

[Warm Up](#)  
[Lesson Presentation](#)  
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**Warm Up**  
**List words that indicate each operation.**

- addition **sum, and, total**
- multiplication **times, product**

**Evaluate each expression.**

- $3x$  for  $x = 2$  **6**
- $5x - 4 - 3x$  for  $x = 7$  **10**

**Simplify each expression.**


- $3(2x)$   **$6x$**
- $4(x + y)$   **$4x + 4y$**

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**Warm Up**  
**Simplify each expression.**

- $2x + 5 - 3x$   **$-x + 5$**       2.  $-(w - 2)$   **$-w + 2$**
- $6(2 - 3g)$   **$12 - 18g$**

**Graph on a number line.**

- $t > -2$  
- Is 2 a solution of the inequality  $-2x < -6$ ? Explain.  
**No; when 2 is substituted for  $x$ , the inequality is false:  $-4 < -6$**

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**Objective**

Simplify and evaluate algebraic expressions.

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There are three different ways in which a basketball player can score points during a game. There are 1-point free throws, 2-point field goals, and 3-point field goals. An algebraic expression can represent the total points scored during a game.

$x + 2y + 3z$

**Total Points Scored**

$f + 2g + 3t$

Number of 1-point free throws      Number of 2-point field goals      Number of 3-point field goals

*x = FT*  
*y = 2pt*  
*z = 3pt*

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To evaluate an algebraic expression, substitute a number for each variable and simplify by using the order of operations. One way to remember the order of operations is by using the mnemonic **PEMDAS**.

**Order of Operations**

1. ~~P~~arentheses and grouping symbols.
2. **E**xponents.
3. **M**ultiply and **D**ivide from left to right.
4. **A**dd and **S**ubtract from left to right.

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**Example 2A: Evaluating Algebraic Expressions**

Evaluate the expression for the given values of the variables.

$2x - xy + 4y$  for  $x = 5$  and  $y = 2$

$2(5) - (5)(2) + 4(2)$       *Substitute 5 for x and 2 for y.*

$10 - 10 + 8$       *Multiply from left to right.*

$0 + 8$       *Add and subtract from left to right.*

$8$

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**Example 2B: Evaluating Algebraic Expressions**

Evaluate the expression for the given values of the variables.

$q^2 + 4qr - r^2$  for  $r = 3$  and  $q = 7$

$(7)^2 + 4(7)(3) - (3)^2$       *Substitute 3 for r and 7 for q.*

$49 + 4(7)(3) - 9$       *Evaluate exponential expressions.*

$49 + 84 - 9$       *Multiply from left to right.*

$124$       *Add and subtract from left to right.*

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Recall that the terms of an algebraic expression are separated by addition or subtraction symbols. *Like terms* have the same variables raised to the same exponents. Constant terms are like terms that always have the same value.

$$3x^2 - 9xy + 2x + 4x^2 - 1$$

Diagram illustrating like terms and constant terms in the expression  $3x^2 - 9xy + 2x + 4x^2 - 1$ . A red bracket labeled "Like terms" groups  $3x^2$  and  $4x^2$ . A blue bracket labeled "Constant terms" groups  $-1$ . A red arrow points from the text "+ 3yx" to the  $-9xy$  term.

### Example 3B: Simplifying Expressions

Simplify the expression.

$$6k^2 + 7kj$$

$$j(6k^2 + 7k) + 9jk^2 - 7jk$$

$$6jk^2 + 7jk + 9jk^2 - 7jk$$

Distribute, and identify like terms.

$$15jk^2$$

Combine like terms.  
 $7jk - 7jk = 0$

$$\begin{array}{l} \cancel{2k^2} \\ \cancel{7kj} \\ 0jk \\ 0a \\ 0b \\ 0c \end{array}$$

### Check It Out! Example 3

Simplify the expression  $-3(2x - xy + 3y) - 11xy$ .

$$\begin{array}{ccccccc} -6x & +3xy & -9y & -11xy \\ \cancel{\times} & \cancel{\times} & \cancel{\times} & \cancel{\times} \end{array}$$

### Example 4A: Application

Apples cost \$2 per pound, and grapes cost \$3 per pound.

$$a = \text{apples}$$

$$2a$$

$$g = \text{grapes}$$

$$3g$$

$$2a + 3g$$

**Check It Out! Example 4a**

A travel agent is selling 100 discount packages. He makes \$50 for each Hawaii package and \$80 for each Cancún package.

$h = \text{Hawaii}$  ✗  
 $c = \text{Cancún}$   
 $c = (100 - h)$  ✗  
~~50h~~  
 $50h + 80(100 - h)$   
 $50h + 8,000 - 80h$   
 $8,000 - 30h$

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**Lesson Quiz: Part I**

Write an algebraic expression to represent each situation.

