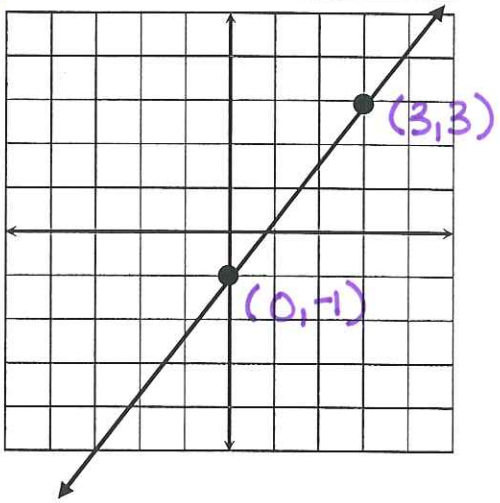
Key!

2.4 More About Linear Equations

How to Write an Equation of a Line	
Slope-Intercept Form When given the slope m and the y-intercept b use this equation:	$y = mx + b$
Point-Slope Form When given the slope m and a point (x_1, y_1) use this equation:	$y - y_1 = m(x - x_1)$
Two Points When given two points (x_1, y_1) *and* (x_2, y_2), use the slope formula. Then, use the point-slope form with this slope and one of the two given points.	① Find slope $m = \frac{y_2 - y_1}{x_2 - x_1}$ ② use point-slope form or $y = mx + b$

Example 1: Write an equation of the line shown below.



$m = \frac{4}{3}$ $b = -1$

$y = \frac{4}{3}x - 1$

$m = \frac{3+1}{3-0} = \frac{4}{3}$

$y + 1 = \frac{4}{3}(x - 0)$

or

$y - 3 = \frac{4}{3}(x - 3)$

Example 2: Write and equation of the line that passes through $(-3, 4)$ and has a slope of $\frac{2}{3}$.

$y - 4 = \frac{2}{3}(x + 3)$

$y - 4 = \frac{2}{3}x + 2$

$+4 \quad +4$

$y = \frac{2}{3}x + 6$

Example 3: Write and equation of the line that passes through $(1, 5)$ *and* $(4, 2)$.

$m = \frac{2-5}{4-1} = \frac{-3}{3} = -1$

$y - 5 = -1(x - 1)$

$y - 5 = -x + 1$

$+5 \quad +5$

$y = -x + 6$

OR

$5 = -1(1) + b$

$5 = -1 + b$

$+1 \quad +1$

$6 = b$

$y = -x + 6$

STANDARD FORM: $Ax + By + C = 0$

where A and B $\neq 0$.

Example 4: Write and equation of the line that passes through $(3, 0)$ *and* $(-3,\ 1)$ in standard form.

$m = \frac{1-0}{-3-3} = \frac{1}{-6}$

$y - 0 = -\frac{1}{6}(x-3)$

$y = -\frac{1}{6}x + \frac{1}{2}$

Standard Form:

$\left[y = -\frac{1}{6}x + \frac{1}{2}\right]6$

$6y = -x + 3$

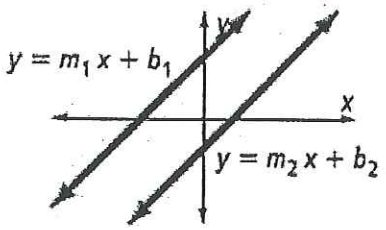
$+x \quad -3$

$x + 6y - 3 = 0$

take note

Key Concepts Parallel and Perpendicular Lines

The slopes of **parallel lines** are equal.

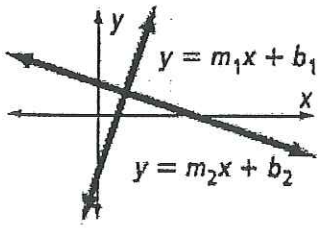


$m_1 = m_2$

$b_1 \neq b_2$

No line can be vertical.

The slopes of **perpendicular lines** are negative reciprocals of each other.



$m_1 \cdot m_2 = -1$

$m_1 = \frac{1}{m_2}$

$m_2 = \frac{1}{m_1}$

m_1 and m_2 are negative reciprocals of each other.

Example 5: Write an equation of the line that passes through $(1, -3)$ and is parallel to the line $y = 6x - 2$. $m = 6$ $(1, -3)$

$y + 3 = 6(x-1)$

$y + 3 = 6x - 6$

$-3 \quad -3$

$y = 6x - 9$

$-y \quad -y$

Standard Form:

$6x - y - 9 = 0$

Example 6: Write an equation of the line that passes through $(8, -5)$ and is perpendicular to the line $y = -4x + \frac{2}{3}$. $m = \frac{1}{4}$ $(8, -5)$

$y + 5 = \frac{1}{4}(x-8)$

$y + 5 = \frac{1}{4}x - 2$

$-5 \quad -5$

$y = \frac{1}{4}x - 7$

X-INTERCEPT: $(x, 0)$ — set $y=0$ and solve.

Y-INTERCEPT: $(0, y)$ — set $x=0$ and solve.

Example 7: Graph $x + 2y - 4 = 0$ using the *x*- and *y-intercepts.*

X-intercept: $y=0$ $\quad x+2(0)-4=0$

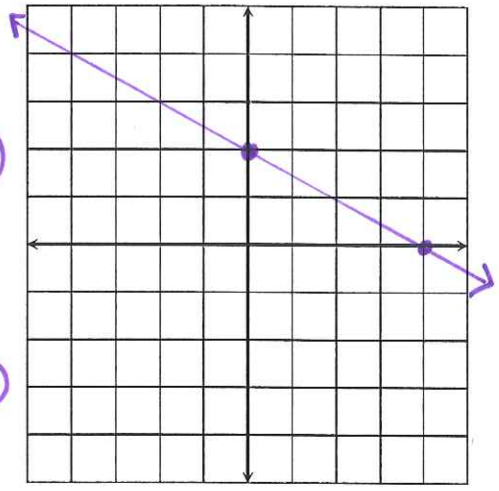
$x-4=0$

$x=4 \quad (4,0)$

Y-intercept: $x=0 \quad 0+2y-4=0$

$2y=4$

$y=2 \quad (0,2)$



$m=-\frac{2}{4}=-\frac{1}{2} \quad b=2$

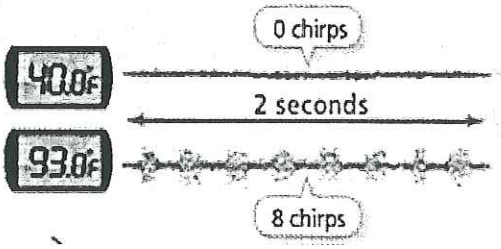
$y=-\frac{1}{2}x+2$

Example 8: The number of times a cricket chirps per minute depends on the temperature. The number of chirps in 2 seconds for two temperatures are shown at the right.

a) What is the equation of the line in standard form?
   a. Find the number of chirps per minute (x= temperature, y=chirps)
   b. If the temperature is 70°*F*, how many times would a cricket be expected to chirp in one minute?

$x=40°F \quad y=30(0) \quad (40, 0)$

$x=93°F \quad y=30(8) \quad (93, 240)$



$m=\frac{240-0}{93-40}=\frac{240}{53}\approx 4.5$

$y-0=4.5(x-40)$

$y=4.5x-180$

b) $y=4.5(70)-180$

$315-180=135$

If the temp is 70°F the cricket would chirp 135 times in one minute.