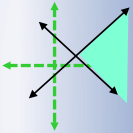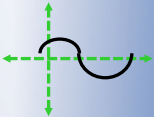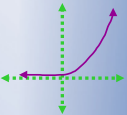$5x - 2y \leq 75$

$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$

$S = Pe^{rt}$

$APY = \left(1 + \dfrac{r}{n}\right)^{n} - 1$

Math 1090 ~ Business Algebra

Section 1.3 Equations of Lines

Objectives:
- Determine the slope, x-intercept and y-intercept of a line.
- Determine whether lines are parallel, perpendicular or neither.
- Write the equation of a line in several forms.

Linear Equations in Two Variables

The equation of a non-vertical line can be written in the form $y = mx + b$ where m and b are real numbers.

Slope : pts (x_1, y_1) and (x_2, y_2) on the line

steepness of the line; a number

$$m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{vertical\ change}{horizontal\ change}$$

Parallel lines   Perpendicular lines

have same slope

intersect at 90° angle
their slopes are negative reciprocals of each other

Equations of a line:

① Slope-intercept

m = slope
y-int. = $(0, b)$

$$y = mx + b$$

② Point-slope

m = slope
(x_1, y_1) = pt on line

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

$$m = \frac{y - y_1}{x - x_1}$$

2

Ex 1:

a) Find the slope of the line between *(3,2)* and *(-7,-5)*.

$$x_1\, y_1 \qquad x_2\, y_2$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5-2}{-7-3} = \frac{-7}{-10} = \boxed{\frac{7}{10}}$$
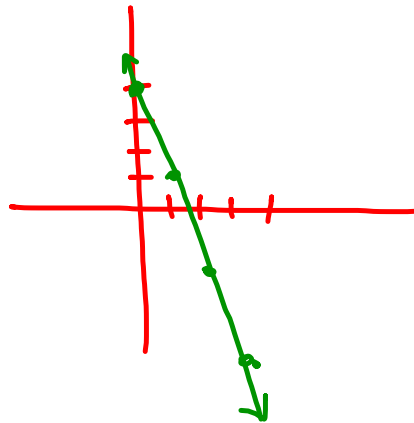
b) Find the equation of the line in part a.

$$m = \frac{7}{10} \qquad (3,2)\ pt$$

$$y - 2 = \frac{7}{10}(x-3)$$

$$y - 2 = \frac{7}{10}x - \frac{21}{10}$$

$$\boxed{y = \frac{7}{10}x - \frac{1}{10}}$$

Ex 2: Find the equation of the line with a slope of *-3* and *y*-intercept *(0,4)*.

$$m = -3 \qquad b = 4$$

$$y = mx + b$$

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

$$-3 = \frac{-3}{1}$$

Ex 3: For *4 - 5y + 7x = -10*, find the *y*-intercept and the slope.

$$\underset{-4}{}\qquad\underset{-4}{}$$

$$-5y + 7x = -14$$

$$\frac{-5y}{-5} = \frac{-7x - 14}{-5}$$

$$y = \frac{7}{5}x + \frac{14}{5} \quad (\text{slope-intercept form})$$

$$\boxed{\begin{array}{l} \text{slope} = \frac{7}{5} \\[2mm] y\text{-intercept: } \left(0, \frac{14}{5}\right) \end{array}}$$

Ex 4: Find the equation of a line through (4,-3) and (4,5).

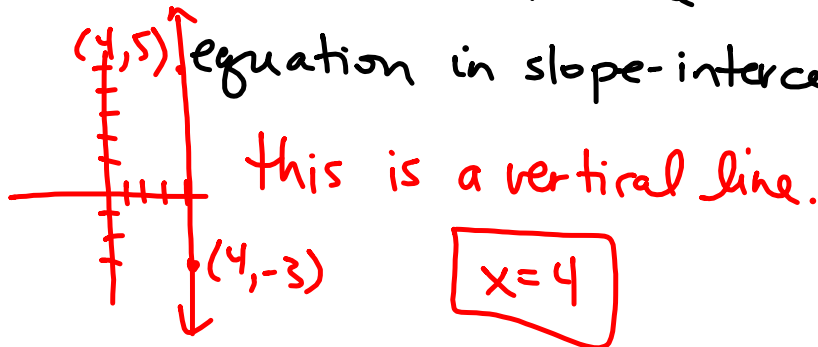$$\underset{x_1\,y_1}{}\qquad\underset{x_2\,y_2}{}$$

$$m = \frac{5 - (-3)}{4 - 4}$$

undefined,
(because we're trying to divide by zero)

$\Rightarrow$ we cannot write this line equation in slope-intercept form.

this is a vertical line.

(4,5)

(4,-3)

$$\boxed{x = 4}$$

Ex 5: Find the equation of the line through *(1,-5)*

a) parallel to *3x - 6y = 5*

$$-6y = -3x + 5$$
$$\frac{-6y}{-6} = \frac{-3x+5}{-6}$$
$$y = \frac{1}{2}x - \frac{5}{6} \Rightarrow m = \frac{1}{2}$$

(a) $y - (-5) = \frac{1}{2}(x-1)$

$y + 5 = \frac{1}{2}x - \frac{1}{2}$

$y = \frac{1}{2}x - 5\frac{1}{2}$

$$\boxed{y = \frac{1}{2}x - \frac{11}{2}}$$

b) perpendicular to *3x - 6y = 5*

$m = -2$ (negative reciprocal of $\frac{1}{2}$)

$(1,-5)$

$y - (-5) = -2(x-1)$ $\boxed{y = -2x - 3}$

$y + 5 = -2x + 2$

Ex 6: Water freezes at 32ºF, which is 0ºC. Water boils at 212ºF which is the same as 100ºC. Write a linear equation that fits these data.

$(\degree F; \degree C)$ ^{2pts} $(32, 0)$ ①

$(212, 100)$ ②

$$m = \frac{100-0}{212-32} = \frac{100}{180} = \frac{10}{18} = \frac{5}{9}$$

$$y - 0 = \frac{5}{9}(x - 32)$$

$$\boxed{y = \frac{5}{9}x - \frac{160}{9}}$$

x is ºF

y is ºC