

Name _____

Key

Period _____

Chapter 6A Notes

(Equations)

6.1 – One Step Equations (Add/Subtract)

6.2 – One Step Equations (Multiply/Divide)

6.3 – Equations with Rational Coefficients

6.4 – Two Step Equations

6.5 – More Two Step Equations

Lesson 6.1 (One Step Equations using Addition and Subtraction)

- **Equation** – a mathematical sentence stating that two quantities are equal.
- **Solution** – the value of a variable that makes an equation true.
- **Equivalent Equations** – equations with the same solution
 - Example: $x + 2 = 6$ and $x = 4$ (both have a solution of 4)
- The goal of solving an equation is to **find the value of the variable**.
 - We do this by **isolating** the variable on one side of the equation using **Inverse Operations!**
 - **Inverse operations** “undo” each other!

Inverse of addition?	<u>Subtraction</u>
Inverse of subtraction?	<u>Addition</u>
- **Subtraction Property of Equality** – the two sides of an equation remain equal when you subtract the same number from each side

1. Solve each equation. Check your solution.

a. $x + 6 = 4$

$$\begin{array}{r} -6 \quad -6 \\ \hline x = -2 \end{array}$$

b. $-5 = b + 8$

$$\begin{array}{r} -8 \quad -8 \\ \hline -13 = b \end{array}$$

c. $y + 6 = 9$

$$\begin{array}{r} -6 \quad -6 \\ \hline y = 3 \end{array}$$

d. $x + 3 = 1$

$$\begin{array}{r} -3 \quad -3 \\ \hline x = -2 \end{array}$$

e. $-3 = a + 4$

$$\begin{array}{r} -4 \quad -4 \\ \hline -7 = a \end{array}$$

2. An angelfish can grow to be 12 inches long. If an angelfish is 8.5 inches longer than a clown fish, how long is a clown fish?

$$\begin{array}{r} c + 8.5 = 12 \\ - 8.5 \quad - 8.5 \\ \hline c = 3.5 \end{array}$$

3.5 inches

3. The highest recorded temperature in Warsaw, Missouri is 118 degrees Fahrenheit. This is 158 degrees greater than the lowest recorded temperature. Find the lowest recorded temperature.

$$\begin{array}{r} L + 158 = 118 \\ - 158 \quad - 158 \\ \hline L = 40 \end{array}$$

40° F

- **Addition Property of Equality** – the two sides of an equation remain equal when you add the Same number to each side

4. Solve each equation. Check your solution

a. $x - 2 = 1$

$$\begin{array}{r} x - 2 = 1 \\ + 2 \quad + 2 \\ \hline x = 3 \end{array}$$

c. $r - 4 = -2$

$$\begin{array}{r} r - 4 = -2 \\ + 4 \quad + 4 \\ \hline r = 2 \end{array}$$

b. $y - 3 = 4$

$$\begin{array}{r} y - 3 = 4 \\ + 3 \quad + 3 \\ \hline y = 7 \end{array}$$

d. $q - 8 = -9$

$$\begin{array}{r} q - 8 = -9 \\ + 8 \quad + 8 \\ \hline q = -1 \end{array}$$

5. A pair of shoes costs \$25. This is \$14 less than the cost of a pair of jeans. Find the cost of the jeans.

J = cost of jeans

$$\begin{array}{r} J - 14 = 25 \\ + 14 \quad + 14 \\ \hline J = \$39 \end{array}$$

Lesson 6.2 (One Step Equations using Multiplication and Division)

- The goal of solving an equation is to find the value of the variable.
- We do this by isolating the variable on one side of the equation using Inverse Operations!

- Inverse operations "undo" each other!

Inverse of multiplication?

Division

Inverse of division?

Multiplication

- The expression $3x$ means 3 times x.
- Coefficient – the numerical factor of a multiplication expression like $3x \Rightarrow 3$
- Division Property of Equality – the two sides of an equation remain equal when you divide each side by the same nonzero number

1. Solve each equation. Check your solution.

a. $20 = 4x$
 $\frac{20}{4} = \frac{4x}{4}$
 $5 = x$

d. $-6a = 36$
 $\frac{-6a}{-6} = \frac{36}{-6}$
 $a = -6$

b. $-8y = 24$
 $\frac{-8y}{-8} = \frac{24}{-8}$
 $y = -3$

e. $-9d = -72$
 $\frac{-9d}{-9} = \frac{-72}{-9}$
 $d = 8$

c. $30 = 6x$
 $\frac{30}{6} = \frac{6x}{6}$
 $5 = x$

2. Lelah sent 574 text messages last week. On average, how many messages did she send each day?

$$m = \# \text{ messages per day}$$

$$7m = \frac{574}{7} \Rightarrow m = \boxed{82} \text{ messages}$$

3. Mrs. Acosta's car can travel an average of 24 miles on each gallon of gas. Write and solve an equation to find how many gallons of gas she will need for a trip of 348 miles.

$$g = \# \text{ of gallons}$$

$$\frac{24g}{24} = \frac{348}{24} \Rightarrow g = \boxed{14.5} \text{ gallons}$$

- **Multiplication Property of Equality** – the two sides of an equation remain equal if you multiply each side by the same number.

