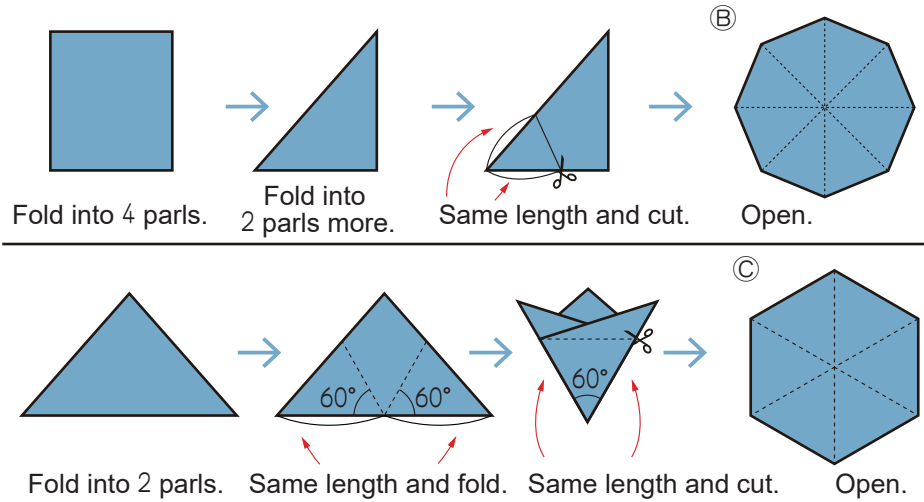


15-1

Regular Polygons and Circles

Regular Polygons

Instruction Polygons Use square paper to make figures.



- A polygon is made of straight lines, and the shape is “closed” (all the lines connect up).
- All sides are equal in length and all angles equal in size is called a **regular polygon**.

How many sides and angles are there in each?



Also, how about the length of sides and sizes of angles?

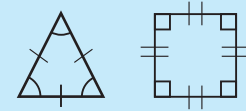


The table below shows typical kinds of polygons.

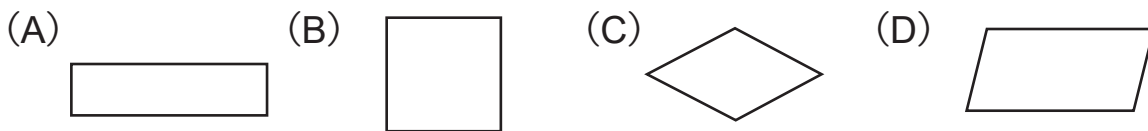


Name of figure	Triangle	Quadrilateral	Pentagon
Number of sides	3	4	5
Example figures			
Name of figure	Hexagon	Heptagon	Octagon
Number of sides	6	7	8
Example figures			

A regular polygon has all the sides, and the angles are equal in length and in size.

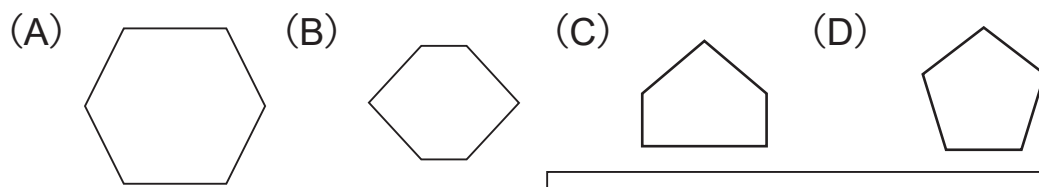


Example 1 Find the regular polygons and write the names.



B, Regular quadrilateral (Square).

1 Find the regular polygons and write the names.

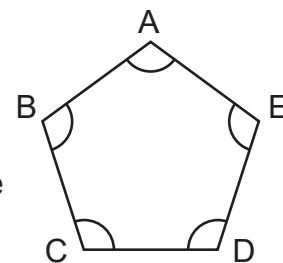


[Empty box for answer]

Example 2 The following figure is a polygon whose length of sides and size of angles are equal. Answer the following questions.

1 What is the name of the polygon?

Regular pentagon
(pentagon)



2 Write down the sides where the length is the same as side AB.

BC, CD, DE, EA

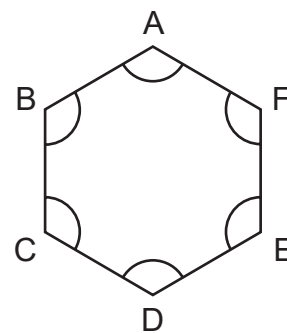
3 Write down the angles where the size is the same as angle A.

