Section 1.5 (More on Slope)

Two nonvertical lines are ____________________ if they have the same slope and different y-intercepts. Two nonvertical lines are _____________________ (they intersect at a 90^o angle) if the product of their slopes is -1 (negative reciprocals). Draw and explain on board (for perp. use a line with slope a/b and rotate 90^o).

Example: Are the following pairs of lines parallel, perpendicular or neither?

$5y = -2x + 1$	$x - 4y = 3$	$-2x + 3y = 1$
$4x + 10y = 3$	$3x + 12y = 7$	$3x + 2y = 12$

Example: Find the slope of lines parallel and perpendicular to $y = 3x - 7$

Example: Find an equation of the line containing the point $(-1, 2)$ and parallel to $3x + y = 5$ (point-slope and slope-intercept and general (standard) form).

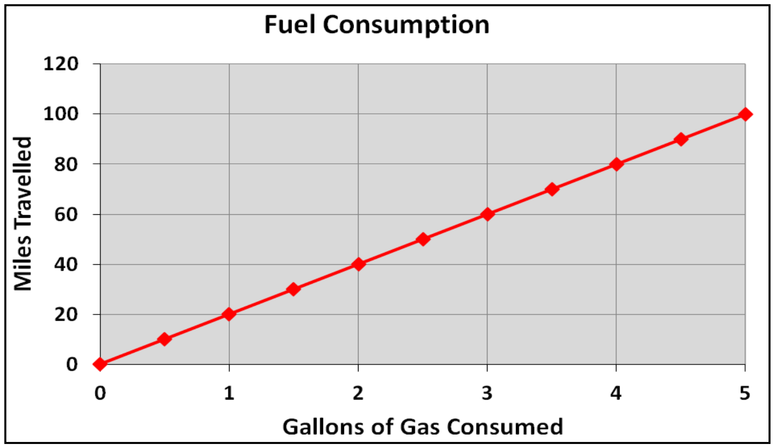
Example: Find an equation (slope-intercept) that describes the line containing the point $(3,4)$ and perpendicular to the line $2x + 4y = 5$.

Forms of Linear Equations	
General form (A and B are not both 0)	$Ax + By = C$
Slope-intercept form (slope is m and y-intercept is (0,b))	$y = mx + b$
Point-slope form (slope is m and (x_1,y_1) is a point on the line)	$(y - y_1) = m(x - x_1)$
Horizontal line (slope is 0 and y-intercept is (0,c))	$y = c$
Vertical line (slope is undefined and x-intercept is (c,0))	$x = c$
Parallel and Perpendicular Lines	
Nonvertical **parallel** lines have the same slope. The product of the slopes of two **perpendicular** lines is -1.	

Book problems: 5,7,9,11,13,15,17,21,29

Slope can also be considered as a rate of change (ratio of a change in y to a corresponding change in x)

Example: The following graph shows data for Oscar the Grouch's Minican driven on interstate highways. Find the rate of change (miles per gallon)

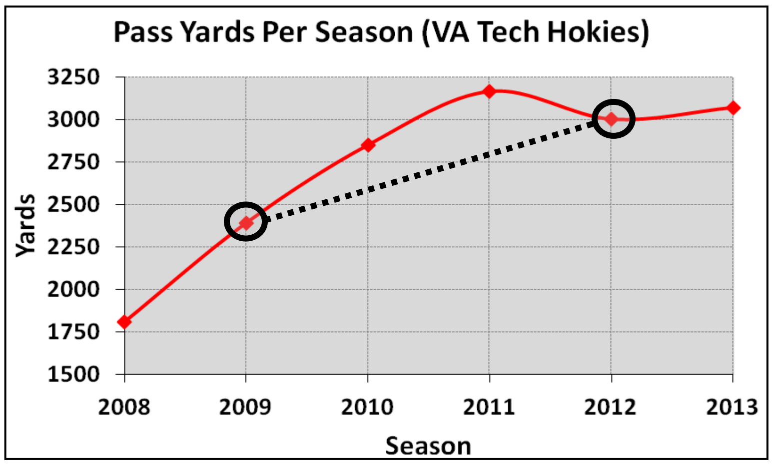


Example: Given the graph below, what is the average rate of change in Hokie rushing yards from years 2009 to 2012?

Δy Yds. changed from ______ to ______ or ______ yds.

Δx Change occurred from 2002 to 2005 or over a period of _______ years

$\frac{\Delta y}{\Delta x}$ Avg. rate of change was thus ______ / ______ or _______ yds. / year



Given 2 distinct points $(x_1,f(x_1))$ and $(x_2,f(x_2))$ of a function f, the avg. rate of change between these 2 points is given by $\frac{change in y}{change in x} = \frac{\Delta y}{\Delta x} = \frac{f(x_2)-f(x_1)}{x_2-x_1}$ -- (This is also the slope / secant line – plot on board)

Example: Find the average rate of change of $\mathbf{f(x) = x^2}$ and note the slope from

$x_1 = 0$ to **$x_2 = 2$** **$x_1 = 2$ to $x_2 = 4$**

Common application: Average velocity of an object. Suppose a function expresses an object's position s(t) in terms of time t. The average velocity of the object from time t_1 to time t_2 is $\frac{\Delta s}{\Delta t} = \frac{s(t_2)-s(t_1)}{t_2-t_1}$

Example: In a trip to Blacksburg to watch the awesome Hokies win another bball game, I learned that the distance or my position s(t), in miles, that I had travelled was given by $s(t) = 16t^2$, where t was the time, in hours, after the I left Huntsville (apparently, I drove faster over time). Find my average velocity (distance / time)…

From $t_1 = 1$ to $t_2 = 2$ hours (what was my average driving speed during my second hour on the road) ?

From $t_1 = 1$ to $t_2 = 1.5$ hours (what was my average driving speed during this interval on the road) ?

The avg. rate of change of f from x1 = x to x2 = x + h is $\frac{f(x+h)-f(x)}{h}$ (from section 1.3). What is h in the examples above?

As the interval get smaller and smaller, we get closer to discovering the ***instantaneous velocity*** of my car (discuss another example of average velocity vs. instantaneous velocity of a ball rolled down a ramp)

Book problems: 5,7,9,11,13,15,17,21,29