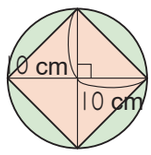
7 - 1 Area of a Circle

Area of a Circle (1)

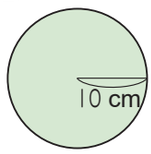
Instruction How to find the area of circle B.

Let's find the area of a circle with a radius of 10 cm, comparing to the area of the following figures.

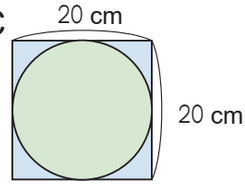
A



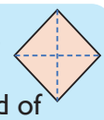
B



C



The area of is composed of 4



The area of square A:

Math sentence $(10 \times 10 \div 2) \times 4 = 200$

Answer $200\ cm^2$

The area of square C:

Math sentence $20 \times 20 = 400$

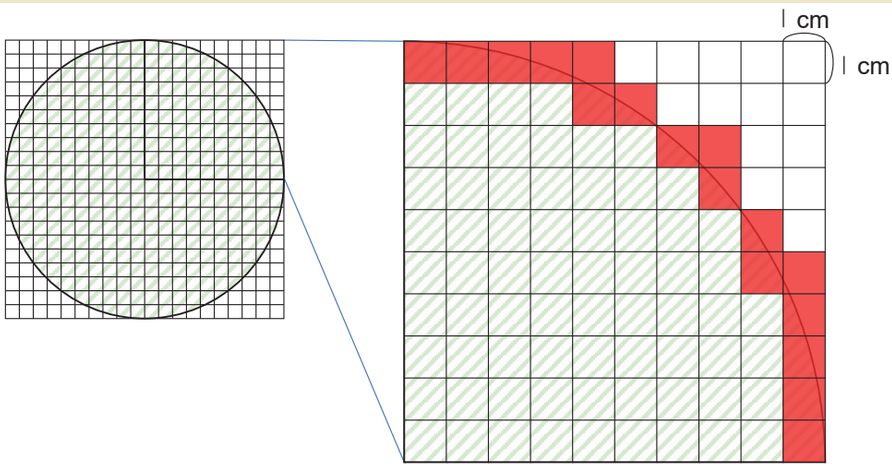
Answer $400\ cm^2$

The area of circle B is larger than $200\ cm^2$ and smaller than $400\ cm^2$.

How we can calculate the area?

How about laying graph paper with 1 cm square sides and counting the number of squares?

Example Separate the circle into 4 parts and look at one of them. Answer the following questions to find the area of the figure below.



Red squares pass through the circumference of the circle and green squares overlap the circle.

1 How many green and red squares are there?

Patterned squares 69 Coloured squares 17

2 If we consider the red squares, as squares with an area of 0.5 cm^2, about how many cm^2 is the area of a quarter of this circle?

Green squares [69] × 1 = [69] (cm^2)

Red squares [17] × 0.5 = [8.5] (cm^2)

The area of a quarter of the circle is about [77.5] (cm^2)

Red squares do not overlap with the circle completely. To estimate the area, we assume the red squares have 0.5 cm^2

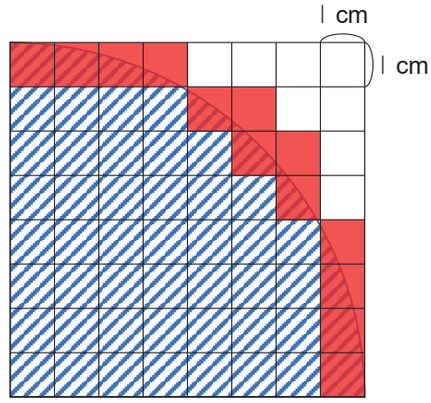
3 About how many cm^2 is the area of the entire circle?

Math sentence (77.5) × 4 = 310

Answer 310 cm^2

1 The following diagram shows a quarter of the circle with a radius of 12 cm.

Answer the following questions.
Red squares pass through the circumference of the circle and blue squares overlap the circle.



1 How many blue and red squares are there?

Patterned squares [ ] Coloured squares [ ]

2 If we consider the red squares as squares with an area of 0.5 cm^2, about how many cm^2 is the area of a quarter of this circle?

