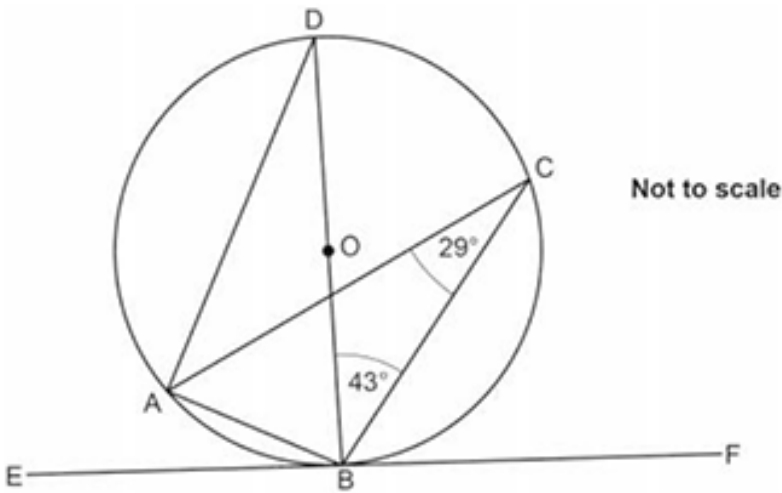


1(a). A, B, C and D are points on the circumference of a circle, centre O.
BD is a diameter of the circle.
EBF is a tangent to the circle.



Give a reason why angle BAD = 90°.

..... [1]

(b). Write down **one** other angle that is 90°.
Give a reason for your answer.

Angle because

..... [2]

(c). Write down the value of angle CAD.

..... ° [1]

(d). Write down the value of angle EBA.

..... ° [1]

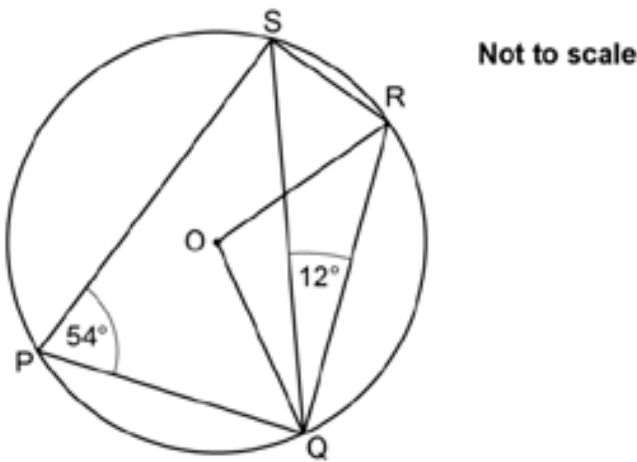
2(a). Work out the size of an exterior angle of a regular octagon.

..... [2]

(b). Use your answer to part (a) to write down the size of an interior angle of a regular octagon.

..... [1]

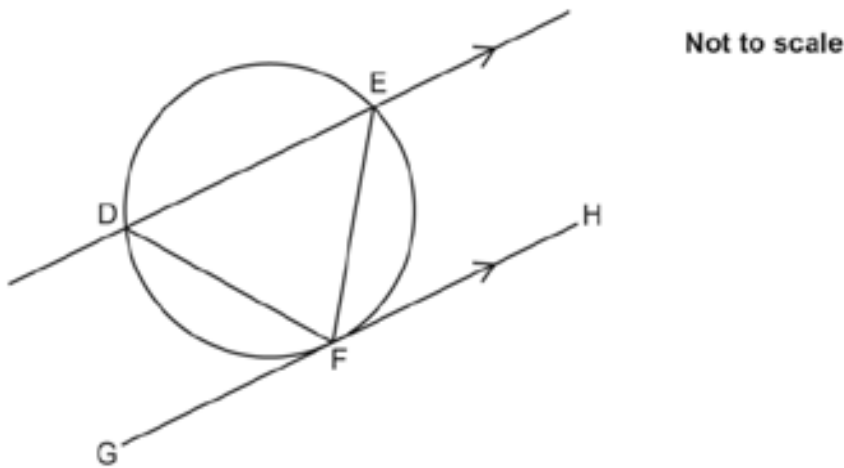
3(a). P, Q, R and S are points on the circumference of a circle, centre O.
Angle SQR = 12° and angle SPQ = 54°.



Find the size of angle ROQ.

Angle ROQ = ° [3]

(b). D, E and F are points on the circumference of a circle.



Line GH is a tangent to the circle at F.

Line DE is parallel to line GH.

Complete these statements to prove that triangle DEF is isosceles.
Give reasons for your statements.
You may not need all of the lines.

Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

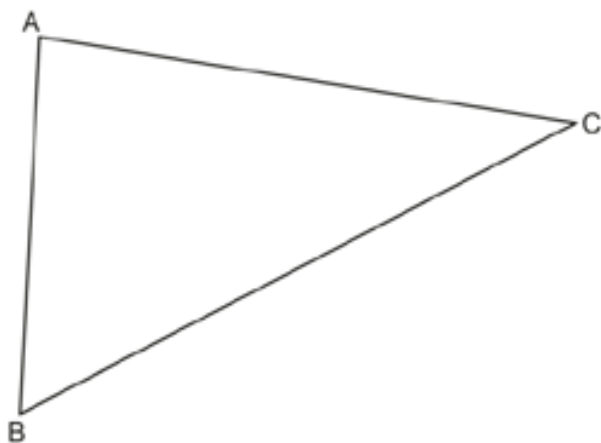
Triangle DEF is isosceles because [3]

4. A regular polygon has n sides.
The interior angle of the polygon is 7 times its exterior angle.

Find the value of n .

$n = \dots\dots\dots$ [4]

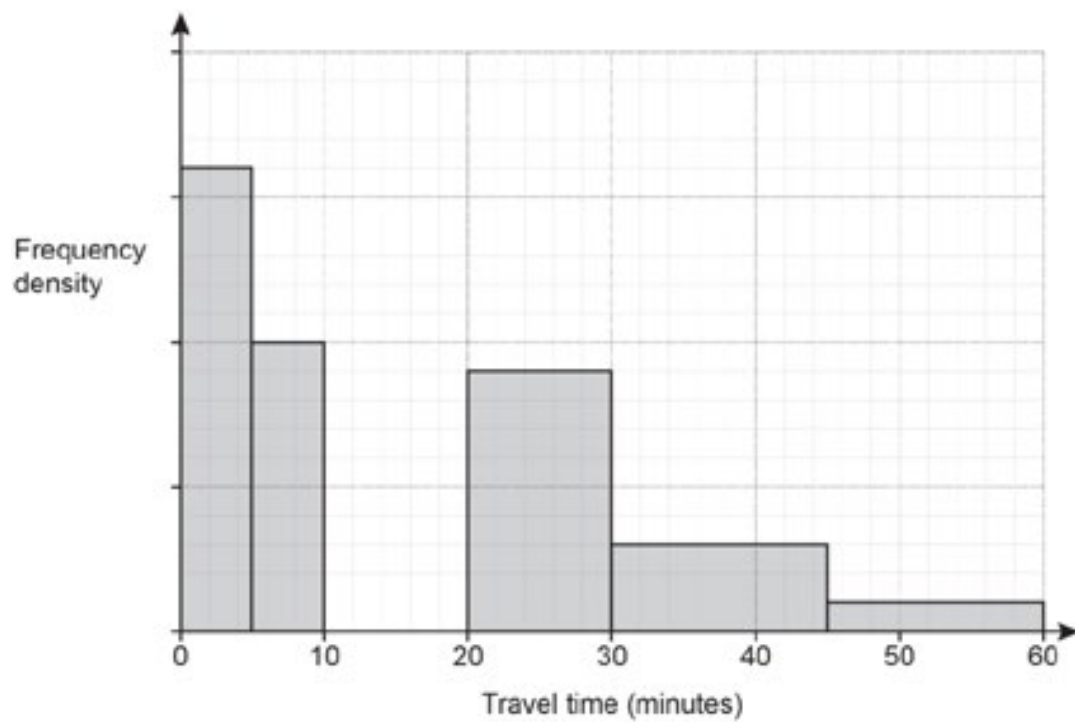
5. Triangle ABC is drawn below.



Using a ruler and compasses only, construct and shade the region which is closer to AC than BC.

[3]

6. A group of students record the time taken to travel to school. All students in the group took less than an hour to travel to school. Some of their results are recorded on this histogram.