- the number of cards in a 52-card deck after  $n$  cards are dealt.  $52 - n$
- the number of days in  $W$  weeks  $7W$
- Evaluate:  $rq^2 + 3qr + r^2$  for  $r = 5$  and  $q = 2$ .  $75$
- Simplify:  $5h^2 + 4k + 7h - 4h^2$ .  $h^2 + 4k + 7h$

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**Lesson Quiz: Part II**

Jake has only nickels and dimes in his pocket.

5. Write and simplify an expression for the total value if Jake has 20 coins.

Possible answer:  $\$2 - (\$0.05)N$

6. How much does he have if he has 7 nickels?

$\$1.65$

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**Objectives**

Solve linear equations using a variety of methods.

Solve linear inequalities.

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**Check It Out! Example 3**Solve  $3(w + 7) - 5w = w + 12$ .

$$\begin{array}{r} -2w + 21 = w + 12 \end{array} \quad \text{Simplify each side by combining like terms.}$$

$$\begin{array}{r} +2w \quad \quad +2w \\ \hline 21 = 3w + 12 \end{array} \quad \text{Collect variables on the right side.}$$

$$21 = 3w + 12 \quad \text{Add.}$$

$$\begin{array}{r} -12 \quad \quad -12 \\ \hline 9 = 3w \end{array} \quad \text{Collect constants on the left side.}$$

$$\begin{array}{r} 9 = 3w \\ \hline 3 \quad \quad 3 \end{array} \quad \text{Isolate the variable.}$$

$$3 = w$$

**Example 4A: Identifying Identities and Contractions**Solve  $3v - 9 - 4v = -(5 + v)$ .

$$3v - 9 - 4v = -(5 + v)$$

$$-9 - v = -5 - v \quad \text{Simplify.}$$

$$\begin{array}{r} +v \quad \quad +v \\ \hline -9 \neq -5 \quad \mathbf{x} \end{array} \quad \text{Contradiction}$$

The equation has no solution. The solution set is the *empty set*, which is represented by the symbol  $\emptyset$ .

$$\emptyset$$

An **inequality** is a statement that compares two expressions by using the symbols  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ , or  $\neq$ . The graph of an inequality is the **solution set**, the set of all points on the number line that satisfy the inequality.

The properties of equality are true for inequalities, with one important difference. If you multiply or divide both sides by a negative number, you must *reverse* the inequality symbol.

**Example 5: Solving Inequalities**Solve and graph  $8a - 2 \geq 13a + 8$ .

$$\begin{array}{r} 8a - 2 \geq 13a + 8 \\ -13a \quad -13a \\ \hline -5a - 2 \geq 8 \end{array} \quad \text{Subtract } 13a \text{ from both sides.}$$

$$\begin{array}{r} -5a - 2 \geq 8 \\ +2 \quad +2 \\ \hline -5a \geq 10 \end{array} \quad \text{Add 2 to both sides.}$$

$$\begin{array}{r} -5a \geq 10 \\ -5 \quad -5 \\ \hline a \leq -2 \end{array} \quad \text{Divide both sides by } -5 \text{ and reverse the inequality.}$$

$$a \leq -2$$

**Lesson Quiz: Part I**

1. Alex pays \$19.99 for cable service each month. He also pays \$2.50 for each movie he orders through the cable company's pay-per-view service. If his budgets \$35 a month, how many movies can Alex order?

**Lesson Quiz: Part III**

5. Solve and graph.

$$12 + 3q > 9q - 18$$

**Solve.**

1.  $2(x - 3) = -4$

\_\_\_\_\_

2.  $12 - 3(w + 7) = 15$

\_\_\_\_\_

3.  $4(8 - p) - (7 - p) = 22$

\_\_\_\_\_

4.  $18 - 4y = -2(6 + 2y)$

\_\_\_\_\_

5.  $7t + 6 - 2\left(5 + \frac{3t}{2}\right) = 5t - 11$

\_\_\_\_\_

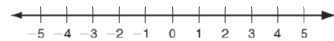
6.  $32 + 4(c - 1) = -(4c + 5)$

\_\_\_\_\_

**Solve and graph.**

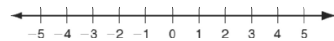
7.  $-5x + 7 \geq -3$

\_\_\_\_\_



8.  $4 - (-7 - k) > 2(k + 3)$

\_\_\_\_\_



9.  $-18d + 5(8 + 3d) \leq 7(3d - 8)$

\_\_\_\_\_

