1

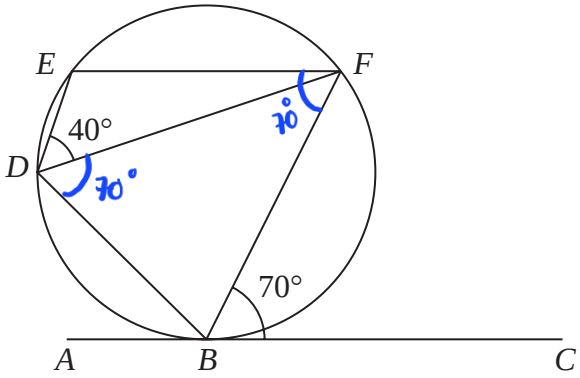


Diagram **NOT** accurately drawn

B, *D*, *E* and *F* are points on a circle.
ABC is the tangent to the circle at *B*.

Angle *EDF* = 40°
Angle *FBC* = 70°

Prove that the tangent *ABC* is parallel to *EF*.
Give a reason for each stage of your working.

$\angle BDF = \angle FBC = 70^\circ$ (1)

(alternate segment theorem) (1)

$\angle EFB = 180^\circ - \angle EDB$

$= 180^\circ - (40^\circ + 70^\circ)$

$= 180^\circ - 110^\circ$

$= 70^\circ$ (1)

(angles opposite to each other in a cyclic quadrilateral sums up to 180°)

∴ since $\angle EFB = 70^\circ$ which is the same as $\angle FBC$,

line EF and line ABC are parallel. (1)

($\angle EFB$ and $\angle FBC$ are alternate angles)

(Total for Question 1 is 4 marks)

2

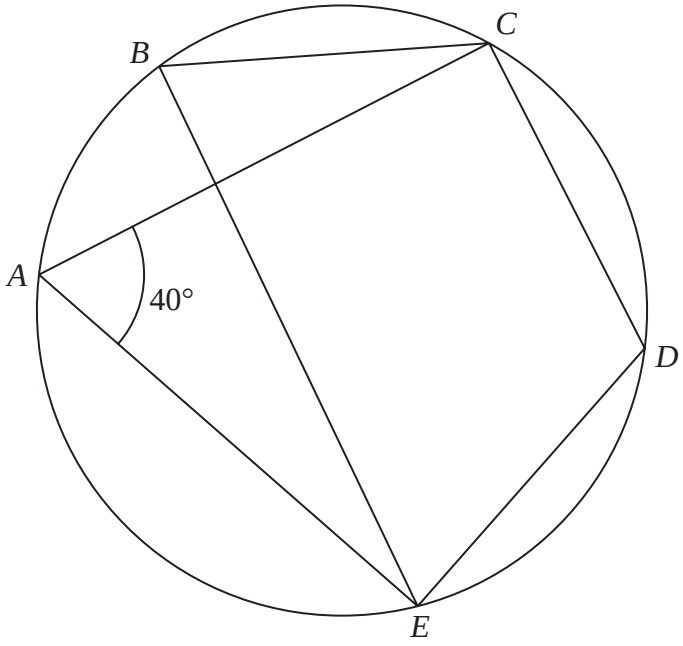


Diagram **NOT** accurately drawn

A, *B*, *C*, *D* and *E* are points on a circle.

Angle *EAC* = 40°

(a) (i) Write down the size of angle *EBC*.

angle EBC = angle EAC = 40°

40 (1) °

(1)

(ii) Give a reason for your answer.

Angles in the same segment are equal. (1)

(1)

(b) Find the size of angle *EDC*.

opposite angles in a cyclic quadrilateral sums up to 180°.

angle EDC = 180° − angle EAC

= 180° − 40°

= 140° (1)

140 °

(1)

(Total for Question 2 is 3 marks)

3

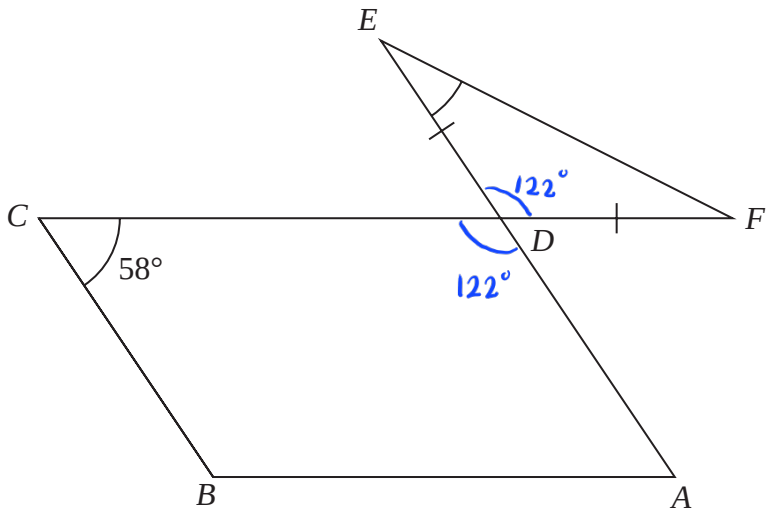


Diagram **NOT** accurately drawn

The diagram shows a parallelogram *ABCD* and an isosceles triangle *DEF* in which *DE* = *DF*