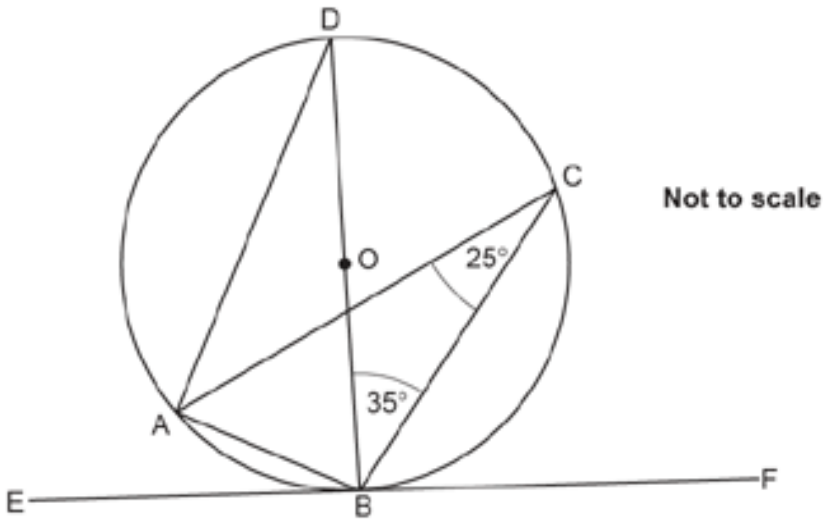


3 students took more than 45 minutes to travel to school.

14 students took between 10 and 20 minutes to travel to school.

Add these students' results to the histogram.

7(a). A, B, C and D are points on the circumference of a circle, centre O.
BD is a diameter of the circle.
EBF is a tangent to the circle.



Give a reason why angle BAD = 90°.

..... [1]

(b). Write down **one** other angle that is 90°. Give a reason for your answer.

Angle because

..... [2]

(c). Keep Write down the value of angle CAD.

..... ° [1]

(d). Write down the value of angle EBA.

..... ° [1]

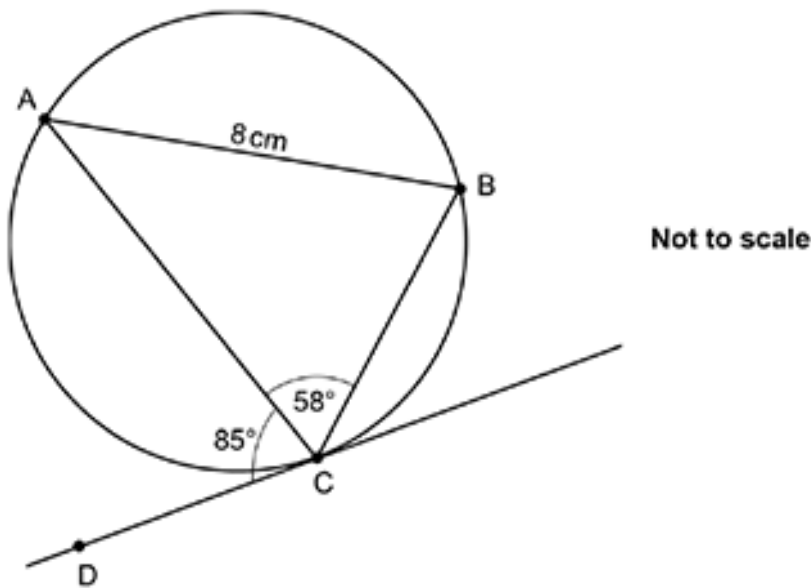
8(a). Work out the size of an exterior angle of a regular hexagon.

..... [2]

(b). Use your answer to part **(a)** to write down the size of an interior angle of a regular hexagon.

..... [1]

9. A, B and C are points on the circumference of a circle.

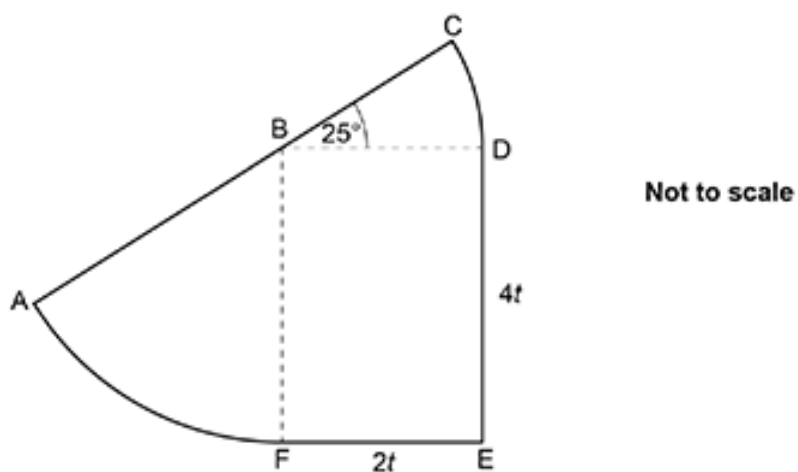


Points C and D lie on a tangent to the circle at C.
Angle ACD = 85°.
Angle ACB = 58°.
AB = 8 cm.

Find the length of AC.

..... cm [4]

10(a). This shape is formed from a rectangle and two sectors of circles.



Points A, B and C lie on a straight line.

Angle CBD = 25° .

DE = $4t$ and EF = $2t$.

Explain why AB = $4t$.

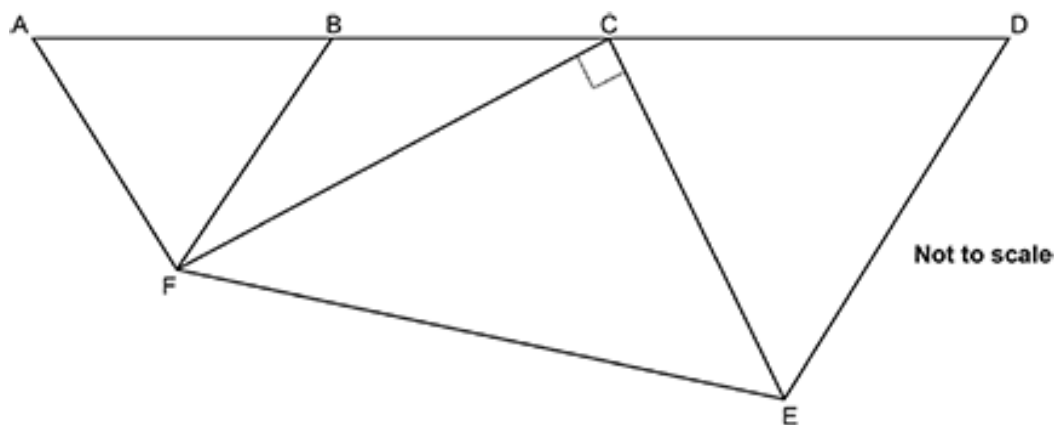
Give a reason for each step of your explanation.

[2]

(b). Show that the perimeter of the shape is $\frac{31}{18}\pi t + 12t$.

[5]

11. The diagram shows four triangles that are joined together.



- Points A, B, C and D lie on a straight line.
- Triangles ABF and CDE are equilateral triangles.
- Triangle CEF is a right-angled triangle.
- Angle ECF is 90°

Show that triangle BCF is an isosceles triangle with $BF = BC$.

Give a reason for each stage of your working.

Use the template below to help present your work. You may not need all of the lines.

Angle _____ = _____ $^\circ$
because _____

Angle _____ = _____ $^\circ$
because _____

Angle _____ = _____ $^\circ$
because _____

Angle _____ = _____ $^\circ$
because _____

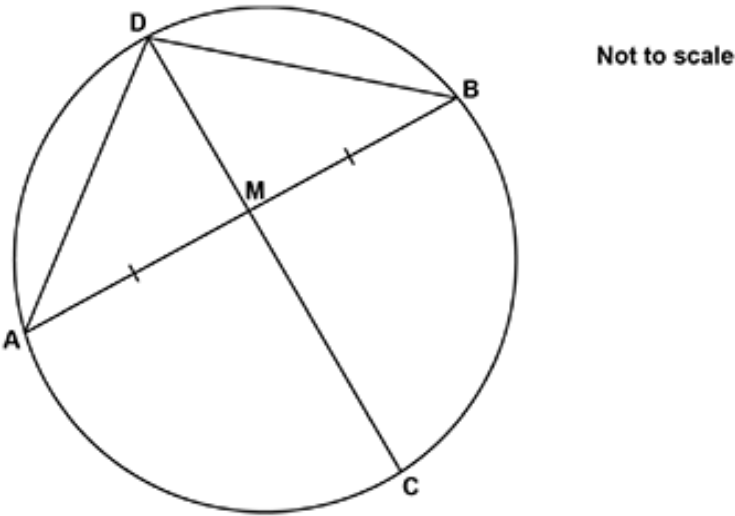
Angle _____ = _____ $^\circ$
because _____

Angle _____ = _____ °
because _____

Angle _____ = _____ °
because _____

[5]

12. A, B, C and D are points on the circumference of a circle.
CD is a diameter of the circle.
M is a point on AB such that AM = MB.



Complete these sentences to show that triangle DMA is congruent to triangle DMB.

Side AM = side MB because it is given to you.

