

**Combine Like Terms**

$$5(x + 3) + (4x - 7y) + (3x + 2y) = 5x + 15 + 4x - 7y + 3x + 2y = 12x + 15 - 5y$$

Combine like terms.

1.  $-2x + 3y - 5x - 8y + 9y =$

$$\underline{-7x + 20y}$$

2.  $3x + (-3y) - (5x) + y =$

$$\underline{-2x - 2y}$$

3.  $7 - 4y + x + 9y =$

$$\underline{7 + x + 5y}$$

4.  $-21x + (-2x) =$

$$\underline{-23x}$$

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

$$\underline{-3x - 27y}$$

6.  $-n + 9n + 3 - 8 - 8n =$

$$\underline{-5}$$

7.  $4(x + 5y) + 3(x + 6y) + 6(3x + 8y) =$

$$\underline{25x + 86y}$$

8.  $12x + 6x + 9x - 3y + -7y + y =$

$$\underline{27x + 86y}$$

9.  $-2(c - d) + (c - d) - 6(c - d) =$

$$\underline{-7c + 7d}$$

10.  $-3(4x + -2y) - 2(x + 3y) - 2(2x + 6y) =$

$$\underline{-18x - 12y}$$

11.  $3(-4x + 7y) - 3x(2 + 3y)$

$$\underline{-18x - 9xy + 21y}$$

12.  $2y + 3(2y + 8x) - 3(8y + 2x)$

$$\underline{-16y + 18x}$$

13.  $5(3x^2 - 2y^2) + 3x(x + 3y^2)$

$$\underline{18x^2 + 9xy^2 - 10y^2}$$

14.  $2 \bullet 4x \bullet 3y - 4x \bullet 7y$

$$\underline{-4xy}$$

15.  $3x + 4y + 2x + 5y - 4x$

$$\underline{x + 9y}$$

16.  $4(x + 5y) + (5x + y) =$

$$\underline{9x + 21y}$$

17.  $5(x^2 + 3y^2) - y(x^2 + 5y) =$

$$\underline{5x^2 - x^2y + 10y^2}$$

18.  $3(2(-y^2 + y) - 3) - 3(2x + y) =$

$$\underline{8y + 38y}$$

19.  $4(x + 9y) - -2(2x + y) =$

$$\underline{8x + 38y}$$

20.  $7x + -2y^2 + 3xy^2 + 2x^2 + 5xy^2 =$

$$\underline{2x^2 + 7x + 8xy^2 - 2y}$$

# Skill #13



## Variables and Equations



Keep in mind...  
Triumph = Umph! added to Try

### Combining Like Terms

$$8x + 5y + -17x = -9x + 5y$$

1.  $9x + 4x$   $13x$

14.  $3.5y - 7.2y$   $-3.7y$

2.  $17x + x$   $18x$

15.  $-4.7y - 2.3y$   $-7y$

3.  $m + (-4m)$   $-3m$

16.  $3a + 5c - 9a$   $-6a + 5c$

4.  $-7x - 8x$   $-15x$

17.  $2x - 9x + 7$   $-7x + 7$

5.  $14a - 19a$   $-5a$

18.  $7x - 8 - 11x$   $-4x - 8$

6.  $-a + 9a$   $8a$

19.  $3x - 3y - 9x + 7y$   $-6x + 4y$

7.  $6xy + 5xy$   $11xy$

20.  $17x + 4 - 3x$   $14x + 4$

8.  $-9m - m$   $-10m$

21.  $3x - 7y - 12y$   $3x - 19y$

9.  $15a + (-11a)$   $4a$

22.  $11a - 13a + 15a$   $13a$

10.  $-14x + 13x$   $-x$

23.  $17x + 5a - 3x - 4a$   $14x + a$

11.  $5x^2y + 13x^2y$   $18x^2y$

24.  $6x + 9y + 2x - 8y + 5$   $8x + y + 5$

