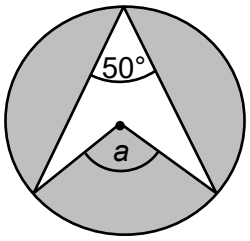
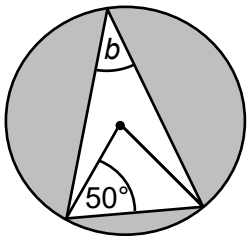
Higher Check In - 8.05 Circles

1. Calculate angle *a*.



Not to scale

2. Calculate angle *b*.



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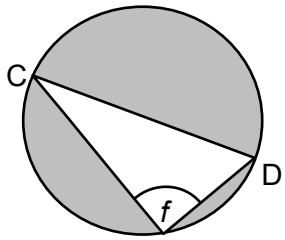
3. Given that CD is the diameter, find angle *f*.



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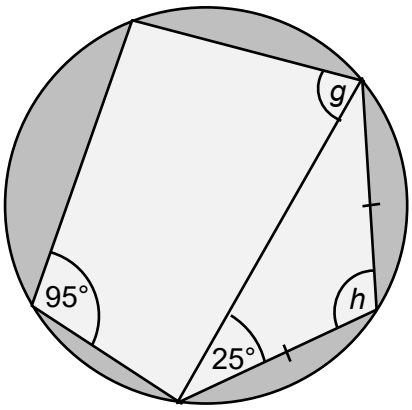
4. Calculate angle *g* and angle *h*.



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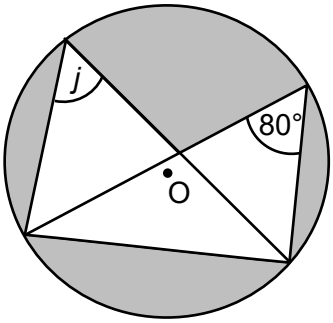
5. Find angle *j*.



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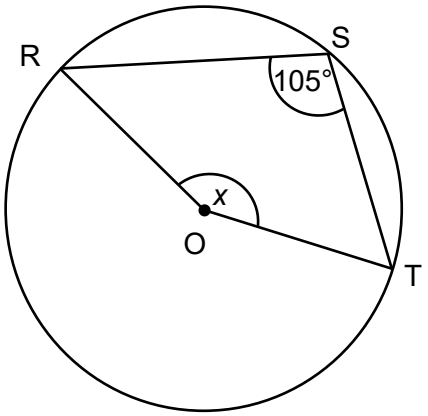
6. George states that a segment is part of a circle enclosed by two radii of the circle and the section of the circumference between them. Is he correct? Explain your answer.

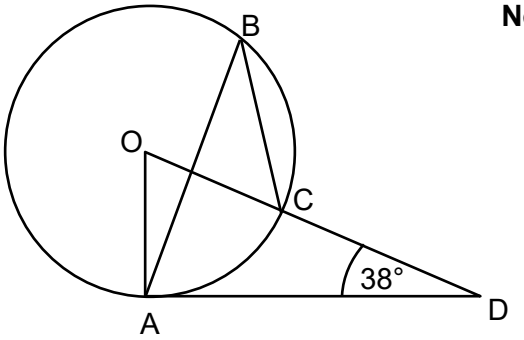
7. Chiara says that she can use the proof that opposite angles of a cyclic quadrilateral are supplementary to work out angle *x*. Explain why Chiara is wrong and then find angle *x*.



Not to scale

8. Prove that two angles in the same segment are equal.

9. A, B and C are points on the circumference of the circle and O is the centre of the circle. Angle ADO = 38° and AD is a tangent to the circle at point A. OCD is a straight line. Calculate angle ABC.



