Circles

1 Mark:

1. If the angle between two tangents drawn from an external point \( P \) to a circle of radius \( a \) and centre \( O \), is \( 60° \), then find the length of \( OP \).

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2. \( PQ \) is a tangent drawn from an external point \( P \) to a circle with centre \( O \), \( QO \) is the diameter of the circle. If \( \angle POR = 120° \), what is the measure of \( \angle OPQ \)?

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3. In the given figure \( PA \) and \( PB \) are tangents to a circle with centre \( O \).
   If \( \angle APB = (2x + 3)° \) and \( \angle AOB = (3x + 7)° \), then find the value of \( x \).

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4. In figure, \( PQ \) is a tangent at a point \( C \) to a circle with centre \( O \). If \( AB \) is a diameter and \( \angle CAB = 30° \), find \( \angle PCA \).

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5. From an external point \( P \), tangents \( PA \) and \( PB \) are drawn to a circle with centre \( O \). If \( \angle PAB = 50° \), then find \( \angle AOB \).

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6. In figure, \( AOB \) is a diameter of a circle with centre \( O \) and \( AC \) is a tangent to the circle at \( A \). If \( \angle BOC = 130° \), then find \( \angle ACO \).

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7. In figure, \( PA \) and \( PB \) are tangents to the circle with centre \( O \) such that \( \angle APB = 50° \). Write the measure of \( \angle OAB \).

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8. In figure, \( PQ \) is a chord of a circle with centre \( O \) and \( PT \) is a tangent. If \( \angle QPT = 60° \), find \( \angle PRQ \).

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9. Two circles touch each other externally at \( P \). \( AB \) is a common tangent to the circles touching them at \( A \) and \( B \). The value of \( \angle APB \) is

   A) \( 30° \)   B) \( 45° \)   C) \( 60° \)   D) \( 90° \)

   CBSE 2014, Outside Delhi (30/1), (30/2), (30/3)

10. In a right triangle \( ABC \), right-angled at \( B \), \( BC = 12 \text{ cm} \) and \( AB = 5 \text{ cm} \).
    The radius of the circle inscribed in the triangle (in cm) is

    A) \( 4 \)   B) \( 3 \)   C) \( 2 \)   D) \( 1 \)

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11. In figure, $PA$ and $PB$ are two tangents drawn from an external point $P$ to a circle with centre $C$ and radius $4 \text{ cm}$. If $PA \perp PB$, then the length of each tangent is:

A) $3 \text{ cm}$  
B) $4 \text{ cm}$  
C) $5 \text{ cm}$  
D) $6 \text{ cm}$

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12. In figure, a circle with centre $O$ is inscribed in a quadrilateral $ABCD$ such that, it touches the sides $BC, AB, AD$ and $CD$ at points $P, Q, R$ and $S$ respectively. If $AB = 29 \text{ cm}, AD = 23 \text{ cm}, \angle B = 90^\circ$ and $DS = 5 \text{ cm}$, then the radius of the circle (in cm) is:

A) $11$  
B) $18$  
C) $6$  
D) $15$

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13. In figure, the sides $AB, BC$ and $CA$ of a triangle $ABC$, touch a circle at $P, Q$ and $R$ respectively. If $PA = 4 \text{ cm}, BP = 3 \text{ cm}$ and $AC = 11 \text{ cm}$, then the length of $BC$ (in cm) is:

A) $11$  
B) $10$  
C) $14$  
D) $15$

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14. In figure, a circle touches the side $DF$ of $\triangle EDF$ at $H$ and touches $ED$ and $EF$ produced at $K$ and $M$ respectively. If $EK = 9 \text{ cm}$, then the perimeter of $\triangle EDF$ (in cm) is:

A) $18$  
B) $13.5$  
C) $12$  
D) $9$

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15. In figure, $PQ$ and $PR$ are tangents to a circle with centre $A$. If $\angle QPA = 27^\circ$, then $\angle QAR$ equals.

A) $63^\circ$  
B) $153^\circ$  
C) $126^\circ$  
D) $117^\circ$

CBSE 2012, Foreign (30/2/1)
16. In figure, $AB$ and $AC$ are tangents to a circle with centre $O$ and radius 8 cm. If $OA = 17$ cm, then the length of $AC$ (in cm) is

A) $\sqrt{353}$  B) 15  C) 9  D) 25  

CBSE 2012, Foreign (30/2/1)

17. From a point $Q$, 13 cm away from the centre of a circle, the length of tangent $PQ$ to the circle is 12 cm. The radius of the circle (in cm) is.