12.  $21xy + (-9xy)$   $12xy$

25.  $3xy + 4xy + 5x^2y + 6xy^2$   $7xy + 5x^2y + 6xy^2$

13.  $17x + 1$   $17x + 1$

26.  $-25y - 17y + 6xy - 3xy$   $42y + 3xy$

# Variables and Equations



...More Combining Like Terms

$$3(a + 2) + (2a - 6b) = 3a + 6 + 2a - 6b = 5a - 6b + 6$$

1.  $5t + 3r + 9t - 10r - 8$

$$14t - 7r - 8$$

2.  $4a + (-2b) + (-2a) + b$

$$2a - b$$

3.  $12x - 3y + x + 2y$

$$13x - y$$

4.  $-30x - (-1x)$

$$-29x$$

5.  $6(x - y) - 3(3x + y)$

$$-3x - 9y$$

6.  $17x + 3y + 30x - 5y$

$$47x - 2y$$

7.  $4p - 6q + 6q - 10p + q$

$$-6p + 8$$

8.  $r + 7 + 3r - 9 - 2r$

$$-2$$

9.  $8(x + y) + 3(x - y)$

$$11x + 5y$$

10.  $3(x + 7y) - 5(x + 7y) + 9(x + 7y)$

$$7(x + 7y) \text{ or } 7x + 49y$$

11.  $2(-2a^2 - 4d) - (-3a^2 + 17d)$

$$-a^2 - 25d$$

12.  $2(3(-x^2 + x) - 1) - 5x + 6x^2$

$$x^2 - 2$$

13.  $3(a + 2b) + -(b + 2a)$

$$a + 5b$$

14.  $-5(a - b) - (a - b) + 8(a - b)$

$$2a - 2b$$

15.  $-4(x + 5(-3xy + x)) - (10 + 15xy)$

$$45xy - 24x - 10$$

16.  $\frac{5}{8}c^2 - \frac{1}{4}d - \frac{3}{7}c^2 + \frac{3}{5}d$

$$\frac{11}{56}c^2 + \frac{7}{20}d$$

17.  $3 \cdot 5a - 7 \cdot 3b - 3 \cdot 2a + 2 \cdot 9b$

$$9a - 3b$$

18.  $2\frac{1}{2}xy - xy + 3\frac{1}{3}xy$

$$4\frac{5}{6}xy$$

19.  $6(x^2 + y^2) - 7(x^2 + y^2)$

$$-x^2 - y^2$$

20.  $4x - y + 2\frac{1}{2}x + 3\frac{1}{4}y$

$$6\frac{1}{2}x + 2\frac{1}{4}y$$

Simplifying Expressions

$$\begin{aligned}3n - 2n + 4r &= (3 - 2)n + 4r \\&= n + 4r\end{aligned}$$

Combine like terms.

1.  $7r + 2r - 4 = 9r - 4$

8.  $12p + 5pd - 3p + 6pd = 9p + 11pd$

2.  $23x - 7x + 4x = 20x$

9.  $4x - 2x + 6xy + 21x + -9xy - 9 = 23x + -3xy - 9$

3.  $3xy + 13xy - 12xy = 4xy$

10.  $4e + 5ed + 4d - 7ed + 7 = 4e + 4d - 2ed + 7$

4.  $-3n + 12 - 4n = -7n + 12$

11.  $3x + 2y - 2xy + 5x - 2xy = 8x - 4xy + 2y$

5.  $12ax - 2ax + 14x - 2a + -3x = 10ax + 11x - 2a$

12.  $7a + a - a + 3ab - ab + 2ab = 7a + 4ab$

6.  $3x + 2y + xy - 6xy + 4x + -4y = 7x - 2y - 5xy$

13.  $5m + 2m + 40m + m + 17 = 48m + 17$

7.  $2r + 4ry - 5r + 3x - 4ry = -3r + 3x$

14.  $2x + 3xy + 4x + 5xy + 6x = 12x + 8xy$

**Simplifying Expressions**

$$\begin{aligned} 5r - 3r + 4k &= (5 - 3)r + 4k \\ &= 2r + 4k \end{aligned}$$

Combine like terms.