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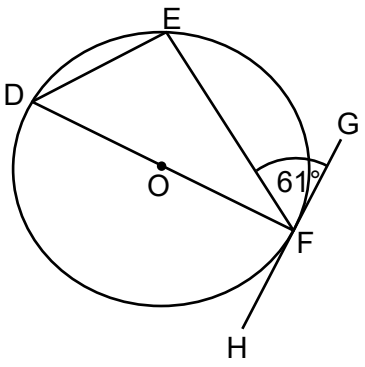
10. D, E and F are points on the circumference of the circle and O is the centre of the circle. Angle EFG = 61° and GH is a tangent to the circle at point F. Calculate angle DFE and angle EDF.



Not to scale

Extension

The diameter of a circle is 26 cm and the length of one of its chords is 24 cm. Find the shortest distance of the chord from the centre.

Answers

1. 100°

2. 40°

3. 90°

4. Angle *g* is 85° and angle *h* is 130°

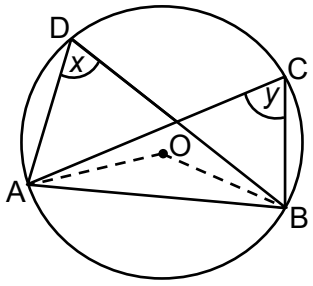
5. 80°

6. No, his description is of a sector of a circle. A segment is the region between a chord of a circle and its associated arc.

7. RSTO is not a cyclic quadrilateral as all four vertices do not touch the circumference, so Chiara is wrong. She should use the angle subtended by an arc at the centre is twice the angle at the circumference proof.

   Angle $x = 360 - \text{reflex angle ROT}$
   Reflex angle $\text{ROT} = 2 \times 105 = 210°$
   Angle $x = 360 - 210 = 150°$

8. The angle at the centre $= 2x$ (angle subtended by an arc at centre is twice angle at the circumference).
   The angle at the centre $= 2y$ (angle subtended by an arc at centre is twice angle at the circumference).
   Therefore $2x = 2y$, and $x = y$.

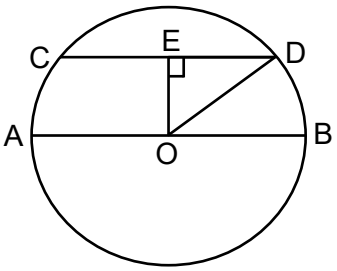


Not to scale

9. Angle AOD = 52° as tangent is 90° to the radius (OA), $180 - 90 - 38 = 52°$
   Angle ABC = AOD ÷ 2 = 52 ÷ 2 = 26° (as angle subtended at the centre is twice the angle subtended at the circumference).

10. Angle DFE = 29° (as tangent is 90° to the radius (OF) or diameter (DF)).
    Angle EDF = 61° (as alternate segments), or as DEF = 90° (angle in semicircle is 90°) and 180 – (90 + 29) = 61° (as there are 180° in a triangle).

Extension



Not to scale

AB = 26 cm (diameter) so OB = 13 cm (radius) as O is the centre of the circle.
DE = 12 cm as radius bisects chord
OD = 13 cm as radius
Angle DEO is 90°

Using Pythagoras' theorem:
$OE^2 = OD^2 - DE^2$
$OE^2 = 13^2 - 12^2$
$OE^2 = 169 - 144 = 25$
$OE = \sqrt{25} = 5$

The shortest distance is 5 cm

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AO1	1	Apply the theorem that the angle subtended by an arc at the centre is twice the angle at the circumference			
AO1	2	Apply the theorem that the angle subtended by an arc at the centre is twice the angle at the circumference			
AO1	3	Apply the theorem that the angle on the circumference subtended by a diameter is a right angle			
AO1	4	Apply the theorem that opposite angles of a cyclic quadrilateral are supplementary			
AO1	5	Apply the theorem that two angles in the same segment are equal			
AO2	6	Understand and use the terms sector and segment			
AO2	7	Understand and apply circle theorems			
AO2	8	Prove the theorem that two angles in the same segment are equal			
AO3	9	Solve a problem using circle theorems			
AO3	10	Solve a problem using circle theorems			

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