Blue squares [ ] × 1 = [ ] (cm^2)

Red squares [ ] × 0.5 = [ ] (cm^2)

The area of a quarter of the circle is about [ ] (cm^2)

3 About how many cm^2 is the area of the entire circle?

Math sentence

Answer _____

7 – 2 Area of a Circle

Area of a Circle (2)

Instruction How to find the area of a circle (2).

Let's think about how to find the area of a circle with a radius of 5 cm.

Remember how we learned to find the area of parallelograms. Cut a part of the figure and change it to a known figure, rectangle.

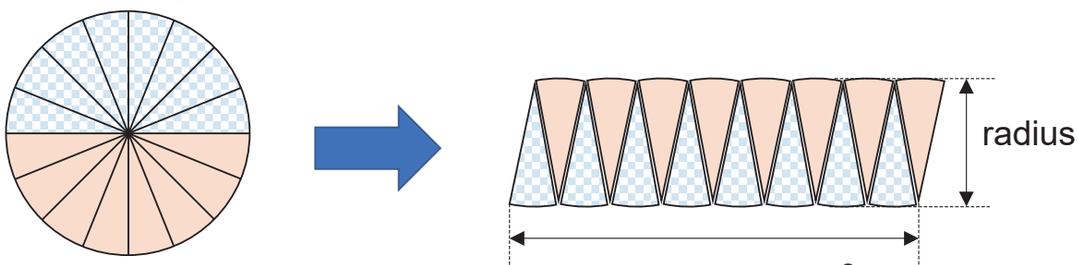
I see. Let us think cut the circle and rearrange a known figure. Not only rectangle, can we rearrange other shapes?

Also remember
(Circumference) = (Diameter) × 3.14

The circle was separated into 16 parts.

Idea 1

It is rearranged into a parallelogram.



The area of the circle

Math sentence

(circumference ÷ 2) × (radius)

= 31.4 ÷ 2 × 5

= 78.5

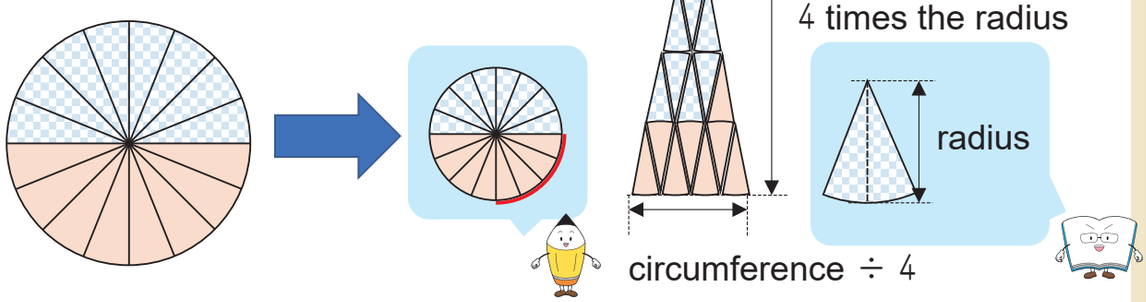
78.5 cm^2

When we look at it carefully, it has curves and doesn't look like a rectangle…

As we divide the circle into small sections of equal size, it resembeles the shape of a rectangle.

Idea 2

In the case of dividing a circle into 16 parts, they were rearranged into a triangle.



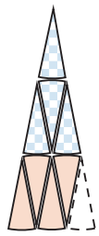
Since the radius is 5 cm,
The circumference is

Math sentence $5 \times 2 \times 3.14 = 31.4$ 31.4 cm

The area of the circle

Math sentence (circumference ÷ 4) × (4 times of radius) ÷ 2

$= 31.4 \div 4 \times 4 \times 5 \div 2$
$= 78.5$ $78.5\ cm^2$



In short,

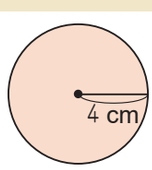
(Area of Circle) = (Radius) × (Circumference ÷ 2)
= (Radius) × (Diameter × 3.14 ÷ 2)
= (Radius) × (Diameter ÷ 2 × 3.14)
= (Radius) × (Radius) × 3.14

The area of a circle can be found with the following formula:
(Area of Circle) = (Radius) × (Radius) × 3.14

Example Find the area of the circle with a radius of 4 cm.