1.  $6r + 5r - 8p + 6p + 7(2r - 4r) =$   
 $-3r - 2p$

8.  $12p + 5pd - 3p + 6pd =$   
 $9p + 11pd$

2.  $9x - 7x + 2x + 8(6x + 2x) =$   
 $68x$

9.  $3(x - 5x) + 2(xy + 8x) + (-8xy) =$   
 $4x - 6xy$

3.  $5xy - 12xy + 12xy - 9(x + y) =$   
 $5xy - 9x - 9y$

10.  $-2a - 3(a + 7) - 4(-a + b) =$   
 $5a - 4b + 21$

4.  $2t + 12t - 4(n + 4n) =$   
 $14t - 20n$

11.  $4n(x - y) + 3n(x + y) - 2 =$   
 $7nx - ny - 2$

5.  $-2(g + 5g) + -4(8f - (-12g)) =$   
 $-60g - 32f$

12.  $3(h - (-k)) + 2(-3h + -4k) =$   
 $-3h - 5k$

6.  $7(2x + 5y) + xy - 6(3xy + 5x) =$   
 $-16x + 35y - 17xy$

13.  $8(2x + 2y) - 4(3xy - (-5x)) =$   
 $-4x + 16y - 12xy$

7.  $5m + 6mn - (-9n) + 2(m-n) =$   
 $7m + 6mn + 7n$

14.  $3c - 4bc + (-7b) + 3(2bc - b) =$   
 $3c + 2bc - 10b$

**Solving One-Step Equations (Addition and Subtraction)**

$$\begin{aligned} 12 + x &= -13 \\ 12 + -12 + x &= -13 + -12 \\ x &= -25 \end{aligned}$$

Solve each equation for the given variable.

1.  $y - 12 = 15$

$y = 27$

2.  $x - 13 = -23$

$x = -12$

3.  $12 + g = 14$

$g = -2$

4.  $3 + x = 9$

$x = 6$

5.  $-13 + x = 18$

$x = 31$

6.  $-t + -7 = -56$

$t = 49$

7.  $27 = v + -5$

$v = 32$

8.  $-19 + b = 31$

$b = 50$

9.  $a + 5.7 = 18.9$

$a = 13.2$

10.  $-100 = b + -73$

$b = -27$

11.  $-4 = x - 3$

$x = -1$

12.  $2\frac{1}{3} + r = 4\frac{2}{9}$

$r = \frac{18}{9}$

13.  $x + 2 = 2(3 - 4)$

$x = -4$

14.  $-13 = n + (-36)$

$n = 23$

15.  $c - 3 = 4.7$

$c = 7.7$

16.  $r = 4.4 + 3.9$

$r = 8.3$

17.  $z + 3.5 = 3.7$

$z = 0.2$

18.  $s - 9 = (6 + -8)$

$s = 7$

19.  $n + \frac{1}{2} = \frac{3}{4}$

$n = \frac{1}{4}$

20.  $12 - u = 19$

$u = 7$

**Solving Basic Equations**

$$\begin{aligned}
 9x + 3 &= 21 \\
 9x + 3 - 3 &= 21 - 3 \\
 9x &= 18 \\
 x &= 2
 \end{aligned}$$

Solve each equation for the given variable.

