Lesson 6: Section 2.2 & 2.3

Objectives:

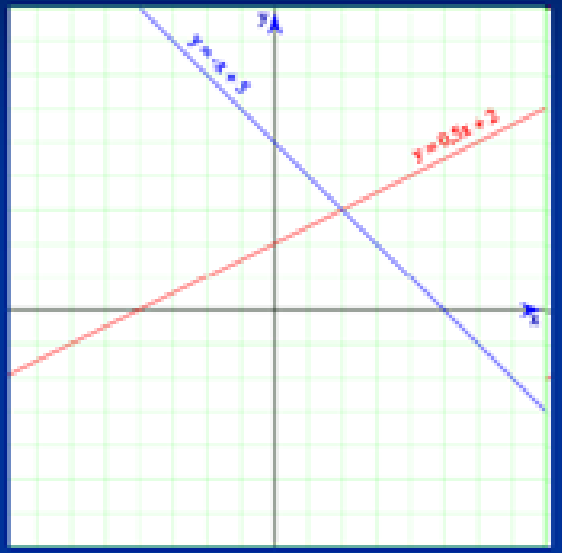
- ~ Find the Slope of a line
- ~ State whether an equation is Linear
- ~ Find x and y intercepts of a line
- ~ Graph a line by x and y intercepts

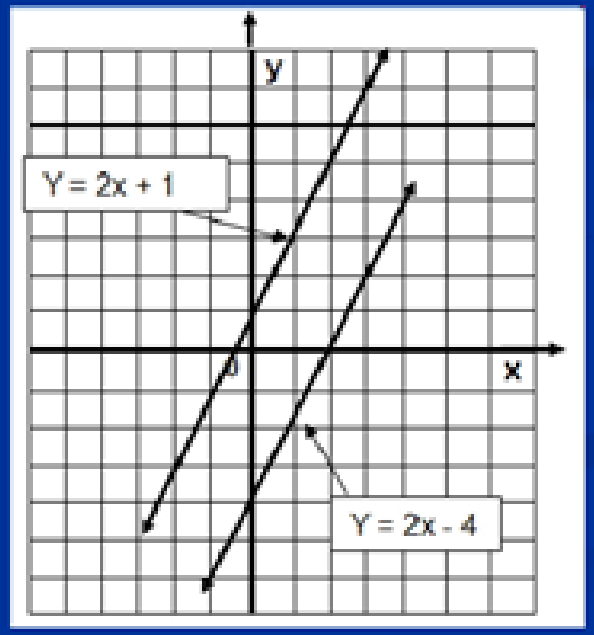
Linear Equations

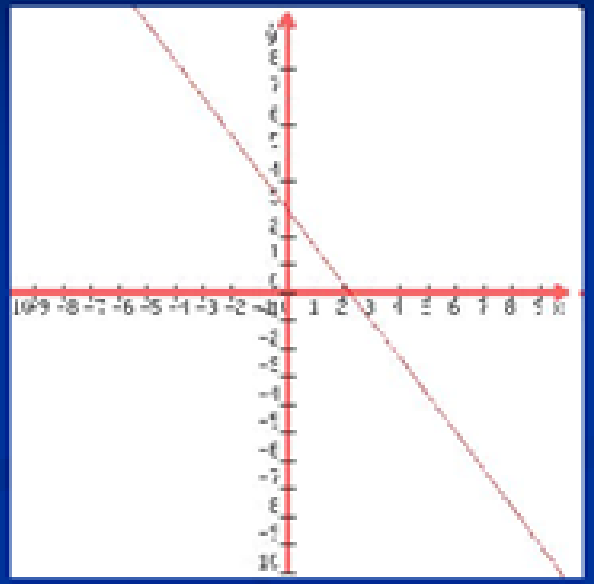
Definition:

A Linear Equation is an equation that when graphed forms a straight line.

