Solving Multi-Step Equations

When solving a multi-step equation…

- If the variable is on both sides of the equation, add/subtract to put it on the same side
- Combine any like terms that are on the same side of the equation
- Your equation should now be a two-step or one-step equation
  - Undo any addition and/or subtraction first using the opposite operation
  - Undo any multiplication and/or division next using the opposite operation

Example One

Solve: $4x - 3 = 2x + 5$

$-2x \quad -2x$ — Subtract $2x$ from each side of the equation

$2x - 3 = 5$

$+3 \quad +3$ — Add 3 to each side of the equation

$2x = 8$

$\frac{2x}{2} = \frac{8}{2}$ — Divide both sides of the equation by 2

$x = 4$

Example Two

Solve: $3x + 2 - 6x = 4 - 2x$

$-3x + 2 = 4 - 2x$ — Combine like terms

$+3x \quad +3x$ — Add $3x$ to each side of the equation

$2 = 4 + x$

$-4 \quad -4$ — Subtract 4 from each side of the equation

$-2 = x$

$x = -2$

Example Three

Solve: $\frac{x}{2} + \frac{1}{3} = \frac{4x}{3} - \frac{1}{2}$ — The least common denominator is 6.

$\frac{3x}{6} + \frac{2}{6} = \frac{8x}{6} - \frac{3}{6}$ — Change all the fractions to equivalent fractions with a LCD of 6.

$-\frac{3x}{6} \quad -\frac{3x}{6}$ — Subtract $\frac{3x}{6}$ from each side of the equation

$\frac{2}{6} = \frac{5x}{6} - \frac{3}{6}$

$+\frac{3}{6} \quad +\frac{3}{6}$ — Add $\frac{3}{6}$ to each side of the equation

$\frac{5}{6} = \frac{5x}{6}$

$\left(\frac{6}{5}\right)\left(\frac{5}{6}\right) = \left(\frac{5x}{6}\right)\left(\frac{6}{5}\right)$ — Multiply each side by $\frac{6}{5}$

$1 = 1x$

$x = 1$

Try These

1. $2x + 1 = 5x - 2$
2. $13 - 6x = 6x + 1$
3. $8y - 7 = 7y - 15$
4. $4y - 11 = 9 - 4y$
5. $4a + 2 = 8a + 18$
6. $15b + 14 = 5b + 4$
7. $9x + 6 = 26 - x$
8. $7.5p - 10.2 = 12.6 - 4.5p$
9. $12c - 19 = 15c + 8$
10. $2a + 3a + 4a = 5a - 18$

11. $-3t - 8 + 7t = 34 + 9t - 2$

12. $2x - 8x + 1 = 9 - 10x$

13. $-\frac{1}{5}p + 6 + \frac{9}{5}p = 30$

14. $-3 - 10x = 30 + 4x - 5$

15. $\frac{1}{5} + 2n = \frac{2}{3} + 3n$

16. $\frac{5y}{6} - 1 = \frac{3y}{4} + 2$

17. $\frac{m}{3} = \frac{m}{2} - 1$

18. $\frac{x}{8} = \frac{x}{4} + 2$

19. $-\frac{3}{4}x + 5 = \frac{9}{8}x - 10$

20. $6 - 12x = 8 + 7x$