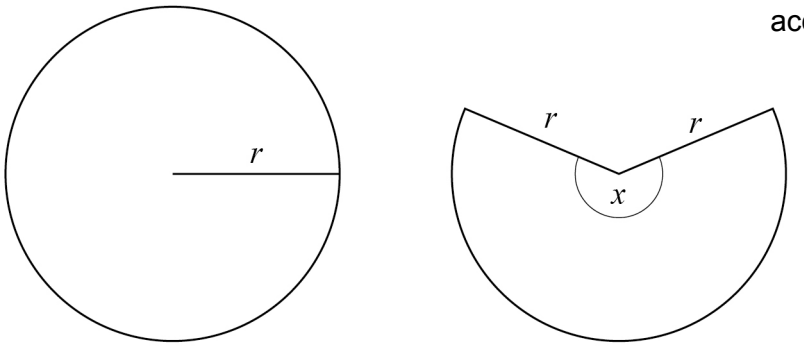
1 Here are a circle and a sector of the circle.

They each have radius r.

Not drawn accurately



circumference of circle = perimeter of sector

Work out the size of angle x.

Give your answer in terms of π

[4 marks]

circumference $= 2\pi r$ (1)

length of arc $= \frac{x}{360} \times 2\pi r$ (1)

perimeter of sector $= \frac{x}{360} \times 2\pi r + 2r$

$2\pi r = \frac{x}{360} \times 2\pi r + 2r$ (1)

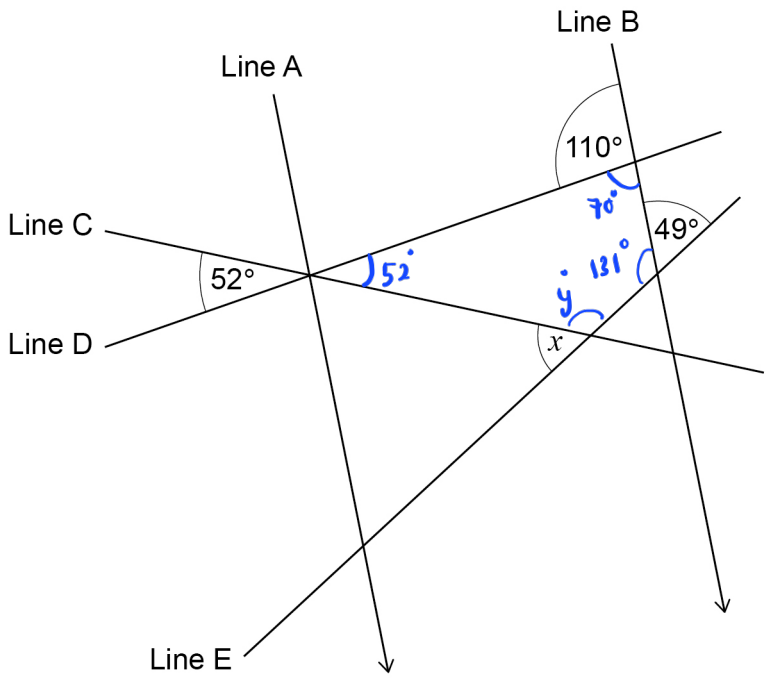
$2r(\pi) = 2r\left(\frac{x\pi}{360} + 1\right)$

$x = \frac{360\pi - 360}{\pi} = 360 - \frac{360}{\pi}$ (1)

Answer $360 - \frac{360}{\pi}$ degrees

2 Lines A, B, C, D and E intersect as shown.

Lines A and B are parallel.



Not drawn accurately

Work out the size of angle x.

[3 marks]

$y^\circ = 360^\circ - 52^\circ - 70^\circ - 131^\circ$

$= 107^\circ$

$x = 180^\circ - 107^\circ$

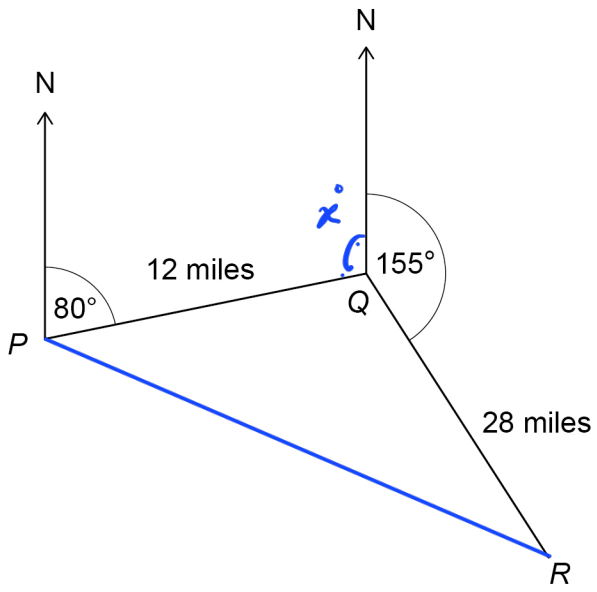
$= 73^\circ$ (3)

