4.1 notes

4.1 Review for Mastery

For use with pages 173–178

the only even prime

2, 3, 5, 7, 11, 13, 17, 19, 23

GOAL Write the prime factorization of a number.

VOCABULARY

A **prime number** is a whole number that is greater than 1 and has exactly two whole number factors, 1 and itself. A **composite number** is a whole number that is greater than 1 and has more than two whole number factors.

4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20

When you write a number as a product of prime numbers, you are writing its **prime factorization.** You can use a diagram called a **factor tree** to write the prime factorization of a number.

A **monomial** is a number, a variable, or the product of a number and one or more variables raised to whole number powers.

3, 10, x, y 30xy

EXAMPLE 1 **Writing Factors**

To play a game at a party, the guests need to divide into groups with more than 1 person and no more than 10 people. There are 30 people at the party. How many different group sizes are possible?

Solution

(1) Write 30 as a product of two whole numbers in all possible ways.

1 • 30 2 • 15 3 • 10 5 • 6

The factors of 30 are 1, 2, 3, 5, 6, 10, 15, and 30.

24
4·6
2·12
3·8

(2) Use the factors to find all the group sizes with more than 1 person but no more than 10 people.

3 groups of 10 5 groups of 6

10 groups of 3 6 groups of 5 15 groups of 2

Answer: There are 5 possible group sizes.

Exercises for Example 1

Write all the factors of the number.

1. 42 **2.** 19 **3.** 51 **4.** 21

1·42
14·3
2·21
6·7

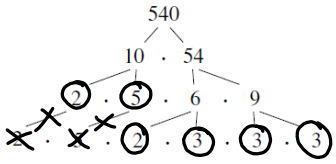
1, 2, 3, 6, 7, 14, 21, 42

4.1 notes

EXAMPLE 2 **Writing a Prime Factorization**

Write the prime factorization of 540.

One possible factor tree:



Write original number.

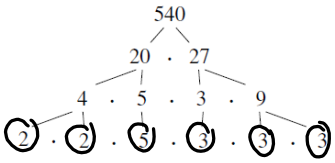
Write 540 as 10 • 54.

Write 10 as 2 • 5. Write 54 as 6 • 9.

Write 6 as 2 • 3. Write 9 as 3 • 3.

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

Another possible factor tree:



Write original number.

Write 540 as 20 • 27.

Write 20 as 4 • 5. Write 27 as 3 • 9.

Write 4 as 2 • 2. Write 9 as 3 • 3.

Both trees give the same result:

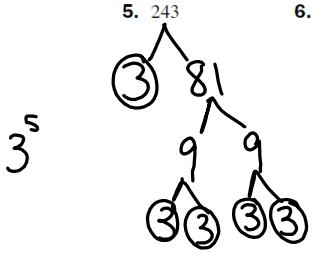
$540 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 = 2^2 \cdot 3^3 \cdot 5.$

Answer: The prime factorization of 540 is $2^2 \cdot 3^3 \cdot 5$.

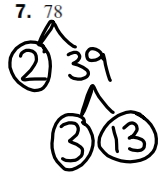
Exercises for Example 2

Tell whether the number is *prime* or *composite*. If it is composite, write its prime factorization.

5. 243 **6.** 67 **7.** 78 **8.** 81

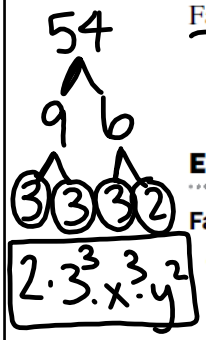


3^5



$2 \cdot 3 \cdot 13$

EXAMPLE 3 **Factoring a Monomial**



$2 \cdot 3^3 \cdot x^3 \cdot y^2$

Factor the monomial $54x^3y^2$.

$54x^3y^2 = 2 \cdot 3 \cdot 3 \cdot 3 \cdot x^3 \cdot y^2$ Write 54 as $2 \cdot 3 \cdot 3 \cdot 3$.

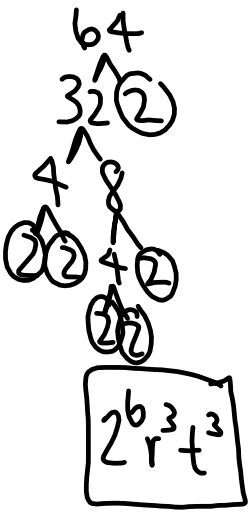
$= 2 \cdot 3 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot y \cdot y$ Write x^3 as $x \cdot x \cdot x$ and y^2 as $y \cdot y$.

Exercises for Example 3

Factor the monomial.

9. $16a^4b$ **10.** $25x^5y^2$ **11.** $64r^3t^3$ **12.** $19cd^6$

$5^2 x^5 y^2$



$2^6 r^3 t^3$