Algebra 2 Notes Name: Key
Section 2.4 – Writing Linear Functions

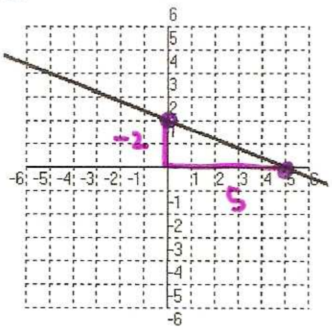
DAY ONE:

Recall from Section 2.3 that the slope-intercept form of a linear equation is $y = mx + b$, where m is the slope and b is its y-intercept.

In order to write an equation of a line in slope-intercept form, you would need both the slope and y-intercept.

Example 1: Write the equation of the graphed line in slope-intercept form.

a.

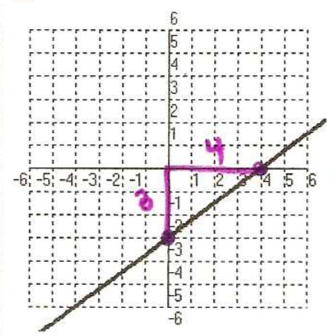


$m = -\frac{2}{5}$

$b = 2$

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

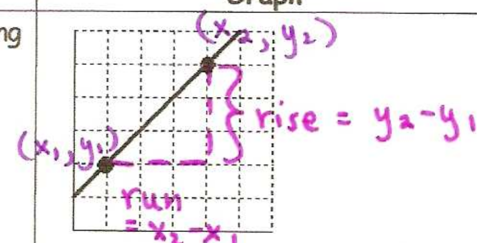
b.



$m = \frac{3}{4}$

$b = -3$

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

Slope Formula		
Words	**Algebra**	**Graph**
Given two points on a line, the slope is the ratio of the difference in the y-values to the difference in the corresponding x-values, or rise over run.	The slope of the line containing (x_1, y_1) and (x_2, y_2) is $m = \frac{y_2 - y_1}{x_2 - x_1}$	

Example 2: Find the slope of each line.

a. line through $(3, -2)$ & $(-1, 2)$

$(-1)\ (2)$

$m = \frac{-2 - 2}{3 + 1}$

$m = \frac{-4}{4}$

$\boxed{m = -1}$

b.

+3 +3 +3

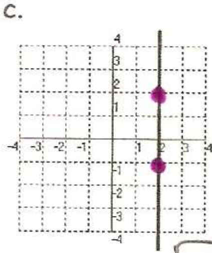
x	2	5	8	11
y	1	6	11	16

+5 +5 +5

$m = \frac{\Delta y}{\Delta x}$

$\boxed{m = \frac{5}{3}}$

c.



$m = \frac{\text{rise}}{\text{run}}$

$m = \frac{3}{0}$

$\boxed{m = \text{undefined}}$

Because the slope of a line is constant, it is possible to use ANY point of a line and the slope of the line to write an equation of the line in point-slope form.

Point-Slope Form

The equation of a line with a slope of m and the point (x_1, y_1) is $y - y_1 = m(x - x_1)$.

Example 3: Write the equation of each line in slope intercept form.

a.

x	-3	-1	1	3
y	1.5	1	0.5	0

+2

−0.5

use point (3, 0)

$m = \frac{\Delta y}{\Delta x}$

$m = \frac{-0.5}{2}$

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

$y - y_1 = m(x - x_1)$

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

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

b. with slope -5 and through the point $(1, 3)$

$y - y_1 = m(x - x_1)$

$y - 3 = -5(x - 1)$

$y - 3 = -5x + 5$

$\quad\; +3 \qquad\qquad\;\; +3$

$\boxed{y = -5x + 8}$

c. through the points $(-2, -3)$ and $(2, 5)$

$(-2, -3)$

$m = \frac{5 + +3}{2 + +2}$

$m = \frac{8}{4}$

$m = 2$

$y - y_1 = m(x - x_1)$

$y + +3 = 2(x + +2)$

$y + 3 = 2x + 4$

$\quad\; -3 \qquad\quad\; -3$

$\boxed{y = 2x + 1}$

Example 4: Application

In the game of Monopoly, a player who lands on a property that is owned by another player must pay rent to the owner of the property. For most color properties, the rent can be modeled by a linear function of the selling price.

(a) Express the rent as a function of the selling price.