Answer 73 degrees

3 A ship sails from *P* to *Q* and then from *Q* to *R*.

Q is 12 miles from *P*, on a bearing of 080°

R is 28 miles from *Q*, on a bearing of 155°



Not drawn accurately

Work out the direct distance from *P* to *R*.

[4 marks]

$x^\circ = 180^\circ - 80^\circ = 100^\circ$

$PQR = 360^\circ - 155^\circ - 100^\circ$

$= 105^\circ$ (1)

$PR^2 = 12^2 + 28^2 - 2(12)(28)\cos 105^\circ$

$= 1101$ (1)

$PR = \sqrt{1101}$ (1)

$= 33.19$ (1)

Answer 33.19 miles

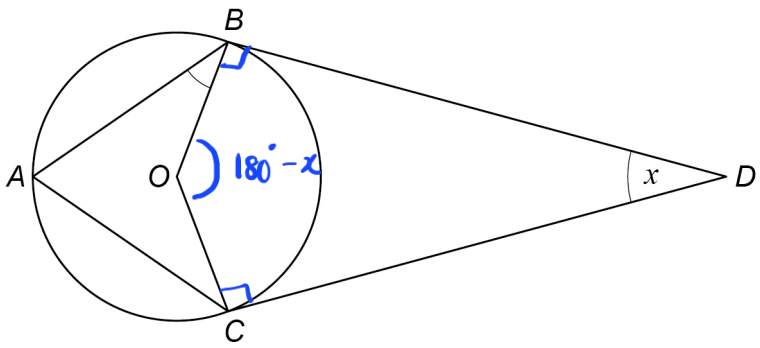
4 *A*, *B* and *C* are three points on the circumference of a circle, centre *O*.

BD and *CD* are tangents to the circle.

ABDC is a kite.

Angle *BDC* is x

Not drawn accurately



Prove that angle *ABO* is $45° - \frac{x}{4}$

[4 marks]

$OBD = OCD = 90°$ (1)

(tangent meets the radius at 90°)

BOC (obtuse) $= 180° - x$

(angles in a quadrilateral add up to 360°)

$BAC = \frac{180° - x}{2}$ (1)

(angles at circumference is half angles at centre)

BOC (reflex) $= 360° - (180° - x)$ (1)

$= 180° + x$

(angles around a point add up to 360°)

$ABO + ACO = 360° - (180 + x + 90° - \frac{x}{2})$

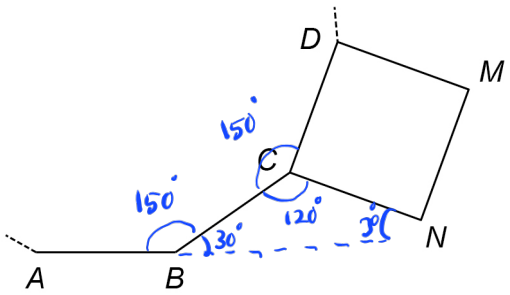
$= 90° - \frac{x}{2}$ (1)

$ABO = \frac{1}{2}(90° - \frac{x}{2}) = 45° - \frac{x}{4}$ (proved)

5 *AB*, *BC* and *CD* are sides of a regular 12-sided polygon.

CDMN is a square.

Not drawn accurately



Prove that points *A*, *B* and *N* lie on a straight line.

[4 marks]

Interior angle $= 180 - \frac{360}{12} = 150°$ (1)

ABC + CBN $= 180°$

CBN $= 180° - 150° = 30°$

DCN $= 90°$ (square has 4 90° angle)

BCN $= 360° - 90° - 150°$ (1)

$= 120°$ (angles at a point add up to 360°)

BNC $= 180° - 120° - 30°$ (1)

$= 30°$ (angles in a triangle add up to 180°)