B, C, D, E

2 The following figure is a polygon whose length of sides and size of angles are equal. Answer the following questions.

1 What is the name of the polygon?

[Empty box for answer]



2 Write down the sides where the length is the same as side AF.

[Empty box for answer]

3 Write down the angles where the size is the same as angle B.

[Empty box for answer]

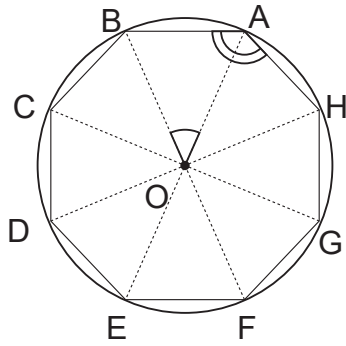
15 - 2

Regular Polygons and Circles

Regular Octagons and Regular Hexagon

Example 1

Investigate the regular octagon shown below, the diagonals connect opposite vertices and intersect at point O. Answer the following questions.



1 How many degrees is angle AOB?

Math sentence $360 \div 8 = 45$ Answer angle AOB = 45°

2 What kind of triangle is formed by the diagonals? Write the reason.

Name of triangle

Isosceles triangle

Reason

The point O is the centre of the circle and the length from O is the same.

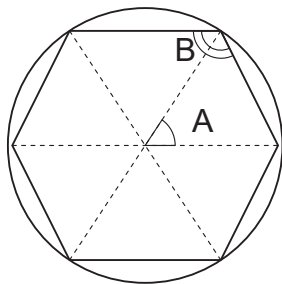
3 How many degrees is angle BAH?

Since the triangles formed by the diagonals are isosceles triangle, angle OAB = OBA. Since triangle OAB and OHA are congruent, angle OAH = OAB. $AOB + OAB + OBA = 180^\circ$. Since $BAH = OAB + OBA$, $180^\circ - AOB = BAH$.

Math sentence $180 - 45 = 135$

Answer angle BAH = 135°

1 In the regular hexagon shown below, the diagonals connect opposite vertices and intersect at point O. Answer the following questions.



1 How many degrees is angle A?

Math sentence

Answer

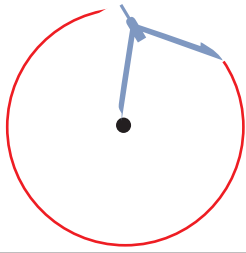
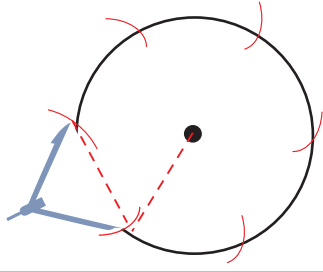
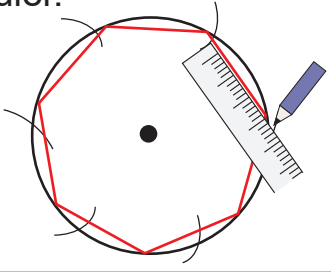
2 What kind of triangle is formed by the diagonals?

3 How many degrees is angle B?


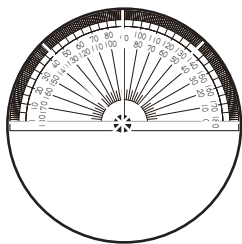
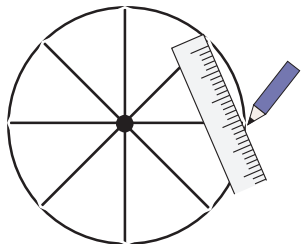
Math sentence

Answer

Example 2 Draw a regular hexagon by using a circle.

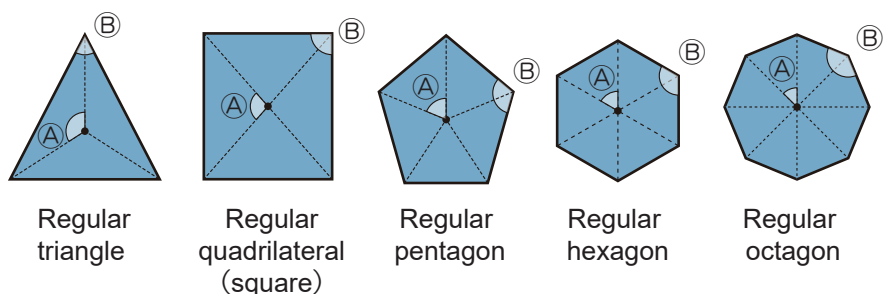
<p>1. Draw a circle.</p> 	<p>2. Mark the length same as radius on the circumference.</p> 	<p>3. Connect the intersections with straight lines using a ruler.</p> 
--	---	--

