

Powers and Roots

Name: _____ Class: _____ Date: _____

So, if subtraction is the opposite operation or the reverse operation of addition, and division is the reverse operation of multiplication, what is the reverse of an exponent?

The answer is called a '**root**'. It has a bent division sign like this $\sqrt{\quad}$. Much like the Power where the large number is the base and the little number is the exponent, the big number in the centre is the number being 'rooted' and the small number is the number of times that it is being rooted into. This can get very complicated quickly since we are dealing with large number and repeated multiplication and so we usually limit the smaller number to 2 and call it a **Square Root**. When we use the square root, we do not put in the '2', we only put in a number when it is something other than 2. For instance, we can have the following:

$\sqrt[3]{125}$ This is stated as 'The cube root of one hundred twenty-five'.

In this case, it takes $5 \times 5 \times 5$ to make 125 or 5^3 , so the reverse of 5^3 or 125 is the cube root of 125 which is 5.

The easiest way to find out is to use a scientific calculator that has the $\sqrt[y]{x}$ key on it. Put in the number you want to root for (x) and then press that key and they the number of the root (y). The other way is to get a factor tree and group your prime factors. ...This means we have to know what prime numbers are, what factors are and what factor trees are.

Prime number – *a number that can only be divided by one and itself without a fraction.*

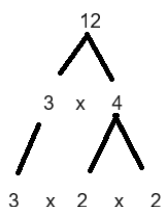
e.g., 2, 3, 5, 7, 11, 13, ... (FYI 1 is not considered a prime number)

Factor – A number that is multiplied to give you another number.

e.g., 12 has possible factors of 1, 2, 3, 4, 6, and 12

since $1 \times 12 = 12$
 $2 \times 6 = 12$
 $3 \times 4 = 12$

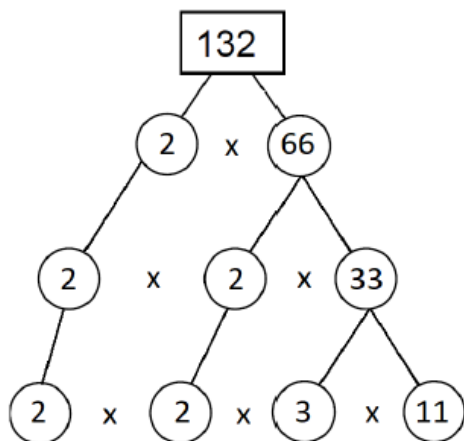
Factor Tree -



Therefore, the prime factors of 12 can be listed as 2, 2, and 3 (or combination)

Factor trees can be used for a number of things in Mathematics but one of the ways is in finding the roots of a number and its factors in find out the base and exponent.

To find the factors of a number, we divide it into numbers that go in evenly (whole numbers). So, 132 has the following Prime Factor Tree:



Note: This factor tree can look differently through the middle but the top number and the bottom numbers should be the same in some order.

It is important to show all prime factors and when you find a non-prime factor (called a composite number), create a new line and branch out the non-prime number. Remember that each line is equivalent to the one above so you must bring down your prime factors.

If a number is prime, you MUST indicate that through the following:

19
|
Prime

Remember that you are basically dividing by whole numbers and listing your factors. A hint is that if it is an even number, you can divide out the two, it is a number ending in 5, you can divide by 5 and if it ends in a 0, you can divide out a 10.

The more you practice, the more you will start recognizing some of the factors.