Angle AMD = angle _____ because _____

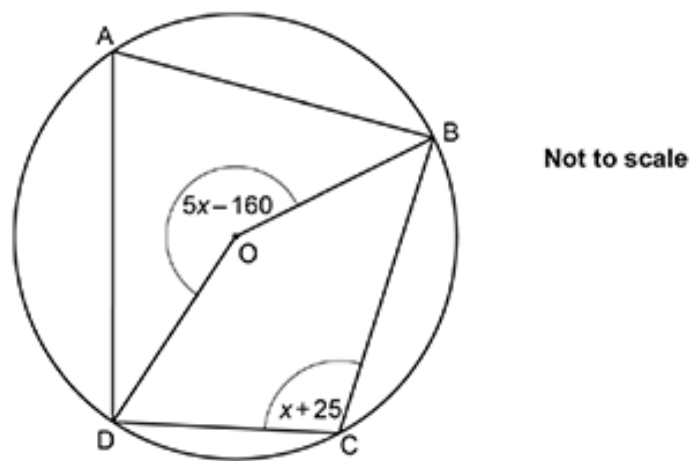
Side MD is _____

Triangle DMA is congruent to triangle DMB because _____

[3]

13(a). In this question all angles are given in degrees.

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



Find the size of angle BCD.

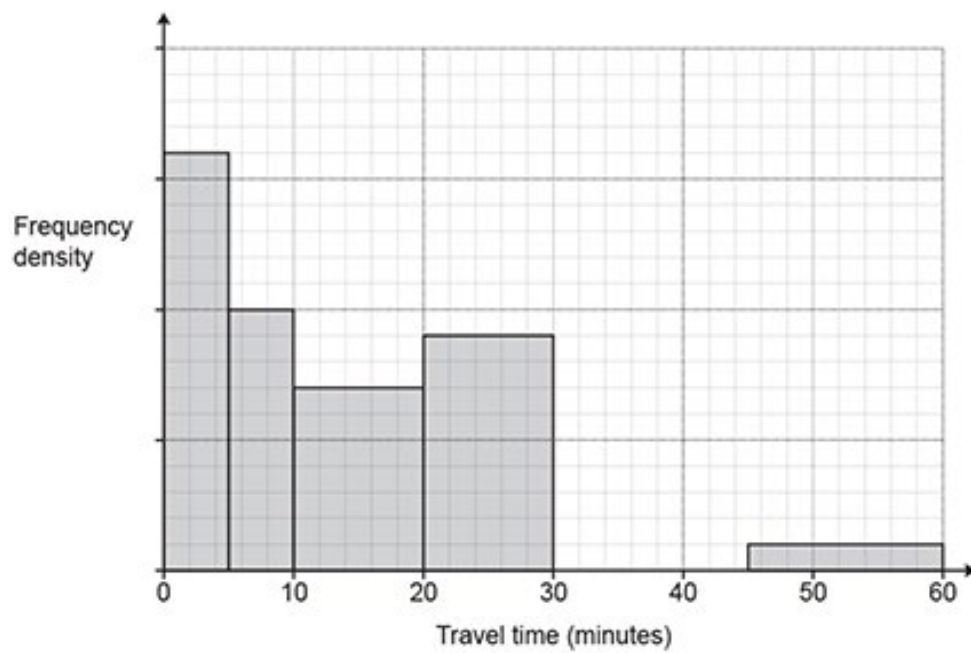
..... ° **[4]**

(b). Find the size of angle DAB.
Give a reason for your answer.

..... ° because

..... **[2]**

14. A group of students record the time taken to travel to school.
All students in the group took less than an hour to travel to school.
Some of their results are recorded on this histogram.

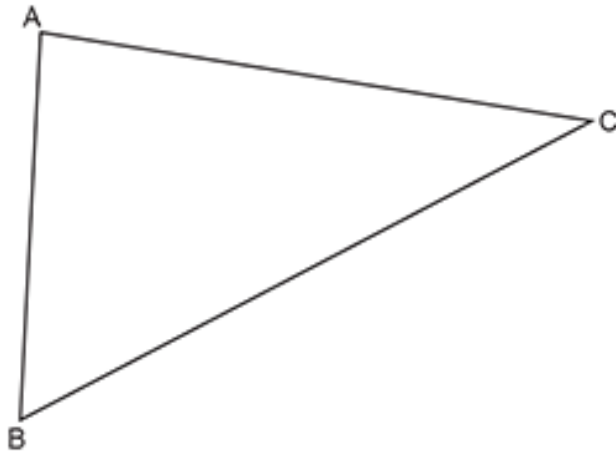


16 students took less than 5 minutes to travel to school.

9 students took between 30 and 45 minutes to travel to school.

Add these students' results to the histogram.

15. Triangle ABC is drawn below.



Using a ruler and compasses only, construct and shade the region which is closer to AB than AC.

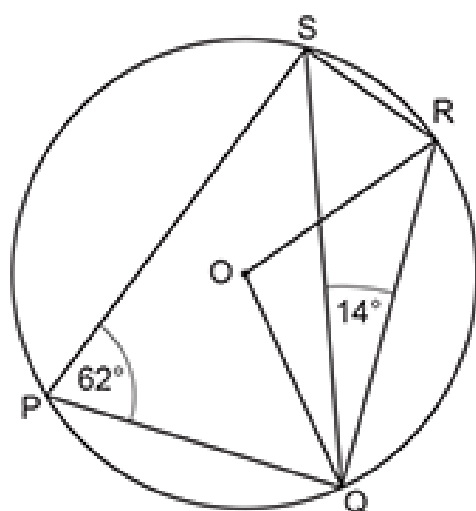
[3]

16. A regular polygon has n sides.
The interior angle of the polygon is 15 times its exterior angle.

Find the value of n .

$n = \dots\dots\dots$ [4]

17(a). P, Q, R and S are points on the circumference of a circle, centre O.
Angle SQR = 14° and angle SPQ = 62° .

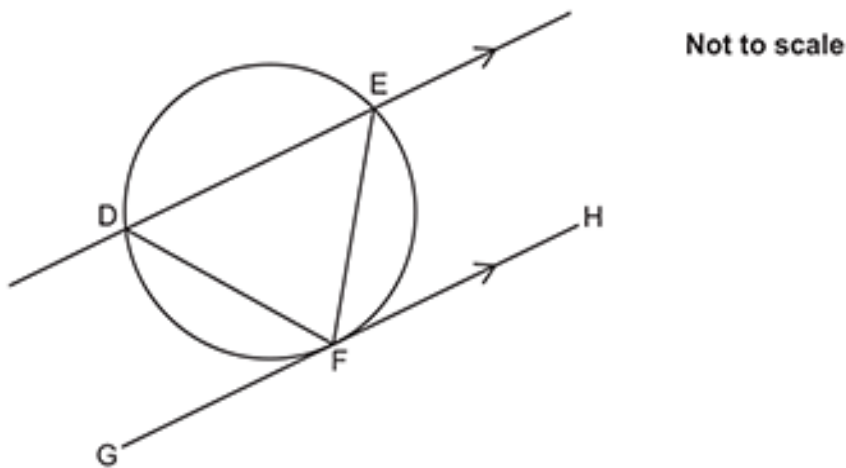


Not to scale

Find the size of angle ROQ.

Angle ROQ = $^\circ$ [3]

(b). D, E and F are points on the circumference of a circle.



Line GH is a tangent to the circle at F.
Line DE is parallel to line GH.

Complete these statements to prove that triangle DEF is isosceles.
Give reasons for your statements.
You may not need all of the lines.

Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

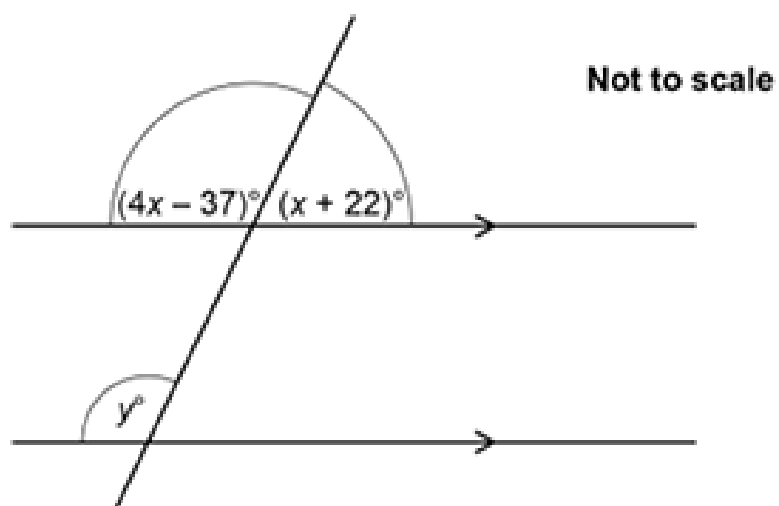
Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

Angle _____ = Angle _____ because _____

Triangle DEF is isosceles because [3]

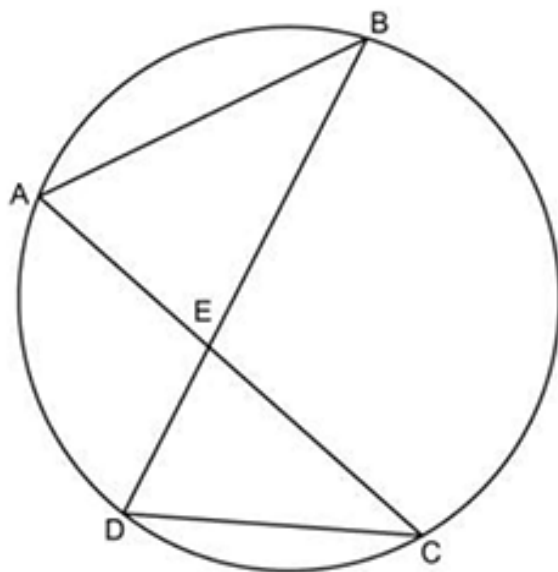
18. The diagram shows a straight line crossing a pair of parallel lines.