2 Draw a regular octagon by using a circle.

<p>1. Draw a circle.</p> 	<p>2. Divide the angle around the centre of a circle into 8 equal angles, 45° each.</p> 	<p>3. Connect the intersections with straight lines using a ruler.</p> 
--	--	--

3 Summarize the number of sides and the size of angles of regular polygons.

	Regular triangle	Regular quadrilateral (square)	Regular pentagon	Regular hexagon	Regular octagon
Number of sides	3				
Size of angle A	120°				
Size of angle B	60°				



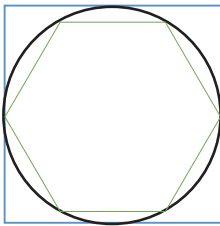
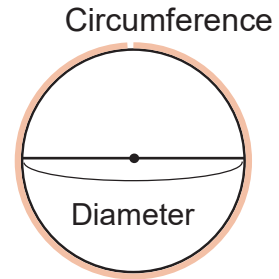
15 - 3

Regular Polygons and Circles

Circumference

Instruction Circumference

- The perimeter of a circle is called **circumference**. A line that bends like a circumference is called a **curve**.
- The circumference is longer than 3 times the diameter and shorter than 4 times the diameter.



Is this true with any circle?



Regardless of the circle's size, (circumference) \div (diameter) is always the same number.



- The number we get from (circumference) \div (diameter) is called the ratio of circumference.
- The ratio of circumference, 3.1415... It is a number that continues infinity, but normally is used as 3.14.
(Ratio of circumference) = (circumference) \div (diameter)

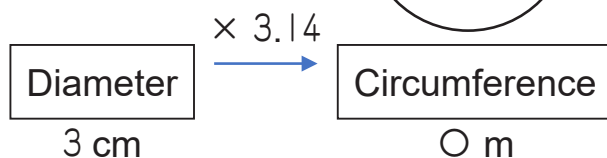
If you know a diameter and ratio of the circumference, 3.14, you can find the circumference.



Example 1 Find the circumference of the circle below

Math sentence $3 \times 3.14 = 9.42$

Answer 9.42 cm

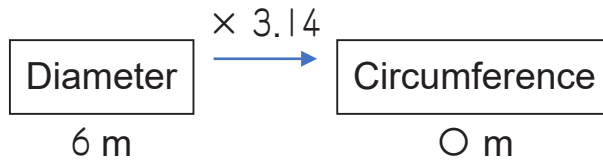


Example 2

When you draw a circle with a diameter of 6 m on the playground, how many m will the circumference of the circle be?

Math sentence $6 \times 3.14 = 18.84$

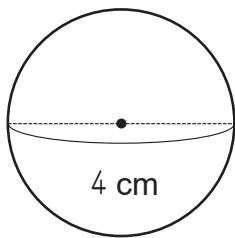
Answer 18.84 m



1

Find the circumference of the circle below

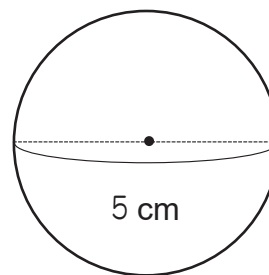
(1)



Math sentence

Answer _____

(2)



Math sentence

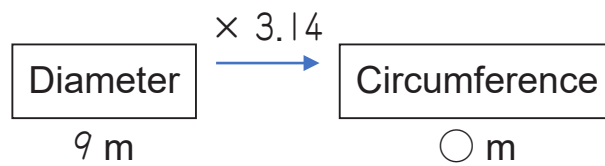
Answer _____

2

When you draw a circle with a diameter of 9 m on the playground, how many m will the circumference of the circle be?

Math sentence

Answer _____

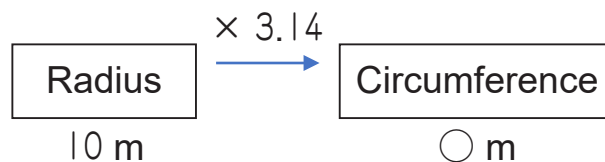


3

A circle with a radius of 10 m was drawn. How many meters is the circumference?