1.  $5n - 8 = -23$

$n = -3$

2.  $6x - 2 = 22$

$x = 4$

3.  $5t - 8 = -18$

$t = -2$

4.  $6x - 5 = -41$

$x = -6$

5.  $13x + 7 = -32$

$x = -3$

6.  $2x + 8 = 6$

$x = -1$

7.  $-8(r - 2) = 40$

$r = -3$

8.  $2(w - 6) = 8$

$w = 10$

9.  $2(f + 7) - 8 = 22$

$f = 8$

10.  $3x - 4 = -16$

$x = -4$

11.  $2 + \frac{1}{5}x = -7$

$x = -45$

12.  $-6 = \frac{3u}{4} + 12$

$u = -24$

13.  $7.2 + 4x = 19.2$

$x = 3$

14.  $-3 + 2n = -15$

$n = -6$

15.  $5 - \frac{1}{2}g = 12$

$g = -14$

16.  $4k + 7 = -1$

$k = -2$

17.  $3(c - 2) = 15$

$c = 7$

18.  $7h + 1 = -13$

$h = -2$

19.  $5e + -4 = 26$

$e = 6$

20.  $\frac{m}{3} - 7 = -10$

$m = -9$

**Solving Equations with 2 Operations**

$$\begin{aligned}
 3y - 6 &= 30 \\
 3y - 6 + 6 &= 30 + 6 \\
 3y &= 36 \\
 \frac{3y}{3} &= \frac{36}{3} \\
 y &= 12
 \end{aligned}$$

Solve each equation for the given variable.

1.  $-8r - 7 = -24$   
 $r = 8$

8.  $13n - 13 = -12$   
 $n = \frac{1}{13}$

2.  $5x - 5 = -10$   
 $x = -1$

9.  $23x - 12 = -33$   
 $x = \frac{-21}{23}$

3.  $9 = 3y + 5$   
 $y = \frac{4}{3}$

10.  $-42 = 6b + 8$   
 $b = \frac{25}{3}$

4.  $12 = 6c - 4$   
 $c = \frac{16}{6}$

11.  $16 + 4y = -32$   
 $y = -12$

5.  $-23 = 3e - (-9)$   
 $e = \frac{-32}{3}$

12.  $16 + \frac{r}{2} = -11$   
 $r = -54$

6.  $16 = -2v + 9$   
 $v = \frac{-7}{2}$

13.  $2x - 5 = 16$   
 $x = \frac{21}{2}$

7.  $\frac{3y}{4} = 12$   
 $y = 16$

14.  $11 = 3y - 10$   
 $y = 7$

**Solving Basic Equations**

$$\begin{aligned}
 12x + 3 &= 147 \\
 12x + 3 - 3 &= 147 - 3 \\
 12x &= 144 \\
 x &= 12
 \end{aligned}$$

Solve each equation for the given variable.

1.  $3(x - 7) = 9$

$x = 10$

2.  $\frac{m}{4} + 6 = 2$

$m = -16$

3.  $4(c + 2) = -28$

$c = -9$

4.  $-9r + 5 = -22$

$r = 3$

5.  $4 + 3g = -14$

$j = -6$

6.  $7t - 3 + 4t = -25$

$t = -2$

7.  $14a + 5 - 8a = -1$

$a = -1$

8.  $2m - 3 - 8m = -27$

$m = 4$

9.  $-5 + 7d + 3 = 33$

$d = 5$

10.  $b + 9 - 2b = 6$

$b = 3$

11.  $4j - 9j + 3 = -32$

$j = 7$

12.  $3d - 5 - 2d = -9$

$d = -4$

13.  $2k + 3(k + 4) = -3$

$k = -3$

14.  $3e + 4e + 1 = 36$

$e = 5$

15.  $5(j - 4) + j = -8$

$j = 2$

16.  $12k - 3(k + 5) = 48$

$k = 7$

17.  $-6r + 12 - 8r = -2$

$r = 1$

18.  $-j + 3j + 2 = -14$

$j = -8$

19.  $5(m - 3) + 2m = 27$

$m = 6$

20.  $4e + 6 - 11e = -8$

$e = 2$

**Solving Equations**

$$\begin{aligned}
 3x + 5 &= 4x + 6 \\
 3x - 4x + 5 &= 4x - 4x + 6 \\
 -x + 5 &= 6 \\
 -x + 5 - 5 &= 6 - 5 \\
 -x &= 1 \\
 \frac{-x}{-1} &= \frac{1}{-1} \\
 x &= -1
 \end{aligned}$$

Solve each equation for the given variable.