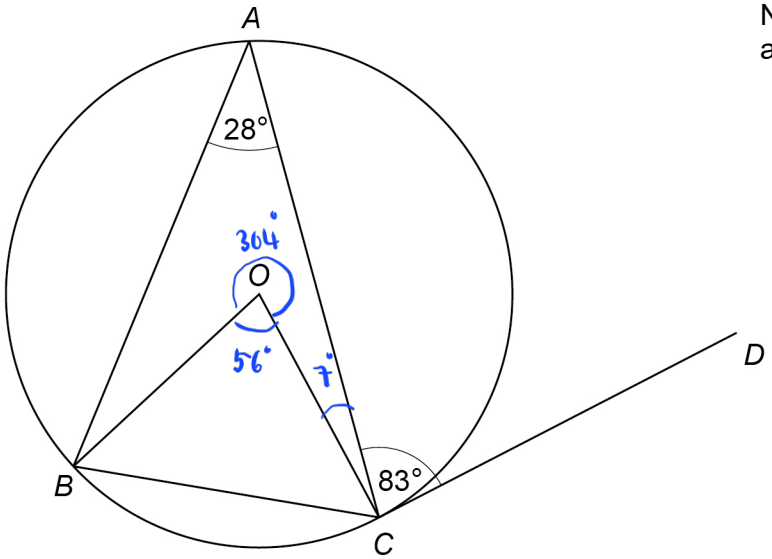
since BCN is an isosceles triangle, BC = CN $= 30°$

ABN is a straight line because $150° + 30° = 180°$ (1)

(angles on a straight line).

6 *A*, *B* and *C* are points on a circle, centre *O*.

DC is a tangent to the circle.



Not drawn accurately

Show that angle *ABO* : angle *ACO* = 3 : 1

[5 marks]

ACO = 90 - 83 = 7° (1)

BOC (small) = 2 × 28° = 56° (1)

BOC (large) = 360° - 56° = 304° (1)

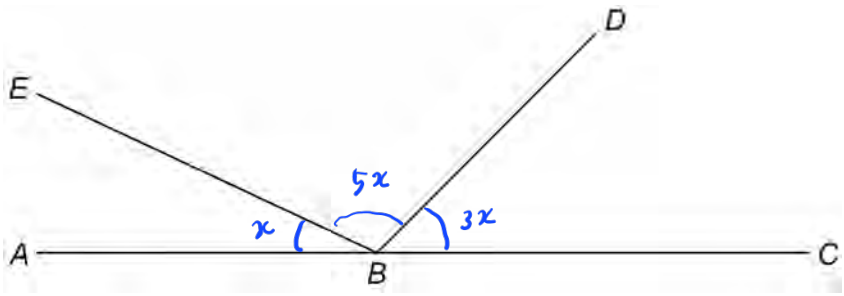
ABO° = 360° - 304° - 7 - 28°

= 21° (1)

ABO : ACO = 21 : 7 ÷7

3 : 1 (1)

7 *ABC*, *BD* and *BE* are straight lines.



Not drawn accurately

angle *EBD* = 5 × angle *ABE*

angle *DBC* = 3 × angle *ABE*

Work out the size of angle *EBD*.

[3 marks]

let ABE = x

total angle = x + 5x + 3x = 9x (1)

$EBD = \frac{5x}{9x} \times 180^\circ = 100^\circ$ (1) (1)

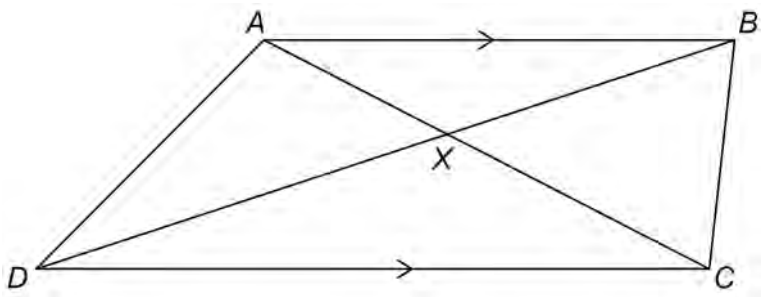
Answer 100 °

8 *ABCD* is a trapezium.

All four sides are different lengths.

AB is parallel to *CD*.

The diagonals intersect at *X*.



Not drawn accurately

For each statement, tick the correct box.