Math sentence

Answer _____



(Diameter) = (Radius) × 2



15-4

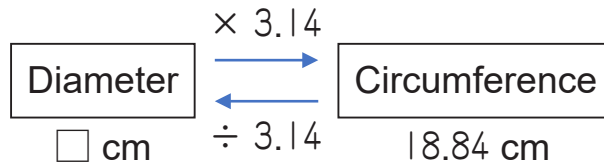
Regular Polygons and Circles

Calculation of the Circumference

Example 1 Find the diameter of a circle with circumferences of 18.84 cm.

Math sentence $18.84 \div 3.14 = 6$

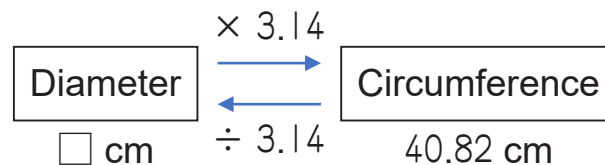
Answer 6 cm



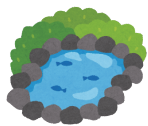
1 Find the diameter of a circle with circumferences of 40.82 cm.

Math sentence

Answer _____

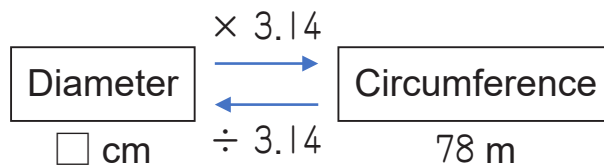


Example 2 A girl measured the length around a rounded pond and found it was 78 m. How many m is the diameter of the pond? Round the number to the nearest one.



Math sentence $78 \div 3.14 = 24.8407643$

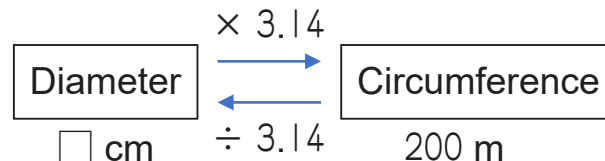
Answer Approximately 25 m



2 A boy measured the length around a round pond. It was 200 m. How many m is the diameter of the pond? Round the number to the nearest one.

Math sentence

Answer _____

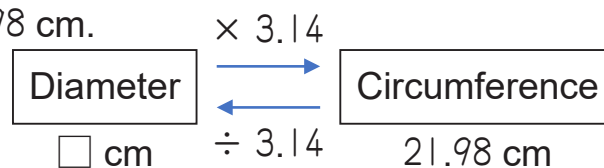


Example 3 Find the radius of the following figures.

a circle with a circumference of 21.98 cm.

Math sentence $21.98 \div 3.14 = 7$
 $7 \div 2 = 3.5$

Answer 3.5 cm



(Radius) = (Diameter) $\div 2$



3 Find the radius of the following figures.

1 a circle with a circumference of 25.12 cm.

Math sentence

Answer _____

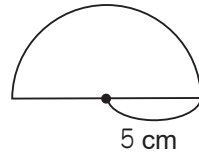
2 a circle with a circumference of 62.8 cm.

Math sentence

Answer _____

Example 4 Find the length around the figure below.

Math sentence



The figure is a half circle with a 5 cm radius.



$$(5 \times 2 \times 3.14 \div 2) + (5 \times 2) = 25.7$$

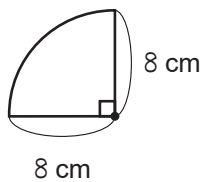
Answer 25.7 cm

There are two kinds of lengths, curved and straight lines.



4 Find the length around the figure below.

(1)



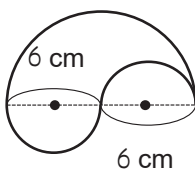
Math sentence

The curved line is a quarter of the circumference with 8 cm radius.



Answer _____

(2)



Math sentence

Answer _____

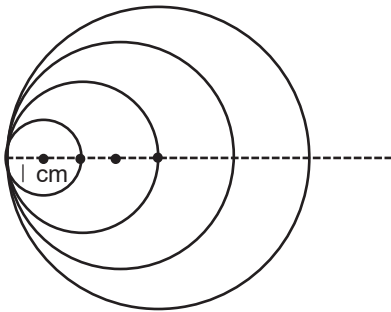
15 - 5

Regular Polygons and Circles

Relationship between Circumference and Diameter

Example

Investigate how the circumference changes when the diameter changes.



When the diameter increases, the size of the circle is larger...



- 1 Write a math sentence to calculate the circumference, \bigcirc cm, if the diameter is \square cm.

$$\bigcirc = \square \times 3.14$$

Circumference = Diameter \times Pi

- 2 As \square changes from 1 to 4, what are the corresponding values for \bigcirc ? Complete the table below.

Diameter \square (cm)	1	2	3	4
Circumference \bigcirc (cm)	3.14	6.28	9.42	12.56

- 3 When the diameter increases by 1 cm, how many cm does the circumference increase?

Math sentence $6.28 - 3.14 = 3.14$

Find the difference the length of the circumference when diameter is 1 cm and 2 cm.

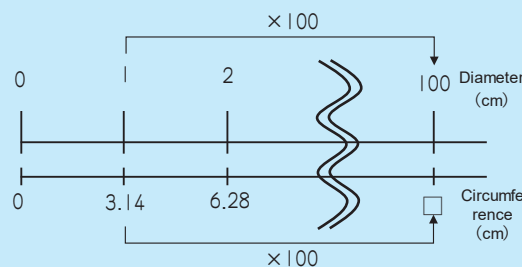


Answer 3.14 cm

- 4 Calculate the circumference when the diameter is 100 cm.

Math sentence $100 \times 3.14 = 314$

Answer 314 cm



How does the circumference change when the radius changes?

- 1 Write a math sentence to calculate the circumference, \bigcirc cm, if the radius is \triangle cm.

$$\begin{array}{c} \bigcirc \\ \text{Circumference} \end{array} = \begin{array}{c} \square \\ \text{Radius} \end{array} \times \square \times \begin{array}{c} \square \\ \text{Pi} \end{array}$$

- 2 As \triangle changes from 1 to 4, what are the corresponding values for \bigcirc ? Complete the table below.

Radius \triangle (cm)	1	2	3	4	5
Circumference \bigcirc (cm)					

- 3 When the radius increases by 1 cm, how many cm does the circumference increase?

Math sentence

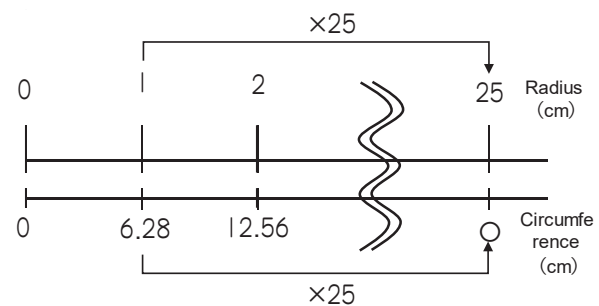
Answer _____

- 4 How many times does the circumference increase when you double the radius?

- 5 Calculate the circumference when the radius is 25 cm.

Math sentence

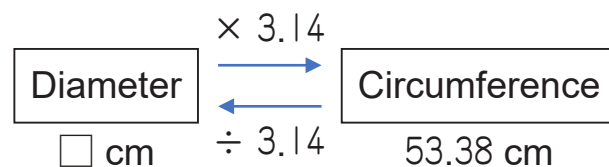
Answer _____



- 6 Find the diameter of a circle with a circumference of 53.38 cm.

Math sentence

Answer _____

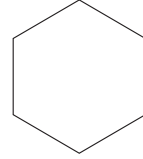
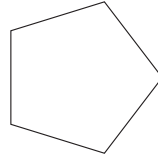
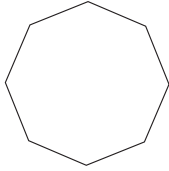
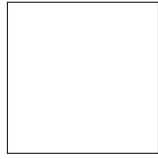


15-6

Regular Polygons and Circles

Review

1 Match the figures of the regular polygons to their names.



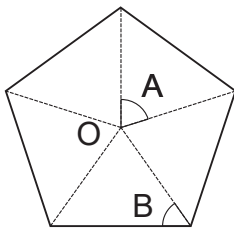
Pentagon

Hexagon

Quadrilateral
(Square)

Octagon

2 In the regular pentagon shown below, the diagonals connect opposite vertices and intersect at point O. Answer the following questions.



How many degrees is angle A and angle B?

Math
sentence

Answer

Math
sentence

Answer

3 Find the circumferences of the following figures.

- 1 a circle with a diameter of 30 cm. 2 a circle with a radius of 7.5 cm.

Math
sentence

Math
sentence

Answer _____

Answer _____

4 A girl measured the length around a rounded forest and found it was 400 m. How many m is the diameter of the forest? Round the number to the nearest one.

Math
sentence

Answer _____

