B and C are points on the circumference of a circle, centre O. AB and AC are tangents to the circle. Angle BAC = 40°. Find the size of angle BCO.
B, C and D are points on the circumference of a circle, centre O. 
AB and AD are tangents to the circle. 
Angle DAB = 50°

Work out the size of angle BCD. 
Give a reason for each stage in your working.
Q3.

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

Work out the size of angle $DOA$.

Q4.

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

Angle $DAB = 40^\circ$
Angle $CBE = 75^\circ$

Work out the size of angle $ODC$. 
Q5. 

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

Angle CAB = 25° 
Angle DEC = 100° 

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

Q6. 

A, B and C are points on the circumference of a circle. 
The straight line PAQ is a tangent to the circle. 

Angle PAC = 56° 
Angle ACB = 75° 

Work out the size of the angle marked x. 
Give reasons for each stage of your working.
Q7.

A and B are points on the circumference of a circle, centre O. 
AT is a tangent to the circle.

Angle $\angle TAB = 58^\circ$.
Angle $\angle BTA = 41^\circ$.

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

Q8.

$A$, $B$, $C$ and $D$ are points on the circumference of a circle, centre $O$.
Angle $\angle AOC = y$.

Find the size of angle $\angle ABC$ in terms of $y$.
Give a reason for each stage of your working.
Q9.

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

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

Q10.

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

Prove that angle ACB = (90 – x)°.
**Topics listed in objectives**

- Recall the definition of a circle and identify (name) and draw parts of a circle, including sector, tangent, chord, segment;
- Prove and use the facts that:
  - the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference;
  - the angle in a semicircle is a right angle;
  - the perpendicular from the centre of a circle to a chord bisects the chord;
  - angles in the same segment are equal;
  - alternate segment theorem;
  - opposite angles of a cyclic quadrilateral sum to 180°;
- Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point;
- Find and give reasons for missing angles on diagrams using:
  - circle theorems;
  - isosceles triangles (radius properties) in circles;
  - the fact that the angle between a tangent and radius is 90°;
  - the fact that tangents from an external point are equal in length.

**Answers**

Q1. 20°
Q2. 65°
Q3. 68°
Q4. 55°
Q5. 35°
Q6. 49°
Q7. 113°
Q8. \((180 - y/2)°\)
Q9. \(OMN = (180 - y)/2°\) (isosceles triangles) = \((90 - y/2)°\),
so \(BMN = (y/2)°\) (tangent at right angle to radius)
Q10. \(AOB = 360 - 90 - 90 - 2x = 180 - 2x°\) (tangent at right angle to radius),
so \(ACB = 180 - 2x ÷ 2\) (angle at centre double angle at circumference) = \((90 - x)°\)