

Algebra

Work Sheets

The work sheets are grouped according to math skill. Each skill is then arranged in a sequence of work sheets that build from simple to complex. Choose the work sheets that best fit the student's need and will bring him up to the desired level.

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Simplifying Expressions in the Right Order

Follow these order of operation rules when simplifying expressions:

1. First, do all the multiplication and division from left to right.
2. Then, do all the addition and subtraction from left to right.

Simplify each expression. The first one is done for you.

1. a. $5 + 3 - 4 \times 3 \div 2$

$$5 + 3 - \underline{12 \div 2}$$

$$\underline{5 + 3} - 6$$

$$8 - 6$$

$$2$$

b. $5 + 36 \div 9$

c. $9 + 24 \div 8$

2. a. $18 - 12 \div 6 \times 7$

b. $22 - 25 \div 5 \times 4$

c. $8 + 9 - 12 \times 2 \div 3$

3. a. $14 - 8 \times 3 \div 4 + 7$

b. $11 - 4 \div 2 + 3 \times 2$

c. $15 - 8 \div 4 + 2 \times 2$

4. a. $7 \times 9 + 15 \div 5 - 3 \times 2$

b. $20 - 7 \times 4 \div 2 + 3$

c. $4 \times 4 + 12 \div 3 - 2 \times 5$

Rules for Combining Integers

Hills and holes help us to visualize what is happening when we combine integers, but they would be difficult to use for large integers. Instead, we use rules to help us add positive and negative integers.

1. Positive + Positive

Add the numbers.

$$5 + 7 = 12$$

Make the answer positive.

$$12$$

2. Negative + Negative

Ignore the signs.

$$-4 + (-3) = ?$$

Add the numbers.

$$4 + 3 = 7$$

Make the answer negative.

$$-7$$

3. Negative + Positive or Positive + Negative

Ignore the signs.

$$-8 + 5 = ?$$

$$10 + (-6) = ?$$

Subtract the numbers.

$$8 - 5 = 3$$

$$10 - 6 = 4$$

Use the sign of the larger number in the problem.

$$-3$$

$$4$$

Combine integers.