Monopoly Price and Rates		
Property Name	**Selling Price (\$)** x	**Rent (\$)** y
Mediterranean Avenue	60	2
Vermont Avenue	100	6
Tennessee Avenue	180	14
Marvin Gardens	280	24
Pennsylvania Avenue	320	28

+40 +4

$m = \frac{\Delta \text{rent}}{\Delta \text{selling price}}$

$m = \frac{4}{40}$

$m = \frac{1}{10}$

$y - y_1 = m(x - x_1)$

$y - 2 = \frac{1}{10}(x - 60)$

$y - 2 = \frac{1}{10}x - 6$

$\quad\; +2 \qquad\qquad\quad +2$

$\boxed{y = \frac{1}{10}x - 4}$

(b) How much is the rent for Illinois Avenue, which has a selling price of \$240?

$x = 240$

$y = \frac{1}{10}(240) - 4$

$y = 24 - 4$

$y = 20$

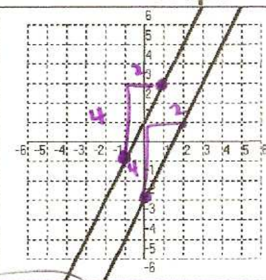
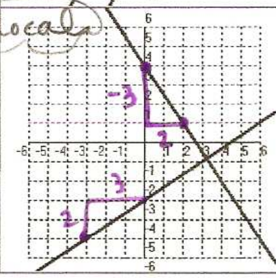
$\boxed{\$20}$

DAY TWO:

By comparing slopes, you can determine if lines are parallel or perpendicular. You can also write equations of lines that meet certain needs.

$\parallel$ = parallel $\perp$ = perpendicular

Parallel and Perpendicular Lines

Words	Algebra	Graph
Parallel Lines – If both slopes are defined, the slopes of parallel lines are equal. The slopes of parallel vertical lines are undefined.	$y_1 = 2x+1$ $m_1 = 2$ $y_2 = 2x+3$ $m_2 = 2$ $2 = 2$ same $m_1 = m_2$ parallel $\parallel$	 $m_1 = \frac{4}{2}$ $m_1 = 2$ $m_2 = \frac{4}{2}$ $m_2 = 2$
Perpendicular Lines – If both slopes are defined, the slopes of perpendicular lines are opposite reciprocals. Their product is -1. A vertical line and a horizontal line are perpendicular.	opp reciprocal $y_1 = -\frac{3}{2}x+4$ $m_1 = -\frac{3}{2}$ $y_2 = \frac{2}{3}x-3$ $m_2 = \frac{2}{3}$ $\left(-\frac{3}{2}\right)\left(\frac{2}{3}\right) = -1$ ✓ $\perp$	 $m_1 = -\frac{3}{2}$ $m_2 = \frac{2}{3}$

Example 1: Given the slope of a line, find the slope of a line that is parallel to it and the slope of a line that is perpendicular to it.

a. $\frac{2}{3}$	b. -5	c. 1	d. 0	e. $-\frac{5}{2}$
$m_{\parallel} = \frac{2}{3}$, $m_{\perp} = -\frac{3}{2}$	$m_{\parallel} = -5$ $m_{\perp} = \frac{1}{5}$	$m_{\parallel} = 1$ $m_{\perp} = -1$	$m_{\parallel} = 0$ $m_{\perp}$ = undefined	$m_{\parallel} = -\frac{5}{2}$ $m_{\perp} = \frac{2}{5}$

Example 2: Determine if each pair of lines is parallel, perpendicular, or neither.

a. $x+y=5 \rightarrow y = -1x+5$ $x-y=-6$ $y = 1x+6$ $m=-1$ $m=1$ $\boxed{\perp}$	b. $2x+3y=6$ $3y=-2x+6$ $y = -\frac{2}{3}x+2$ $y=-\frac{2}{3}x-5$ $m=-\frac{2}{3}$ $m=-\frac{2}{3}$ $\boxed{\parallel}$	c. $x=5$ m= undefined $y=-2$ m=0 $\boxed{\perp}$

Example 3: Write the equation of each line in slope-intercept form.

a. parallel to $y=1.5x+6$ & through $(4,5)$ $m = 1.5$ or $\frac{3}{2}$ so $m_{\parallel} = \frac{3}{2}$ $y-y_1 = m(x-x_1)$ $y-5 = \frac{3}{2}(x-4)$ $y-5 = \frac{3}{2}x - 6$ $+5$ $+5$ $\boxed{y = \frac{3}{2}x - 1}$	b. perpendicular to $y=-\frac{3}{4}x+2$ & through $(6,-4)$ $m = -\frac{3}{4}$ so $m_{\perp} = \frac{4}{3}$ $y-y_1 = m(x-x_1)$ $y+4 = \frac{4}{3}(x-6)$ $y+4 = \frac{4}{3}x - 8$ -4 -4 $\boxed{y = \frac{4}{3}x - 12}$