



Factors, Primes & Composite Numbers

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Definition

- ★ **Product** – An answer to a multiplication problem.

$$7 \times 8 = 56$$

Product



Definition

- ★ **Factor** – a number that is multiplied by another to give a product.

$$7 \times 8 = 56$$

Factors

A diagram consisting of two red arrows pointing upwards from the word 'Factors' to the numbers 7 and 8 in the equation above. The arrows originate from a single point below the word and branch out to point at the base of each number.

Definition

- ★ **Factor** – a number that divides evenly into another.

$$56 \div 8 = 7$$



Factor



What are the factors?

$$6 \times 7 = 42$$

6 & 7

$$7 \times 9 = 63$$

7 & 9

$$8 \times 6 = 48$$

8 & 6

$$4 \times 9 = 36$$

4 & 9



What are the factors?

$$42 \div 7 = 6 \quad 7$$

$$63 \div 9 = 7 \quad 9$$

$$48 \div 6 = 8 \quad 6$$

$$36 \div 9 = 4 \quad 9$$

Definition

- ★ **Prime Number** – a number that has only two factors, itself and 1.

7

7 is prime because the only numbers that will divide into it evenly are 1 and 7.

Examples of Prime Numbers

2, 3, 5, 7, 11, 13, 17, 19

Special Note:
One is not a prime number.

Definition

- ★ **Composite number** – a number that has more than two factors.

8

The factors of 8 are 1, 2, 4, 8

Examples of Composite Numbers

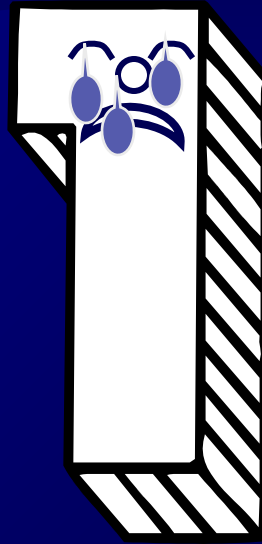
4, 6, 8, 9, 10, 12, 14, 15

Special Note:

Every whole number from 2 on is either composite or prime.

Our Lonely 1

It is not prime because it does not have exactly two different factors.



It is not composite because it does not have more than 2 factors.

Special Note:
One is not a prime nor
a composite number.

Definition

- ★ **Prime Factorization** – A way to write a composite number as the product of prime factors.

$$2 \times 2 \times 3 = 12$$

or

$$2^2 \times 3 = 12$$

How to Do Prime Factorization Using a Factor Tree

Step 1 – Start with a composite number.

48

Step 2 – Write down a multiplication problem that equals this number or any pair of factors of this number.

$$6 \times 8 = 48$$

How to Do Prime Factorization Using a Factor Tree

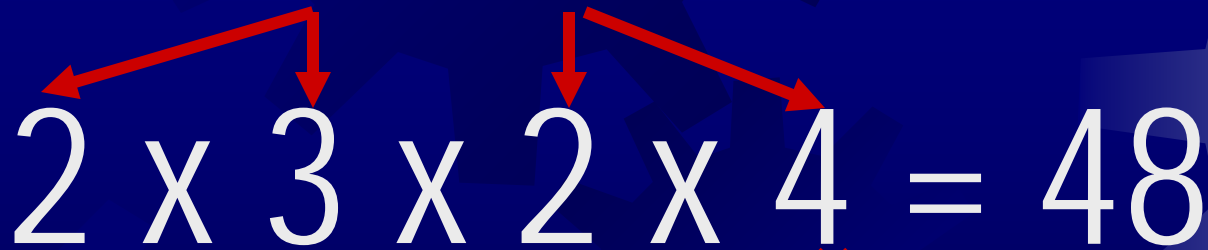
Step 3 – Find factors of these factors.

