

Section 2.3 Linear Functions and Slope

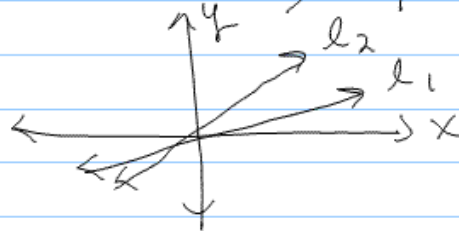
Note Title

10/16/2005

Slope

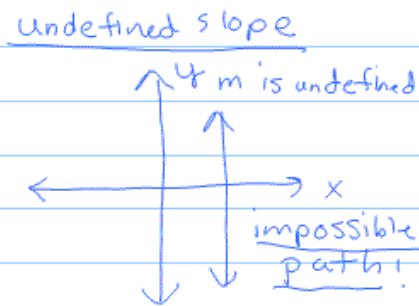
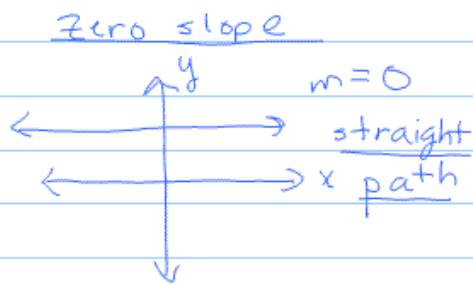
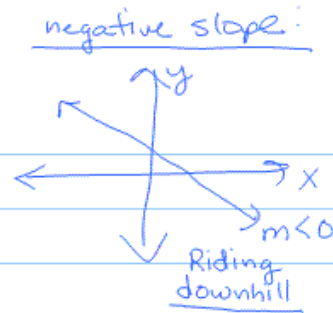
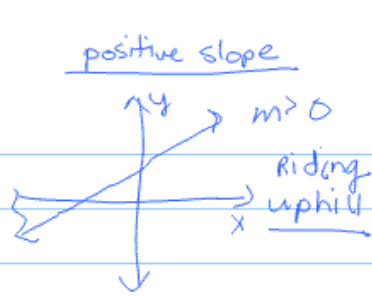
You can think of slope as a measure of the steepness of a line.

Suppose we are comparing the graphs of two lines, l_1 and l_2 :



If you ride your bike first up l_1 and then up l_2 (from left to right), then you would notice that l_2 is much steeper.

On page **218** of your book, table **2.2** gives the possibilities for a line's slope. Let's think of this in terms of riding your bike (from left to right)



Formula for slope of a line thru (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Note:

In the formula for slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

It does not matter which point you call (x_1, y_1) and which one you call (x_2, y_2) but you must always subtract in the same order in the numerator and the denominator.

Example:

Given two points $(4, -2)$ and $(2, -5)$

(a) let $(x_1, y_1) = (4, -2)$ and
 $(x_2, y_2) = (2, -5)$

then

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-2)}{2 - 4} = \frac{-5 + 2}{-2} = \frac{-3}{-2} = \left(\frac{3}{2}\right)$$

(b) If we let $(x_2, y_2) = (4, -2)$ and
 $(x_1, y_1) = (2, -5)$ then

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-5)}{4 - 2} = \frac{-2 + 5}{2} = \left(\frac{3}{2}\right)$$

same
thing!

Equations of Lines

point-slope equation: $y - y_1 = m(x - x_1)$.

You use this formula when you know a point on a line and the slope of a line.

(ex) find the point-slope equation for a line thru $(-1, 2)$ and $(3, 4)$.

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

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

slope-intercept form: $y = mx + b$,
where $m = \text{slope}$, $b = \text{y-intercept}$.

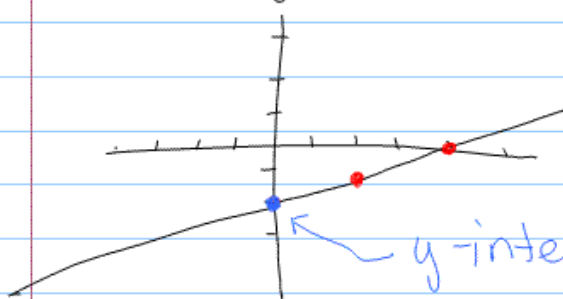
This form is very useful for
graphing.

ⓧ Write the above equation in slope-intercept form and graph it.

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

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

$$y = \frac{1}{2}x - 2 \quad \text{so } m = \frac{1}{2} \quad b = -2.$$



↑
Slope (m) = $\frac{1}{2}$
says "up 1, over 2"

Summary of Equations of Lines:

1. Point-slope equation: $y - y_1 = m(x - x_1)$
2. slope-intercept equation: $y = mx + b$
3. Horizontal line: $y = b$ through the point $(0, b)$
4. vertical line: $x = a$ through the point $(a, 0)$

Using Intercepts to Graph a Line

Another way to graph a line quickly and fairly easily is to find the x and y intercepts.

Example: Given the linear equation $6x - 3y + 12 = 0$, find the x and y intercepts and use them to graph the line.

Solution:

x -intercept: Let $y = 0$ and solve for x :

$$6x - 3(0) + 12 = 0$$

$$6x - 0 + 12 = 0$$

$$6x + 12 = 0$$

$$6x = -12$$

$$x = -2$$

We will graph the point $(-2, 0)$

y -intercept: Let $x = 0$ and solve for y :

$$6(0) - 3y + 12 = 0$$

$$-3y + 12 = 0$$

$$-3y = -12$$

$$y = 4$$

We will graph the point $(0, 4)$

Graph the line:

