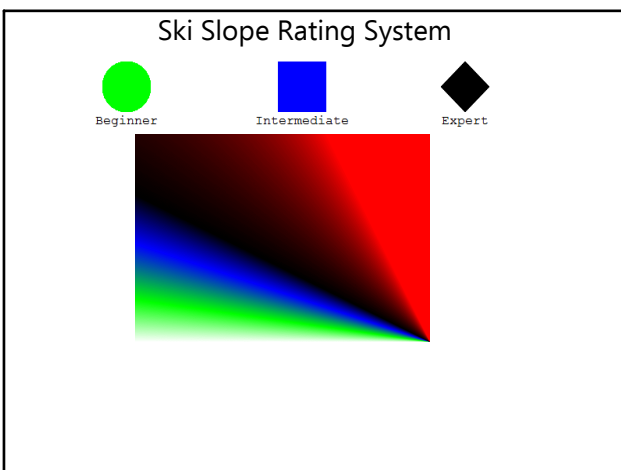


Precalculus
Objective:
Review slope and exploit it



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Question and Answer Time

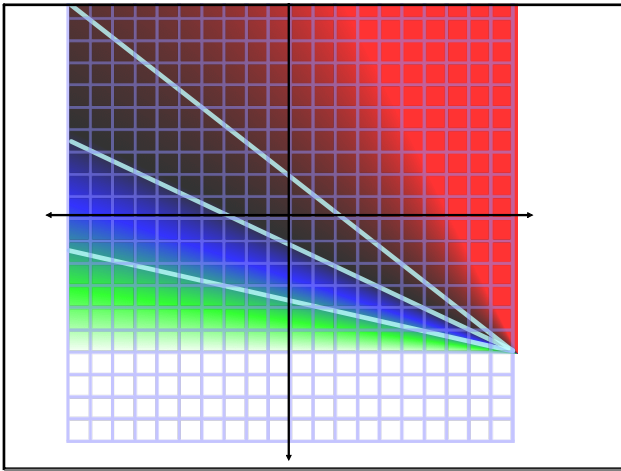
Q: Which of the 3 levels (green, blue, or black) should be the steepest?

A: *Black*

Q: What algebraic concept could we use to measure the steepness of these ski slopes?

A: $\frac{\text{Rise}}{\text{Run}}$

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So, slope measures the Steepness of a line.
 The larger the magnitude (aka absolute value) of the slope, the Steeper the line.

Definition. The **slope** m of a nonvertical line through (x_1, y_1) and (x_2, y_2) is

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

as long as $x_2 - x_1 \neq 0$

Another way to think about slope: It measures **how fast** the height of your function (the y -values) changes.

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WANT TO KNOW A CALCULUS SECRET?

CALCULUS IS ENTIRELY ABOUT SLOPE.

LET'S LEARN SLOPE WELL THIS YEAR.

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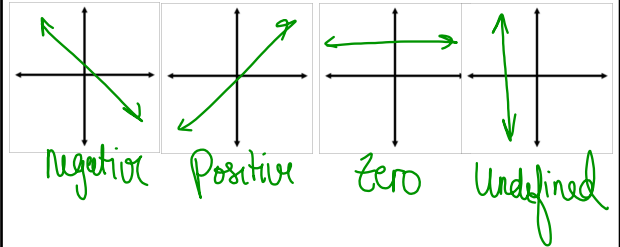
IN WORDS

To find the slope between two points:

$(2, 5)$ $(-3, 8)$

$$\text{Slope} = \frac{8-5}{-3-2} = \frac{3}{-5} = -\frac{3}{5}$$

Possibilities for a Line's Slope:



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Jul 30-12:30 PM

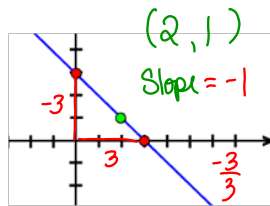
Point-Slope Form

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

$$y - 1 = -1(x - 2)$$

$$y - 1 = -x + 2$$

$$y = -x + 3$$



Example $2004 = 0$ $2005 = 1$

During 2004, Nike's net sales were \$12.25 billion, and in 2005 net sales were \$13.75 billion. Write a linear equation giving the net sales y in terms of the year x . Then use the equation to predict the net sales for this year.

$(0, 12.25)$
 $(1, 13.75)$

$$\text{Slope} = \frac{13.75 - 12.25}{1 - 0} = \frac{1.5}{1} = \$1.5 \text{ billion}$$

$2016 = 12$

$$y = 1.5x + 12.25$$

$$y = 1.5(12) + 12.25$$

$\$30.25 \text{ billion}$



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Slope-Intercept Form

Two important questions in coordinate geometry:

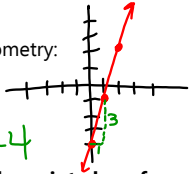
- Given a graph, find its equation.
- Given an equation, sketch its graph.