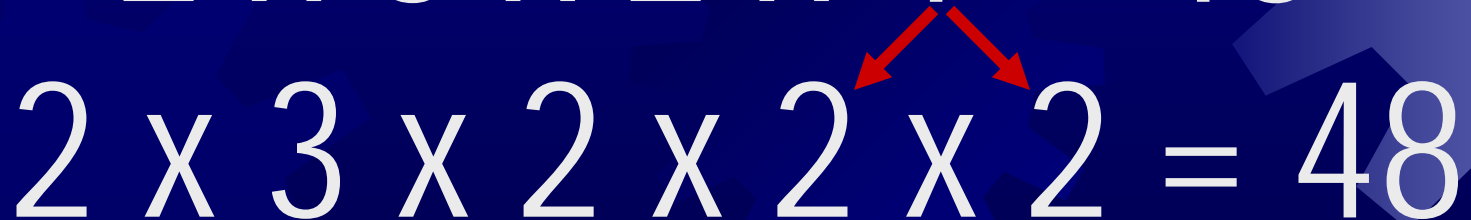
$$\begin{array}{c} 6 \times 8 = 48 \\ \swarrow \quad \downarrow \quad \downarrow \quad \searrow \\ 2 \times 3 \times 2 \times 4 = 48 \end{array}$$

How to Do Prime Factorization Using a Factor Tree

Step 4 – Find factors of these numbers until all factors are prime numbers.

$$6 \times 8 = 48$$


$$2 \times 3 \times 2 \times 4 = 48$$


$$2 \times 3 \times 2 \times 2 \times 2 = 48$$

How to Do Prime Factorization Using a Factor Tree

Step 5 – Write the numbers from least to greatest.

$$6 \times 8 = 48$$

$$2 \times 3 \times 2 \times 2 \times 2 = 48$$

$$2 \times 2 \times 2 \times 2 \times 3 = 48$$

How to Do Prime Factorization Using a Factor Tree

Step 6 – Count how many numbers are the same and write exponents for them.

$$6 \times 8 = 48$$

$$2 \times 3 \times 2 \times 2 \times 2 = 48$$

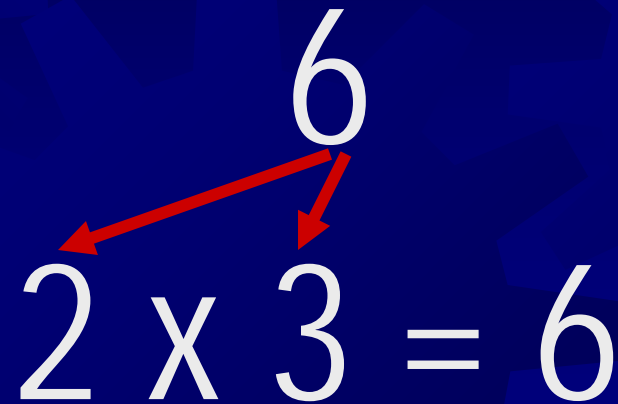
$$\textcircled{2} \times \textcircled{2} \times \textcircled{2} \times \textcircled{2} \times 3 = 48$$

