## Warm-Up

Write the following expressions in algebraic form.

| | |
|---|---|
| 1. 9 more than c $\quad 9 > c$ | 2. b minus 4 $\quad b - 4$ |
| 3. the quotient of z and 9 $\quad z \div 9$ or $\frac{z}{9}$ | 4. the total of n and 40 $\quad n + 40$ |
| 5. the sum of 8 and m $\quad 8 + m$ | 6. x divided by 5 $\quad x \div 5 \quad \frac{x}{5}$ |
| 7. the difference of h and 7 $\quad h - 7$ | 8. 23 less than p $\quad 23 < p$ |
| 9. the product of g and 2 $\quad \frac{2g}{2(g)} \quad 2 \cdot g$ | 10. 77 plus twice v $\quad 77 + 2v$ |
| 11. two times r increased by 12 $\quad 2r + 12$ | 12. 3 times j decreased by 12 $\quad 3j - 12$ |

13. Write the expressions in their simplest equivalent form by expanding and then combining like-terms.

$\dfrac{4}{2} = 2$

$\dfrac{2}{2} = 1$

a) $7(3y - 2) + 6y$

$21y - 14 + 6y$

$\boxed{27y - 14}$

b) $8(x + 5) - 3(x - 2)$

$8x + 40 - 3x + 6$

$\boxed{5x + 46}$

c) $5(x + 3) - \dfrac{4x + 2}{2}$

$5x + 15 - 2x + 1$

$\boxed{3x + 16}$

# Notes: Solving Multi-Step Equations

## Solving Multi-Step Equations

1. Use the Distributive Property to eliminate parentheses
2. Clear the equation of fractions by multiplying by the common denominator (optional step)
3. Combine like terms
4. "Undo" addition or subtraction
5. "Undo" multiplication or division

## Examples: Solve each equation.

**1.** $2x + x + 12 = 78$

$$3x + 12 = 78$$
$$-12 \quad -12$$
$$\boxed{X = 22}$$
$$\frac{3x}{3} = \frac{66}{3}$$

**2.** $2 \ominus 2(x - 4) = 10$

$$2 - 2x + 8 = 10$$
$$-2x + 10 = 10$$
$$-10 \quad -10$$
$$\boxed{X = 0}$$
$$\frac{-2x}{-2} = \frac{0}{-2}$$

### You try:

**3.** $-2x + 5 + 5x = 14$

$$3x + 5 = 14$$
$$-5 \quad -5$$
$$\boxed{X = 3}$$
$$\frac{3x}{3} = \frac{9}{3}$$

**4.** $15 = 9 - 3(x - 1)$

$$15 = 9 - 3x + 3$$
$$15 = 12 - 3x$$
$$-12 \quad -12$$
$$\boxed{X = -1}$$
$$\frac{3}{-3} = \frac{-3x}{-3}$$

## Solving Equations with Variables on Both sides

1. Clean up both sides of the equation individually (combine like terms and simplify).
2. Move all variables to one side of the equation.
3. Move everything else to the other side of the equation.
4. Solve for the variable!

## Examples: Solve each equation.

**1.** $n + 4n - 5 = 2n + 12 - 2n$

$$5n - 5 = 0 + 12$$
$$5n - 5 = 12$$
$$+5 \quad +5$$
$$\frac{5n}{5} = \frac{17}{5}$$

$$\boxed{n = \frac{17}{5} \text{ or } 3.4}$$

**2.** $38 - y = -3(4y + 2)$

$$38 - y = -12y - 6$$
$$+12y \quad +12y$$
$$38 + 11y = -6$$
$$-38 \quad -38$$
$$\frac{11y}{11} = \frac{-44}{11}$$

$$\boxed{y = -4}$$

### You try:

**3.** $2(c - 6) = 9c + 2$

$$2c - 12 = 9c + 2$$
$$-9c \quad\quad -9c$$
$$-7c - 12 = 2$$
$$+12 \quad +12$$
$$\boxed{C = -2}$$
$$\frac{-7c}{-7} = \frac{14}{-7}$$

**4.** $3(2x + 1) - x = 8 - 4x + 6$

$$6x + 3 - x = 14 - 4x$$
$$5x + 3 = 14 - 4x$$
$$+4x \quad\quad +4x$$
$$9x + 3 = 14$$
$$-3 \quad -3$$
$$\frac{9x}{9} = \frac{11}{9}$$

$$\boxed{X = \frac{11}{9} \text{ or } 1.2}$$

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**State each property used to justify each step.**

5.  $4(x - 1) = 5x + 3 - 2x$

$4x - 4 = 5x + 3 - 2x$ _____

$4x - 4 = 3x + 3$ _____

-3x          -3x

$x - 4 = 3$ _____

      +4     +4

$x = 7$ _____

Fractions and Decimals can be scary… let's check out a few tricks ☺

Example 1: $\left(\frac{2}{7}x + \frac{4}{7}x = -\frac{30}{7}\right)$    Multiply by 7 to clear the fraction. $2x + 4x = -30$.

Solve like other equations.

Example 2: $(28 - 2.2y = 11.6y + 262.6)$    Multiply by 10 (since lowest decimal is tenths place).

280 – 22y = 116y + 2626 and solve.