CDF and *ADE* are straight lines.
Angle *BCD* = 58°

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

angle ADC = $180^\circ - 58^\circ$

$= 122^\circ$ (1)

(co-interior angles add up to 180°) (1)

angle EDF = angle ADC = 122°

(vertically opposite angles are equal)

angle DEF = $\frac{180^\circ - 122^\circ}{2}$ (1) = $\frac{58^\circ}{2}$ ← (base angles in isosceles are the same)

$= 29^\circ$ (1)

(angles in triangle adds up to 180°) (1)

29 .....°

(Total for Question 3 is 5 marks)

4 The diagram shows the prism *ABCDEF* with cross section triangle *ABC*.

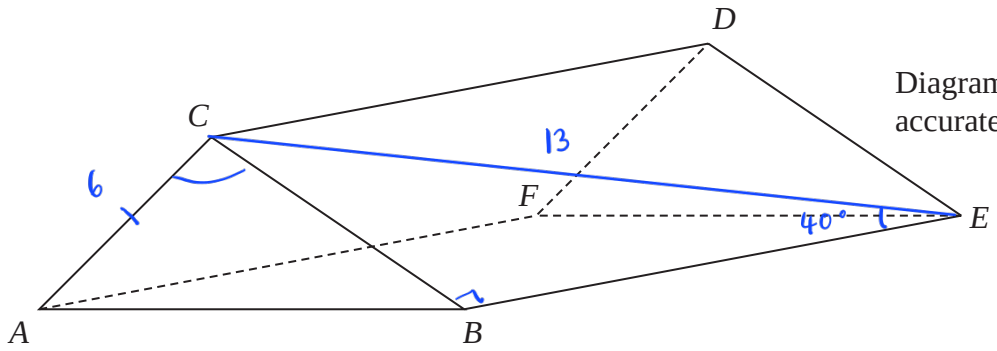


Diagram **NOT** accurately drawn

Angle *BEC* = 40° and angle *ACB* is obtuse.
AC = 6 cm and *CE* = 13 cm

The area of triangle *ABC* is 22 cm^2

Calculate the length of *AB*.
Give your answer correct to one decimal place.

$CB = 13 \sin 40°$

$= 8.3562\ldots$ (1)

Area of triangle $= \frac{1}{2} ab \sin C$

$22 = \frac{1}{2} \times 6 \times 8.3562\ldots \sin \angle ACB$ (1)

$\sin \angle ACB = 0.87758\ldots$

Acute version $ACB = \sin^{-1}(0.87758\ldots)$

$= 61.353°$ (1)

$ACB = 180 - 61.353 = 118.647°$ (1)

cosine rule → $a^2 = b^2 + c^2 - 2bc \cos A$

$(AB)^2 = 6^2 + (8.3562)^2 - 2(6)(8.3562) \cos 118.647°$

$= 153.899$ (1)

$AB = \sqrt{153.899}$

$= 12.4$ cm (1)

12.4 ..... cm

(Total for Question 4 is 6 marks)

5 *P*, *Q* and *R* are points on a circle, centre *O*.
TRV is the tangent to the circle at *R*.

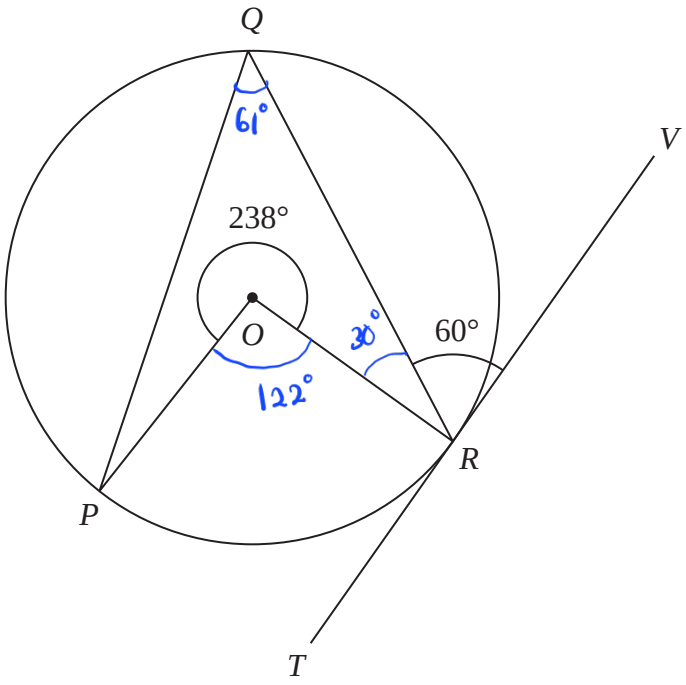


Diagram **NOT** accurately drawn

Reflex angle *POR* = 238°
Angle *QRV* = 60°

Calculate the size of angle *OPQ*.
Give a reason for each stage of your working.

