1. **Angle Properties of Circles**

1. In the figure below PQR and S are points on the circumference of a circle centre O. The point TSO and Q lie on a straight line MPT is a tangent to the circle at P.

![Circle Diagram](image)

Find the values of the following angles stating reasons in each case.

(a) \( \angle SRP \)  
(b) \( \angle ORP \)  
(c) \( \angle RPT \)  
(d) \( \angle STP \)  
(e) \( \angle QPM \)

2. In the figure below, TA is a tangent to the circle ABCD with centre O. \( \angle TAD = 48^\circ \) and \( \angle BOD = 116^\circ \)

![Tangent Diagram](image)

Giving reasons calculate:

a) \( \angle ACD \)  
(b) \( \angle ABO \)  
(c) \( \angle ADO \)  
(d) \( \angle ACB \)  
(e) \( \angle ATB \)

3. In the figure below AB = 8cm and O is the centre of the circle. Determine the area of the circle if \( \angle OAB = 15^\circ \)
4. The figure above is a cyclic quadrilateral PQRS. Given that TPX is a tangent at P and O is the centre of the circle and that RQX is a straight line with $\angle RPQ = 50^\circ$ and $\angle PRS = 25^\circ$, giving reason in each case find:

(a) $\angle PRQ$  
(b) $\angle PSR$  
(c) $\angle PXQ$  
(d) $\angle TPS$  
(e) $\angle POS$

5. In the figure below ABCD is a circle with centre O. AB and DC meet at a point E outside the circle. DC = BC and $\angle BCE = 48^\circ$.

Find the angles

a) BAD  
b) BDC  
c) BEC

6. In the figure O and P are centres of intersecting circles ABD and DBC respectively. Line ABE is a tangent to circle BCD at B and angle $BCD = 42^\circ$. 
Giving reasons determine the size of:

(a) Angle CBD. (2mks)
(b) Angle ODB. (2mks)
(c) Angle BAD. (2mks)
(d) Angle ABD (2mks)
(e) Angle ODA. (2mks)

7. In the figure below, O is the centre of the circle. Express the angle W in terms of angles p and q. (2mks)

8. Two circles of radii 4cm and 6cm intersect as shown below. If angle XBY = 30° and angle XAY = 97.2°. Find the area of the shaded part. (Take $\pi = \frac{22}{7}$)

9. In the diagram, O is the centre of the circle and AD is parallel to BC. If angle ACB = 50° and angle ACD = 20°.
Calculate; (i) $\angle OAB$
(ii) $\angle ADC$

10. Two intersecting circles have centres S and R. Given that their two radii are 28cm and 35cm, their common chord $AB = 38cm$ and angles $ASB = 85.46^\circ$ and $ARB = 65.76^\circ$.

Calculate the shaded area

11. In the figure below ABCD is a cyclic quadrilateral in which $AD = DC$ and AB is parallel to CD. Given that angle $ABC = 80^\circ$. Find the size of:

(a) $\angle DAC$
(b) $\angle BAC$
(c) $\angle BCD$

12. Line QR = 6.5cm is given below:- (Do not use a protractor for this question)

(a) Draw triangle PQR such that $P$ lies above line QR, $\angle PQR = 30^\circ$ and PQ = 7cm

(b) By accurate construction on the diagram above, show the locus of a point which lies within the triangle such that:-

(i) T is more than 2.5cm from line PQ

(ii) T is not more than 4.5cm from Q

Shade the region in which T lies

(c) Lines QP and QR are produced to K and M respectively

(i) Show by construction on the diagram above, the locus of a point C which is equidistant from each of the lines PK, PR and RM

(ii) With centre C and an appropriate radius, draw a circle to touch each of the lines PK, PR and RM only once

Measure the radius
What name is given to the circle drawn in (c) (ii) with respect to triangle QPR.

13. The figure below shows a circle centre O and a cyclic quadrilateral ABCD. AC = CD, angle ACD is 80° and BOD is a straight line. Giving reasons for your answer, find the size of:

(i) Angle ACB
(ii) Angle AOD
(iii) Angle CAB
(iv) Angle ABC
(v) Angle AXB

14. The figure below shows two circles of equal radius of 9 cm with centres A and B. Angle CAD = 80°

a) Calculate the area of:
   i) The sector CAD.
   ii) The triangle CAD.
   iii) The shaded region.

15. In the diagram below, \(\angle QOT\) is a diameter. \(\angle QTP = 48^\circ\), \(\angle TQR = 46^\circ\) and \(\angle SRT = 37^\circ\)

Calculate, giving reasons in each case:
(a) \(\angle RST\)
16. The diagram below shows a circle with a chord PQ = 3.4 cm and angle PRQ = 40°. Calculate the area of the shaded segment.

![Diagram of a circle with chord PQ and angles PRQ = 40°](image)

17. The figure below shows circle ABCD. The line EDF is a tangent to the circle at D. \( \angle ADF = 70° \), \( \angle FAD = 65° \) and \( \angle CDE = 35° \). Find the values of the following angles, stating your reasons in each case:

(a) \( \angle ABC \)
(b) \( \angle BCD \)
(c) \( \angle DCE \)
(d) \( \angle ACD \)

![Diagram of a circle with tangents and angles](image)

18. In the figure below BD is the diameter of the circle and O is the centre. Find the size of the angles.

![Diagram of a circle with diameter BD](image)
(a) $\angle ADC$

(b) $\angle AEB$

48°

C