4. Solve each equation. Check your solution.

a. $-4 \cdot \frac{a}{-4} = -9 \cdot -4$

$$a = \boxed{36}$$

c. $5 \cdot \frac{m}{5} = -7 \cdot 5$

$$m = \boxed{-35}$$

b. $3 \cdot \frac{y}{-3} = -8 \cdot -3$

$$y = \boxed{24}$$

d. $-6 \cdot 30 = \frac{b}{-6} \cdot -6$

$$\boxed{-180} = b$$

5. The distance d Tina travels in her car while driving 60 miles per hour for 3 hours is given by the equation $\frac{d}{3} = 60$. How far did she travel?

$$\frac{d}{3} = 60 \cdot 3$$

$$d = \boxed{180} \text{ miles}$$

Lesson 6.3 (Equations with Rational Coefficients)**Decimal Coefficients:**

- If the coefficient is a decimal, divide each side by the decimal.

1. Solve each equation. Check your solution.

$$\begin{aligned} \text{a. } \frac{16}{.25} &= \frac{0.25n}{.25} \\ (64) &= n \end{aligned}$$

$$\begin{aligned} \text{c. } \frac{-2.8p}{-2.8} &= \frac{4.2}{-2.8} \\ p &= (-1.5) \end{aligned}$$

$$\begin{aligned} \text{b. } \frac{6.4}{.8} &= \frac{0.8m}{.8} \\ (8) &= m \end{aligned}$$

$$\begin{aligned} \text{d. } \frac{-4.7k}{-4.7} &= \frac{-10.81}{-4.7} \\ k &= (2.3) \end{aligned}$$

2. Jaya's coach agreed to buy ice cream for all of the team members. Ice cream cones are \$2.40 each. Write and solve an equation to find how many cones the coach can buy with \$30.

$c = \# \text{ of cones}$

$$\frac{2.40c}{2.40} = \frac{30}{2.40} \Rightarrow c = 12.5 \quad \boxed{12 \text{ cones}}$$

Fraction Coefficients:

- If the coefficient is a fraction, multiply each side by the reciprocal of the coefficient.

3. Solve each equation. Check your solution.

$$\begin{aligned} \text{a. } \frac{4}{3} \cdot \frac{3}{4}x &= \frac{12}{20} \cdot \frac{4}{3} \\ x &= (4/5) \end{aligned}$$

$$\begin{aligned} \text{b. } -\frac{9}{7} \cdot -\frac{7}{9}d &= 5 \cdot -\frac{9}{7} \\ d &= \left[-\frac{45}{7} \text{ OR } -6\frac{3}{7} \right] \end{aligned}$$

c. $2 \cdot \frac{1}{2}x = 8 \cdot 2$

$x = 16$

e. $-\frac{8}{7} \cdot -\frac{7}{8}x = -\frac{21}{64} \cdot -\frac{8}{7}$

$x = \frac{3}{8}$

d. $-\frac{4}{3} \cdot -\frac{3}{4}x = 9 \cdot -\frac{4}{3}$

$x = -\frac{36}{3} = -12$

4. Valerie needs $\frac{2}{3}$ yard of fabric to make a hat for the school play. Write and solve an equation to find how many hats she can make with 6 yards of fabric.

$h = \# \text{ of hats}$

$$\frac{3}{2} \cdot \frac{2}{3}h = 6 \cdot \frac{3}{2}$$

$$h = 9 \text{ hats}$$

Lesson 6.4 (Solving Two Step Equations)

- **Two-Step Equation** – an equation that contains two different operations (multiplication and division)

- Example: $2x + 3 = 9$

- To solve a two-step equation, undo the operations in reverse order of the order of operations.

Step 1

Undo the addition or subtraction first.

Step 2

Undo the multiplication or division.

1. Solve each equation. Check your solution.

a. $2x + 3 = 9$

$$\begin{array}{r} 2x + 3 = 9 \\ -3 \quad -3 \\ \hline 2x = 6 \\ \frac{2x}{2} = \frac{6}{2} \\ x = \boxed{3} \end{array}$$

d. $4 + \frac{1}{5}r = -1$

$$\begin{array}{r} 4 + \frac{1}{5}r = -1 \\ -4 \quad -4 \\ \hline \frac{1}{5}r = -5 \\ \frac{1}{5}r \cdot 5 = -5 \cdot 5 \\ r = \boxed{-25} \end{array}$$

b. $3x + 2 = 23$

$$\begin{array}{r} 3x + 2 = 23 \\ -2 \quad -2 \\ \hline 3x = 21 \\ \frac{3x}{3} = \frac{21}{3} \\ x = \boxed{7} \end{array}$$

