

Circle Geometry and Pi



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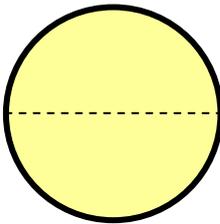
$$\pi = 3.14159265358979323846264\dots$$

Starter worksheet

What's the point of π ? It's a number, a little bigger than 3.14, that helps us relate how wide a circle is to its area or circumference.

It helps people:

- work out the volume of a tin of soup – and so make more profit selling it
- calculate the amount of steel needed to make a pipe
- decide how much paint is needed to mark the lines on a sports playing field
- put together x-ray data to pinpoint exactly where someone's leg is broken
- program better graphics for a video game
- design ways to pack more songs into an iPod
- ... and lots more!



The number π is just a number, like 2.5 or -3. It was called π - a Greek letter that we pronounce like **pie** – because it's the first letter of the Greek word for perimeter. Given a circle, the distance around its perimeter (measuring along the heavy black line) is known as its **circumference**. The distance straight across the circle (measuring along the dashed line) is its **diameter**.

When a circle's diameter is 1 metre, its circumference is 3.14159... metres.

What makes π important is that for **any** circle, if you divide the length of the circumference by its diameter, you get this same number. The letter π is just used so that we don't spend all our time writing out 3.14159...

Thousands of years ago, engineers and designers needed to know how to work out volumes and areas, but they didn't know exactly what value of π to use. Even these days, sometimes you only need to know that the circumference is roughly **three** times the diameter. In most business applications using a value of 3.14 is fine. But in medical or electronic applications, you have to be much more accurate, perhaps using a value of 3.1416 or 3.141593.

**Read the information above and use it to answer the following questions.
The key thing you have to decide is what value of π you are going to use.**

1. If a circle has diameter 10 metres, how long is its circumference to the nearest metre?
2. If a circle has diameter 100 metres, how long is its circumference to the nearest metre?
3. Philip Bell is an engineer. He wants to estimate the circumference of a circular room which has diameter 20 metres. He needs to know the circumference to the nearest metre. What is it, and what approximate value for π could he use and still get the right answer?
4. Farzana Iqbal is a medical student. She needs to calculate the circumference of a circular red blood cell which has diameter 691.2 nanometres, to the nearest nanometre. What is it, and which approximate values for π could she use and still get the right answer?
(A nanometre is a millionth of a millimetre.)

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Core worksheet

Melissa Chen is a fashion design student. She decides to design some earrings like the one shown in the picture, with seven silver circles all of the same size.

Melissa wants to make a pair of these earrings but doesn't want to spend more than £30 on materials. She looks up her online supplier and finds out the following prices.

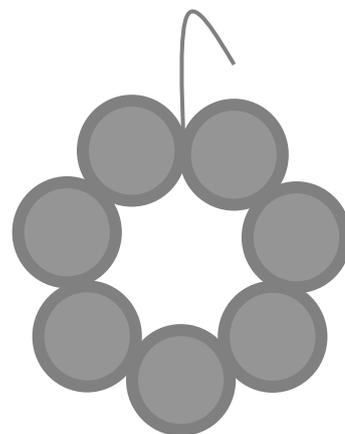
A plain sterling silver hook costs £0.80.

A 50mm by 50mm sheet of 0.55mm thick silver costs £11.26.

A 50mm by 50mm sheet of 1.1 millimetre thick silver costs £22.51.

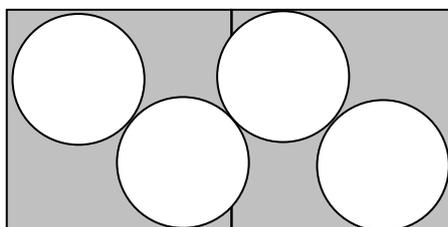
A 50mm by 100mm sheet of 0.55mm thick silver also costs £22.51.

A 50mm by 100mm sheet of 1.1 millimetre thick silver costs £45.02.



1. Melissa first decides to see how big she can make the earrings if she uses 0.55mm thick silver. She needs to fit 14 circles of the same size on a sheet of silver 50mm by 100mm.

Investigate ways of packing 14 circles on the sheet. It may help you to use some scrap paper to draw the sheet and different ways of packing circles on it. For example, the diagram below shows how you can pack four circles of diameter about 30mm on a 50mm by 100mm sheet.



2. When Melissa explains her plan to her teacher, he suggests that if she used the thicker silver, she would be able to re-use any leftover silver by soldering it together. From a 50mm by 50mm sheet of 1.1mm thick silver, how big can Melissa make the circles for her earrings now?

In this situation she doesn't have to think about placing circles on the sheet, but just the total area of silver sheet involved.