A) 25  B) $\sqrt{313}$  C) 5  D) 1  

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18. In figure, $AP$ and $AQ$ and $BC$ are tangents to the circle if $AB = 5$ cm, $AC = 6$ cm and $BC = 4$ cm, then the length of $AP$ (in cm) is

A) 7.5  B) 15  C) 10  D) 9  

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19. In figure, $O$ is the centre of a circle, $AB$ is a chord and $AT$ is the tangent at $A$. If $\angle AOB = 100^\circ$, then $\angle BAT$ is equal to

A) 100°  B) 40°  C) 50°  D) 90°  

CBSE 2011, Delhi (30/1/1)

20. In figure, $PA$ and $PB$ are tangents to the circle with centre $O$. If $\angle APB = 60^\circ$, then $\angle OAB$ is

A) 30°  B) 60°  C) 90°  D) 15°  

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21. In figure, point $P$ is 26 cm away from the centre $O$ of a circle and the length $PT$ of the tangent drawn from $P$ to the circle is 24 cm. Then the radius of the circle is

A) 25 cm  B) 26 cm  C) 24 cm  D) 10 cm  

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22. In the figure, $TP$ and $TQ$ are two tangents to a circle with centre $O$ such that $\angle POQ = 110^\circ$. Then $\angle PTQ$ is equal to

A) $55^\circ$  
B) $70^\circ$  
C) $110^\circ$  
D) $90^\circ$

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23. In the figure, $O$ is the centre of a circle, $PQ$ is a chord and $PT$ is the tangent at $P$. If $\angle POQ = 70^\circ$, then $\angle TPQ$ is equal to

A) $55^\circ$  
B) $70^\circ$  
C) $45^\circ$  
D) $35^\circ$

CBSE 2011, Outside Delhi (30/1)

24. In the figure, $AB$ and $AC$ are tangents to the circle with centre $O$ such that $\angle BAC = 40^\circ$. Then $\angle BOC$ is equal to

A) $40^\circ$  
B) $55^\circ$  
C) $140^\circ$  
D) $150^\circ$

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25. A tangent $PQ$ at a point $P$ of a circle of radius $5 \text{ cm}$ meets a line through the centre $O$ at a point $Q$ so that $OQ = 13 \text{ cm}$. Find the length $PQ$.

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26. In Figure, $CP$ and $CQ$ are tangents to a circle with centre $O$. $ARB$ is another tangent touching the circle at $R$. If $CP = 11 \text{ cm}$, and $BC = 7 \text{ cm}$, then find the length of $BR$.

CBSE 2009, Delhi (30/1/1)

27. In Figure, $\triangle ABC$ is circumscribing a circle. Find the length of $BC$.

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28. Two tangents $TP$ and $TQ$ are drawn from an external point $T$ to a circle with centre $O$, as shown in Fig. If they are inclined to each other at an angle of $100^\circ$ then what is the value of $\angle POQ$?

CBSE Sample Paper III 2008

29. What is the distance between two parallel tangents of a circle of the radius $4 \text{ cm}$?

CBSE Sample Paper II 2008
30. The length of tangent from a point $A$ at a distance of 5 cm from the centre of the circle is 4 cm. What will be the radius of the circle?

31. In the figure given below, $PA$ and $PB$ are tangents to the circle drawn from an external point $P$. $CD$ is a third tangent touching the circle at $Q$. If $PB = 10$ cm, and $CQ = 2$ cm, what is the length of $PC$?

\[ P \quad A \quad B \quad Q \quad D \]

2 Marks:

1. Prove that the tangents drawn at the end points of a chord of a circle make equal angles with the chord.

2. A circle touches all the four sides of a quadrilateral $ABCD$. Prove that $AB + CD = BC + DA$.

3. Using the figure given below, prove that $AR = \frac{1}{2} \text{(perimeter of triangle } ABC)$.

4. In the given figure, common tangents $AB$ and $CD$ to the two circles intersect at $E$. Prove that $AB = CD$.

5. In the given figure, if $AB = AC$, prove that $BE = EC$.

6. Prove that tangents drawn at the ends of a diameter of a circle are parallel to each other.

7. In the given figure, $PA$ and $PB$ are tangents to the circle from an external point $P$. $CD$ is another tangent touching the circle at $Q$. If $PA = 12$ cm, $QC = QD = 3$ cm, then find $PC + PD$. 

\[ A \quad C \quad Q \quad O \quad B \quad D \]
8. In figure, from a point P, two tangents PT and PS are drawn to a circle with centre O such that ∠SPT = 120°. Prove that OP = 2PS.