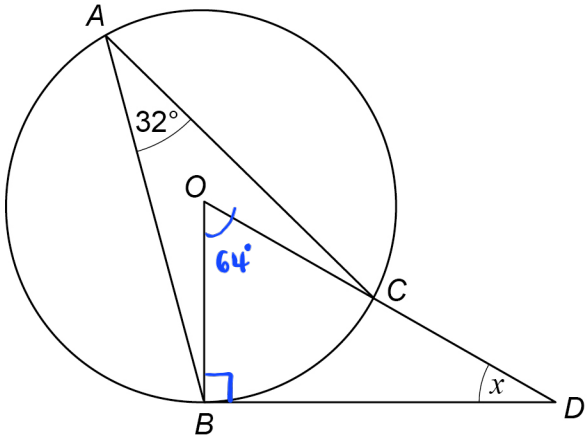
[4 marks]

	True	May be true	Not true
Triangles *AXB* and *CXD* are similar	✓ (1)		
Triangles *AXD* and *BXC* are congruent			✓ (1)
Angle *ADB* = angle *BDC*			✓ (1)
Area of triangle *ABC* = area of triangle *ABD*	✓ (1)		

9 *A*, *B* and *C* are points on a circle, centre *O*.

BD is a tangent to the circle.

OCD is a straight line.



Not drawn accurately

Work out the size of angle x.

[3 marks]

BOD = 32 × 2 = 64° (1)

x + 64° + 90° = 180° (1)

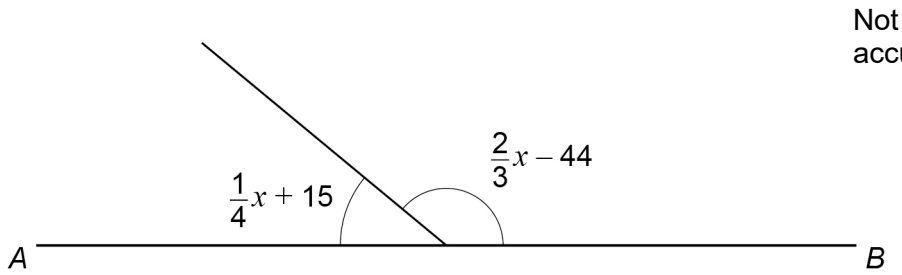
x = 180° − 90° − 64°

= 26° (1)

$x =$ 26 degrees

10 *AB* is a straight line.

Both angles are given in degrees.



By working out the value of x,

work out the ratio smaller angle : larger angle

[4 marks]

$\frac{1}{4}x + 15 + \frac{2}{3}x - 44 = 180$ ✓(1)

$\frac{1}{4}x + \frac{2}{3}x = 180 - 15 + 44$ ✓(1)

$\frac{11}{12}x = 209$ ✓(1)

$x = 228$

Smaller angle : $\frac{1}{4}(228) + 15 = 72$

larger angle : $\frac{2}{3}(228) - 44 = 108$

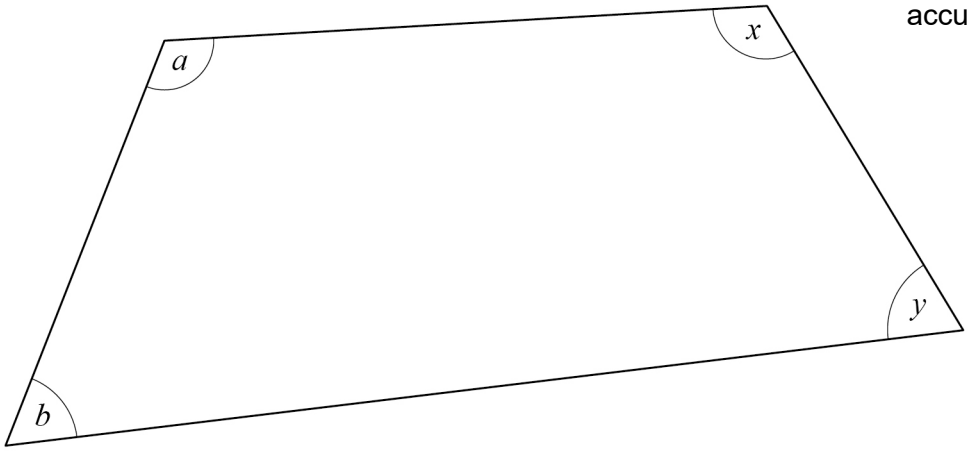
Smaller angle : larger angle $= 72 : 108$

$= 2 : 3$ ✓(1)

Answer 2 : 3

11

Not drawn accurately



$b = 45°$ and $a : b = 7 : 3$ and $x : y = 4 : 1$

Show that $a : y = 5 : 2$

[3 marks]

$a = 45° \times \frac{7}{3} = 105°$ ✓ (1)

$y = \frac{360° - 45° - 105°}{5}$

$= \frac{210°}{5} = 42°$ ✓ (1)

$a : y = 105° : 42$ ✓ (1)
$\div 21 \quad \div 21$
$= 5 : 2$ (shown)