Find the value of y .
You must show your working.

$y = \dots\dots\dots$ [5]

19. Points A, B, C and D lie on the circumference of a circle.
Line AC intersects line BD at point E.

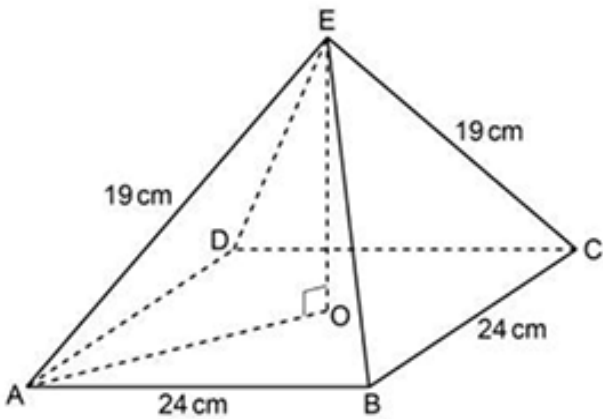


Not to scale

Prove that triangle AEB is similar to triangle DEC.

[3]

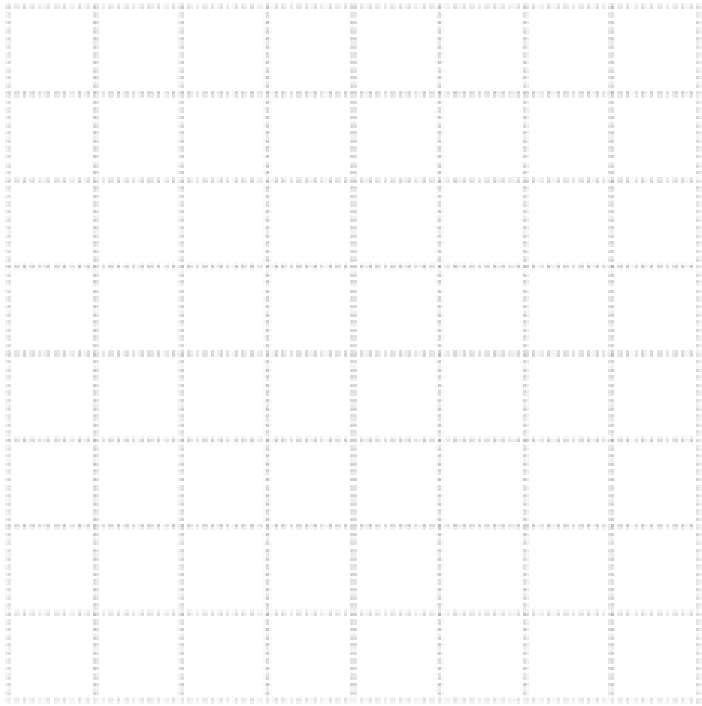
20. The diagram shows a square-based pyramid ABCDE.
O is the centre of the base.



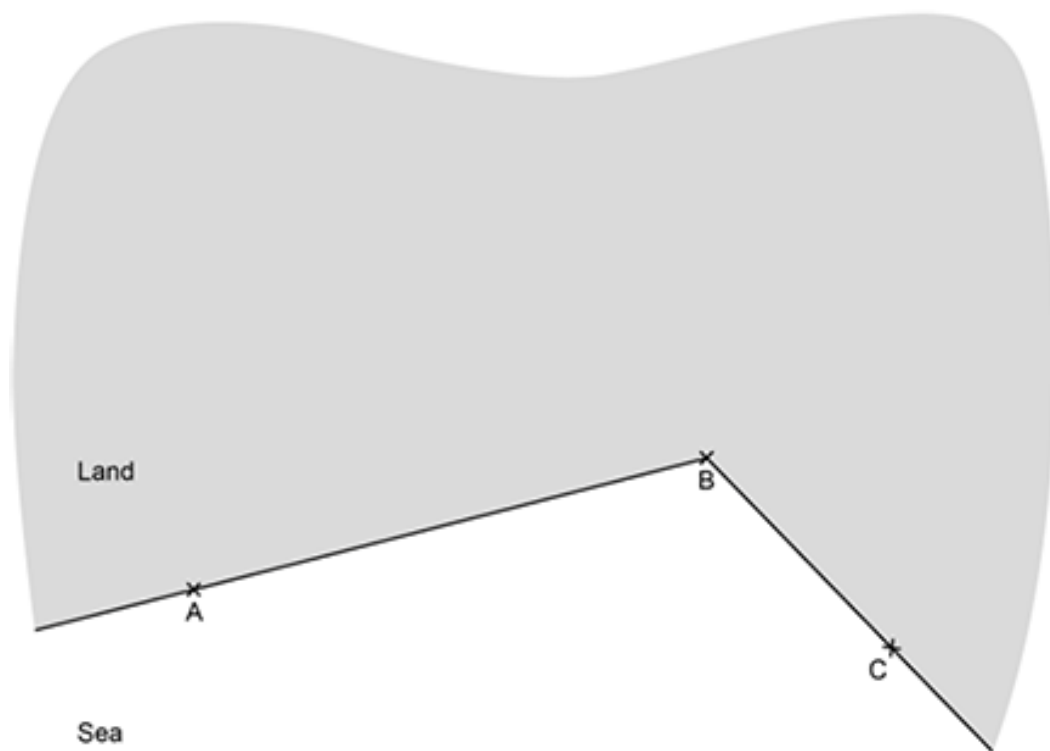
The pyramid has base length 24 cm and each sloping edge has length 19 cm.

Draw the plan view of the pyramid on the one-centimetre grid below.

Scale: 1 cm represents 4 cm.



21. The diagram represents a coastline.
A, B and C are lighthouses.

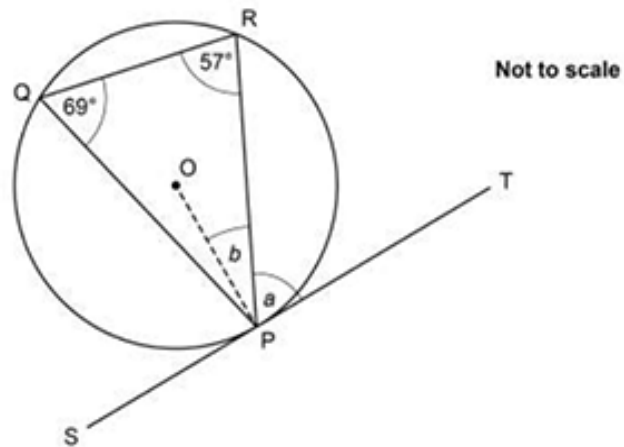


A boat is

- the same distance from B and C
- the same distance from AB and BC.

Using a ruler and compasses only, construct the position of the boat.
Label the position of the boat clearly.

22(a). P, Q and R are points on the circumference of a circle, centre O.



Angle $PRQ = 57^\circ$ and angle $PQR = 69^\circ$.
Line SPT is a tangent to the circle.

- i. Work out angle a .
Give a reason for your answer.

Angle $a =$ _____ $^\circ$ because _____

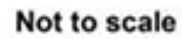
_____ [2]

- ii. Work out angle b .
Give a reason for your answer.

Angle $b =$ _____ $^\circ$ because _____

_____ [2]

(b). E, F, G and H are points on the circumference of a circle, centre O.
Acute angle $\text{EHG} = x^\circ$.



- i. Complete the following, giving the values of the angles in terms of x .

