Area

1. You probably know the formula to calculate the area of a triangle. State the formula and give an explanation as to why the formula is correct.

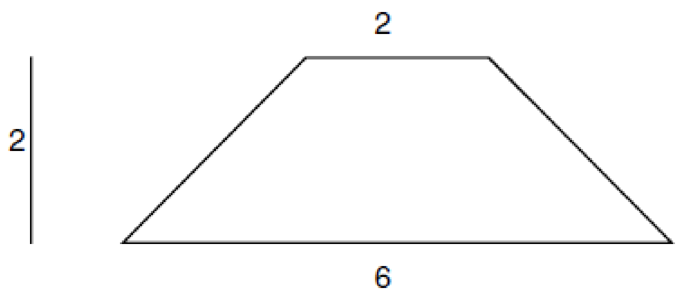
   (Hint: Is the formula related to the area of a rectangle in any way?)

2. A parallelogram is a special quadrilateral where the opposite sides are parallel. Is it true that the opposite sides then must also be equal? Try and make a few different drawings of parallelograms to satisfy yourself.

   Using an approach similar to question 1, deduce the area of any parallelogram.

3. A trapezium is a quadrilateral where one pair of opposite sides is parallel. And you know what an isosceles triangle is. So can you guess what an isosceles trapezium is?

   Figure out the area of the isosceles trapezium to your right.



4. Figure out and state clearly a rule for the area of any trapezium. Give an explanation of why your formula is correct. Be careful not to assume all trapeziums are as symmetrical as the one in the previous question!

   (Hint: Can you see that all trapeziums are made up of two triangles?)

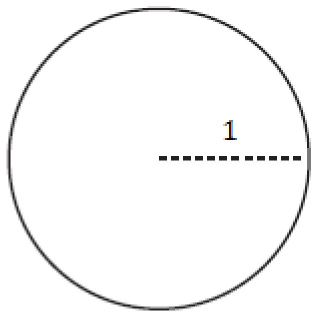
5. The area of a square with side length 1 unit is said to be 1 sq. unit. Can you prove that the area of a circle with radius 1 unit is larger than 2 sq. units but less than 4 sq. units?

Pi and the unit circle

A **'unit circle'** has a radius of 1 unit. Our forefathers were fascinated by the areas of circles. They couldn't exactly calculate the area of a unit circle but their approximations got better and better with time.

We know today that the area of a unit circle does not have a definite answer. But Mathematicians have found a very close approximation. The area of the unit circle is approximately 3.14159 sq. units. We call this constant **Pi** and use the symbol $\boldsymbol{\pi}$ to denote it.

Because $\boldsymbol{\pi}$ cannot be expressed as a fraction of two whole numbers, we call it an **irrational number.**



6. Draw four squares of side lengths 1cm, 2cm, 3cm and 4cm respectively. Determine the areas of each of the squares. Can you now fill in the banks?

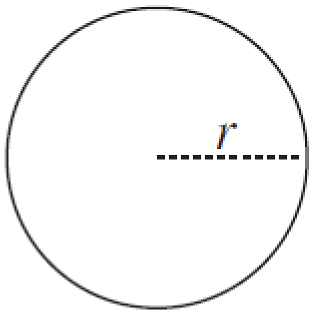
- If I multiply the sides of a square by a factor of 2, it's area increases by a factor of _______.
- If I multiply the sides of a square by a factor of 3, it's area increases by a factor of _______.
- If I multiply the sides of a square by a factor of 4, it's area increases by a factor of _______.
- If I multiply the sides of a square by a factor of s, it's area increases by a factor of _______.
- Hence, the area of a square with side length s, equals _______.

7. In the previous question, we discovered that if we change the side length of a unit square by a factor of s, it's area increases by a factor of s^2. We summarise it as follows:

Square's Side Length	**Square's Area**
1 unit	1 sq. unit
2 units	4 sq. units
3 units	9 sq. units
s units	s^2 sq. units

We can extend this discovery to include all two dimensional shapes, not just squares! Can you complete a similar table for circles?

Circle's Radius	**Circle's Area**
1 unit	π sq. units
2 units	4π sq. units
3 units	9π sq. units
4 units	___________
r units	____________



Hence, what is the area of a circle with radius r units?

8. Find the areas of the figures below. Some are composed of rectangles, triangles and portions of circles.