MATHSKILLS

Pre-Algebra

100 Reproducible Activities

Topics Include:

Number Theory I, Number Theory II,
Integers and Decimals, Fractions and Mixed Numbers,
Operations with Fractions and Mixed Numbers, and More

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Prime Factorization

A number that has only two factors, 1 and itself, is called a *prime number.* Numbers such as 2, 3, 7, and 11 are prime numbers. A number that has more than two factors is a *composite number.* Numbers such as 4, 8, 9, and 15 are composite numbers.

You can write any composite number as a product of prime numbers. For example, you can write 18 as the product of several prime numbers.

$$18 = \underset{\text{prime number}}{2} \times \underset{\text{composite number}}{9}$$

As you can see 9 is also a composite number. You can factor 9 to 3 × 3.

$$18 = 2 \times 9 = 2 \times 3 \times 3$$

Rules for Prime Factorization

1. Find two factors of the number.
2. Determine if the factors are prime.
3. Factor the composite numbers again. Repeat until you have only prime numbers.

Example

Find the prime factorization of 20.

Step 1	Find two factors of the number.	$20 = 5 \times 4$
Step 2	Determine if the factors are prime or composite numbers.	5 is a prime number; 4 is a composite number.
Step 3	Factor the composite numbers again. All the factors are now prime numbers.	$4 = 2 \times 2$, so $20 = 5 \times 4 = 5 \times 2 \times 2$

Practice

Find the prime factorization of each number.

1. 32

Find two factors of the number.	32 = 2 × ______
Determine if the factors are prime or composite numbers.	2 is ________________; ______ is composite.
Factor the composite numbers again.	32 = 2 ___ ______
Repeat until you have only prime numbers.	32 = 2 ___ ______ ___ ______
	32 = 2 ___ ______ ___ ______ ___ ______
	32 = 2 ___ ______ ___ ______ ___ ______ ___ ______

2. 30 = ______________________________

3. 24 = ______________________________

4. 15 = ______________________________

5. 18 = ______________________________

6. 81 = ______________________________

7. 100 = ____________________________

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Least Common Multiple

A *multiple* of a number is the product of the number and a whole number. For example, multiples of 4 are:

$4 \times 0 = 0$ $4 \times 1 = 4$ $4 \times 2 = 8$
$4 \times 3 = 12$ $4 \times 4 = 16$ $4 \times 5 = 20$

Therefore the multiples of 4 are 0, 4, 8, 12, 16, 20, and so on. A *common multiple* of two different numbers is a number that is a multiple of both of those numbers. For example, 12 is a multiple of 3, 4, and 6.

The *least common multiple* (LCM) is the smallest common multiple of two numbers (not including 0).

Rules for Finding the Least Common Multiple

1. List all the multiples of each number.
2. Find the smallest number (other than zero) that is the same in each list. That is your least common multiple.

Example

Find the least common multiple of 3 and 5.

Step 1 List all of the multiples of each number.
Multiples of 3: 0, 3, 6, 9, 15, 18
Multiples of 5: 0, 5, 10, 15, 20

Step 2 Find the smallest number (other than zero) that is the same on each list.
The smallest multiple common to 3 and 5 is 15.

Practice

1. Find the least common multiple of 4 and 6.

List all of the multiples of each number.
Multiples of 4: 0, 4, 8, 12, 16, 20
Multiples of 6: ______________________

Find the smallest number (other than zero) that is the same on each list.
The smallest number on each list is _____,
so the LCM is _____.

List the first six multiples of each number.

2. 3 ______________________

3. 7 ______________________

4. 10 ______________________

Find the least common multiple of each pair of numbers.

5. 2 and 6 ______________________

6. 4 and 5 ______________________

7. 3 and 7 ______________________

8. 6 and 9 ______________________

9. 9 and 12 ______________________

10. 8 and 10 ______________________

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Greatest Common Factor

The numbers that you multiply are called *factors.* The result, or the answer of a multiplication sentence, is called the *product.* There can be several factors that you can multiply to get a certain number. For example, the factors of 12 are found by thinking of all the combinations of two numbers that when multiplied will equal 12.

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

The factors of 12: 1, 2, 3, 4, 6

A number can be a factor in two different numbers. For example, 3 is a factor of 9 ($3 \times 3 = 9$) and 15 ($3 \times 5 = 15$).

The largest common factor of two numbers is called the *greatest common factor* (GFC).

Rules for Finding the Greatest Common Factor

1. List the multiples (factors) of each number.
2. Find the numbers that are the same on both lists.
3. Of the numbers that are the same, find the largest number.

Example

Find the greatest common factor of 12 and 18.