Reflex angle EOG = _____ ° because _____

Therefore, obtuse angle EOG = °

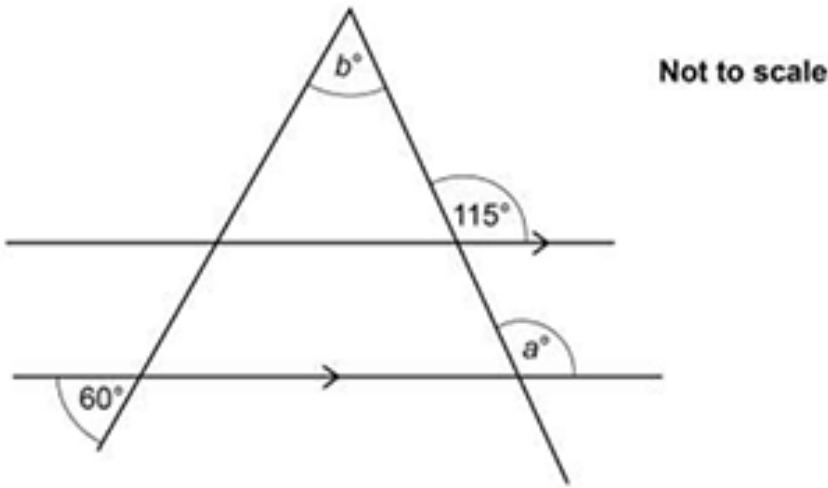
Therefore, angle EHG = $^{\circ}$

[3]

- ii. Write down what your working in part (i) has proved.

[1]

23(a). The diagram shows two straight lines crossing a pair of parallel lines.



Write down the value of a .
Give a reason for your answer.

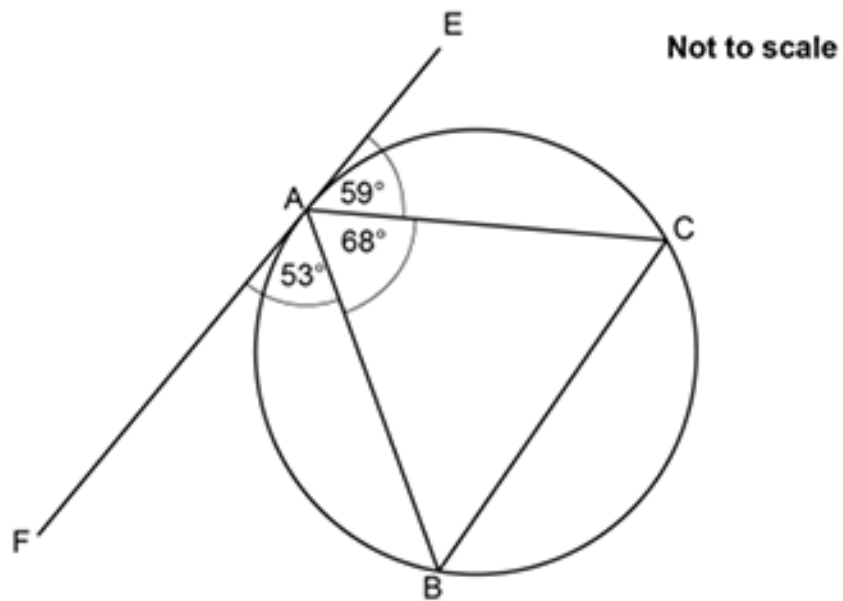
$a =$ _____ because _____

[2]

(b). Work out the value of b .

$b =$ [3]

24(a). Points A, B and C lie on the circumference of a circle.
EAF is a tangent to the circle.

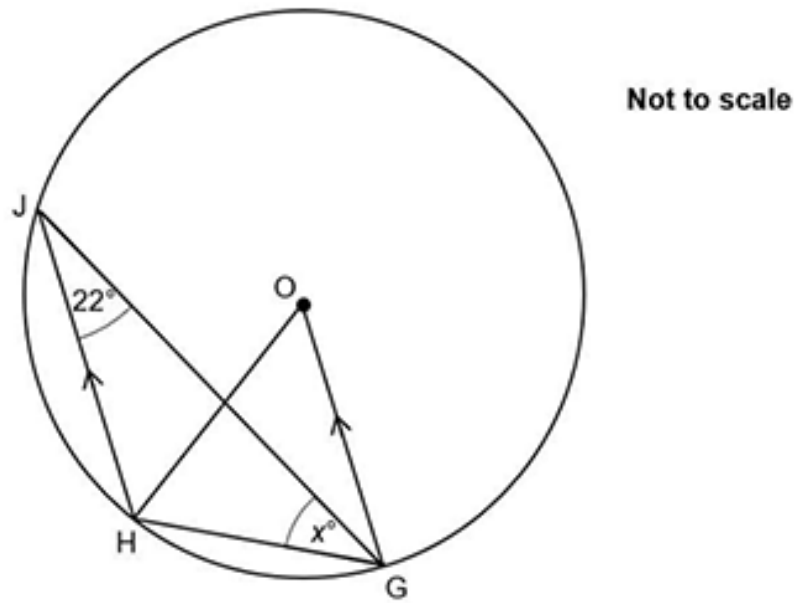


Write down the value of angle ABC giving a reason for your answer.

Angle ABC = _____ $^\circ$ because _____

_____ [2]

(b). Points G, H and J lie on the circumference of a circle, centre O.

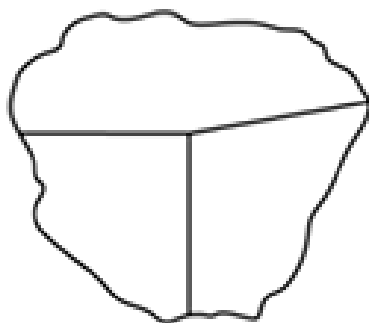


Angle HJG = 22° and angle HGJ = x° .
Lines HJ and GO are parallel.

Find the value of x .
You must show your working

$x = \dots\dots\dots$ [5]

25. Three **regular** polygons meet at a point.



Not to scale

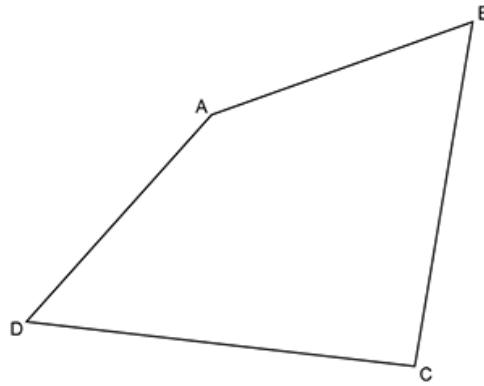
One of the polygons is a square and another is a hexagon.

Find the number of sides of the third polygon.
You must show your working.

..... **[6]**

26(a). The scale drawing represents a park, ABCD.

Scale: 1 cm represents 10 m



A straight path goes across the park from A.
The path is always the same distance from side AB and side AD.

Construct the route followed by the path.
Show all your construction lines.

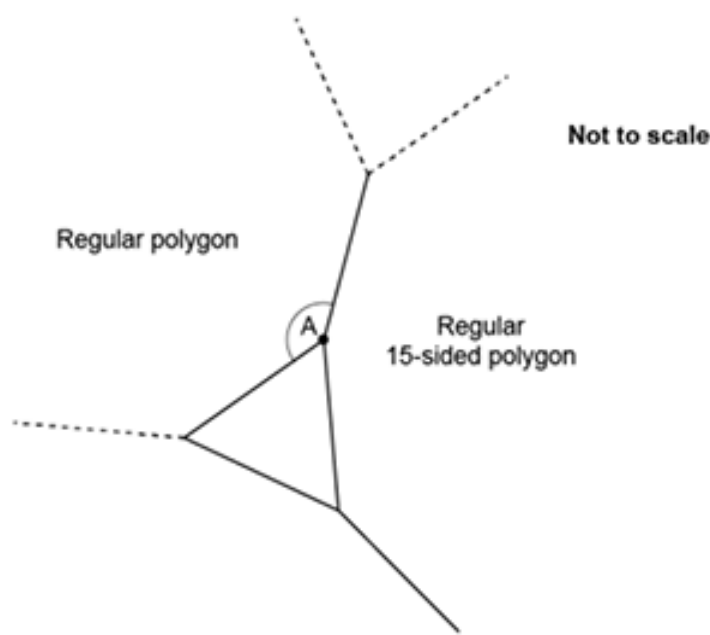
[2]

(b). A bench is to be placed on the path.
The bench must be no more than 40 m from C.

Construct the locus of the possible positions of the bench.
Indicate clearly on the diagram where the bench can be placed.

[3]

27(a). An equilateral triangle, a regular 15-sided polygon and another regular polygon meet at a point.



Show that angle A is 144° .