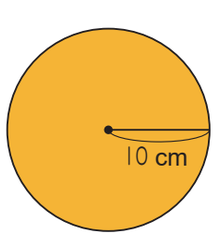
Since (Area of Circle) = (Radius) × (Radius) × 3.14

Math sentence $4 \times 4 \times 3.14 = 50.24$ Answer $50.24\ cm^2$



Find the area of the circles with the following radiuses.

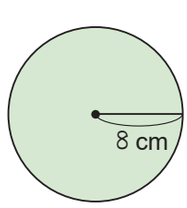
1 with 10 cm



Math sentence

Answer _____

2 with 8 cm



Math sentence

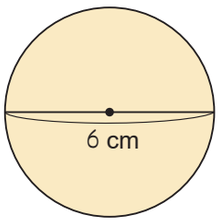
Answer _____

7 – 3 Area of a Circle

Area of a Circle (3)

Example 1 Find the area of the following figures.

1



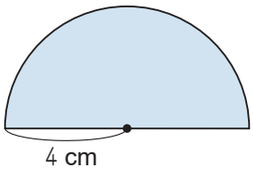
Find the length of the radius.
(Radius) = (Diameter) ÷ 2

Since the diameter is 6 cm, the radius is 3 cm.

Math sentence $3 \times 3 \times 3.14 = 28.26$

Answer $28.26\ cm^2$

2



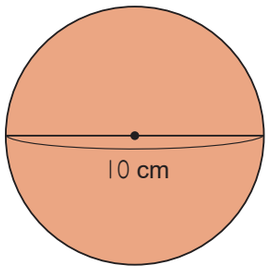
This is a half circle with a radius of 4 cm. We can find the area by calculating the area of the circle and divide it into 2.

Math sentence $(4 \times 4 \times 3.14) \div 2 = 25.12$

Answer $25.12\ cm^2$

1 Find the area of the following figures.

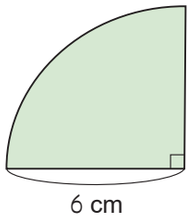
1



Math sentence

Answer _____

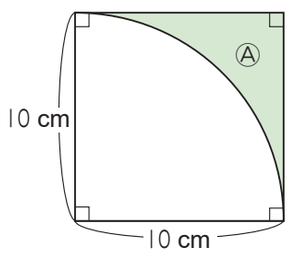
2



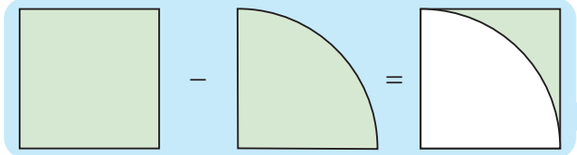
Math sentence

Answer _____

Example 2 Find the area of the A parts.



What kind of figures do you observe? Also, what does it consist of?



The area of the square

Math sentence $10 \times 10 = 100$

The area of the quarter of the circle

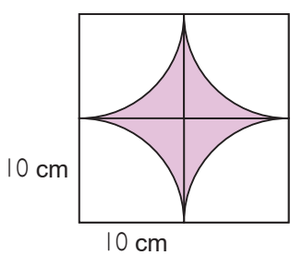
Math sentence $(10 \times 10 \times 3.14) \div 4 = 314 \div 4$
$= 78.5$

The area of figure A

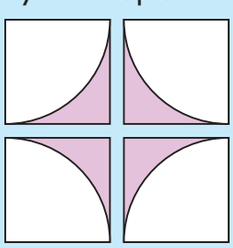
Math sentence $100 - 78.5 = 21.5$

Answer $21.5\ cm^2$

2 Find the area of the coloured parts.



How many are the part A above?