$$2^4 \times 3 = 48$$

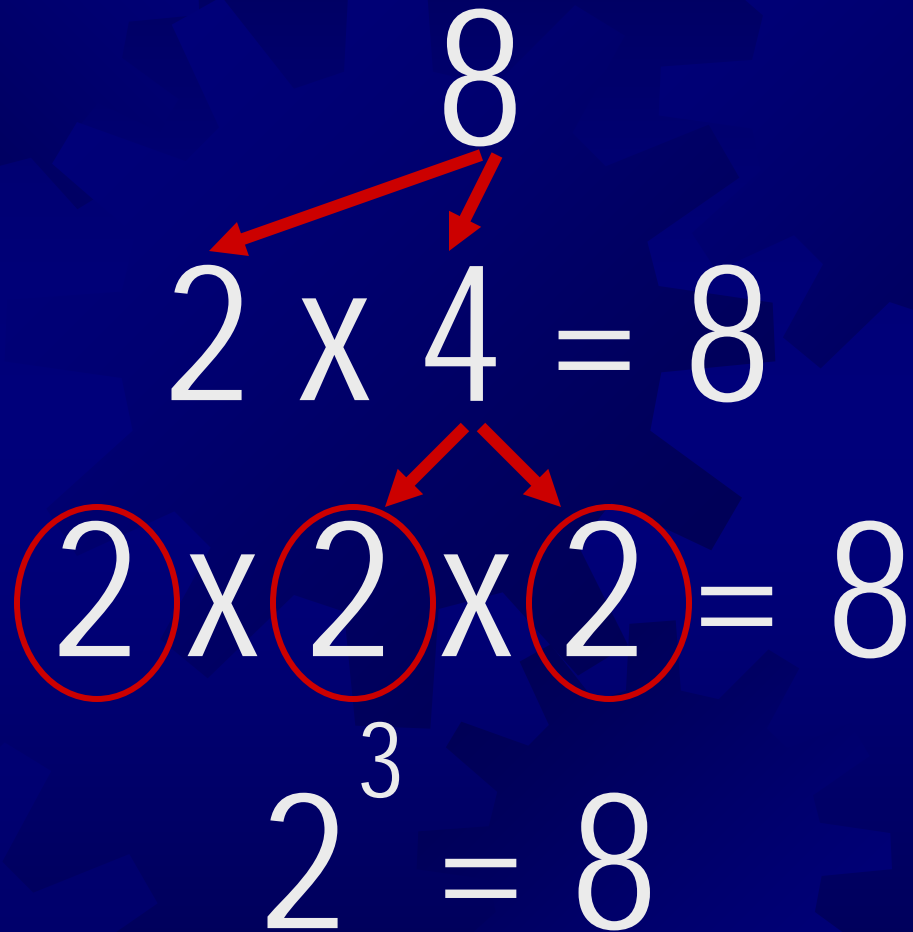
Prime factor this number

$$\begin{array}{c} 4 \\ \swarrow \searrow \\ \textcircled{2} \times \textcircled{2} = 4 \\ 2^2 = 4 \end{array}$$