angle ORQ = 90° - 60°
= 30°
(angle between a tangent and radius is 90°)

angle POR = 360° - 238°
= 122° (1)
(angle around a point is 360°)

angle PQR = $\frac{122^\circ}{2}$ = 61° (1)
(angle at centre of circle is twice the angle at circumference) (1)

angle OPQ = 360° - 238° - 30° - 61°
= 31° (1)
(angle in quadrilateral = 360°)

31 °

(Total for Question 5 is 4 marks)

6

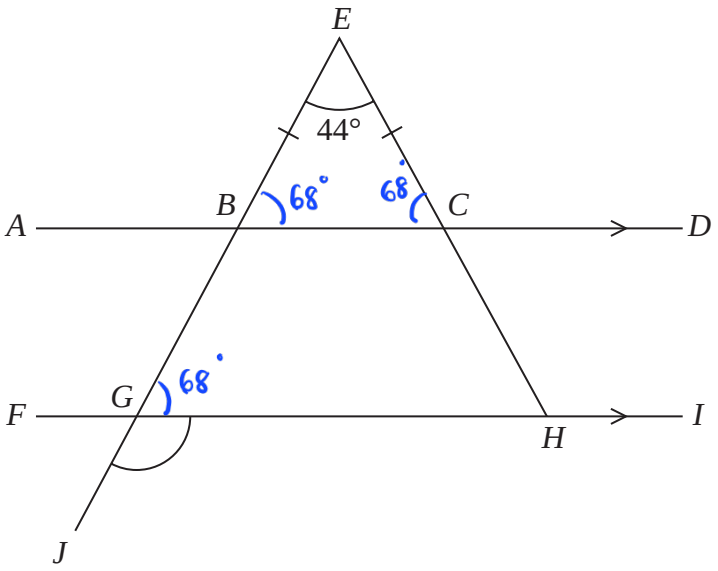


Diagram **NOT** accurately drawn

ABCD and *FGHI* are parallel straight lines.
EBGJ and *ECH* are straight lines.

BE = *CE*
Angle *BEC* = 44°

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

angle EBC = $\frac{180^\circ - 44^\circ}{2}$ = 68° (1)

(angles at the base of isosceles triangle are the same)

Angle BGH = angle EBC = 68° (1)

(corresponding angles are the same) (1)

angle JGH = 180° - 68° = 112° (1)

(angles on a straight line sum up to 180°) (1)

112 °

(Total for Question 6 is 5 marks)

7

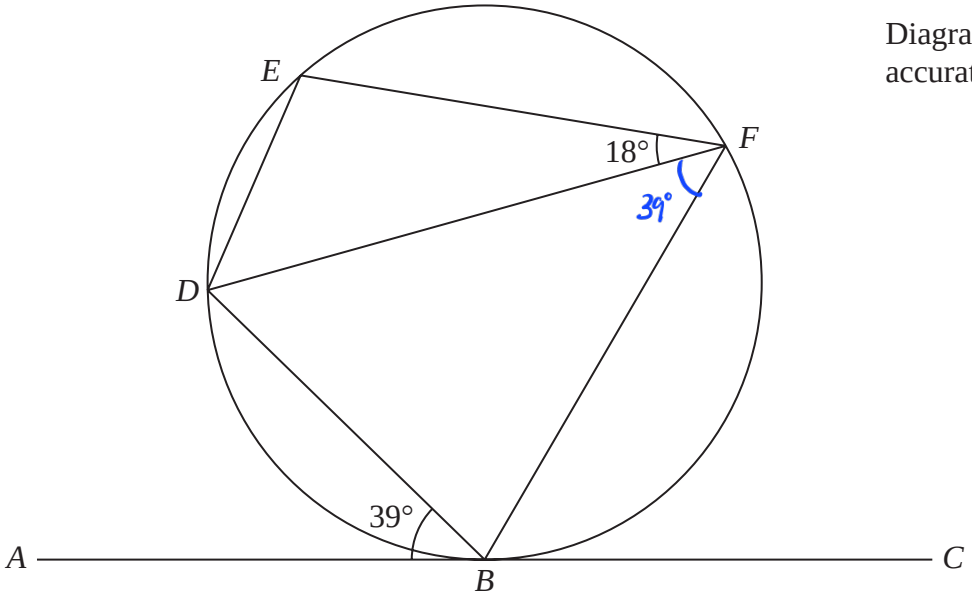


Diagram **NOT** accurately drawn

B, *D*, *E* and *F* are points on a circle.

ABC is the tangent at *B* to the circle.
Angle *ABD* = 39°
Angle *EFD* = 18°

Work out the size of angle *BDE*.
Give reasons for your working.

angle BFD = angle ABD = 39° (1)
(alternate segment theorem) (1)

angle BDE = 180° - (18° + 39°) (1)
= 180° - 57°
= 123° (1)
(opposite angles in a cyclic quadrilateral sum up to 180°)

123 °

(Total for Question 7 is 4 marks)

8 *P*, *Q*, *R*, *S* and *T* are points on a circle with centre *O*.

