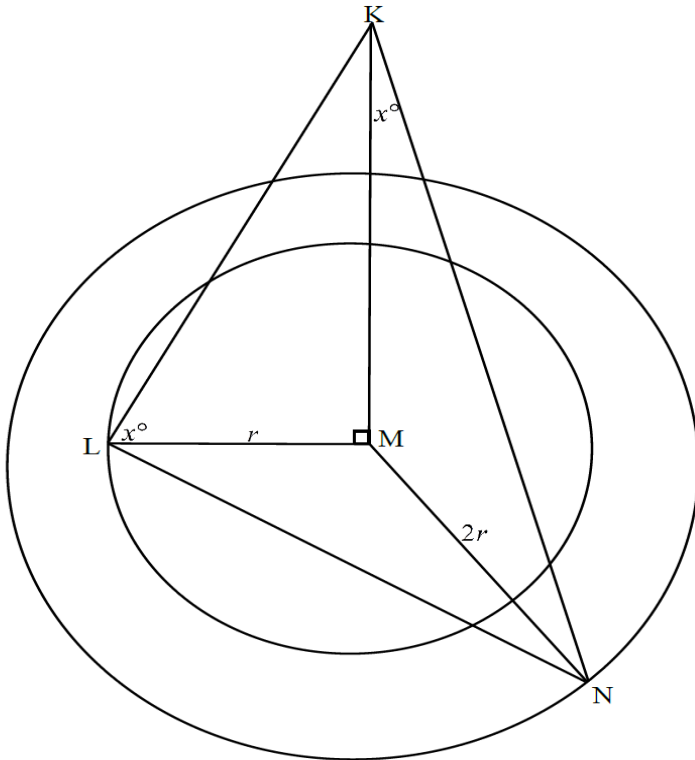
2020 Gauteng Preliminary Paper 2 Q 7

In the figure alongside, KM is a vertical flag post set in the centre of two circles which lie on the same horizontal plane. $\angle MKN = \angle MLK = x$. The radius of the inner circle $ML = r$ and the radius of the outer circle $MN = 2r$

7.1 Calculate the value of x . (6)

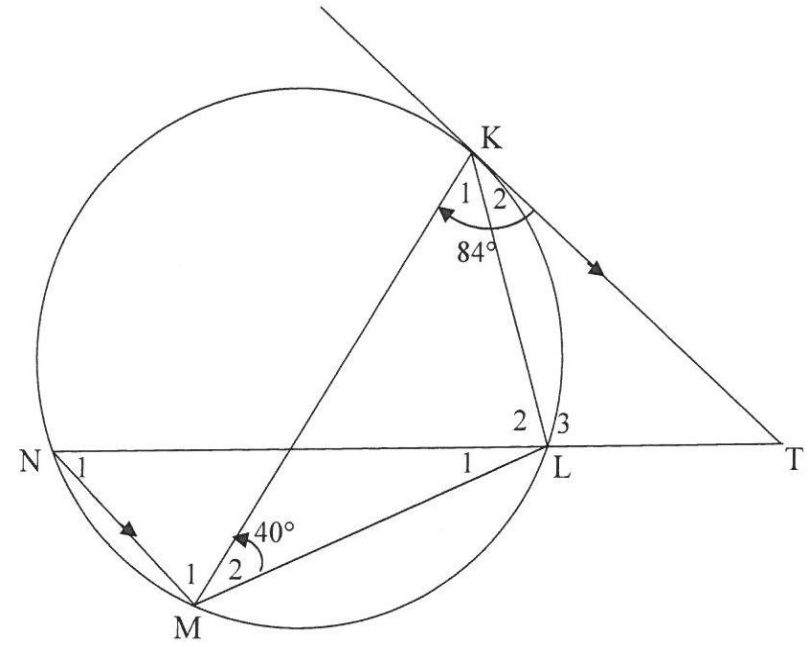
7.2 If $r = 5m$ and $\angle LMN = 110^\circ$.

Calculate the length of LN. (2)



2016 March Paper 2 Q 8

In the diagram below, tangent KT to the circle K is parallel to the chord NM. NT cuts the circle at L. ΔKML is drawn. $\angle M_2 = 40^\circ$ and $\angle MKT = 84^\circ$.

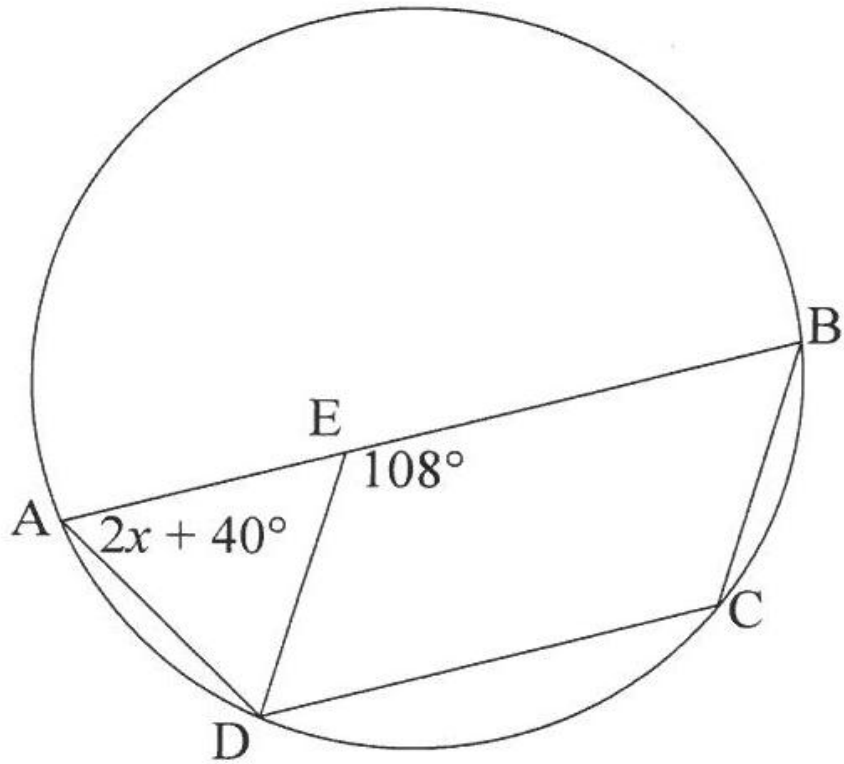


Determine, giving reasons, the size of:

- 8.1.1 $\angle K_2$ (2)
- 8.1.2 $\angle N_1$ (3)
- 8.1.3 $\angle T$ (2)
- 8.1.4 $\angle L_2$ (2)
- 8.1.5 $\angle L_1$ (1)

CONTINUED....

8.2 In the diagram below, AB and DC are chords of a circle. E is a point on AB such that BCDE is a parallelogram. $\angle DEB = 108^\circ$ and $\angle DAE = 2x + 40^\circ$.



Calculate giving reasons, the value of x .

(5)

