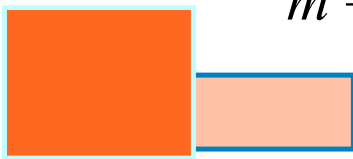## Parallel and Perpendicular Lines

Example:

Determine the equation of the line that passes through the point $(-4, 3)$, and is parallel to the line $y = 2x - 6$.

equation of a line: $y = mx + b$

1. Determine m

2. Determine b

1 Since the lines are parallel, they have the same slope.

$$m = 2$$

$$\therefore y = 2x + 11$$

2 Using the point as x and y, and m, fill in these values and solve for b.

$$y = mx + b$$

$$3 = 2(-4) + b$$

$$3 = -8 + b$$

$$3 + 8 = -8 + 8 + b$$

$$11 = b$$

Example:

Determine the equation of the line that passes through point $(6, -1)$ and is perpendicular to the line $y = 3x + 5$.

1. Perpendicular means that the slope is going to be the negative reciprocal of 3.

$$3 = \frac{3}{1} \longrightarrow \therefore m = -\frac{1}{3}$$

2. With the point, we know an x value and a y value, and we know m, so find b.

$$y = mx + b$$

$$-1 = -\frac{1}{3}(6) + b$$

$$-1 = -2 + b$$

$$-1 + 2 = -2 + 2 + b$$

$$1 = b$$

$$\therefore y = -\frac{1}{3}x + 1$$

General Form

1. Standard, or Function form of a Line

$$y = mx + b$$

Example: $y = -3x + 7$

2. General Form of a Line

$$Ax + By + C = 0 \, , \quad \text{where } A, B \text{ \& } C$$

are integers

Example: $5x - 3y + 12 = 0$

Converting from One Form to Another

1. From function form to general form.

   Example: Convert $y = 2x + 7$ to general form.

   $$Ax + By + C = 0$$

   Since one side equals 0, get rid of the y.

   $$y - y = 2x - y + 7$$
   $$0 = 2x - y + 7$$
   $$2x - y + 7 = 0$$

Example: Convert $y = \dfrac{2}{3}x - 4$ to general form.

$$y - y = \dfrac{2}{3}x - y - 4$$

$$0 = \dfrac{2}{3}x - y - 4$$

But we can't have fractions in general form.

$$0 \times 3 = \left(\dfrac{2}{3}x - y - 4 \right) \times 3$$

$$0 = 2x - 3y - 12$$

Convert $y = 2.9x + 4.2$ into general form.

$$0 = 2.9x - y + 4.2$$

1 place   1 place   ×10   no decimals

decimal
moves
right
one place

$$10 \cdot \left(0 = 2.9x - y + 4.2 \right)$$

$$0 = 29x - 10y + 42$$

a) Convert $y = 0.05x + 2.003$ to general form

$$0 = 0.05x - y + 2.003$$

2 places   3 places

$$1000 \cdot (0 = 0.05x - y + 2.003)$$
$$0 = 50x - 1000y + 2003$$

b) Convert $y = \dfrac{5}{6}x - \dfrac{1}{4}$ to general form

$$0 = \frac{5}{6}x - y - \frac{1}{4}$$

LCM = 12
4, 6

$$12\left(0 = \frac{5}{6}x - y - \frac{1}{4}\right)$$

$$\boxed{0 = 10x - 12y - 3}$$

×24

$$\boxed{0 = 26x - 24y - 6}$$

Coincident parallel

2. From General form to Function form.

Example: Convert $3x + 2y - 10 = 0$ to function form. $y = mx + b$

We need to isolate y. ⟶ $3x + 2y - 2y - 10 = 0 - 2y$

$$3x - 10 = -2y$$

$$\frac{3x - 10}{-2} = \frac{-2y}{-2}$$

$$y = -1.5x + 5$$

Example: Convert $6x - 5y + 15 = 0$ to function form.

$$6x - 5y + 5y + 15 = 0 + 5y$$

$$6x + 15 = 5y$$

$$\frac{6x + 15}{5} = \frac{5y}{5}$$

$$\frac{6}{5}x + 3 = y$$

$$y = 1.2x + 3$$