1.4 Prime Factorization

ESSENTIAL QUESTION

What does it mean to find the prime factorization of a number?

COMMON CORE STATE STANDARDS

6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor.

What are all the different ways you could get the following numbers by multiplying using whole numbers

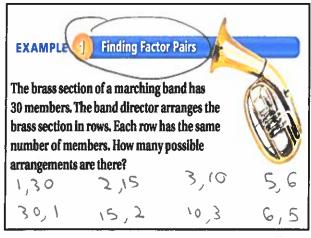|			
18	1,18	2,9	3,6
23	1,23		
31	1,31		
24	1,24	2,12	
	6,4	3,8	

FACTOR PAIR->a set of two numbers, which when multiplied result in a definite number.

2,5 is a factor pair of 10 because 2 times 5 equals 10.

🔴 On Your Own

List the factor pairs of the number.

1. 20   1,20   2,10   4,5

2. 51   1,51   17,3

3. 16   1,16   4,4   2,8

EXAMPLE 1 **Finding Factor Pairs**

The brass section of a marching band has 30 members. The band director arranges the brass section in rows. Each row has the same number of members. How many possible arrangements are there?

1, 30	2, 15	3, 10	5, 6
30, 1	15, 2	10, 3	6, 5

There are 8 possible arrangements

Factor Pairs

23 → 1, 23

23 is a PRIME NUMBER

PRIME NUMBER->a whole number greater than 1 with exactly two factors, 1 and itself
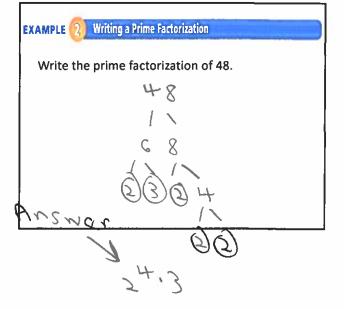

Factor Pairs

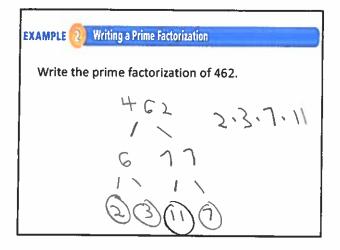**18** → 2, 9   6, 3   18, 1

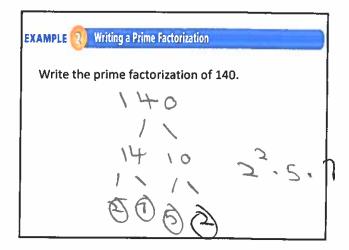**18 is a COMPOSITE NUMBER**

COMPOSITE NUMBER->a whole number greater than 1 with factors other than 1 and itself
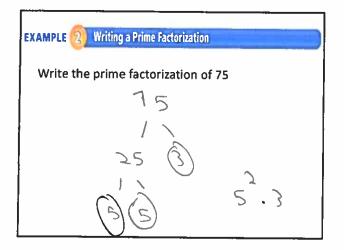

THE FIRST 25 PRIME NUMBERS

2, 3, 5, 7, 11
13, 17, 19, 23, 29
31, 37, 41, 43, 47
53, 59, 61, 67, 71
73, 79, 83, 89, 97

EXAMPLE 2 **Writing a Prime Factorization**

Write the prime factorization of 60.

A circled number means it is prime.

```
      60
     /  \
   10    6
   /\    /\
  ② ⑤  ② ③
```

→ 2 · 3 · 5
Answer

EXAMPLE 2 **Writing a Prime Factorization**

Write the prime factorization of 48.

```
      48
     /  \
    6    8
   /\   /\
  ②③ ② 4
         /\
        ②②
```

Answer
↓
$2^4 \cdot 3$

EXAMPLE 2 · Writing a Prime Factorization

Write the prime factorization of 462.

$$462$$
$$6 \quad 77$$
$$(2)(3)(11)(7)$$

$$2 \cdot 3 \cdot 7 \cdot 11$$

EXAMPLE 2 · Writing a Prime Factorization

Write the prime factorization of 140.

$$140$$
$$14 \quad 10$$
$$(7)(7)(5)(2)$$

$$2^2 \cdot 5 \cdot 7$$

EXAMPLE 2 · Writing a Prime Factorization

Write the prime factorization of 75

$$75$$
$$25 \quad (3)$$
$$(5)(5)$$

$$5^2 \cdot 3$$

● On Your Own

Write the prime factorization of the number.

1. 20

$$20$$
$$4 \quad (5)$$
$$(2)(2)$$

$$2^2 \cdot 5$$

● On Your Own

Write the prime factorization of the number.

2. 68

$$68$$
$$4 \quad (17)$$
$$2 \quad 2$$

$$2^2 \cdot 17$$

● On Your Own

Write the prime factorization of the number.

3. 90

$$90$$
$$10 \quad 9$$
$$2 \quad 5 \quad 3 \quad 3$$

$$2 \cdot 3^2 \cdot 5$$

On Your Own

Write the prime factorization of the number.
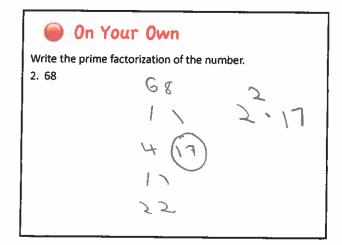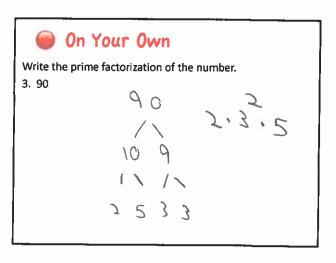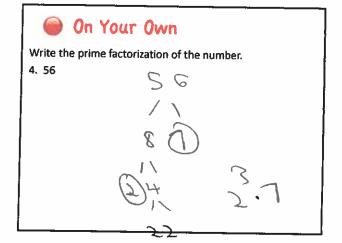
4. 56

$$56$$

8 (7)

(2) 4

22

3 · 7

2 · 7

The **PRIME FACTORIZATION** of a composite number is the number written as the product of its prime factors.

You can use factor pairs and a **FACTOR TREE** to help find the prime factorization of a number. The factor tree is complete when only prime factors appear in the product.