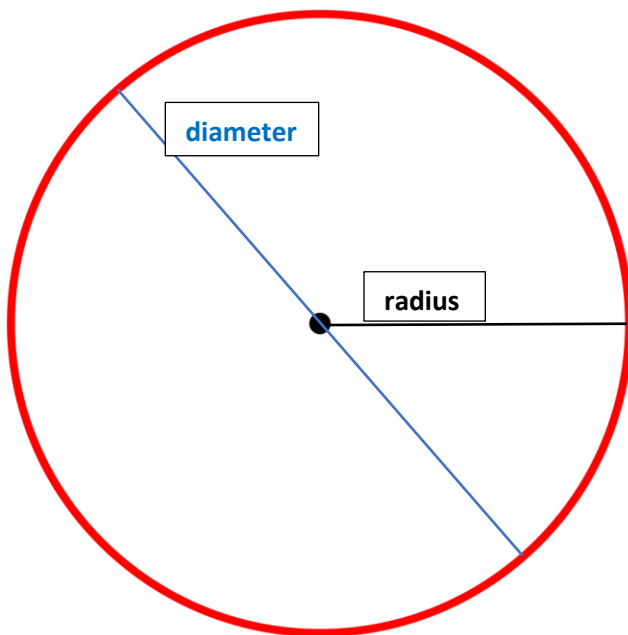


Hi everyone!

This week we will move along and take a look at circles. We will learn about the parts of a circle, and how to find the circumference and area of a circle.

Parts of a circle:

A **circle** is a geometric shape made of a set of points that are all the same distance from the centre.



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The **radius** is a line that extends from the centre of the circle to the edge of the circle. (plural - radii)

The **diameter** is a line that extends edge to edge across the circle, but passing through the **centre**.

These definitions present a clear relationship between between the radius and diameter.

1. The radius is half the distance of the diameter

so we can write it as:

$$r = d/2 \quad \text{where } r = \text{radius and } d = \text{diameter}$$

2. The diameter is the distance of two radii

so we can write it as :

$$d = 2r \quad \text{where } r = \text{radius and } d = \text{diameter}$$

By example:

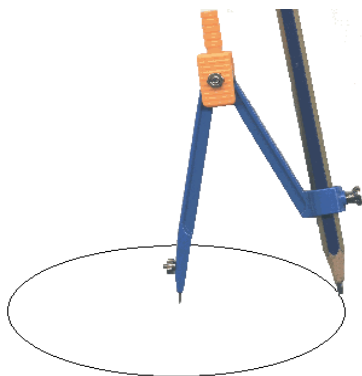
If a circle has a diameter of 6cm, the radius can be found using:

$$\begin{aligned} r &= d/2 \\ &= 6\text{cm}/2 \\ &= 3\text{cm} \end{aligned}$$

If a circle has a radius of 4cm, the diameter can be found using:

$$\begin{aligned} d &= 2r \\ &= 2 \times 4\text{cm} \\ &= 8\text{cm} \end{aligned}$$

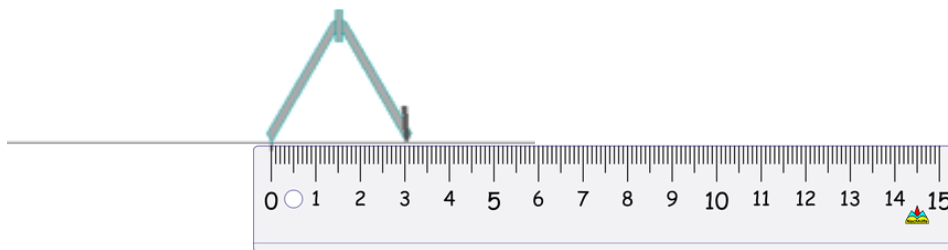
To draw a circle, think about which measure will be needed. If you consider that we use a compass to make a circle, lets look:



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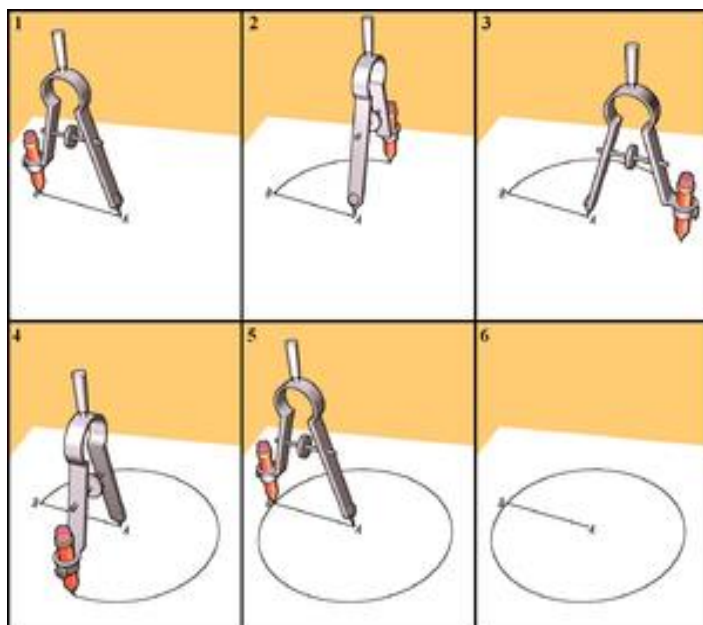
The point of the compass is at the centre of the circle, so notice the **distance from the centre to the edge** is where the pencil lands. This tells us then, that we need the radius of a circle, to draw a circle.

To draw a circle of a given radius:



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Place the compass tip at zero on the ruler and move the compass so that the pencil tip is at the desired measure. In the above, $r = 3\text{cm}$. Place the compass on your page, then proceed to draw the circle.



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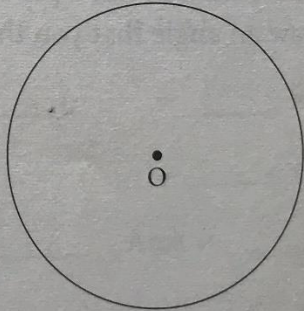
If you have a compass at home you can practice drawing a few. If not try the circled questions on the relationship between radius and diameter.

1. This circle has its centre at point O.

a) Draw a radius of the circle.
What is the length of the radius? _____

b) Draw a diameter of the circle.
What is the length of the diameter? _____

2. From your results in question 1, write a relationship between the radius and the diameter of a circle.



Hint: look back under the definitions and see the formulas!

(see next page for more questions)

3. Find the diameter of the circle with each radius.

- a) 12 cm _____ b) 27 cm _____ c) 3.4 cm _____

4. Find the radius of the circle with each diameter.

- a) 12 cm _____ b) 28 cm _____ c) 3.4 cm _____

5. Write the steps you would take to draw a circle with radius 1 cm.

Draw the circle.

6. Draw 4 radii in the circle you drew in question 5.

What is the sum of the central angles of the circle? _____

7. Write the steps you would take to draw a circle with diameter 4 cm.

8. Circular plates with diameter 20 cm are placed side by side on a table. The table measures 2.4 m by 1.2 m.

a) What is the length of the table in centimetres? _____

b) How many plates can fit side by side along the length of the table?

c) What is the width of the table in centimetres? _____

d) How many plates can fit side by side along the width of the table? _____

e) How many plates can fit on the table? _____

f) How many plates can fit around the perimeter of the table? _____

Tip

To convert metres to centimetres, multiply by 100.

Now that we have the definitions, an understanding of how to make a circle and the relationship between radius and diameter, let's apply that knowledge.

Circumference and Area of a circle:

1. **Circumference**: The circumference of a circle is the "perimeter" of the circle and is the measure of the distance around the outside edge of the circle. (units will be mm, cm, etc.)

For any circle, regardless of its size, the measure of the circumference divided by the diameter of the circle is **about 3**.

This relationship is important as the ratio, $C \div d$ or C/d represents a special number for which the Greek symbol π (pi) is used.

The value $\pi = 3.141592653589\dots$ is a decimal value that never repeats and never terminates. This number is called an **irrational** number.

To find the circumference of a circle, we use:

$$C = \pi d \text{ or if given the radius } C = 2\pi r,$$

where $d = 2r$

where the value of pi is rounded to the first two decimal places, $\pi = 3.14$ (note: a good estimate for pi is 3 - the value found from $C \div d$)

For example: A circle has a **diameter** of 6cm, find the circumference.

$$\begin{aligned} C &= \pi d \\ &= 3.14 \times 6\text{cm} \\ &= 18.84\text{cm} \end{aligned}$$

Or: A circle has a **radius** of 4cm, find the circumference.