1.  $3m - 8 = 5m + 8$

$m = \frac{-15}{2}$

8.  $23b + 9 = 4b + 66$

$b = 3$

2.  $-t + 9 = t + 5$

$t = 2$

9.  $-4g + 12 = g + 2$

$g = 2$

3.  $7y - 7 = 5y + 13$

$y = 10$

10.  $-8t = 27 + t$

$t = -3$

4.  $4h + 10 = 2h - 22$

$h = -16$

11.  $13y - 26 = 7y + 22$

$y = 8$

5.  $-r - 3 = 1 - 3r$

$r = 2$

12.  $4n - 6 = 6n + 14$

$n = -10$

6.  $17 + p = 7p - 13$

$p = 5$

13.  $e + 8 = 2e - 12$

$e = 20$

7.  $4x - 7 = 2x + 7$

$x = 7$

14.  $9w + 6 = 6w - 15$

$w = -7$

**Solving Equations with Variables on Both Sides**

$$\begin{aligned}
 6x - 7 &= x + 23 \\
 6x - x - 7 &= x - x + 23 \\
 5x - 7 &= 23 \\
 5x &= 30 \\
 x &= 6
 \end{aligned}$$

Solve each equation for the given variable.

1.  $2x - 7 = 3x + 4$

$x = -11$

2.  $-7c + 9 = c + 1$

$c = 1$

3.  $4(2y - 4) = 5y + 2$

$y = 6$

4.  $-6 - 2n = 3n - (6 + 5)$

$n = 5$

5.  $4(t + 5) - 3 = 6t - 13$

$t = 15$

6.  $2(r - 4) = 5(r + -7)$

$r = 9$

7.  $7 - 6a = 6 - 7a$

$a = -1$

8.  $12m - 9 = 4m + 15$

$m = 3$

9.  $8(x - 3) + 8 = 5x - 22$

$x = -2$

10.  $3c - 12 = 14 + 5c$

$c = -13$

11.  $9a + 5 = 3a - 1$

$a = -1$

12.  $6(x - 9) = 4(x - 5)$

$x = 17$

13.  $2(x - 4) + 8 = 3x - 8$

$x = 8$

14.  $3x - 3 = -3x + -3$

$x = 8$

15.  $-10x + 6 = -7x + -9$

$x = 5$

16.  $5 + 3x = 7(x + 3)$

$x = -4$

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

$x = 6$

18.  $2x + 6 = 5x - 9$

$x = 5$

19.  $4e - 19 = -3(e + 4)$

$e = 1$

20.  $5t + 7 = 4t - 9$

$t = -16$

# Skill #14



## Variables and Equations



### Solving Equations with Variables on Both Sides

$$\begin{aligned}
 4x - 6 &= x + 9 \\
 4x - x - 6 &= x - x + 9 \\
 3x - 6 &= 9 \\
 3x - 6 + 6 &= 9 + 6 \\
 \frac{3x}{3} &= \frac{15}{3} \\
 x &= 5
 \end{aligned}$$