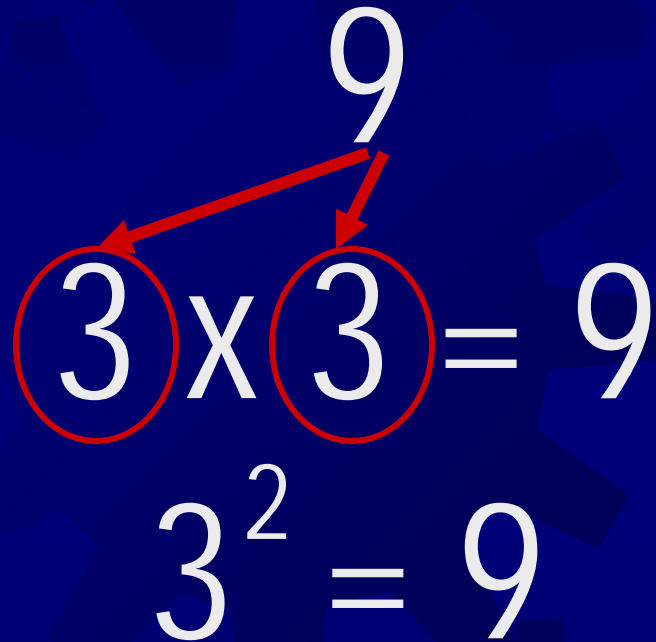
Prime factor this number


$$2 \times 3 = 6$$

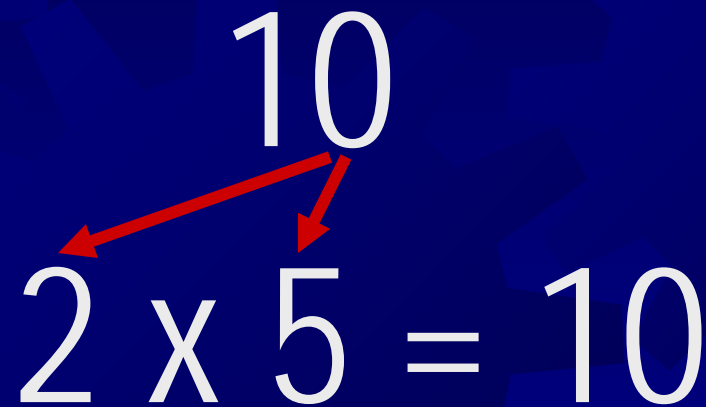
Prime factor this number



Prime factor this number

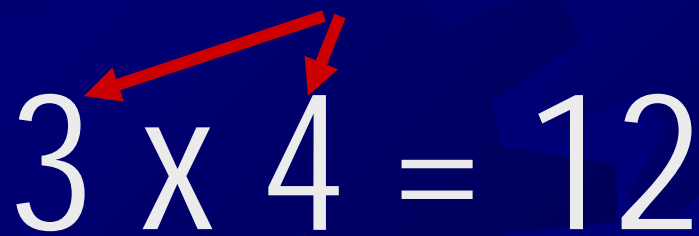

$$\begin{array}{c} 9 \\ \swarrow \searrow \\ \textcircled{3} \times \textcircled{3} = 9 \\ 3^2 = 9 \end{array}$$

Prime factor this number


$$10$$
$$2 \times 5 = 10$$

Prime factor this number

12



3 x 4 = 12

A red arrow points from the number 12 above to the number 3 on the left, and another red arrow points from 12 to the number 4 on the right.



3 x 2 x 2 = 12

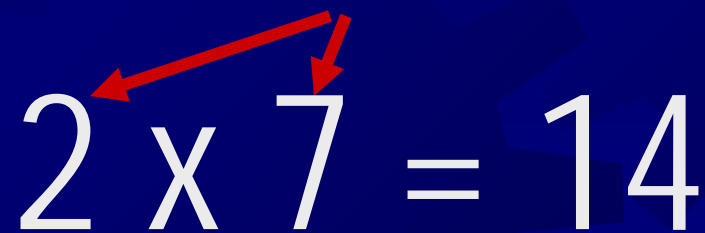
A red arrow points from the number 4 in the equation above to the first 2 on the left, and another red arrow points from 4 to the second 2 on the right.

$\textcircled{2} \times \textcircled{2} \times 3 = 12$

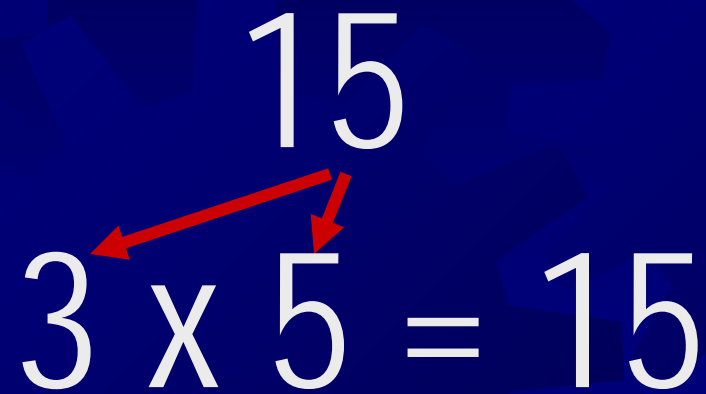
$2^2 \times 3 = 12$

Prime factor this number

14


$$2 \times 7 = 14$$

Prime factor this number

$$15$$

$$3 \times 5 = 15$$

Prime factor this number

16

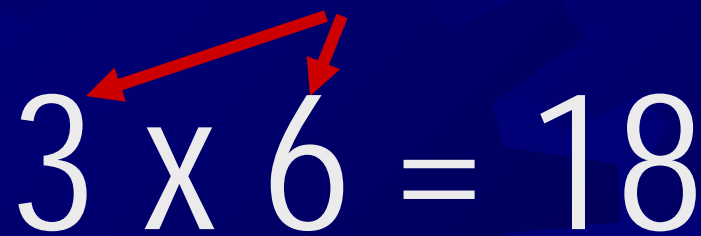
$$4 \times 4 = 16$$

$$\textcircled{2} \times \textcircled{2} \times \textcircled{2} \times \textcircled{2} = 16$$

