UNIT #1, Number Sense:

Chapter #1, Number Connections

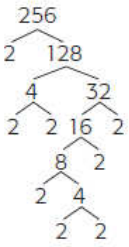
1.1 & 1.2 - Square Number & Perfect Squares

- There are rational numbers and irrational numbers. Irrational numbers are numbers that do not make sense, they are never ending, never repeating decimals. An example is pi (π) 3.14159..... All other numbers that make sense are rational numbers.
- Any number that can be divided by two equal rational numbers is a square number.

e.g. 25 = 5 *5 so 25 is a square number 6.25 = 2.5 *2.5 so 6.25 is a square number.

- A perfect square is the product of a whole number multiplied by itself. If you look at the above examples, 25 is a perfect square because the number that multiplies by itself to produce 25 is a whole number, 5. 6.25 is not a perfect square because 2.5 is not a whole number.
- Here is an example of how to determine if a number is a perfect square using prime numbers (a prime number is a number that is only divisible by itself and one)

Determine whether 256 is a perfect square using prime factors.



Determine the prime factors of 256 using a tree diagram. Each time you divide by a factor, you continue to get another even number. So the only prime factor is 2.

$256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Write 256 as the product of the prime factors.

$256 = (2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2)$
$= 16 \times 16$

Group the factors to rename 256 as the product of two equal factors.

$256 = 16 \times 16$ or 16^2, so it is a square number.

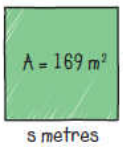
1.3 - Square roots of Perfect Squares

- A square root is one of two equal factors of a number.

e.g. 7 * 7 = 49 so 49 is a perfect square
and 7 is it's square root.

The square root symbol is $\sqrt{\ }$. You can write "the square root of 100" as $\sqrt{100}$.

- It is called a square root because it behaves the same way the area of a square works. Remember that all the sides of a square are equal and you find the are of a square by multiplying the base and the height. If these two numbers are the same the length of one side will be the square root of the area.



$s \times s = 169$
$s = \sqrt{169}$

$13^2 = 169$
So $\sqrt{169} = 13$

The side length of the mat is 13 m.

Exponents and Square Roots

- An exponent is a short way to write repeated multiplication. So if you had: 5*5*5*5*5*5 it would equal 5 to the power of 6 because 5 is being multiplied six times. 5 to the power of 6 would be written as 5^6
- This is important because you need to know that a number squared is to the power of 2. So 4 squared would be 4^2 which would equal 16. So what is the square root of 16? well it is 4!

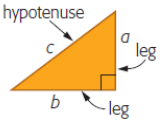
$\sqrt{16} = 4$ $4*4=16$

So basically they are the opposite of each other and can cancel each other out! You will need to use this for 1.6.

a right angle triangle will always have one 90 degree angle!

1.6 - Pythagoras Theorem

- Pythagoras Theorem is a formula that uses right angle (90 degree) triangles and square roots to solve for missing information.
- It shows that the sum of the squares of the lengths of the legs of a right triangle (the two shorter sides) is equal to the square of the length of the hypotenuse (the longest side). This is written in algebra as $a^2 + b^2 = c^2$



According to the Pythagorean Theorem, the sum of the areas of the two green squares, squares A and B, is equal to the area of the orange square, square C.

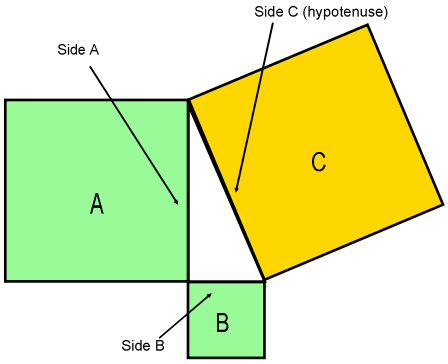
In order to find the area of each square you multiply the base and the height

So the area of square A is side A multiplied by side A, so A^2!

That is why the formula is:

$A^2 + B^2 = C^2$

side C is your hypotenuse, the longest side on any right angle triangle, opposite to the right angle in a right angle triangle.



In some cases you will be given the hypotenuse and one other side. In that case you will have to use your algebra skills to adapt the formula to solve for 'a' or 'b'.

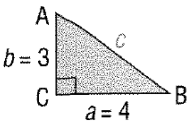
Your steps would look like so:

$a^2 + b^2 = c^2$

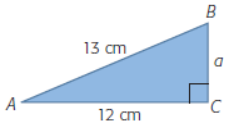
$a^2 + b^2 - b^2 = c^2 - b^2$

so..... $a^2 = c^2 - b^2$

Here are some examples:



$$c^2 = a^2 + b^2$$
$$= 4^2 + 3^2$$
$$= 16 + 9$$
$$c^2 = 25$$
$$c = 5$$



$a^2 + b^2 = c^2$
$a^2 + 12^2 = 13^2$
$a^2 + 144 = 169$
$a^2 + 144 - 144 = 169 - 144$
$a^2 = 25$
$a = \sqrt{25}$
$= 5$

The missing length, a, is 5 cm.