Step 1	List all the multiples (factors) of each number.	Multiples of 12: 1, 2, 3, 4, 6, 12 Multiples of 18: 1, 2, 3, 6, 9, 18
Step 2	Find the numbers that are the same in each list.	The numbers that are the same are 1, 2, 3, 6.
Step 3	Of the numbers that are the same, find the largest number.	The largest number is 6, so 6 is the greatest common factor of 12 and 18.

Practice

1. Find the greatest common factor of 8 and 14.

List all the multiples (factors) of each number.	Multiples of 8: ____________________ Multiples of 14: ____________________
Find the numbers that are the same in each list.	The numbers that are the same are ______ and ______.
Of the numbers that are the same, find the largest number.	The largest number is ______, so ______ is the greatest common factor of 8 and 14.

List the factors of each of the numbers.

2. 10 ____________________

3. 24 ____________________

4. 30 ____________________

Find the greatest common factor (GCF).

5. 16 and 24 ______

6. 10 and 18 ______

7. 22 and 44 ______

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Exponents

You can show the repeated multiplication of the same number using *exponents.* In an expression such as 4^3, the "4" is known as the *base,* and the "3" is the *exponent.*

Rules for Working with Exponents
To solve an expression with an exponent:
Multiply the base by itself the number of times equal to the exponent.
To write an expression using an exponent:
Count the number of times a number is multiplied by itself; that amount is your exponent.
The number being multiplied is the base.

Example

Solve the following expression. 5^3

Multiply the base by itself the number of times equal to the exponent.

The exponent is 3, so you multiply 5 by itself 3 times: $5^3 = 5 \times 5 \times 5 = 125$.

Write $6 \times 6 \times 6 \times 6$ using an exponent.

Step 1 Count the number of times a number is multiplied by itself, that amount is your exponent.

6 is multiplied by itself 4 times; the exponent is 4.

Step 2 The number being multiplied is the base.

6 is being multiplied by itself, so 6 is the base: $6 \times 6 \times 6 \times 6 = 6^4$.

Practice

1. Solve the following expression. 2^6

Multiply the base by itself the number of times equal to the exponent.

$2 \times 2 \times 2 \times$ ______________ = ______

2. Write the expression $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$ using an exponent.

Count the number of times a number is multiplied by itself; that amount is your exponent.

______ is multiplied by itself ______ times.

The number being multiplied is the base.

$5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 =$ ______

Solve the following expressions.

3. $3^5 =$ ______________

4. $12^2 =$ ______________

5. $8^3 =$ ______________

Write the following expressions using an exponent.

6. $10 \times 10 \times 10 \times 10 =$ ______

7. $6 \times 6 \times 6 =$ ______

8. $4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 =$ ______

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Exponents and Multiplication

When multiplying two expressions with exponents where the base is the same, you follow a couple of simple rules. Look at the examples below.

$6^3 \times 6^5 = 6^8$ $12^2 \times 12^{12} = 12^{14}$ $7^2 \times 7^8 = 7^{10}$

Rules for Exponents and Multiplication

1. Add the exponents. The sum is your new exponent.

2. Keep the base the same.

Example

Multiply. $5^2 \times 5^3$

Step 1 Add the exponents. The sum is the new exponent. $2 + 3 = 5$

Step 2 Keep the base the same. $5^2 \times 5^3 = 5^{2+3} = 5^5$

Practice

Multiply.

1. $10^3 \times 10^5$

Add the exponents. The sum is the new exponent. ______ + ______ = ______

Keep the base the same. $10^3 \times 10^5 = 10^{\_\_\_\_\_\_} = 10^{\_\_\_\_}$

2. $2^4 \times 2^3 =$ ______________________________

3. $5^1 \times 5^0 =$ ______________________________

4. $6^4 \times 6^{10} =$ ______________________________

5. $12^2 \times 12^{15} =$ ______________________________

6. $8^4 \times 8^4 =$ ______________________________

7. $9^3 \times 9^6 =$ ______________________________

8. $10^{10} \times 10^5 =$ ______________________________

9. $5^4 \times 5^{-2} =$ ______________________________

10. $12^{10} \times 12^{-5} =$ ______________________________

11. $6^7 \times 6^{-7} =$ ______________________________

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Exponents and Division

When dividing two expressions with exponents where the base is the same, you follow a couple of simple rules. Look at the examples below.

$6^5 \div 6^2 = 6^3 \qquad 12^9 \div 12^3 = 12^6 \qquad \frac{9^{16}}{9^9} = 9^7$

Rules for Exponents and Division

1. Subtract the exponent in the divisor from the exponent in the dividend.
2. Keep the base the same.

Example

Divide. $5^6 \div 5^2$

Step 1 Subtract the exponents. The sum is the new exponent. $6 - 2 = 4$

Step 2 Keep the base the same. $5^6 \div 5^2 = 5^{6-2} = 5^4$

Practice

Divide.