1. a. $-3 + (-8) = \underline{\hspace{2cm}}$

b. $5 + 2 = \underline{\hspace{2cm}}$

c. $-1 + 10 = \underline{\hspace{2cm}}$

2. a. $-9 + 3 = \underline{\hspace{2cm}}$

b. $2 + (-20) = \underline{\hspace{2cm}}$

c. $-5 + (-3) = \underline{\hspace{2cm}}$

3. a. $4 + 6 = \underline{\hspace{2cm}}$

b. $2 + (-2) = \underline{\hspace{2cm}}$

c. $-1 + (-1) = \underline{\hspace{2cm}}$

4. a. $4 + (-1) = \underline{\hspace{2cm}}$

b. $8 + 1 = \underline{\hspace{2cm}}$

c. $-5 + (-2) = \underline{\hspace{2cm}}$

5. a. $-5 + 2 = \underline{\hspace{2cm}}$

b. $5 + (-2) = \underline{\hspace{2cm}}$

c. $-4 + (8) = \underline{\hspace{2cm}}$

6. a. $-12 + (-7) = \underline{\hspace{2cm}}$

b. $4 + (-4) = \underline{\hspace{2cm}}$

c. $-9 + (-8) = \underline{\hspace{2cm}}$

7. a. $-6 + (-8) = \underline{\hspace{2cm}}$

b. $-6 + (-1) = \underline{\hspace{2cm}}$

c. $-5 + 9 = \underline{\hspace{2cm}}$

8. a. $-6 + 6 = \underline{\hspace{2cm}}$

b. $6 + (-8) = \underline{\hspace{2cm}}$

c. $-3 + (-5) = \underline{\hspace{2cm}}$

9. a. $2 + 6 = \underline{\hspace{2cm}}$

b. $-3 + 4 = \underline{\hspace{2cm}}$

c. $4 + (-8) = \underline{\hspace{2cm}}$

10. a. $14 + (-18) = \underline{\hspace{2cm}}$

b. $27 + (-6) = \underline{\hspace{2cm}}$

c. $-42 + (-6) = \underline{\hspace{2cm}}$

11. a. $-13 + (-7) = \underline{\hspace{2cm}}$

b. $-23 + 6 = \underline{\hspace{2cm}}$

c. $32 + (-8) = \underline{\hspace{2cm}}$

Choosing Equations for Problems

To solve the problem of how old is Steve if twice Steve's age decreased by thirteen is fifteen, we must write an equation.

Write equation

Solve the equation.

Steve is 14 years old.

$$\begin{array}{r}
 \begin{array}{ccc}
 \text{Twice} & \text{decreased} & \text{is 15} \\
 \text{Steve's} & \text{by 13} & \\
 \text{age} & & \\
 \swarrow & \downarrow & \swarrow \\
 2a - 13 = 15 \\
 + 13 \quad + 13 \\
 \hline
 2a = 28 \\
 \frac{2a}{2} = \frac{28}{2} \\
 a = 14
 \end{array}
 \end{array}$$

Translate into equations. Then solve and check. The first one is done for you.

The quotient of a number and twelve is four.

Six more than a number is fifteen.

	<div style="border: 1px solid black; display: inline-block; padding: 2px;">Check</div>		<div style="border: 1px solid black; display: inline-block; padding: 2px;">Check</div>
1. a. $\frac{n}{12} = 4$	b. $\frac{48}{12} = 4$	c.	d.
$\frac{n}{12} \cdot 12 = 4 \cdot 12$	$4 = 4$		
$n = 48$			

For each problem, choose the equation which can be used to find the solution. Solve it.

2. Twice Carol's height decreased by 4 is 90 inches.
How tall is Carol?

$90 - 4 = 2c$ $2c - 4 = 90$ $4 - 2c = 90$

a. Equation: _____ b. Answer: _____

3. The number of people divided by 3 then increased by 5 is 13.
How many people are there?

$\frac{n}{3} + 5 = 13$ $\frac{n}{5} + 3 = 13$ $3 + 5n = 13$

a. Equation: _____ b. Answer: _____

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3. Jesse is 26 years old. The rate he can run is 21 mph less than his age. How fast can he run?

$$26 + 21 = r \qquad r = 26 - 21 \qquad 21 = 26 - r$$

a. Equation _____ b. Answer _____

4. Six times George's shoe size is 72. What is George's shoe size?

$$6 + n = 72 \qquad 6n = 72 \qquad 72 = \frac{6}{n}$$

a. Equation: _____ b. Answer: _____

5. Kara rode her bike 9 km. This was 5 km more than her friend Ashley rode. How far did Ashley ride?

$$9 = n - 5 \qquad 5 = 9 + n \qquad 9 = n + 5$$

a. Equation: _____ b. Answer: _____

6. Jesse can run 5 mph. How many hours will it take him to run 15 miles?

$$15 - t = 5 \qquad 5t = 15 \qquad 15 - t = 5$$

a. Equation _____ b. Answer _____

7. Jesse hiked 30 miles in 2 days. He hiked twice as far the first day as he did the second day. How many miles did he hike the second day?

$$x + 2x = 30 \qquad x + x = 30 \qquad x = \frac{30}{2}$$

a. Equation _____ b. Answer _____

8. Three times Jennifer's age less 40 is 23. How old is Jennifer?

$$3j - 40 = 23 \qquad 40 - 3j = 23 \qquad 23 = 3 \cdot 40 - j$$

a. Equation: _____ b. Answer: _____

Solving Equations With Squared Variables

To solve an equation like $x^2 = 9$, we find the *square root of both sides of the equation.

Example 1: $x^2 = 9$

$$\sqrt{x^2} = \sqrt{9}$$

$$x = 3$$

Example 2: $x^2 = 19$

$$\sqrt{x^2} = \sqrt{19}$$

$$x = \sqrt{19}$$

Not a perfect square.

