

Prime Numbers and Prime Factorization on the ISEE All Levels

LESSON GOAL: Be able to provide the prime factorization of any number given on the ISEE.

ISEE Question: How many distinct prime factors does 150 have?

Solution: Pay attention to the phrasing of the question. The most important words are “*distinct*” (different from each other) and “*prime*.”

Prime numbers are those that have exactly two factors (they are divisible by only two numbers): themselves and 1. For example, 7 is a prime number because it is only divisible by 7 and by 1.

NOTE that the number 1 doesn’t fit into the above definition (it has only one factor), and so it is NOT a prime number! That is a very common trap on the ISEE.

So, the **list of prime numbers** starts with 2 (the only even prime), then 3, 5, 7, 11, 13, 17, 19, 23, and so on ...

STEP 1: We’re going to use the **line method**. Write the number and draw a vertical line next to it.

150	
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STEP 2: On the other side of the line, write the smallest prime number that can divide 150. (That is 2.)

STEP 3: Write the quotient below the 150 (it is 75) and next to it, the smallest prime number that divides that.

150	2
75	3
25	5
5	5
1	

Repeat STEPS 2 and 3 until you reach the number 1 (GAME OVER!).

On the right side of the line you have the **prime factorization**: $150 = 2 \times 3 \times 5 \times 5$

But, of course, we are looking for distinct prime factors, so the answer is “3 distinct prime factors: 2, 3 and 5.”

NOTE that 150 has many other factors that AREN’T prime: 6, 10, 15, 25, 50, 75, and 150. Those can be found by using the **factor tree method** (see the lesson on “[Factoring Numbers on the ISEE](#)”).