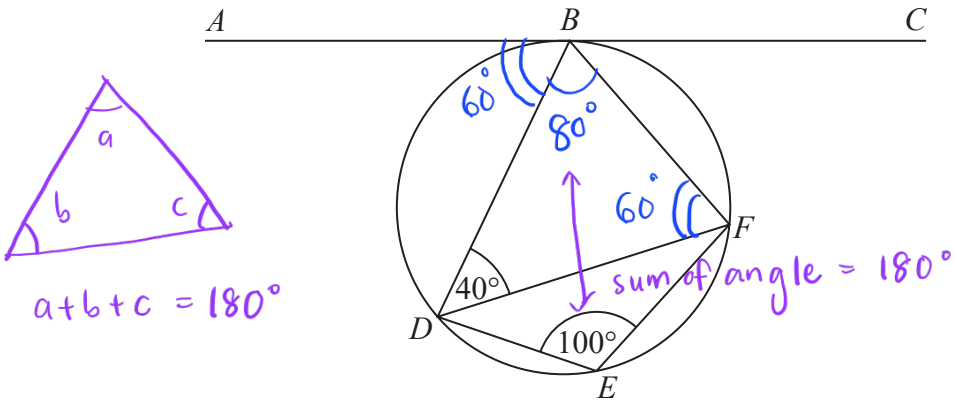
1



Points B, D, E and F lie on a circle.
ABC is the tangent to the circle at B.

Find the size of angle ABD.
You must give a reason for each stage of your working.

$\angle DBF = 180° - 100°$

$= 80°$ (1)

(opposite angle of cyclic quadrilateral adds up to 180°)

$\angle BFD = 180° - 40° - 80°$

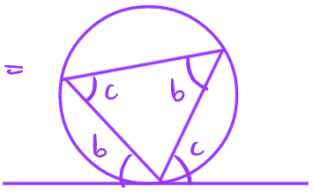
$= 60°$ (1)

(angle in triangle adds up to 180°)

$\angle ABD = 60°$ (1)

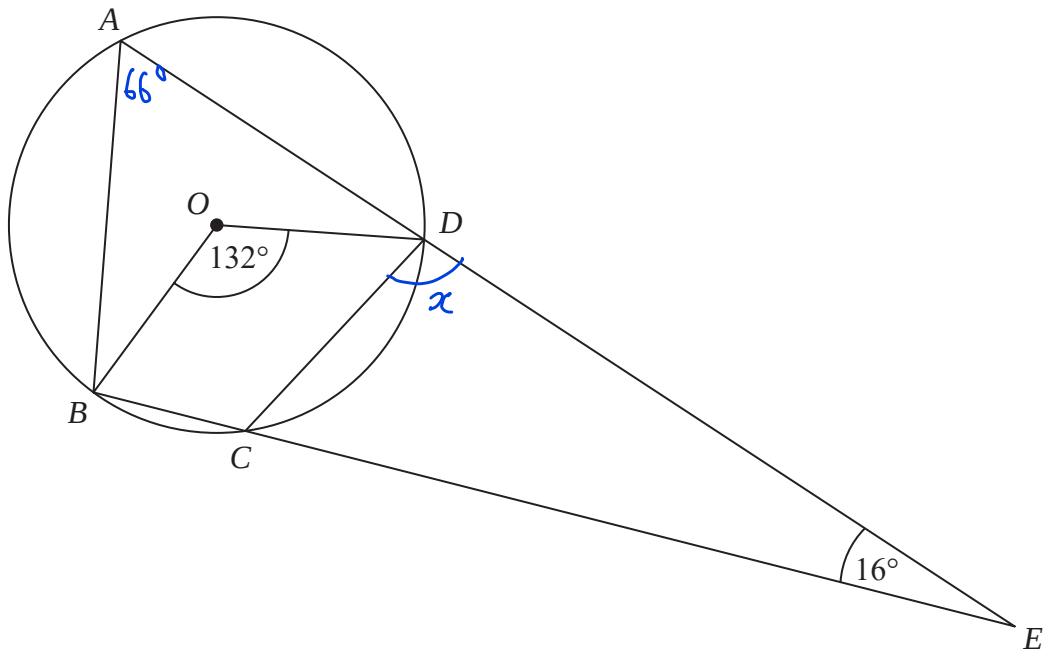
(alternate segment theorem) (1)

Alternate segment theorem =



(Total for Question 1 is 4 marks)

2 *A*, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
ADE and *BCE* are straight lines.



Work out the size of angle *CDE*.
Give a reason for each stage of your working.