Since 9 in Example 1 is a perfect square, its square root is a whole number. But 19 in Example 2 is not a perfect square; therefore, we leave it under the radical sign. This is as far as we need to go to solve the equation unless we are solving a story problem and need an approximate value for the square root.

To solve more complicated equations with a squared variable, follow the usual steps to isolate the variable term on one side of the equation, then find the square roots of both sides.

$$2x^2 - 4 = 196$$

$$\begin{array}{r} + 4 \quad + 4 \\ \hline \end{array}$$

$$\frac{2x^2}{2} = \frac{200}{2}$$

$$x^2 = 100$$

$$\sqrt{x^2} = \sqrt{100}$$

$$x = 10$$

Add 4 to both sides.

Divide both sides by 2.

Simplified.

Find the square root of both sides.

Solution.

Solve and find the square root. If it is not a perfect square, leave your answer under the radical sign.

1. a. $x^2 = 144$

b. $a^2 = 25$

c. $y^2 = 48$

2. a. $3x^2 = 75$

b. $x^2 + 4 = 32$

c. $x^2 - 15 = 25$

*If student does not understand square root assign worksheet 44.

Multiplying Variables With Exponents

An exponent shows how many times the base is used as a factor.

$$n^2 \text{ means } n \cdot n \quad n^3 \text{ means } n \cdot n \cdot n \quad n^4 \text{ means } n \cdot n \cdot n \cdot n$$

Notice what happens when we multiply the following:

$$n^2 \cdot n^3 \text{ is } (n \cdot n) \cdot (n \cdot n \cdot n) \text{ which is also } n^5$$

To multiply like variables with exponents, you simply add the exponents.

Remember that a number or variable with no exponent is the same thing as a number or variable with an exponent of 1 and therefore $n \cdot n^2 = n^3$.

Also Remember that multiplying variables ($n \cdot n \cdot n = n^3$) is not the same as adding variables ($n + n + n = 3n$)

Simplify the expressions. Watch the signs!

1. a. $s^3 \cdot s^2$ b. $b^2 \cdot b^7$ c. $m \cdot m^4 \cdot m^2$ d. $c \cdot c \cdot c^2$

Sometimes you must multiply a combination of variables, constants, and exponents. Consider the following expressions and the steps used to simplify them.

$$\begin{array}{l} 4a^3 \cdot 7a \\ (4 \cdot 7) \cdot (a^3 \cdot a) \\ \swarrow \quad \searrow \\ 28 \cdot a^4 \\ 28a^4 \end{array}$$

Using the associative property of multiplication, mentally group the like terms. Find the product in each group. Write the products together.

$$\begin{array}{l} 2a^2 \cdot 7b^3 \\ (2 \cdot 7) \cdot (a^2) \cdot (b^3) \\ \swarrow \quad \searrow \quad \searrow \\ 14 \cdot a^2 \cdot b^3 \\ 14a^2b^3 \end{array}$$

Simplify. The first one is done for you.

- | | | | |
|--------------------------------|----------------------------|--------------------|------------------------------|
| 1. a. $2c^3 \cdot c$
$2c^4$ | b. $3x \cdot y^2 \cdot z$ | c. $4s \cdot s^2$ | d. $3a^2 \cdot 5a^2$ |
| 2. a. $4a \cdot b$ | b. $5b \cdot 2b$ | c. $3b^2 \cdot 2$ | d. $3x^2 \cdot 9x \cdot y^2$ |
| 3. a. $9x \cdot 2x^3$ | b. $4y \cdot 3y \cdot y$ | c. $4a^3 \cdot 3a$ | d. $2x^2 \cdot 4y^3$ |
| 4. a. $2n^2 \cdot n^2$ | b. $a \cdot 2b \cdot 4a^2$ | c. $5y \cdot 2y^3$ | d. $4x^2 \cdot 2x^2$ |