[3]

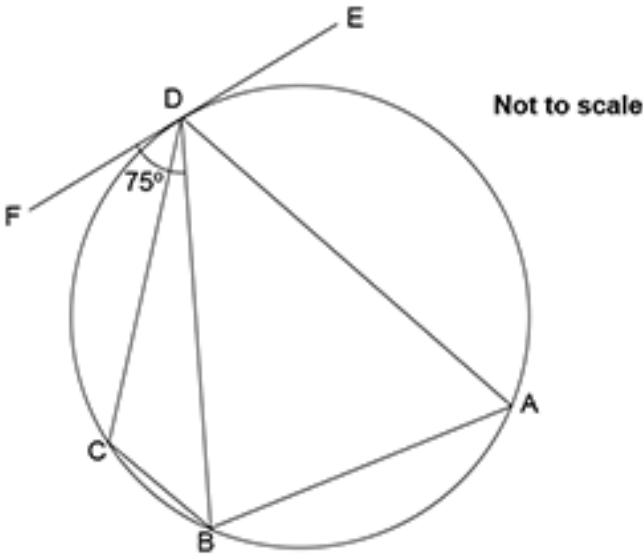
(b). Angle A is 144° . Work out the number of sides of the other regular polygon.

..... [2]

28. A, B, C and D are points on the circumference of a circle.

EF is the tangent to the circle at D.

Angle BDF = 75° .



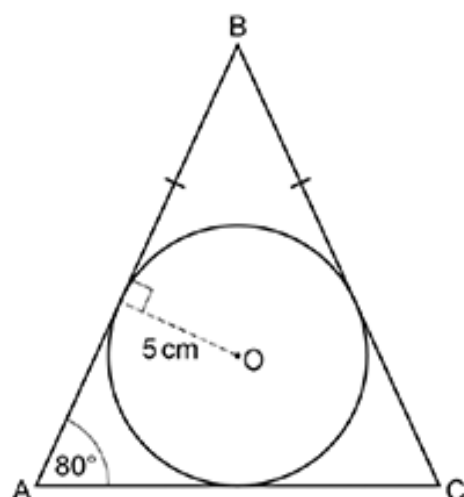
The ratio angle BCD : angle CBD is 7 : 3.

Work out angle CBD.
You must show your working.

..... $^\circ$ [5]

29. ABC is an isosceles triangle.

The sides of the triangle ABC are all tangents to a circle of radius 5 cm, centre O.



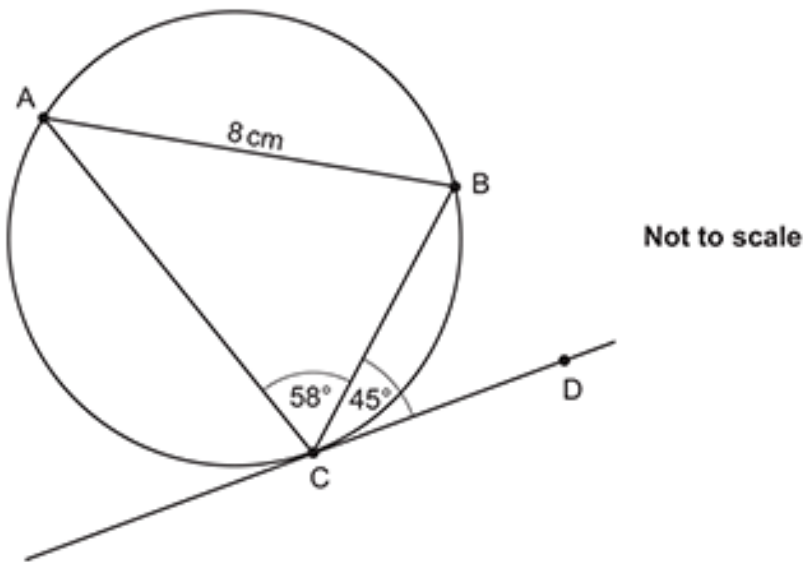
Not to scale

Angle $BAC = 80^\circ$ and $BA = BC$.

Show that length BO is 28.79 cm, correct to 2 decimal places.

[4]

30. A, B and C are points on the circumference of a circle.

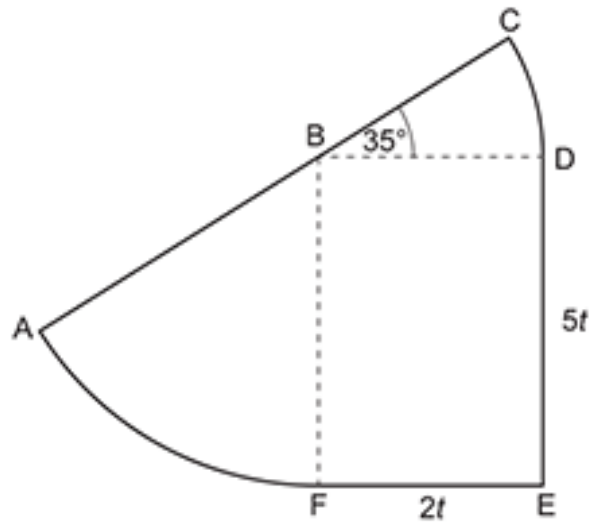


Points C and D lie on a tangent to the circle at C.
Angle BCD = 45°.
Angle ACB = 58°.
AB = 8cm.

Find the length of BC.

..... cm [4]

31(a). This shape is formed from a rectangle and two sectors of circles.



Not to scale

Points A, B and C lie on a straight line.

Angle $CBD = 35^\circ$.

$DE = 5t$ and $EF = 2t$.

Explain why $BC = 2t$.

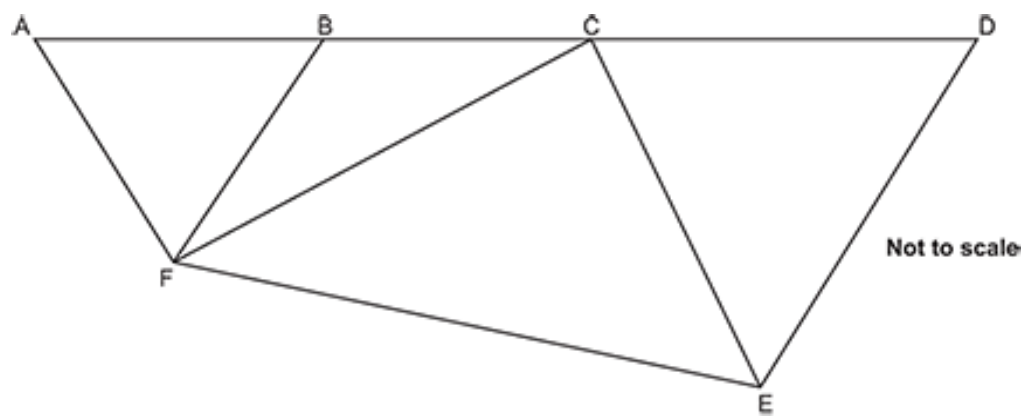
Give a reason for each step of your explanation.

[2]

(b). Show that the perimeter of the shape is $\frac{23}{12}\pi t + 14t$.

[5]

32. The diagram shows four triangles that are joined together.



- Points A, B, C and D lie on a straight line.
- Triangles ABF and CDE are equilateral triangles.
- Triangle BCF is an isosceles triangle with $BF = BC$.

Show that triangle CEF is a right-angled triangle.
Give a reason for each stage of your working.
Use the template below to help present your work. You may not need all of the lines.

Angle _____ = _____ ° because _____

Angle _____ = _____ ° because _____

Angle _____ = _____ ° because _____

Angle _____ = _____ ° because _____

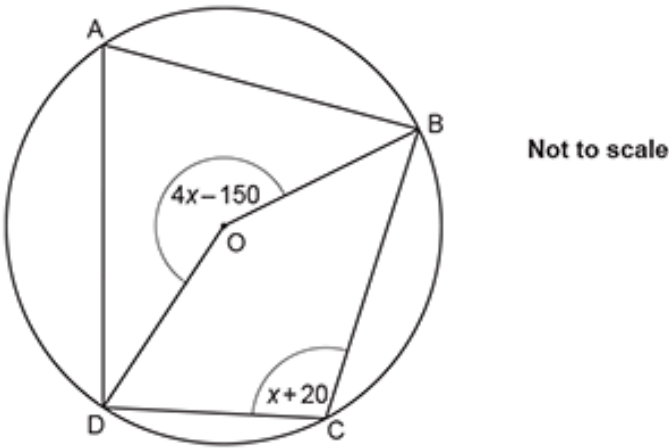
Angle _____ = _____ ° because _____

Angle _____ = _____ ° because _____

Angle _____ = _____ ° because _____

33(a). In this question all angles are given in degrees.

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



Find the size of angle BCD.