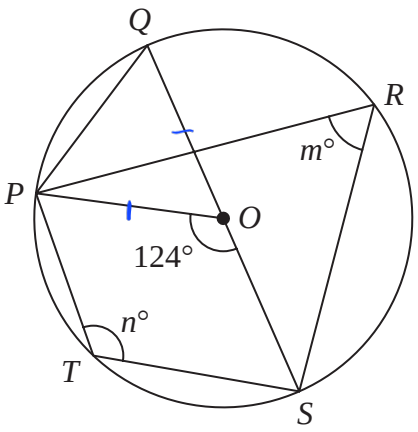


Diagram **NOT** accurately drawn

QOS is a diameter of the circle.

angle *POS* = 124° angle *PRS* = *m*° angle *PTS* = *n*°

(a) Find the value of

(i) *m*

$124° \div 2 = 62°$

62° (1)

(ii) *n*

$180° - 62° = 118°$

118° (1)

(2)

(b) Find the size of angle *QPO*.

PQO = 62°

So, QPO must be 62° as the triangle is isosceles

62 (1) °

(1)

(Total for Question 8 is 3 marks)

9

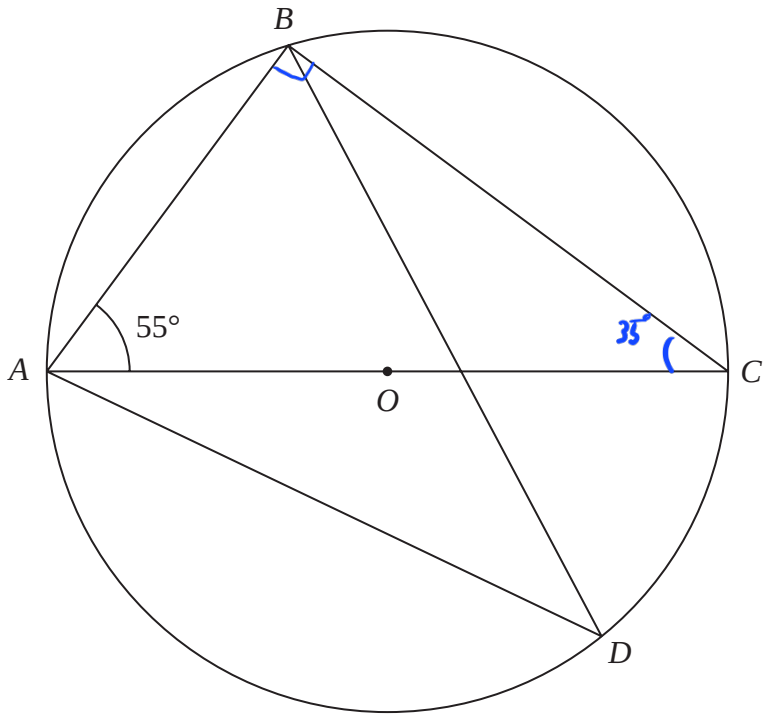


Diagram **NOT** accurately drawn

A, *B*, *C* and *D* are points on a circle, centre *O*
AOC is a diameter of the circle.

Angle *BAC* = 55°

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

ABC = 90° (1)
(angles in semicircle are 90°)

ACB = 180° - 90° - 55°
= 35° (1)
(angles in a triangle add up to 180°)
(1)

ADB = ACB = 35°
(angles in the same segment are equal)

35 (1) °

(Total for Question 9 is 4 marks)

10 The diagram shows triangle *PQR*

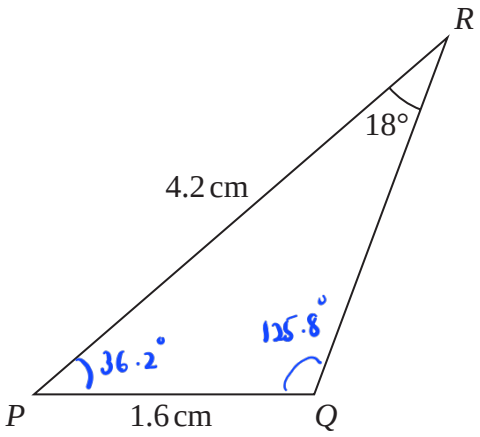


Diagram **NOT** accurately drawn

PQ = 1.6 cm *PR* = 4.2 cm Angle *PRQ* = 18°

Given that angle *PQR* is obtuse,

work out the area of triangle *PQR*
Give your answer correct to 3 significant figures.