1.  $4x - 6 = x + 9$   $x = 15$

11.  $5x - 7 = -10x + 8$   $x = 1$

2.  $4 - 7x = 1 - 6x$   $x = 3$

12.  $7y + 3 = 4y - 18$   $y = -7$

3.  $-4x - 3 = -6x + 9$   $x = 6$

13.  $-3(y + 3) = 2y + 3$   $y = -2\frac{2}{5}$

4.  $41 - 2n = 2 + n$   $n = 13$

14.  $2(-3a + 5) = -4(a + 4)$   $a = 13$

5.  $6(2 + y) = 3(3 - y)$   $y = -\frac{1}{3}$

15.  $7x - 3 = 2(x + 6)$   $x = 3$

6.  $4y = 2(y - 5) - 2$   $y = -6$

16.  $-6x + 9 = 4(5 - x)$   $x = -5\frac{1}{2}$

7.  $6x - 9x - 4 = -2x - 2$   $x = -2$

17.  $3(x + 2) = -5 - 2(x - 3)$   $x = -1$

8.  $-(x + 7) = -6x + 8$   $x = 3$

18.  $2(x - 3) = (x - 1) + 7$   $x = 12$

9.  $3 - 6a = 9 - 5a$   $a = -6$

19.  $\frac{1}{3}(6y - 9) = -2y + 13$   $y = 4$

10.  $-9x + 6 = -x + 4$   $x = \frac{1}{4}$

20.  $\frac{1}{6}(12 - 6x) = 5(x + 4)$   $x = -3$

# Skill #14



## Variables and Equations

Equations, the Big Picture...Putting It All Together

$$1. \frac{3}{2}x - 9 = 0 \quad x = 6$$

$$2. 6x + 3 = -5x + 14 \quad x = 1$$

$$3. \frac{1}{8}x + 3 = 2 \quad x = -8$$

$$4. 5y = 2y - 42 - 3y \quad y = -7$$

$$5. 37 + 8x = 4(7 - x) \quad x = -\frac{3}{4}$$

$$6. 5(2 - x) = 7x - 26 \quad x = 3$$

$$7. 6 + 4x = \frac{1}{3}(6x + 9) \quad x = -\frac{3}{2}$$

$$8. 1.6(3y - 1) + 2 = 5y \quad y = 2$$

$$9. 7x - 10 = 6(11 - 2x) \quad x = 4$$

$$10. 3(4x - 9) = 5(2x - 5) \quad x = 1$$

$$11. \frac{3}{4}(x + 7) = x + 50 \quad x = -179$$

$$12. \frac{5}{7}y - 15 = 5y + 30 \quad y = -10\frac{1}{2}$$

# Skill #14

## Algebraic Fractions

### Proportions



$$\frac{x}{12} = \frac{5}{3}$$

A pipe delivers 5 gallons of water in 45 seconds.  
How much will it deliver in 15 minutes?

$$3x = 12 \cdot 5$$

$$3x = 60$$

$$x = 20$$

$$\frac{5 \text{ gal}}{45 \text{ sec}} = \frac{x \text{ gal}}{15 \cdot 60 \text{ sec}}$$

$$45x = 5 \cdot 900$$

$$45x = 4500$$

$$x = 100$$

100 gallons

1.  $\frac{9}{11} = \frac{16}{x}$   $x = 19\frac{5}{9}$     2.  $\frac{5}{13} = \frac{a}{65}$   $a = 25$     3.  $\frac{y}{2.5} = \frac{21}{5}$   $y = 10.5$

4.  $\frac{z-8}{21} = \frac{1}{3}$   $z = 15$     5.  $\frac{2x+1}{3} = \frac{4}{5}$   $x = \frac{7}{10}$     6.  $\frac{n}{16-n} = \frac{5}{3}$   $n = 10$

7.  $\frac{2x+1}{9} = \frac{x}{4}$   $x = 4$     8.  $\frac{3m}{m+4} = \frac{5}{3}$   $m = 5$     9.  $\frac{x-2}{x} = \frac{x-1}{x+2}$   $x = 4$

10. If 30m of wire weigh 8 kilograms, what will 40m of the same kind of wire weigh?

$10\frac{2}{3} \text{ kg}$

11. On a map,  $1\frac{1}{2}$  cm represents 60 km. What distance does 6 cm represent?

240 km

12. A post casts a shadow 9 feet long. A girl 5 feet tall casts a shadow 15 feet long at the same time and place. How tall is the pole?

3 ft

13. If Marilyn drove 270 miles in  $4\frac{1}{2}$  hours, how far would she travel in 7 hours?

420 miles

14. The sales tax on an \$800 purchase is \$24. At this rate, what is the tax on a \$600 purchase?

\$18