1. $6^7 \div 6^5$

Subtract the exponents. The sum is the new exponent. _____ – _____ = _____

Keep the base the same. $6^7 \div 6^5 = 6^{\_\_\_\_\_\_} = 6^{\_\_\_}$

2. $2^8 \div 2^2 =$ ______________________________

3. $16^5 \div 16^1 =$ ______________________________

4. $8^8 \div 8^0 =$ ______________________________

5. $9^7 \div 9^7 =$ ______________________________

6. $12^{10} \div 12^4 =$ ______________________________

7. $7^{10} \div 7^{-4} =$ ______________________________

8. $4^5 \div 4^{-2} =$ ______________________________

9. $6^{-2} \div 6^2 =$ ______________________________

10. $\frac{13^4}{13^2} =$ ______________________________

11. $\frac{8^{12}}{8^{-10}} =$ ______________________________

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Scientific Notation

A shorthand way to write a large number or small number is to use *scientific notation.*

$$3{,}400 \rightarrow 3.4 \times 10^3 \qquad 0.00923 \rightarrow 9.23 \times 10^{-3}$$

As you can see, a number in scientific notation is made of a number between 1 and 10 multiplied by 10 raised to a power.

Rules for Using Scientific Notation

1. Move the decimal point to the left or right to get a number between 1 and 10.
2. Multiply that number by 10 with an exponent.
3. The exponent is equal to the number of places the decimal point moved.
4. The exponent is positive if the decimal point is moved to the left; negative if moved to the right.

Example

Write 462,000 in scientific notation.

Step 1	Move the decimal point to the left or right to get a number between 1 and 10.	462,000 (5 decimal places): 4.62
Step 2	Multiply the number by 10 with an exponent.	$4.62 \times 10^?$
Step 3	The exponent is equal to the number of places the decimal point moved.	The decimal point moved 5 places. 4.62×10^5
Step 4	The exponent is positive if the decimal point is moved to the left; negative if moved to the right.	The decimal point moved to the left. 4.62×10^5

Practice

Write each number in scientific notation.

1. 0.000433

Move the decimal point to the left or right to get a number between 1 and 10.	0.000433 (_____ decimal places): 4.33
Multiply the number by 10 with an exponent.	4.33 ____________________
The exponent is equal to the number of places the decimal point moved.	4.33×10_____
The exponent is positive if the decimal point is moved to the left; negative if moved to the right.	4.33×10_____

2. 25,000 ______________________

3. 4,000,000 ______________________

4. 663,200 ______________________

5. 0.015 ______________________

6. 0.000791 ______________________

7. 0.0000042 ______________________

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Square Roots

When you multiply a number by itself (for example, 4 × 4), you *square* the number (in this case, 4). The opposite of squaring a number is to find the *square root* of a number. The square root of a given number is the number that, when squared, results in the given number.

For example, 4 squared is 16 ($4 \times 4 = 16$). The square root of 16 is 4 ($\sqrt{16} = 4$). As you can see, the square root of a number uses the square root symbol ($\sqrt{}$) and the number.

Rules for Finding the Square Root

1. Look at the number under the square root symbol. Use guess and test, or a table of squares or square roots to find the square root. **Or**
2. Using a calculator, enter a number, press the square root key ($\sqrt{}$), and equals (=) sign.
3. The square root of any positive number can be either positive or negative; you must include both possibilities in your answer.

Example

What is $\sqrt{144}$?

Step 1	Look at the number under the square root symbol.	You want to find the square root of 144.
Step 2	Use guess and test, or a square root table.	You know that $10 \times 10 = 100$, so $\sqrt{144}$ will be greater than 10. By guess and test, you find $12 \times 12 = 144$. So, $\sqrt{144} = 12$.
Step 3	The square root of any positive number can be either positive or negative.	The square root is either 12 or −12.

Practice

Find the square root of the following.

1. $\sqrt{64}$

Look at the number under the square root symbol.	You need to find the square root of _____ or find what number __________________ by itself equals _____.
Use guess and test, or a square root table.	You know that ___________ = 25. So _____ is greater than _____. By guess and test, ___________ = 64. So, $\sqrt{64}$ = _____.
The square root of any positive number can be either positive or negative.	The square root is either ______________.

2. $\sqrt{121}$ = ______________________

3. $\sqrt{49}$ = ______________________

4. $\sqrt{841}$ = ______________________

5. $\sqrt{289}$ = ______________________