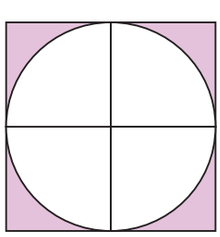
Separate the circle into 4 parts and look at one of them.
The radius of the quarter circle is 10 cm.
The area is 4 times of the area of the quarter of the circle

Math sentence

Answer _____

Alternatively, The area of the figure is as follows:

Math sentence

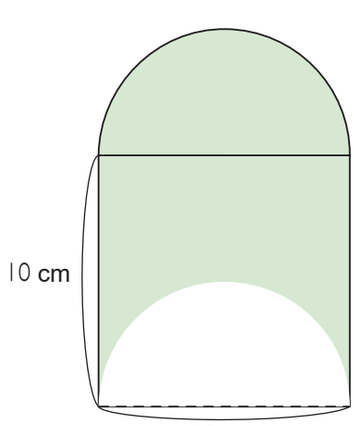


Let's Try !

Find the area of the following figure below.

Math sentence

Answer _____

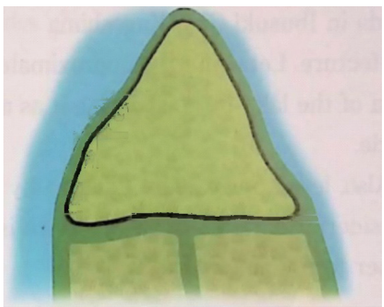


7 – 4 Area of a Circle

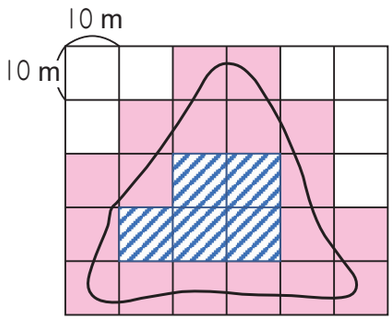
Approximate Area

Example 1 The illustration below shows a field that lies between rivers.

Find the approximate area of the field surrounded by the black line.



Can we do the same as when we calculated the approximate area of a circle?



1 In the diagram on the right, how many blue and red squares are there?

Blue squares 5

Red squares 18

2 If we consider the red squares as squares with an area of 50 m^2, about how many m^2 is the area of a field that lies between rivers?

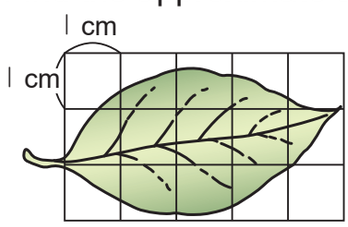
Blue squares 5 × 100 = 500 (m^2)

Red squares 18 × 50 = 900 (m^2)

Approximate area of the field is 1400 (m^2)

We assume Red squares have the half area of Blue squares.

1 Find the approximate area of the leaf below.

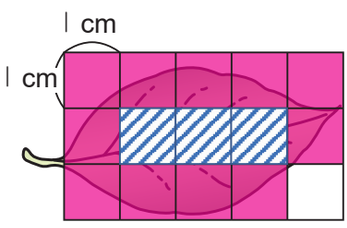


Colour the squares which pass through the edge of the leaf in red and colour the squares that overlap the leaf in blue.

1 In the diagram on the right, how many blue and red squares are there?

Blue squares

Red squares



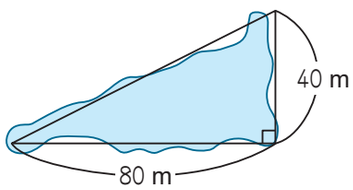
2 If the red squares have an area of 0.5 cm^2, how many cm^2 is the area of a quarter of this circle?

Blue squares ☐ × 1 = ☐ (cm^2)

Red squares ☐ × 0.5 = ☐ (cm^2)

Approximate area of the field is ☐ (cm^2)

Example 2 The illustration below shows a lake. Find the approximate area by considering it as a triangle.

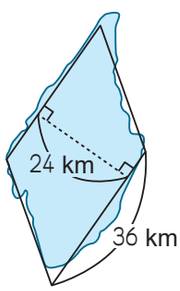


Math sentence $80 \times 40 \div 2 = 1600$

Answer $1600\ m^2$

By considering the object as a known figure, we can find approximate area.

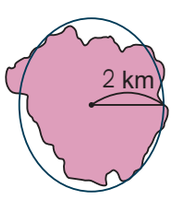
2 The illustration below shows an island. Find the approximate area by considering it as a parallelogram.