$$2^4 = 16$$

Prime factor this number

18



3 x 6 = 18

A red arrow points from the number 18 down to the number 3, and another red arrow points from 18 down to the number 6.



3 x 2 x 3 = 18

A red arrow points from the number 6 in the previous equation down to the number 2, and another red arrow points from 6 down to the number 3.

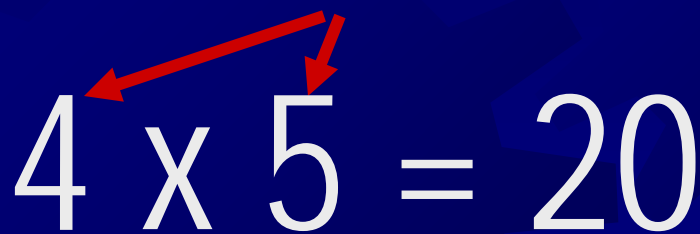
2 x 3 x 3 = 18

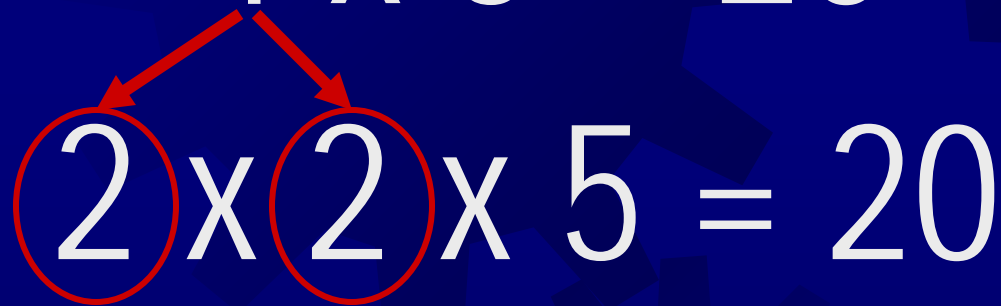
The two 3s in this equation are each circled in red.

$2 \times 3^2 = 18$

Prime factor this number

20


$$4 \times 5 = 20$$


$$\textcircled{2} \times \textcircled{2} \times 5 = 20$$

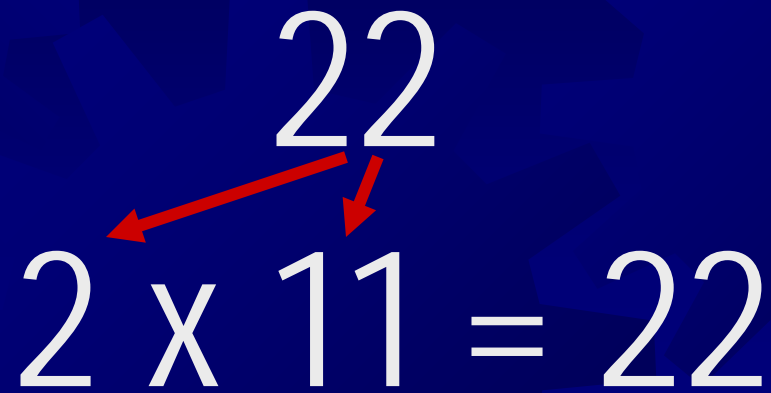
$$2^2 \times 5 = 20$$

Prime factor this number

21


$$3 \times 7 = 21$$

Prime factor this number


$$22$$
$$2 \times 11 = 22$$