Here, we could solve for the diameter first using

$$\begin{aligned}d &= 2r & \text{then, } C &= \pi d \\ &= 2 \times 4\text{cm} & &= 3.14 \times 8\text{cm} \\ &= 8\text{cm} & &= 25.12\text{cm}\end{aligned}$$

We could also use $C = 2\pi r$

$$\begin{aligned}&= 2 \times 3.14 \times 4\text{cm} \\ &= 25.14\text{cm}\end{aligned}$$

We can also find the diameter of a circle if given the circumference:

We know that $C = \pi d$, so to find the diameter, $d = C/\pi$ (remember, solving for circumference is a multiplication sentence, so using the opposite operation allows you to solve for the diameter).

For example: If the circumference of a circle is given as 15cm, find the diameter.

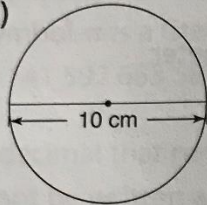
$$\begin{aligned}d &= C / \pi \\ &= 15\text{cm} \div 3.14 \\ &= 4.\overline{77} \\ &= 4.8\text{cm}\end{aligned}$$

At this point, let's try some practice of our own. (see next page)

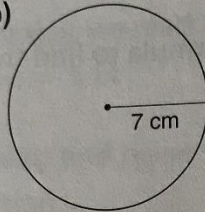
Practice

1. Calculate the circumference of each circle.
Give the answers to two decimal places.
Estimate to check the answers are reasonable.

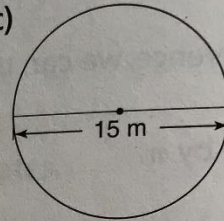
a)



b)

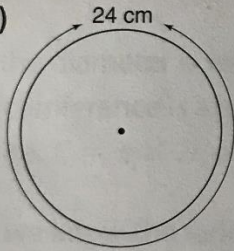


c)

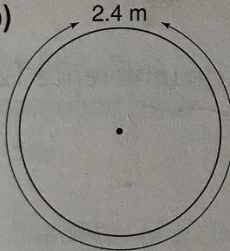


2. Calculate the diameter and radius of each circle.
Give the answers to two decimal places.
Estimate to check the answers are reasonable.

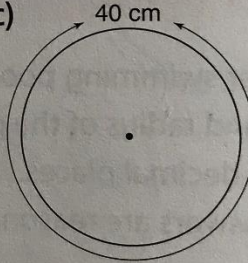
a)



b)



c)



3. When you estimate to check the circumference, you use 3 instead of π .
Is the estimated circumference greater than or less than the actual circumference?
Why do you think so?

4. A circular garden has diameter 2.4 m.
- The garden is to be enclosed with plastic edging. How much edging is needed?
 - The edging costs \$4.53/m. What is the cost to edge the garden?



- SHOW YOUR WORK.
6. A carpenter is making a circular tabletop with circumference 4.5 m.

What is the radius of the tabletop in centimetres?

Recall: 1 m = 100 cm



7. Can you draw a circle with circumference 33 cm? If you can, draw the circle and explain how you know its circumference is correct.

If you cannot, explain why it is not possible.

8. **Assessment Focus** A bicycle tire has a spot of wet paint on it. The radius of the tire is 46 cm.

Every time the wheel turns, the paint marks the ground.

- What pattern will the paint make on the ground as the bicycle moves?
- How far will the bicycle have travelled between two consecutive paint marks on the ground?
- Assume the paint continues to mark the ground. How many times will the paint mark the ground when the bicycle travels 1 km? Show your work.

2. **Area:** The area of a circle is a measure of the number of square units to cover the region. (units will be mm^2 , cm^2 , etc.)

Because we are still working with circles, the irrational number π is still important.

To find the area of a circle we use:

$A = \pi r^2$ *It is important, here, to remember that $r^2 = r \times r$ (when you square a number, you multiply the number by itself) where r is the radius of the circle.

** It is very important to remember that r^2 is NOT the same as the diameter. $d = 2r$, not $r \times r$

If given the diameter of the circle, remember $r = d/2$.

For example:

A circle has a radius of 4cm. Find the area of the circle.

$$\begin{aligned}A &= \pi r^2 \\ &= 3.14 \times 4\text{cm} \times 4\text{cm} \\ &= 3.14 \times 16\text{cm}^2 \\ &= 50.24\text{cm}^2\end{aligned}$$

Or: A circle has a diameter of 6cm. Find the area of the circle.