9. In figure, 3 are two concentric circles of radii 6 cm and 4 cm with centre O. If A.P. is a tangent to the larger circle and BP to the smaller circle and length of AP is 8 cm, find the length of BP.

10. In figure, a circle is inscribed in a ΔABC, such that it touches the sides AB, BC and CA at points D, E and F respectively. If the lengths of sides AB, BC and CA are 12 cm, 8 cm and 10 cm respectively, find the lengths of AD, BE and CF.

11. In figure, AP and BP are tangents to a circle with centre O, such that AP = 5 cm and ∠APB = 60°. Find the length of chord AB.

12. In figure, a quadrilateral ABCD is drawn to circumscribe a circle. With centre O, in such a way that the sides AB, BC, CD and DA touch the circle at the points P, Q, R and S respectively. Prove that AB + CD = BC + DA.

13. In figure, from an external point P, two tangents PT and PS are drawn to a circle with centre O and radius r. If OP = 2r, show that ∠OTS = ∠OST = 30°.

14. In figure, AB is the diameter of a circle with centre O and AT is a tangent. If ∠AOQ = 58°, find ∠ATQ.
15. From a point $T$ outside a circle of centre $O$, tangents $TP$ and $TQ$ are drawn to the circle. Prove that $OT$ is the right bisector of line segment $PQ$.  

CBSE 2015, Delhi (30/1/1)

16. Two concentric circles of radii $a$ and $b$ ($a > b$) are given. Find the length of the chord of the larger circle which touches the smaller circle.  

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17. In Figure, $O$ is the centre of a circle. $PT$ and $PQ$ are tangents to the circle from an external point $P$. If $\angle TPQ = 70^\circ$, find $\angle TRQ$.  

CBSE 2015, Foreign (30/2/1)

18. In figure, $PQ$ is a chord of length $8 \text{ cm}$ of a circle of radius $5 \text{ cm}$. The tangents at $P$ and $Q$ intersect at a point $T$. Find the lengths of $TP$ and $TQ$.  

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19. In figure, two tangents $RQ$ and $RP$ are drawn from an external point $R$ to the circle with centre $O$. If $\angle PRQ = 120^\circ$, then prove that $OR = PR + RQ$.  

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20. In figure, a triangle $ABC$ is drawn to circumscribe a circle of radius $3 \text{ cm}$, such that the segments $BD$ and $DC$ are respectively of lengths $6 \text{ cm}$ and $9 \text{ cm}$. If the area of $\triangle ABC$ is $54 \text{ cm}^2$, then find the lengths of sides $AB$ and $AC$.  

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21. The incircle of an isosceles triangle $ABC$, in which $AB = AC$, touches the sides $BC, CA$ and $AB$ at $D, E$ and $F$ respectively. Prove that $BD = DC$.  

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22. Prove that the parallelogram circumscribing a circle is a rhombus.  

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23. In figure, a circle inscribed in triangle $ABC$ touches sides $AB, BC$ and $AC$ at points $D, E$ and $F$ respectively. If $AB = 12 \text{ cm}, BC = 8 \text{ cm}$ and $AC = 10 \text{ cm}$, then find the lengths of $AD, BE$ and $CF$.  

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24. In figure, an isosceles triangle $ABC$, with $AB = AC$, circumscribes a circle. Prove that the point of contact $P$ bisects the base $BC$.  

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25. In figure, the chord $AB$ of the larger of the two concentric circles, with centre $O$, touches the smaller circle at $C$. Prove that $AC = CB$.

26. Tangents $PA$ and $PB$ are drawn from an external point $P$ to two concentric circles with centre $O$ and radii $8\,\text{cm}$ and $5\,\text{cm}$ respectively, as shown in figure. If $AP = 15\,\text{cm}$, then find the length of $BP$.

27. In figure, a right triangle $ABC$, circumscribes a circle of radius $r$. If $AB$ and $BC$ are of lengths $8\,\text{cm}$ and $6\,\text{cm}$ respectively, find the value of $r$.

28. The incircle of an isosceles triangle $ABC$, with $AB = AC$, touches the sides $AB, BC$ and $CA$ at $D, E$ and $F$ respectively. Prove that $E$ bisects $BC$.

29. Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle, is bisected at the point of contact.

30. Two concentric circles are of radii $7\,\text{cm}$ and $r\,\text{cm}$ respectively, where $r > 7$. A chord of the larger circle, of length $48\,\text{cm}$, touches the smaller circle. Find the value of $r$.