$\angle BAD = \frac{1}{2} \times 132 = 66^\circ$ (angle at the centre is double the angle at the circumference) (1)
(1)

$\angle BCD = 180 - 66 = 114^\circ$ (opposite angles of a cyclic quadrilateral add up to 180°)
(1)

$\angle DCE = 180 - 114 = 66^\circ$ (angle in a straight line = 180°)

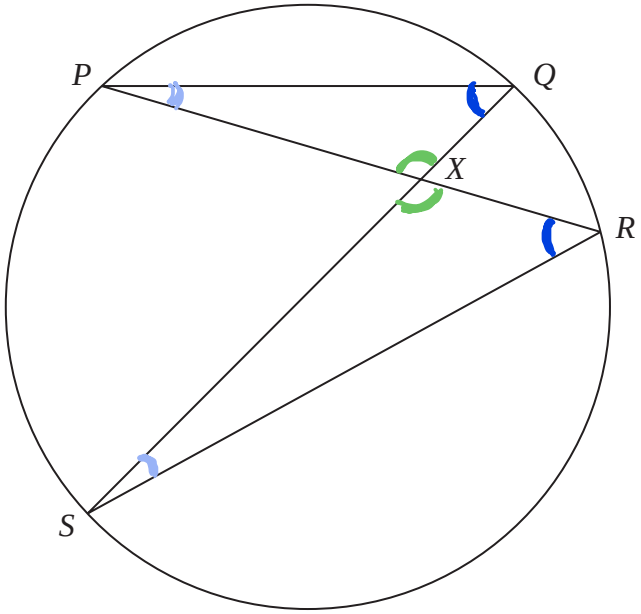
$66 + x + 16 = 180^\circ$ (angles in a triangle add up to 180°)

$x = 98^\circ$ (1)

98 °

(Total for Question 2 is 4 marks)

3 *P*, *Q*, *R* and *S* are four points on a circle.



PXR and *SXQ* are straight lines.

Prove that triangle *PQX* and triangle *SRX* are similar.

$\angle PQX = \angle SRX$ angles in the same segment are equal (1)

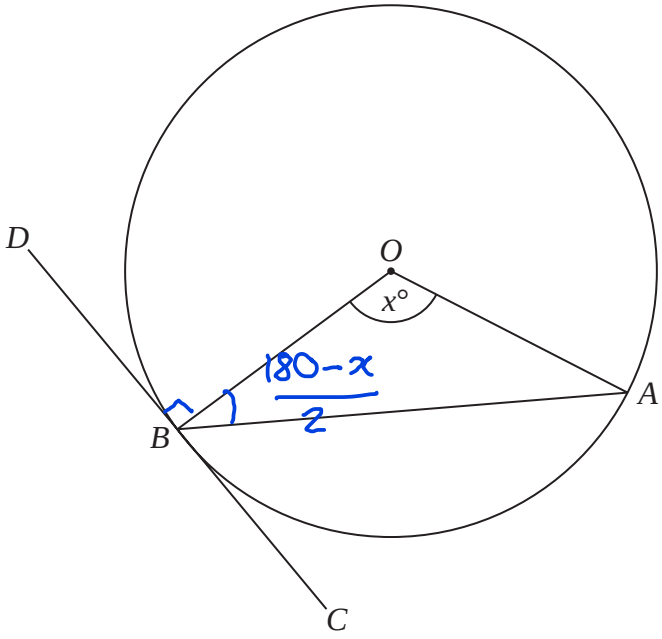
$\angle QPX = \angle RSX$ angles in the same segment are equal

$\angle PXQ = \angle SXR$ vertically opposite angles are equal (1)

All three angles are equal so the triangles are similar. (1)

(Total for Question 3 is 3 marks)

4



A and *B* are points on a circle, centre *O*.
DBC is the tangent to the circle at *B*.
Angle *AOB* = *x*°

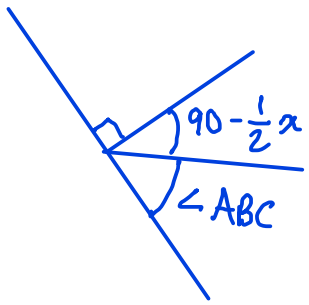
Show that angle *ABC* = $\frac{1}{2}x°$

You must give a reason for each stage of your working.

$\angle OBD = 90°$ (1) the tangent to a circle is perpendicular to the radius

$\triangle OAB$ is isosceles so base angles = $\frac{180-x}{2} = 90-\frac{1}{2}x$ (1)