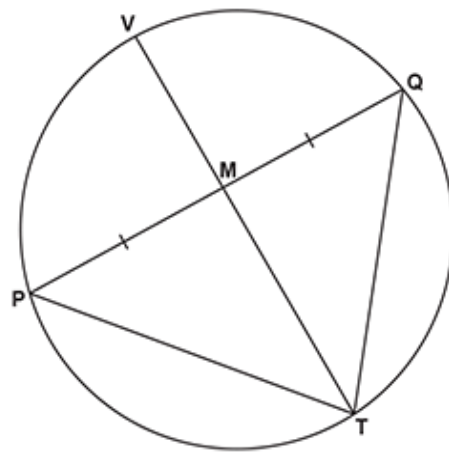
..... ° **[4]**

(b). Find the size of angle DAB.
Give a reason for your answer.

..... ° because

..... **[2]**

- 34.** P, Q, T and V are points on the circumference of a circle.
TV is a diameter of the circle.
M is a point on PQ such that $PM = MQ$.



Not to scale

Complete these sentences to show that triangle TMP is congruent to triangle TMQ.

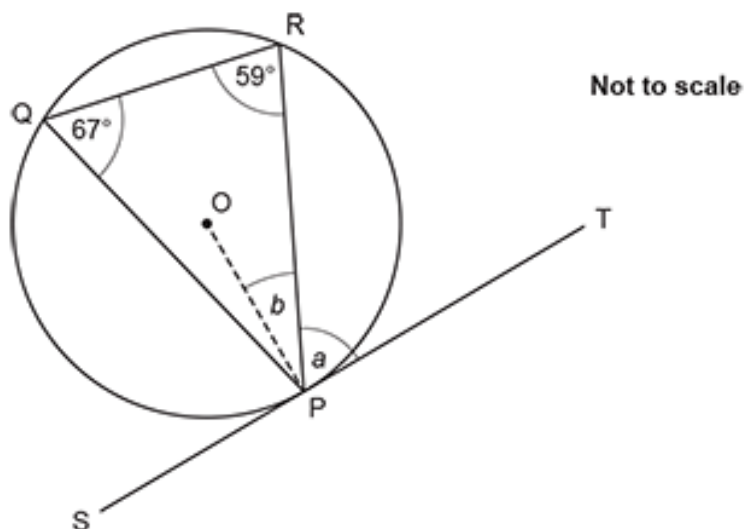
Side $PM =$ side MQ because it is given to you.

Angle $PMT =$ angle _____ because _____

Side MT is _____

Triangle TMP is congruent to triangle TMQ because _____ **[3]**

35(a). P, Q and R are points on the circumference of a circle, centre O.



Angle $PRQ = 59^\circ$ and angle $PQR = 67^\circ$.
Line SPT is a tangent to the circle.

- i. Work out angle a .
Give a reason for your answer.

Angle $a =$ _____ $^\circ$ because _____

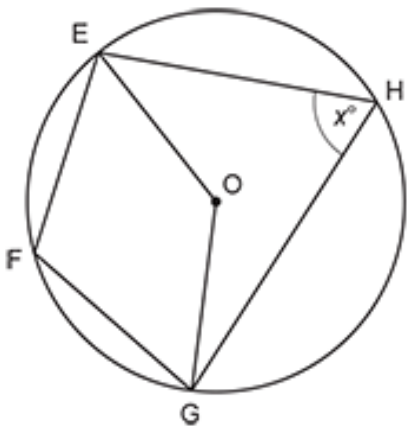
[2]

- ii. Work out angle b .
Give a reason for your answer.

Angle $b =$ _____ $^\circ$ because _____

[2]

(b). E, F, G and H are points on the circumference of a circle, centre O.
Acute angle EHG = x° .



Not to scale

i. Complete the following, giving the values of the angles in terms of x .

Obtuse angle EOG = _____ $^\circ$ because _____

Therefore, reflex angle EOG = $^\circ$

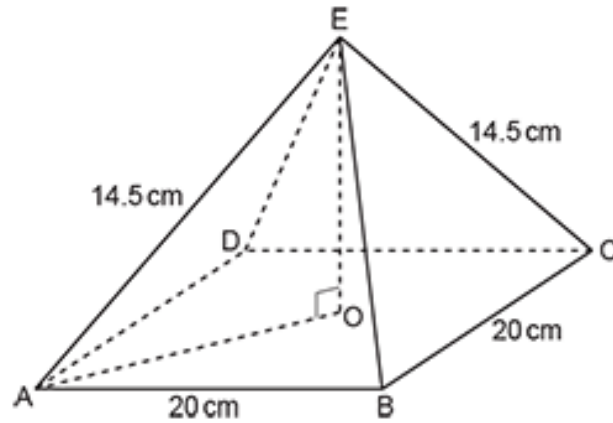
Therefore, angle EFG = $^\circ$

[3]

ii. Write down what your working in part **(b)(i)** has proved.

[1]

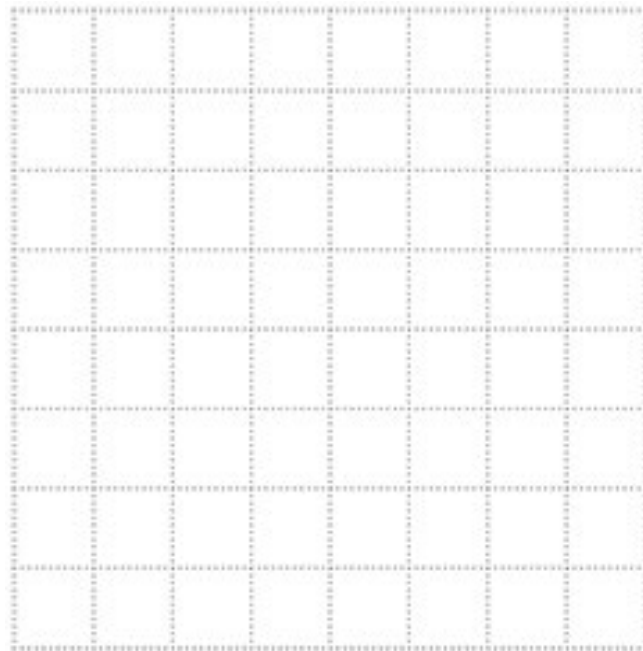
- 36.** The diagram shows a square-based pyramid $ABCDE$.
 O is the centre of the base.



The pyramid has base length 20 cm and each sloping edge has length 14.5 cm.

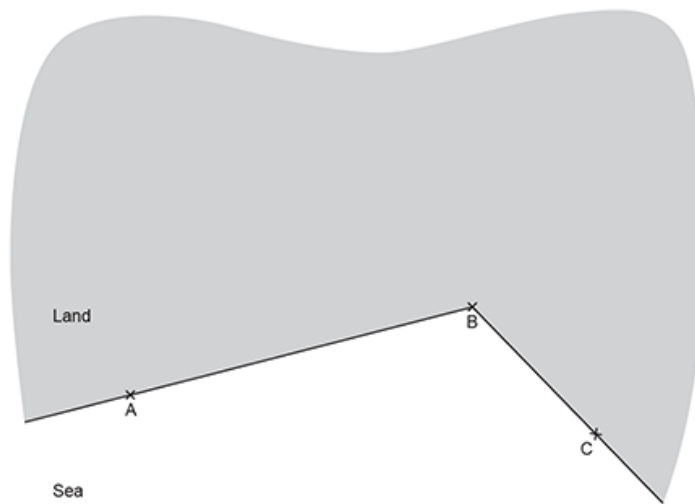
Draw the plan view of the pyramid on the one-centimetre grid below.

Scale: 1 cm represents 4 cm.



37. The diagram represents a coastline.

A, B and C are lighthouses.

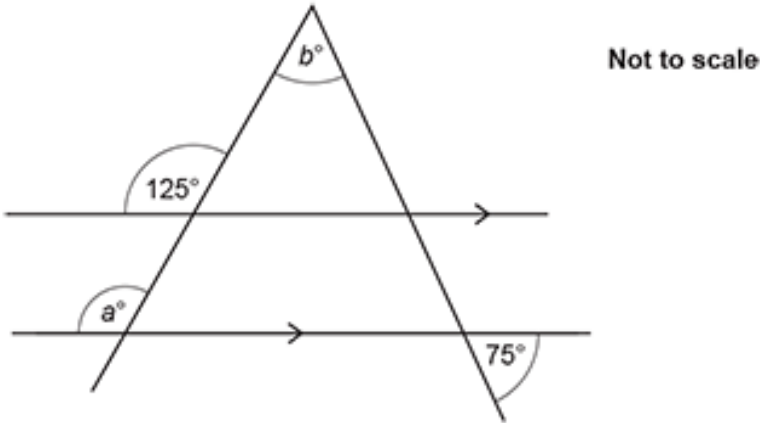


A boat is

- the same distance from A and B
- the same distance from AB and BC.

Using a ruler and compasses only, construct the position of the boat.
Label the position of the boat clearly.

38(a). The diagram shows two straight lines crossing a pair of parallel lines.