$\frac{\sin PQR}{4.2} = \frac{\sin 18}{1.6}$ (1)

$\angle PQR = \sin^{-1}\left(\frac{\sin 18}{1.6}(4.2)\right)$

$= 54.2^\circ$ (acute) (1)

$\angle PQR = 180^\circ - 54.2^\circ = 125.8^\circ$ (obtuse) (1)

$\angle QPR = 180^\circ - 125.8^\circ - 18^\circ = 36.2^\circ$ (1)

Area $= \frac{1}{2} \times 4.2 \times 1.6 \times \sin 36.2^\circ$ (1)

$= 1.98$ (1)

1.98 ..... cm^2

(Total for Question 10 is 6 marks)

11

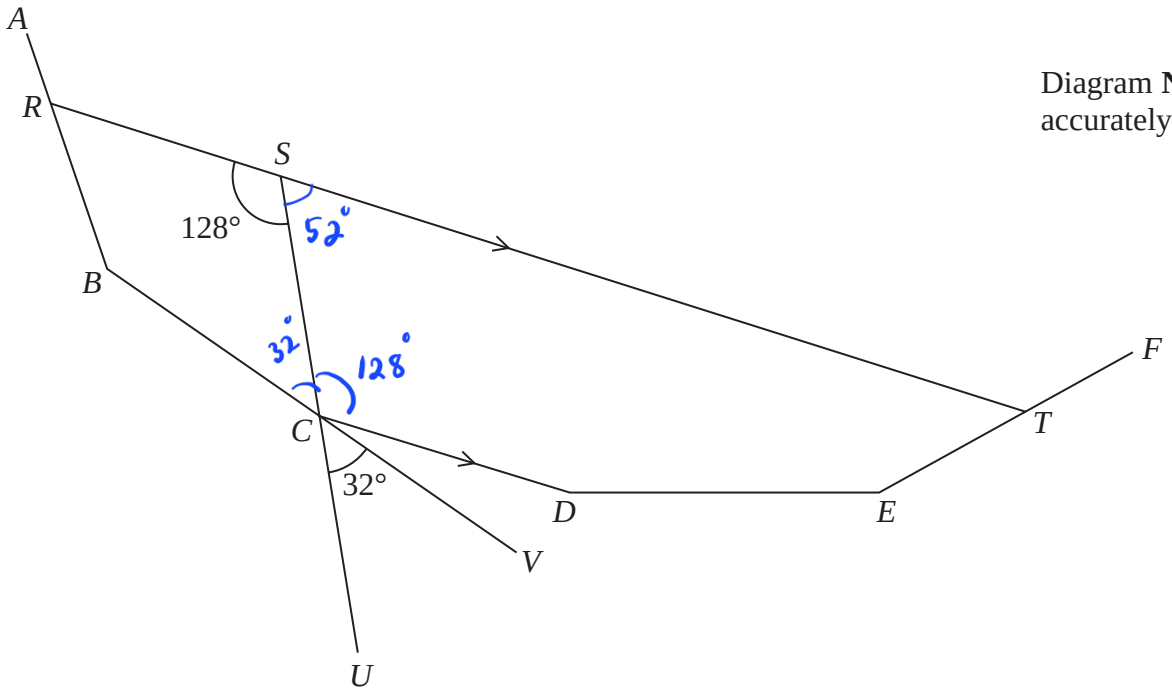


Diagram **NOT** accurately drawn

AB, *BC*, *CD*, *DE* and *EF* are five sides of a regular polygon.

RST, *SCU* and *BCV* are straight lines.
RST is parallel to *CD*
Angle *RSC* = 128°
Angle *UCV* = 32°

Work out how many sides the polygon has.
Show your working clearly.

BCS = UCV = 32°

SCD = RSC = 128° (1)

TSC = 180° − 128° = 52°

interior angle = 128° + 32° = 160° (1)

180 (n − 2) = 160 n (1)

180 n − 360 = 160 n

20 n = 360

n = 18 (1)

18

(Total for Question 11 is 4 marks)

12 The diagram shows a pentagon.

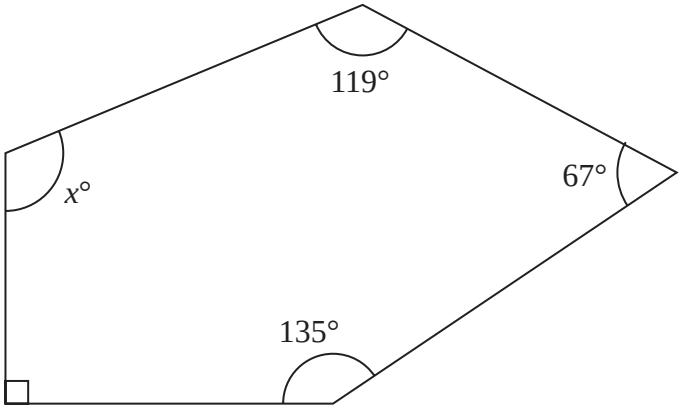


Diagram **NOT** accurately drawn

Work out the value of x

Total angle : $3 \times 180^\circ = 540^\circ$ (1)

$540 - 90 - 135 - 67 - 119$ (1)

$= 540 - 411$

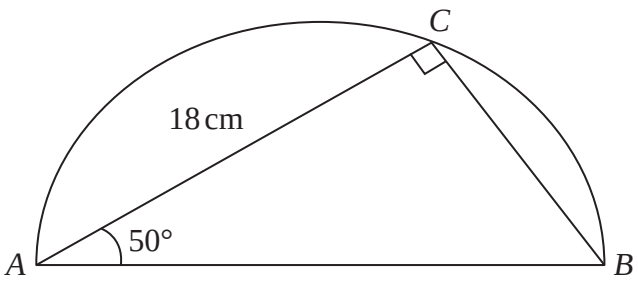
$= 129$ (1)

$x =$ 129

(Total for Question 12 is 3 marks)

13 The diagram shows a triangle *ABC* inside a semicircle.

Diagram **NOT** accurately drawn



A, *B* and *C* are points on the semicircle.