The second part is difficult to do given the point-slope form of a line.

Thus, we rely on the **slope-intercept form**:

$$y = mx + b$$

To get to this form, we simply need to solve for y .



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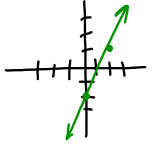
Example

Determine the slope and y-intercept of the following equations. Then use this information to sketch the graph. Check your answer on a graphing calculator.

a) $3x - 2y = 4$

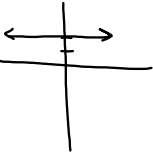
$$\begin{aligned} -2y &= -3x + 4 \\ \frac{-2y}{-2} &= \frac{-3x + 4}{-2} \\ y &= \frac{3}{2}x - 2 \end{aligned}$$

slope = $\frac{3}{2}$
y-int = -2
(0, -2)



b) $y = 2$

Slope = 0
y-int = 2



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Summary of Equations of Lines

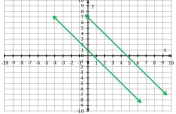
- General Form $Ax + By = C$
- Vertical Line $x =$
- Horizontal Line $y =$
- Slope-Intercept Form $y = mx + b$
- Point-Slope Form $y - y_1 = m(x - x_1)$

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Parallel Lines

Definition. Two lines are *parallel* if they do not intersect any point (i.e., if they have the same steepness).

Q: What do you notice about the slope of these two lines?
A: *Same slope*



Rules of Parallel Lines:

- Two non-vertical lines are parallel if and only if they have equal slope.
- Two distinct vertical lines (slope undefined) are parallel.

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Example

Write an equation for the line passing through $(-2, 5)$ and parallel to the line $6x+3y=-1$.

Express in slope-intercept form.

$$\begin{aligned} 6x+3y &= -1 \\ -6x & \quad -6x \\ \hline 3y &= -6x - 1 \\ \frac{3y}{3} &= \frac{-6x}{3} - \frac{1}{3} \\ y &= -2x - \frac{1}{3} \end{aligned}$$

Slope = -2

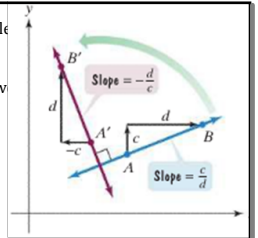
$$\begin{aligned} y-5 &= -2(x+2) \\ y-5 &= -2x-4 \\ y+5 & \quad +5 \\ \hline y &= -2x+1 \end{aligned}$$

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Definition. Two lines that intersect at a right angle are said to be *perpendicular*.

Q: What do you notice about the slope of these two lines?

A: Opposite Reciprocal



Rules of Perpendicular Lines:

- Two lines are perpendicular if and only if their slopes are negative reciprocals of each other (i.e., their product is -1)
- A horizontal line (slope zero) is perpendicular to a vertical line (slope is undefined).

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Example

[A] Find the slope of any line that is perpendicular to the line $x+3y-12=0$.

$$\begin{aligned} x+3y-12 &= 0 \\ -x+12 & \quad -x+12 \\ \hline 3y &= -x+12 \\ \frac{3y}{3} &= \frac{-x}{3} + \frac{12}{3} \\ y &= -\frac{1}{3}x+4 \end{aligned}$$

⊥ 3

$$y=3x \quad y=3x-25$$

[B] Write an equation of the line passing through $(-2, -6)$ and which is perpendicular to $x+3y-12=0$.

⊥ 3

$$\begin{aligned} y+6 &= 3(x+2) \\ y+6 &= 3x+6 \\ \hline y &= 3x \end{aligned}$$

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Final Questions

Q: What is the domain of any line (also called a **linear function**)? Can you write this in algebraic, set, and interval notation?

A: \mathbb{R} $\{x \mid x \text{ is all real \#s}\}$
 $(-\infty, \infty)$

Q: What is the range of any linear function?

A: \mathbb{R} $\{y \mid y \text{ is all real \#s}\}$
 $(-\infty, \infty)$

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HOMEWORK

..because you want to become a master

1.1 (p. 11): 3,7,9 (just draw by hand for 7 & 9), 19-23 odd,37, 45, 51, 57, 59, 103, 104

Be sure to draw out all graphingcalculator parts.

Challenge: Given that a line goes through the point $(-5,4)$ and has slope 2, find 3 points that are on the line that is perpendicular to this one (Answers will vary).

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