**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 90o 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 90o).

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**.

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| ***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 (x1,y1) is a point on the line) | (y - y1) = m(x – x1) |
| **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. |

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?

 Yds. changed from \_\_\_\_\_ to

**Δy**

 \_\_\_\_\_ or \_\_\_\_\_ yds.

 Change occurred from 2002

 to 2005 or over a period of

**Δx**

 \_\_\_\_\_\_ years

 Avg. rate of change was

**Δy**

**Δx**

 thus \_\_\_\_\_ / \_\_\_\_\_

 or \_\_\_\_\_\_ yds. / year

Given 2 distinct points (x1,f(x1)) and (x2,f(x2)) of a function f, the avg. rate of change between these 2 points is given by  -- (This is also the slope / secant line – plot on board)

Example: Find the average rate of change of **f(x) = x2** and note the slope from

 **x1 = 0** to **x2 = 2** **x1 = 2 to x2 = 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 t1 to time t2 is 

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) = 16t2, 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 t1 = 1 to t2 = 2 hours (what was my average driving speed during my second hour on the road) ?

 From t1 = 1 to t2 = 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 (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)