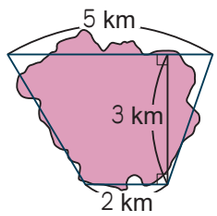


Math sentence

Answer _____

3 When you find the approximate area of the lake. If the actual area is 11 km^2, which approximate area is closer to the actual one?





Considering it as a circle

Math sentence

Answer _____

Considering it as a trapezoid

Math sentence

Answer _____

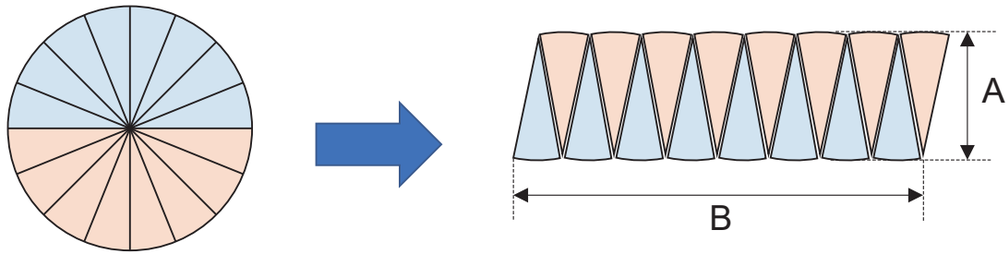
Considering it as a ☐ is closer to the actual one.

7 – 5 Area of a Circle

Review

1 Thinking about how to find the area of a circle.

As we divide the circle into small sections of equal size, it approaches the shape of a rectangle.



Choose appropriate words and fill in the blanks.

The length of A is the same as the [ ] of a circle.

Since the length of B is the same as a half of the [ ] ,

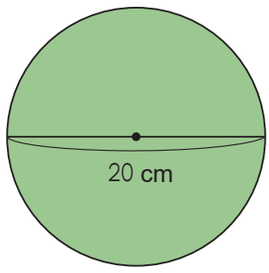
(Length of B) = [ ] × (Ratio of circumference) ÷ 2

= [ ] × (Ratio of circumference)

Circumference	Radius	Diameter	Centre

2 Find the area of the following figures.

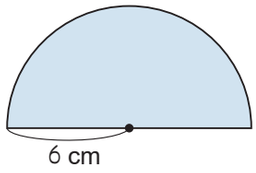
1



Math sentence

Answer _____

2



Math sentence

Answer _____

3 Find the area of the circles with the following length.

1 with a radius of 7 cm

Math sentence

Answer _____

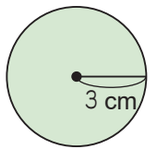
2 with a diameter of 10 cm

Math sentence

Answer _____

4 Find the area of the coloured parts.

A



B

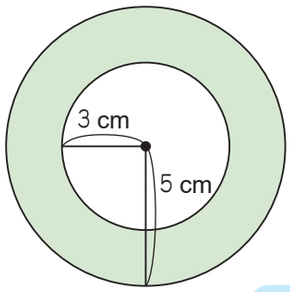


Figure A

Math sentence

Answer _____

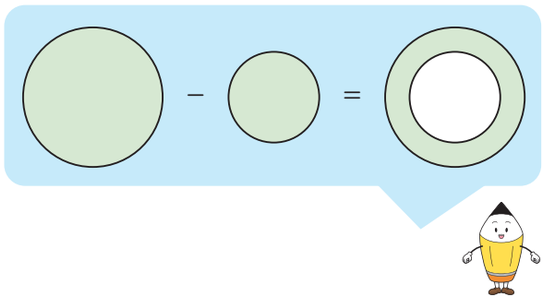


Figure B

Area of the larger circle

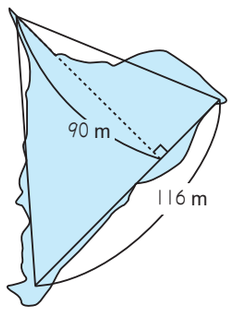
Area of the smaller circle

Math sentence

Area of figure A

Answer _____

5 The illustration below shows a lake. Answer the thefollowing questions.



1 What kind of shape can you use it to find the area?

2 Find the approximate area.

Math sentence

Answer _____