AB is the diameter of the semicircle.

Angle *ACB* = 90°
Angle *BAC* = 50°
AC = 18 cm

Work out the perimeter of the semicircle.
Give your answer correct to 2 significant figures.

$\cos 50° = \frac{18}{AB}$ (1)

$AB = \frac{18}{\cos 50°}$ (1)

$= 28.0030\ldots$

$\frac{1}{2} \times \pi \times 28.0030\ldots = 43.9\ldots$ (1)

$28.0030\ldots + 43.9\ldots$ (1)

$= 71.9900\ldots$

≈ 72 (1)

72

..... cm

(Total for Question 13 is 5 marks)

14 Here is a shape formed from two triangles *ABC* and *CDE*
ACD and *BCE* are straight lines.

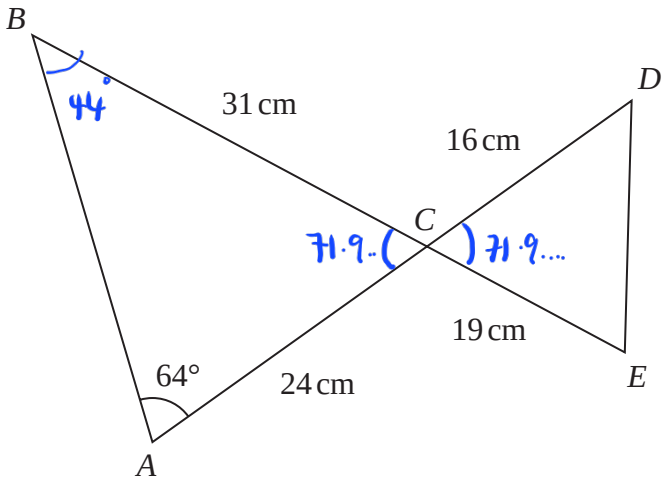


Diagram **NOT** accurately drawn

AC = 24 cm *BC* = 31 cm *CE* = 19 cm *CD* = 16 cm

Angle *BAC* = 64°

Work out the length of *DE*
Give your answer correct to 3 significant figures.

$$\frac{\sin ABC}{24} = \frac{\sin 64}{31}$$ (1)

$$ABC = \sin^{-1}\left(\frac{\sin 64}{31} \times 24\right)$$

$$= 44....$$ (1)

$$BCA = 180 - 44... - 64$$ (1)

$$= 71.9...$$

$$DE^2 = 16^2 + 19^2 - 16(19)\cos 71.9^\circ$$ (1)

$$DE = \sqrt{617 - 181.8...}$$

$$= 20.7$$ (1)

20.7 ..... cm

(Total for Question 14 is 5 marks)

15

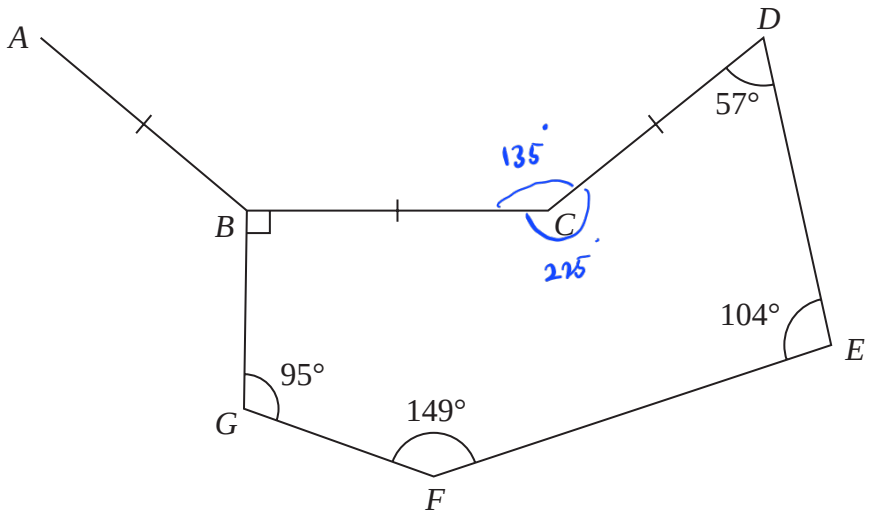


Diagram **NOT** accurately drawn

BCDEFG is a hexagon.
AB, *BC* and *CD* are three sides of a regular *n*-sided polygon.