31. In figure, a circle touches all the four sides of a quadrilateral $ABCD$ whose sides are $AB = 6\,\text{cm}$, $BC = 9\,\text{cm}$ and $CD = 8\,\text{cm}$. Find the length of side $AD$.

32. If all the sides of a parallelogram touch a circle, show that the parallelogram is a rhombus.

33. In figure a triangle $ABC$ is drawn to circumscribe a circle of radius $3\,\text{cm}$, such that the segments $BD$ and $DC$ into which $BC$ is divided by the point of contact $D$ are of lengths $6\,\text{cm}$ and $8\,\text{cm}$ respectively. Find the side $AB$ if the area of $\triangle ABC = 63\,\text{cm}^2$.

34. Two tangents $PA$ and $PB$ are drawn to a circle with centre $O$ from an external point $P$. Prove that $\angle APB = 2\angle OAB$. 
3 Marks:

1. The incircle of \( \triangle ABC \) touches the sides \( BC, CA \) and \( AB \) at \( D, E, \) and \( F \) respectively. If \( AB = AC \), prove that \( BD = CD \). 

2. Prove that the intercept of a tangent between two parallel tangents to a circle subtends a right angle at the centre of the circle. 

3. In the given figure, \( PA \) and \( PB \) are tangents to a circle from an external point \( P \) such that \( PA = 4 \, \text{cm} \) and \( \angle BAC = 135^\circ \). Find the length of chord \( AB \). 

4. Prove that the opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle. 

5. Two tangents \( TP \) and \( TQ \) are drawn to a circle with centre \( O \) from an external point \( T \). Prove that \( \angle PTQ = 2 \angle OPQ \). 

6. In the given figure, the radii of two concentric circles are \( 13 \, \text{cm} \) and \( 8 \, \text{cm} \). \( AB \) is diameter of the bigger circle. \( BD \) is the tangent to the smaller circle touching it at \( D \). Find the length \( AD \). 

7. \( P \) & \( Q \) are centres of circles of radii \( 9 \, \text{cm} \) and \( 2 \, \text{cm} \) respectively. \( PQ = 17 \, \text{cm} \). \( R \) is the centre of the circle of radius \( x \, \text{cm} \) which touches the above circle externally. Given that angle \( PRQ \) is \( 90^\circ \). Write an equation in \( x \) and solve it. 

8. In Figure, a circle is inscribed in \( \triangle ABC \) having sides \( BC = 8 \, \text{cm}, AC = 10 \, \text{cm} \) and \( AB = 12 \, \text{cm} \) as shown in figure. Find \( AD, BE \) and \( CF \). 

9. Two tangents \( TP \) and \( TQ \) are drawn to a circle with centre \( O \) from an external point \( T \). Prove that \( \angle PTQ = 2 \angle OPQ \). 

10. In figure, \( XY \) and \( X'Y' \) are two parallel tangents to a circle with centre \( O \) and another tangent \( AB \) with point of contact \( C \) intersects \( XY \) at \( A \) and \( X'Y' \) at \( B \). Prove that \( \angle AOB = 90^\circ \).
11. In figure, a circle is inscribed in a triangle $PQR$ with $PQ = 10 \text{ cm}$, $QR = 8 \text{ cm}$ and $PR = 12 \text{ cm}$. Find the lengths $QM, RN$ and $PL$. 

12. Prove that the parallelogram circumscribing a circle is a rhombus. 

13. Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle. 

14. In figure, a triangle $ABC$ is drawn to circumscribe a circle of radius $2 \text{ cm}$ such that the segments $BD$ and $DC$ into which $BC$ is divided by the point of contact $D$ are of lengths $4 \text{ cm}$ and $3 \text{ cm}$ respectively. If area of $\triangle ABC = 21 \text{ cm}^2$, then find the lengths of sides $AB$ and $AC$. 

15. In figure, a triangle $ABC$ is drawn to circumscribe a circle of radius $10 \text{ cm}$ such that the segments $BP$ and $PC$ into which $BC$ is divided by the point of contact $P$, are of lengths $15 \text{ cm}$ and $20 \text{ cm}$ respectively. If the area of $\triangle ABC = 525 \text{ cm}^2$, then find the lengths of sides $AB$ and $AC$. 

16. In figure, a triangle $PQR$ is drawn to circumscribe a circle of radius $6 \text{ cm}$ such that the segments $QT$ and $TR$ into which $QR$ is divided by the point of contact $T$, are of lengths $12 \text{ cm}$ and $9 \text{ cm}$ respectively. If the area of $\triangle PQR = 189 \text{ cm}^2$, then find the lengths of sides $PQ$ and $PR$. 