DBC is a straight line so angles add up to 180°



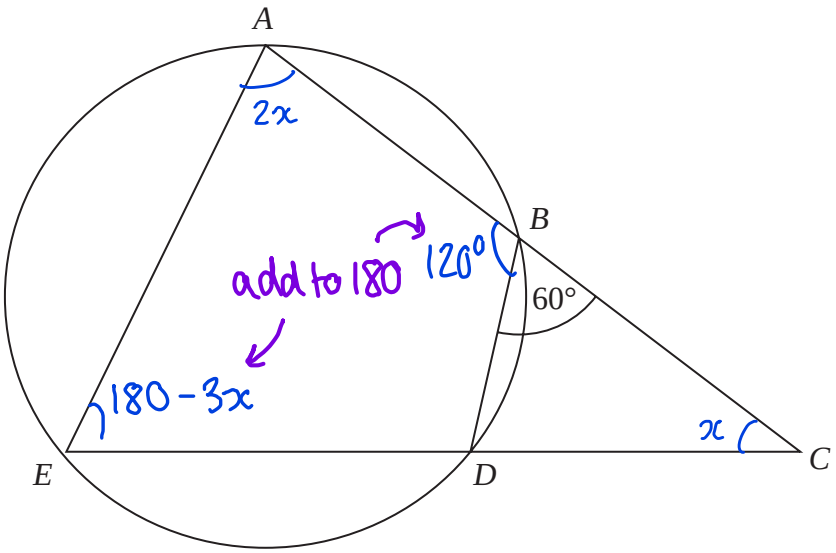
$90 + 90 - \frac{1}{2}x + \angle ABC = 180$

$-\frac{1}{2}x + \angle ABC = 0$

$\angle ABC = \frac{1}{2}x$ (1)

(Total for Question 4 is 3 marks)

5



ABDE is a cyclic quadrilateral.
ABC and *EDC* are straight lines.
Angle *DBC* = 60°

Given that

size of angle *EAB* : size of angle *BCD* = 2 : 1

work out the size of angle *BCD*.
You must show all your working.

let $\angle BCD = x$
then $\angle EAB = 2x$ (0)

From $\triangle ACE$,

$\angle AEC = 180 - (2x + x)$
$= 180 - 3x$ (1)

(angles in a $\triangle$ add up to 180)

$\angle ABD = 180 - 60 = 120$
(angles on a straight line add to 180)

since $\square ABDE$ is cyclic,
$\angle ABD + \angle AEC = 180^\circ$ (1)

$120 + 180 - 3x = 180^\circ$

$120 - 3x = 0$

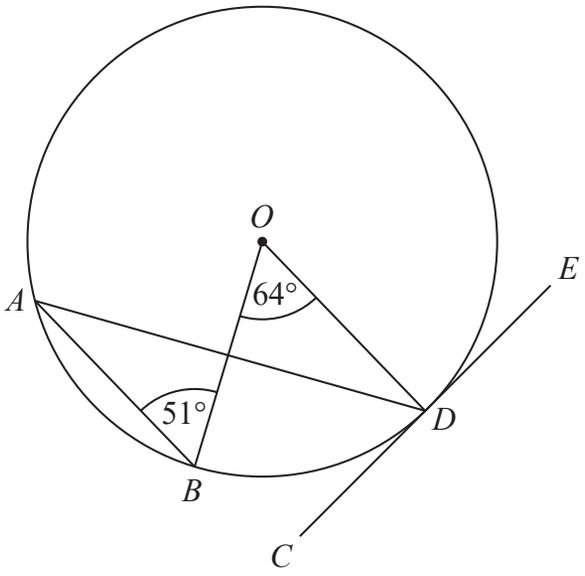
$3x = 120$

$x = 120 \div 3$
$= 40$ (1)

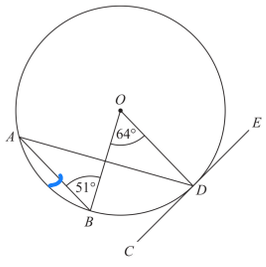
40 °

(Total for Question 5 is 4 marks)

6 A, B and D are points on a circle with centre O.
CDE is the tangent to the circle at D.

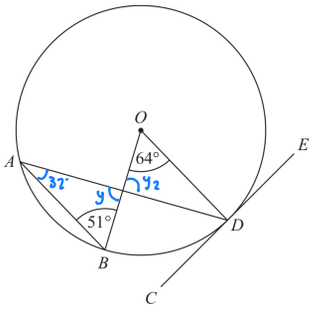


Work out the size of angle ADC.
Write down any circle theorems you use.



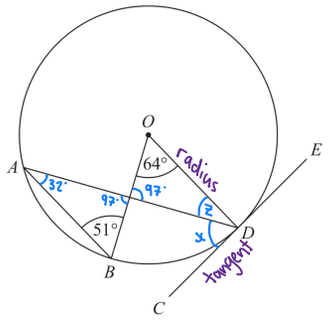
angle BAD = $\frac{1}{2}$ angle BOD
because angle at circumference is half the angle at centre ✓(1)

angle BAD = 32° ✓(1)



let y = angle inside the triangle
y = 180 - 32 - 51
= 97°
because angles in a △ sum to 180°

y_2 = 97°
because vertically opposite angles are equal



angle z = 180 - 97 - 64
= 19°
because angles in a △ sum to 180° ✓(1)

angle x = 90° - 19
= 71° ✓ ✓(1)
because a radius (OD) and tangent meeting form 90° 71 °

(Total for Question 6 is 4 marks)