Calculate the value of *n*
Show your working clearly.

sum of
Interior angle of hexagon : $(6-2) \times 180^\circ = 720^\circ$ (1)

angle BCD (large) $= 720^\circ - 90^\circ - 95^\circ - 149^\circ - 104^\circ - 57^\circ$

$= 225^\circ$ (1)

angle BCD (small) $= 360^\circ - 225^\circ$

$= 135^\circ$ (1)

$$\frac{180(n-2)}{n} = 135^\circ$$

$180n - 360^\circ = 135n$

$180n - 135n = 360$

$45n = 360$

$n = \frac{360}{45} = 8$ (1)

$n =$ 8

(Total for Question 15 is 4 marks)

16 Here is a triangle *ABC*

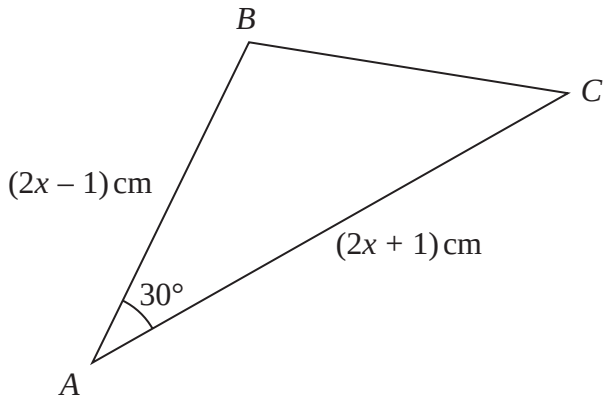


Diagram **NOT** accurately drawn

The area of the triangle is $(x^2 + x - 3.75)\,\text{cm}^2$

Find the size of the largest angle in triangle *ABC*
Give your answer correct to the nearest degree.

$\frac{1}{2}(2x-1)(2x+1)\sin 30^\circ = x^2 + x - 3.75$ (1)

$\frac{1}{4}(4x^2 - 1) = x^2 + x - 3.75$

$x^2 - 0.25 = x^2 + x - 3.75$

$x = -0.25 + 3.75$

$= 3.5$ (1)

$AB = 2(3.5) - 1 = 6$ cm

$AC = 2(3.5) + 1 = 8$ cm

since AC > AB, largest angle is ABC.

$BC^2 = 6^2 + 8^2 - 2(6)(8)\cos 30^\circ$

$= 16.8615\ldots$ (1)

$BC = \sqrt{16.8615\ldots} = 4.10628\ldots$

$$\frac{\sin ABC}{8} = \frac{\sin 30^\circ}{4.10628\ldots}$$ (1)

$\sin ABC = 0.974\ldots$

$ABC = \sin^{-1} 0.974\ldots$ (1)

$= 103^\circ$ (1)

103 °

(Total for Question 16 is 6 marks)

17 *A*, *B* and *C* are points on a circle.

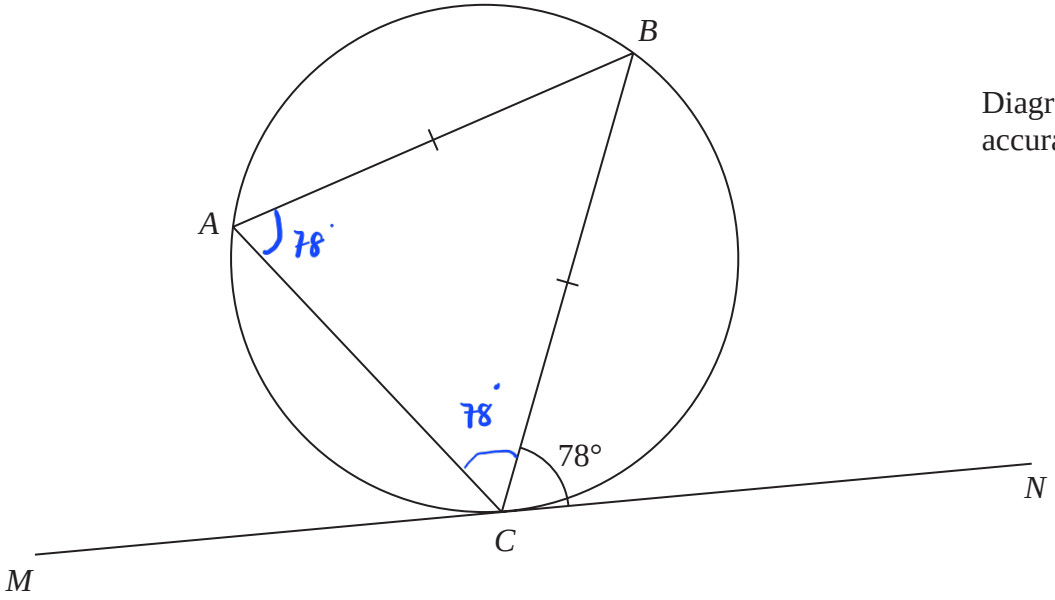


Diagram **NOT** accurately drawn

MN is the tangent to the circle at *C*

AB = *CB*

Angle *BCN* = 78°

Find the size of angle *ABC*

angle BAC = angle BCA = 78°

angle ABC = 180 - 78 - 78 (1)

= 24 (1)

24 °

(Total for Question 17 is 2 marks)

18 The diagram shows two circles with centre O and a regular pentagon $ABCDE$

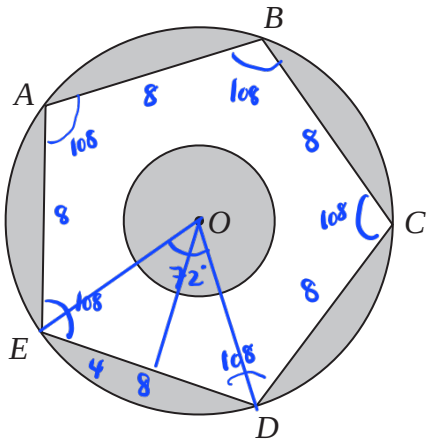


Diagram **NOT** accurately drawn

A, B, C, D and E are points on the larger circle.
The pentagon has sides of length 8 cm.