Try on your own and check with a partner

1. $-\frac{17}{24} = -\frac{4}{3}x - \frac{7}{4} + \frac{1}{2}x$

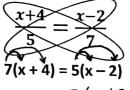2. 13.7b – 6.5 = -2.3b + 8.3

3. $\frac{5}{6} = -x - \frac{4}{3} - 1$

4. 27.67x – 8 = 22.56x + 40

**Equations with fractions on both sides are also known as proportions.**

**Steps:**

1. Cross multiply
2. Distribute
3. Combine like terms
4. Add or subtract to isolate the variable
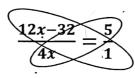5. Multiply or divide to isolate the variable

**Example 1:**

$$\frac{x+4}{5} = \frac{x-2}{7}$$

**Solve like other equations.**

$$7(x + 4) = 5(x - 2)$$

$$7x + 28 = 5x - 10$$
$$-5x \qquad -5x$$

$$\boxed{x = -19}$$

$$2x + 28 = -10$$
$$-28 \quad -28$$

$$\frac{2x}{2} = \frac{-38}{2}$$

**Example 2:**

$$\frac{12x-32}{4x} = \frac{5}{1}$$

**Rewrite as**

$$\frac{12x-32}{4x} = \frac{5}{1}$$

**and Solve.**

$$1(12x - 32) = 4x(5)$$

$$12x - 32 = 20x$$
$$-12x \qquad -12x$$

$$\frac{-32}{8} = \frac{8x}{8}$$

$$\boxed{x = -4}$$

**Try on your own and check with a partner.**

1. $\dfrac{2x-2}{3x+6} = \dfrac{2}{5}$

2. $\dfrac{5}{r-9} = \dfrac{8}{r+5}$

3. $0.07x + 9.95 = 12.47 - .05x$

4. $4x + 2.5 = -28.4 - 2.2x$

# Day 1 Homework
## Solving Multistep Equations

**Directions: Identify the solution for each equation. Show your work on a separate sheet of paper.**

1) $x + 6 = 14 + 5x$

$-x \quad -x$

$6 = 14 + 4x$
$-14 \quad -14$
$-8 = 4x$ → $\boxed{x = -2}$

2) $6r - 1 = 11 + 6r$

$-6r \qquad -6r$

$-1 = 11$

$\boxed{\text{no solution}}$

3) $-10 - 14v = -14v$

$+14v \quad +14v$

$-10 = 0$

$\boxed{\text{no solution}}$

4) $-2x + 9 = -6 - 2x + 15$

$+2x \qquad +2x$

$9 = 9$

$\boxed{\text{infinite solutions}}$

5) $7x - 3 + 2x = 9 - 3x$

$9x - 3 = 9 - 3x$
$+3x \qquad +3x$
$12x - 3 = 9$
$+3 \quad +3$
$12x = 12$ → $\boxed{x = 1}$

6) $-3 + 5x + 6 = 7x - 4 + 5x$

$5x + 3 = 12x - 4$
$-5x \qquad -5x$
$3 = 7x - 4$
$+4 \qquad +4$
$7 = 7x$ → $\boxed{x = 1}$

**Directions: Each problem has been incorrectly solved for the variable x. Identify which step the mistake was made and complete the problem to correctly solve for x. Use a separate sheet of paper for your work.**

7)
(step1) $-3x + 7 = 8 - 2x + 4$
(step2) $\boxed{-3x + 7 = 4 - 2x}$
(step3) $-5x + 7 = 4$
(step4) $-5x = -3$
(step5) $x = \dfrac{3}{5}$

The mistake is in step __2__

The correct answer is x = __-5__

$-3x + 7 = -2x + 12$
$+2x \qquad +2x$
$-x + 7 = 12$
$\quad -7 \quad -7$
$\dfrac{-x}{-1} = \dfrac{5}{-1}$ → $x = -5$

8)
(step1) $5x - 3 = 9x + 9 - 4x - 12$
(step2) $5x - 3 = 5x + 9 - 12$
(step3) $5x = 5x + 9 - 12 + 3$
(step4) $0x = 0$
(step5) $\boxed{x = 0}$

The mistake is in step __5__

The correct answer is x = __infinite solution__

$5x - 3 = 5x - 3$
$\quad +3 \qquad +3$
$\dfrac{5x}{5} = \dfrac{5x}{5}$
$0 = 0$

9)
(step1) $-6x + 3x - 14 = 12x + 16$
(step2) $\boxed{9x - 14 = 12x + 16}$
(step3) $-14 = 3x + 16$
(step4) $-30 = 3x$
(step5) $-10 = x$
(step6) $x = -10$

The mistake is in step __2__

The correct answer is x = __-2__

$-3x - 14 = 12x + 16$
$+3x \qquad +3x$
$-14 = 15x + 16$
$-16 \qquad -16$
$\dfrac{-30}{15} = \dfrac{15x}{15}$ → $x = -2$

**Directions: Using a separate sheet of paper set up an equation to help you solve each word problem below. Check your work by substituting your answer back into your equation. (If you use guess & check, show your work)**

10) Four more than twice Jason's age is the same as his age ten years from now. How old is Jason now?

$4 + 2j = j + 10$

$4 + 2j = j + 10$
$\quad -j \quad -j$
$4 + j = 10$
$-4 \qquad -4$
$j = 6$ years old

11) Seven increased by the product of three and a value x is the same as the product of 3 and a value x decreased by seven

$7 + 3x = 3x - 7$
$-7 \qquad\quad -7$
$3x = 3x - 14$
$-3x \quad -3x$
$\boxed{0 = -14}$ → no solution

12) The sum of two **consecutive even numbers** is the same as three times the smallest number. What are the two numbers?

$2x + 2x + 2 = 3(2x)$
$4x + 2 = 6x$
$-4x \qquad -4x$
$\dfrac{2}{2} = \dfrac{2x}{2}$ → $x = 1$

$\boxed{\begin{array}{l} 1^{st} \text{ \# } = 2 \\ 2^{nd} \text{ \# } = 4 \end{array}}$