17. Prove that a parallelogram circumscribing a circle is a rhombus. 

18. A circle touches the side $BC$ of $\triangle ABC$ at a point $P$ and touches $AB$ and $AC$ when produced at $Q$ and $R$ respectively. Show that 

$$AQ = \frac{1}{2}(\text{Perimeter of } \triangle ABC)$$ 

4 Marks:

1. Prove that the lengths of two tangents drawn from an external point to a circle are equal. 

2. In given figure, $XY$ and $PQ$ are two parallel tangents to a circle with centre $O$ and another tangent $AB$ with point of contact $C$ intersecting $XY$ at $A$ and $PQ$ at $B$. Prove that $\angle AOB = 90^\circ$. 

4 Marks:
3. The radii of two concentric circles are 13 cm and 8 cm. AB is a diameter of the bigger circle and BD is tangent to the smaller circle touching it at D and intersecting the larger circle at P, on producing. Find the length of AP.

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4. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

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5. In figure, AB is a chord of a circle, with centre O, such that AB = 16 cm and radius of circle is 10 cm. Tangents at A and B intersect each other at P. Find the length of PA.

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6. Prove that the lengths of the tangents drawn from an external point to a circle are equal. Using the above theorem, prove that AB + CD = AD + BC, if a quadrilateral ABCD is drawn to circumscribe a circle. CBSE Sample Paper 2016

7. In figure, O is the centre of a circle of radius 5 cm. T is a point such that OT = 13 cm and OT intersects circle at E. If AB is a tangent to the circle at E, find the length of AB, where TP and TQ are two tangents to the circle.

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8. In figure, two equal circles, with centres O and O′, touch each other at X. OO′ produced meets the circle with centre O′ at A. AC is tangent to the circle with centre O, at the point C. O′D is perpendicular to AC. Find the value of \( \frac{DO}{CO} \).

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9. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

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10. In figure, tangents PQ and PR are drawn from an external point P to a circle with centre O, such that \( \angle RPQ = 30^\circ \). A chord RS is drawn parallel to the tangent PQ. Find \( \angle RQS \).

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11. Prove that the lengths of the tangents drawn from an external point to a circle are equal. CBSE 2015, Outside Delhi (30/1)

12. Prove that the tangent drawn at the mid-point of an arc of a circle is parallel to the chord joining the end points of the arc. CBSE 2015, Outside Delhi (30/1)

13. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact. CBSE 2015, Foreign (30/2/1) CBSE 2014, Outside Delhi (30/1), (30/2), (30/3)

14. In figure, O is the centre of the circle and TP is the tangent to the circle from an external point T. If \( \angle PBT = 30^\circ \), prove that \( BA : AT = 2 : 1 \).

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15. In Figure, \( PQ \) is a chord of length 16 cm, of a circle of radius 10 cm. The tangents at \( P \) and \( Q \) intersect at a point \( T \). Find the length of \( TP \).

16. Prove that opposite sides of a quadrilateral circumscribing a circle sub tend supplementary angles at the centre of the circle.

17. In Figure a triangle \( ABC \) is drawn to circumscribe a circle of radius 4 cm, such that the segments \( BD \) and \( DC \) are of lengths 8 cm and 6 cm respectively. Find the sides \( AB \) and \( AC \).

18. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

19. If figure, \( l \) and \( m \) are two parallel tangents to a circle with centre \( O \), touching the circle at \( A \) and \( B \) respectively. Another tangent at \( C \) intersects the line \( l \) at \( D \) and \( m \) at \( E \). Prove that \( \angle DOE = 90^\circ \).

20. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

21. A quadrilateral \( ABCD \) is drawn to circumscribe a circle. Prove that \( AB + DC = AD + BC \).

22. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

23. Prove that the length of tangents drawn from an external point to a circle are equal.

24. Prove that the lengths of tangents drawn from an external point to a circle are equal.

25. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

26. Prove that the lengths of the tangents drawn from an external point to a circle are equal.

Using the above theorem prove that:

If quadrilateral \( ABCD \) is circumscribing a circle, then
\[ AB + CD = AD + BC. \]

27. Prove that the lengths of tangents drawn from an external point to a circle are equal.

Using the above, prove the following:

\( ABC \) is an isosceles triangle in which \( AB = AC \), circumscribed about a circle, as shown in Fig. Prove that the base is bisected by the point of contact.