Here, we need to find the radius first by,

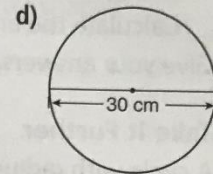
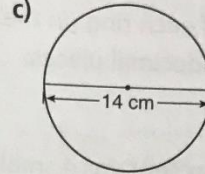
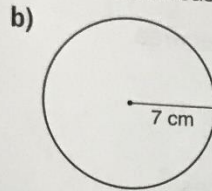
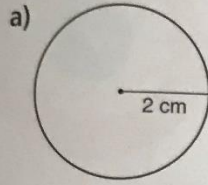
$$\begin{array}{ll}r = d/2 & \text{then, } A = \pi r^2 \\ = 6\text{cm} \div 2 & = 3.14 \times 3\text{cm} \times 3\text{cm} \\ = 3\text{cm} & = 3.14 \times 9\text{cm}^2 \\ & = 28.26\text{cm}^2\end{array}$$

Let's try some practice here with the circled questions on the next pages.

Practice

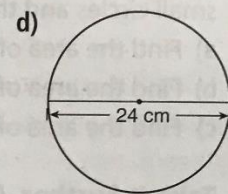
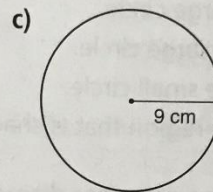
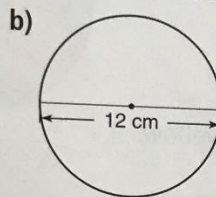
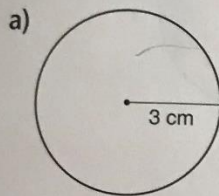
1. Calculate the area of each circle.

Estimate to check your answers are reasonable.



2. Calculate the area of each circle. Give your answers to two decimal places.

Estimate to check your answers are reasonable.



3. Use the results of questions 1 and 2. What happens to the area in each case?

- You double the radius of a circle.
- You triple the radius of a circle.
- You quadruple the radius of a circle.

Justify your answers.

4. **Assessment Focus** Use 1-cm grid paper.

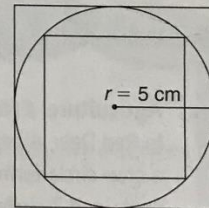
Draw a circle with radius 5 cm.

Draw a square outside the circle that just encloses the circle.

Draw a square inside the circle so that its vertices lie on the circle.

Measure the sides of the squares.

- How can you use the areas of the two squares to estimate the area of the circle?
- Check your estimate in part a by calculating the area of the circle.
- Repeat the activity for circles with different radii.
Record your results. Show your work.



5. In the biathlon, athletes shoot at targets. Find the area of each target.

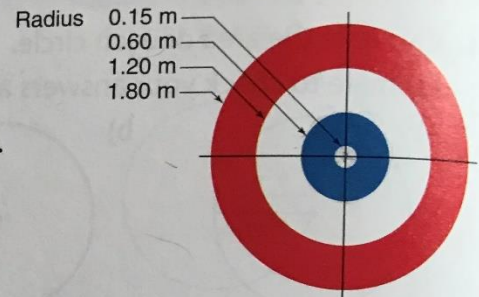
- The target for the athlete who is standing is a circle with diameter 11.5 cm.
 - The target for the athlete who is lying down is a circle with diameter 4.5 cm.
- Give the answers to the nearest square centimetre.



6. In curling, the target area is a bull's eye with 4 concentric circles.

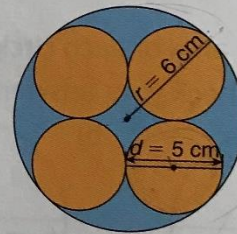
- a) Calculate the area of the smallest circle.
b) When a smaller circle overlaps a larger circle, a ring is formed.
Calculate the area of each ring on the target area.
Give your answers to 4 decimal places.

Concentric circles have the same centre.



7. Take It Further

- A circle with radius 6 cm contains 4 small circles.
Each small circle has diameter 5 cm.
Each small circle touches two other small circles and the large circle.
a) Find the area of the large circle.
b) Find the area of one small circle.
c) Find the area of the region that is shaded yellow.



To finish, I'll leave you with a short video.



Have a fantastic week! 😊