The diagram is shaded such that

shaded area = unshaded area

Work out the radius of the smaller circle.
Give your answer correct to 3 significant figures.

pentagon angle $= \frac{180 \times 3}{5} = 108°$

angle EOD $= 180 - 54 - 54$
$= 72°$

height of triangle; $\tan 54 = \frac{\text{height}}{4}$
$\therefore 4 \tan 54 = 5.505\ldots$ (1)

$\frac{\text{length OE}}{\sin 54°} = \frac{8}{\sin 72}$

$OE = \frac{8 \sin 54}{\sin 72} = 6.805\ldots$ = radius of large circle

Area of whole diagram $= \pi \times 6.805^2 = 145.489\ldots$ (1)

Area of pentagon $= 5 \times \frac{1}{2} \times 8 \times 5.505\ldots = 110.11$ (1)

shaded area = unshaded area

$145.489 - 110.11 + \pi r^2 = 110.11 - \pi r^2$ (1)

$2\pi r^2 = 74.731\ldots$ (1)

$r^2 = 11.89\ldots$

$r = 3.45$ (3 s.f.) (1)

3.45 ..... cm

(Total for Question 18 is 6 marks)

19 *ABCD* is a trapezium.

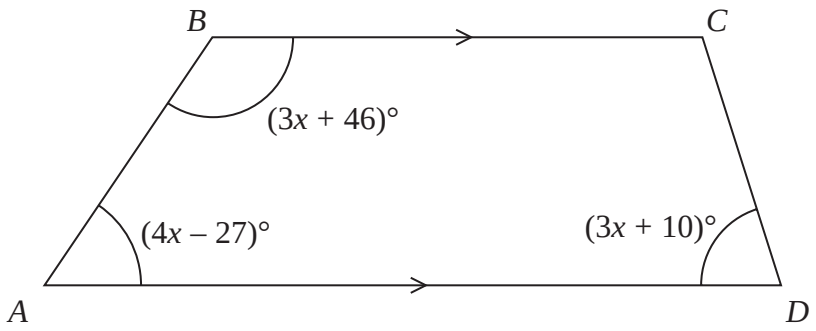


Diagram **NOT** accurately drawn

BC is parallel to *AD*

Find the size of the largest angle inside the trapezium.

$(4x - 27) + (3x + 46) = 180$ (1)

$7x = 180 - 19$

$7x = 161$

$x = 23$ (1)

$ABC = 3(23) + 46 = 115$

$BAD = 4(23) - 27 = 65$ (1)

$ADC = 3(23) + 10 = 79$

$BCD = 180 - 79 = 101$

(1) 115 °

(Total for Question 19 is 4 marks)

20 Here is a 9-sided regular polygon *ABCDEFGHJ*, with centre *O*

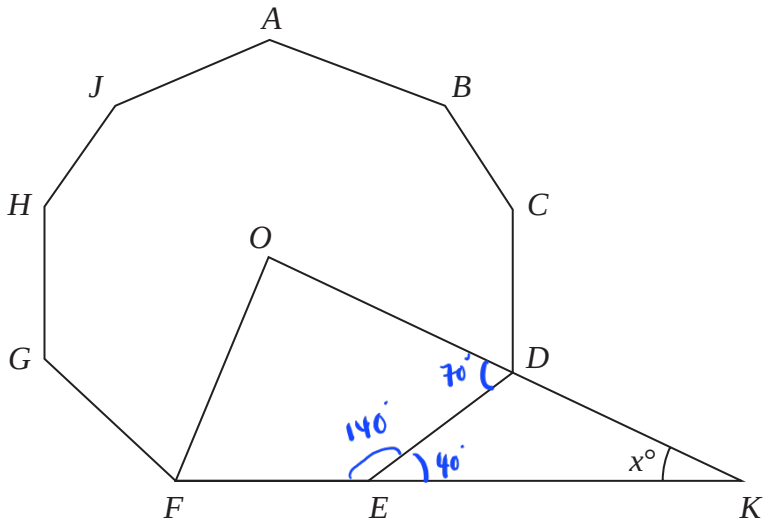


Diagram **NOT** accurately drawn

ODK and *FEK* are straight lines.

Work out the value of *x*

interior angle of polygon $= \frac{(9-2)(180)}{9} = 140°$ (1)

$DEK = 180° - 140° = 40°$

$EDK = 180° - \left(\frac{140}{2}\right) = 110°$ (1)

$x = 180° - 110° - 40°$

$= 30°$ (1)

$x =$ 30

(Total for Question 20 is 3 marks)