e. $-5s + 8 = -2$

$$\begin{array}{r} -5s + 8 = -2 \\ -8 \quad -8 \\ \hline -5s = -10 \\ \frac{-5s}{-5} = \frac{-10}{-5} \\ s = \boxed{2} \end{array}$$

c. $-2y - 7 = 3$

$$\begin{array}{r} -2y - 7 = 3 \\ +7 \quad +7 \\ \hline -2y = 10 \\ \frac{-2y}{-2} = \frac{10}{-2} \\ y = \boxed{-5} \end{array}$$

f. $-2 + \frac{2}{3}w = 10$

$$\begin{array}{r} -2 + \frac{2}{3}w = 10 \\ +2 \quad +2 \\ \hline \frac{2}{3}w = 12 \\ \frac{2}{3}w \cdot \frac{3}{2} = 12 \cdot \frac{3}{2} \\ w = \boxed{18} \end{array}$$

2. Toya had her birthday party at the movies. It cost \$27 for pizza and \$8.50 per friend for the movie tickets. How many friends did Toya have at her party if she spent \$78?

 $f = \# \text{ of friends}$

$$\begin{array}{r} 27 + 8.5f = 78 \\ -27 \quad -27 \\ \hline 8.5f = 51 \\ \frac{8.5f}{8.5} = \frac{51}{8.5} \end{array}$$

$\Rightarrow f = \boxed{6 \text{ friends}}$

Lesson 6.5 (More Two Step Equations)

- Special Two Step Equation: $p(x + q) = r$
 - Example: $2(w + 36) = 114$
 - It contains two factors, p and $(x + q)$.
 - **2 Solution Methods:**
 - **Method 1** – Distribute. Then solve.
 - **Method 2** – Divide by the number outside the parentheses. Then solve.

1. Solve $3(x + 5) = 45$. Check your solution.

a. Distribute. Then solve.

$$\begin{array}{r} 3x + 15 = 45 \\ -15 \quad -15 \\ \hline 3x = 30 \Rightarrow x = 10 \end{array}$$

b. Divide by the number outside the parentheses. Then solve.

$$\begin{array}{r} 3(x+5) = 45 \\ \hline x+5 = 15 \\ -5 \quad -5 \\ \hline x = 10 \end{array}$$

2. Solve each equation.

a. $5(n - 2) = -30$

$$\begin{array}{r} 5n - 10 = -30 \\ +10 \quad +10 \\ \hline 5n = -20 \\ \hline n = -4 \end{array}$$

c. $3(b - 6) = 12$

$$\begin{array}{r} 3b - 18 = 12 \\ +18 \quad +18 \\ \hline 3b = 30 \\ \hline b = 10 \end{array}$$

b. $2(x + 4) = 20$

$$\begin{array}{r} 2x + 8 = 20 \\ -8 \quad -8 \\ \hline 2x = 12 \\ \hline x = 6 \end{array}$$

d. $-7(6 + d) = 49$

$$\begin{array}{r} -42 - 7d = 49 \\ +42 \quad +42 \\ \hline -7d = 91 \\ \hline d = -13 \end{array}$$

- **Fractions and Decimals as the Factor**

- If the factor is a fraction, *multiply* by the reciprocal of the factor.
- If the factor is a decimal, *divide* by the decimal.

3. Solve each equation. Check your solution.

a. $\frac{3}{2} \cdot \frac{2}{3}(n + 6) = 10 \cdot \frac{3}{2}$

$$\begin{array}{r} n+6 = 15 \\ -6 \quad -6 \\ \hline n = \textcircled{9} \end{array}$$

b. $0.2(c - 3) = -10$

$$\begin{array}{r} c-3 = -50 \\ +3 \quad +3 \\ \hline c = \textcircled{-47} \end{array}$$

c. $\frac{4}{1} \cdot \frac{1}{4}(d - 3) = -15 \cdot \frac{4}{1}$

$$\begin{array}{r} d-3 = -60 \\ +3 \quad +3 \\ \hline d = \textcircled{-57} \end{array}$$

d. $0.75(6 + d) = 12$

$$\begin{array}{r} 6+d = 16 \\ -6 \quad -6 \\ \hline d = \textcircled{10} \end{array}$$

e. $\frac{9}{5}(t + 3) \cdot \frac{5}{9} = 40 \cdot \frac{9}{5}$

$$\begin{array}{r} t+3 = 72 \\ -3 \quad -3 \\ \hline t = \textcircled{69} \end{array}$$

4. Jamal and two cousins received the same amount of money to go to a movie. Each boy spent \$15. Afterward, the boys had \$30 altogether. Write and solve an equation to find the amount of money each boy received.

m = amount of money received

$$\frac{3(m-15)}{3} = \frac{30}{3}$$

$$\begin{array}{r} m-15 = 10 \\ +15 \quad +15 \\ \hline m = \textcircled{\$25} \end{array}$$