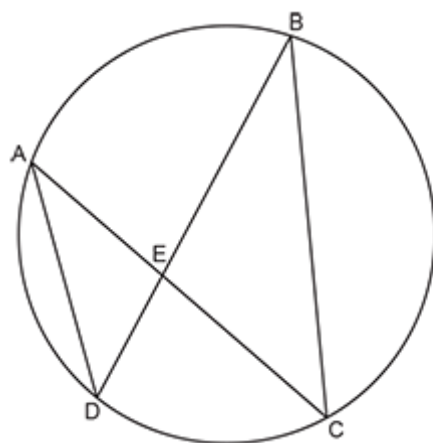
Write down the value of a .
Give a reason for your answer.

$a =$ _____ because _____
[2]

(b). Work out the value of b .

$b =$ [3]

- 39.** Points A, B, C and D lie on the circumference of a circle.
Line AC intersects line BD at point E.

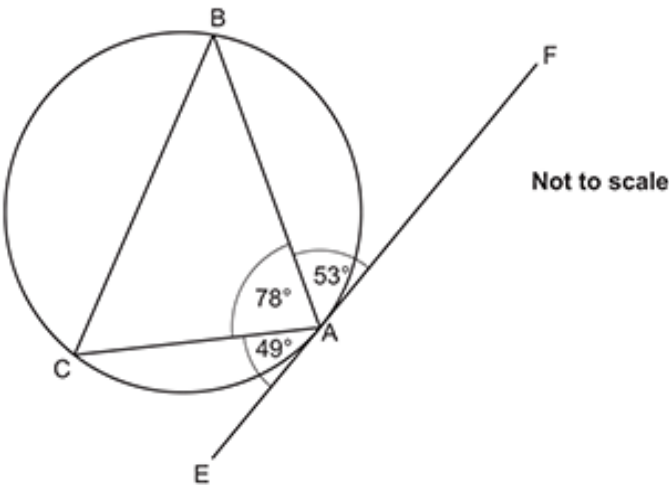


Not to scale

Prove that triangle AED is similar to triangle BEC.

[3]

40(a). Points A, B and C lie on the circumference of a circle.
EAF is a tangent to the circle.

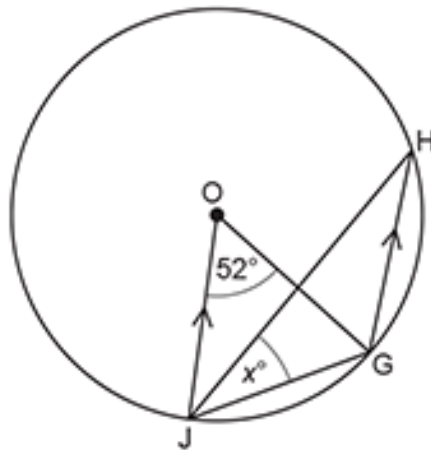


Write down the value of angle BCA giving a reason for your answer.

Angle BCA =° because

[2]

(b). Points G, H and J lie on the circumference of a circle, centre O.



Not to scale

Angle $GOJ = 52^\circ$ and angle $GJH = x^\circ$.
Lines JO and GH are parallel.

Find the value of x .
You must show your working.

(b) $x = \dots\dots\dots$ [5]

41. Three **regular** polygons meet at a point.



Not to scale

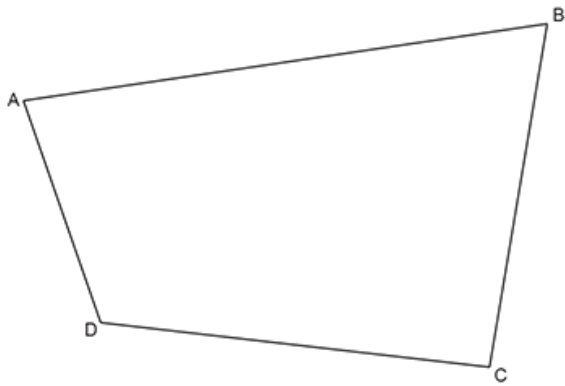
Two of the polygons are pentagons.

Find the number of sides of the third polygon.
You must show your working.

..... **[6]**

42(a). The scale drawing represents a park, ABCD.

Scale: 1 cm represents 10 m



A straight path goes across the park from B.
The path is always the same distance from side AB and side BC.

Construct the route followed by the path.

Show all your construction lines.

[2]

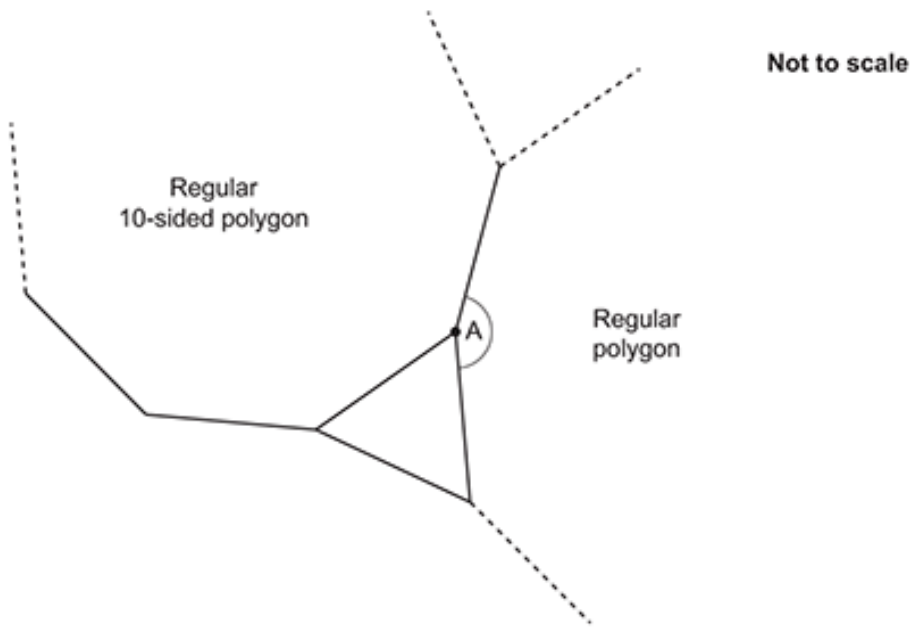
(b). A bench is to be placed on the path.
The bench must be no more than 50 m from C.

Construct the locus of the possible positions of the bench.

Indicate clearly on the diagram where the bench can be placed.

[3]

43(a). An equilateral triangle, a regular 10-sided polygon and another regular polygon meet at a point.



Show that angle A is 156° .

[3]

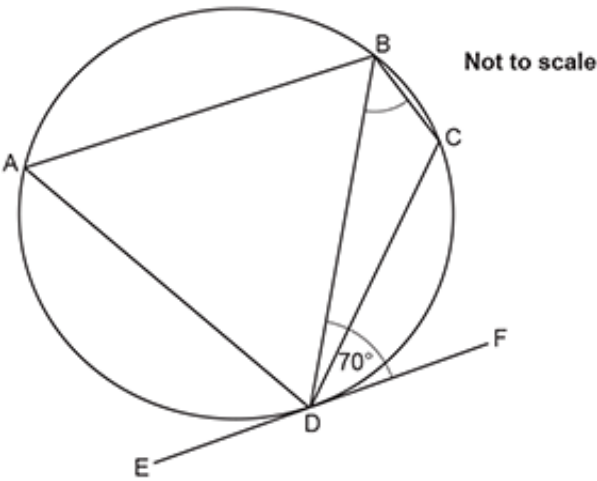
(b). Work out the number of sides of the other regular polygon.

..... [2]

44. A, B, C and D are points on the circumference of a circle.

EF is the tangent to the circle at D.

Angle BDF = 70° .



The ratio angle BCD : angle CBD is 5 : 2.

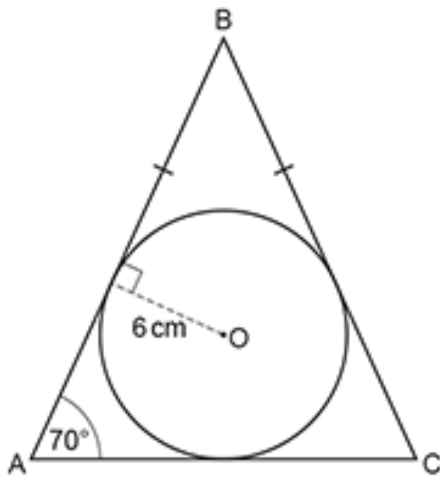
Work out angle CBD.

You must show your working.

..... $^\circ$ [5]

45. ABC is an isosceles triangle.

The sides of the triangle ABC are all tangents to a circle of radius 6 cm, centre O.



Not to scale

Angle BAC = 70° and $BA = BC$.

Show that length BO is 17.54 cm, correct to 2 decimal places.

[4]

END OF QUESTION PAPER