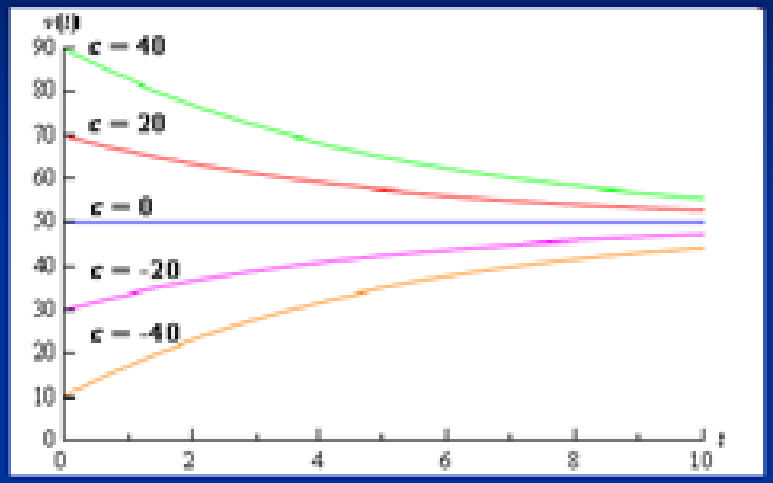
Graph Examples

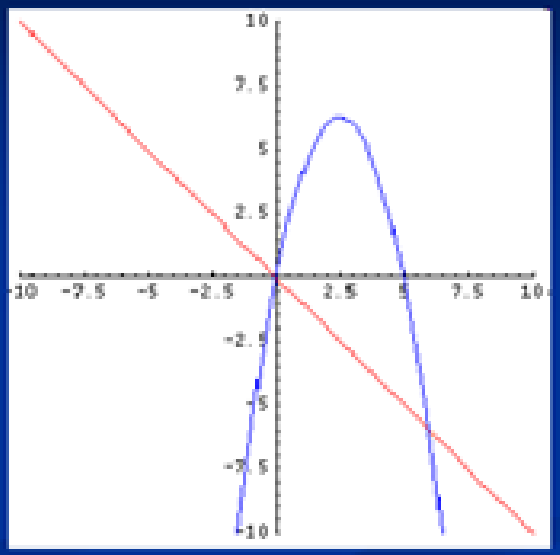


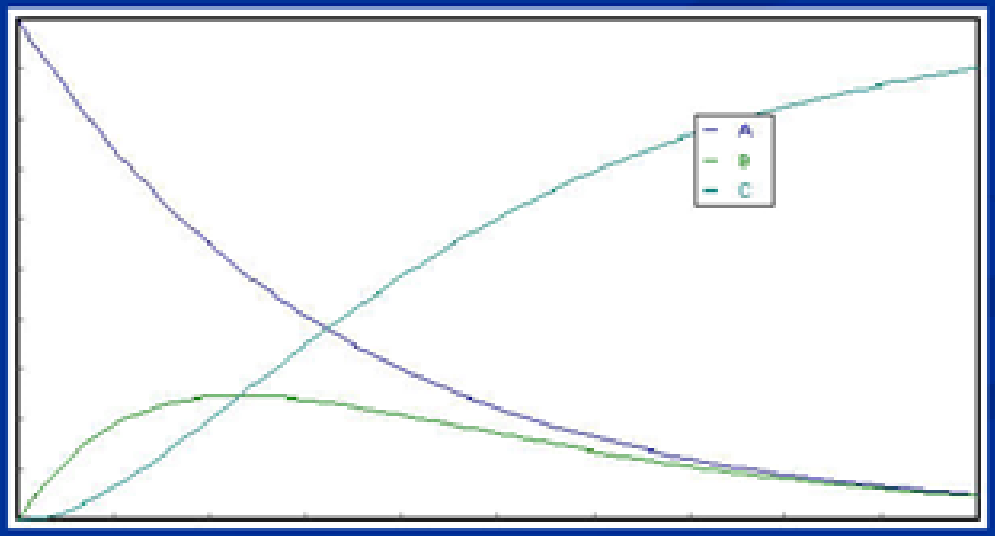




Graph Non-Examples







How can we tell from just an equation…?

A linear equation needs to have one or two variables. They are usually "x" and "y". You cannot have more than two variables.

Standard Form:

$Ax + By = C$, where A, B, C are Real numbers and A, B are not 0.

How can we tell from just an equation…?

A linear equation CANNOT have:

- ★ Powers (exponents) on variables no x^2 y^3
- ★ Square roots on variables no $\sqrt{x}$ $\sqrt{y}$
- ★ Dividing by variables no $\frac{2}{x}$ $\frac{4}{y}$
- ★ Multiplying variables no xy
- ★ Variables in the denominator of a fraction no $\frac{3}{x}$

Linear Equations Examples

$y = 5x - 7$ linear

$y = x/2$ $y = \frac{1}{2}x$ linear

$3^2x + 4y = 1$ linear

$9x + 4y = 1$

$42y + 21x = 14$ linear

$3y = 4^2x$ linear

$7n - 8m = 4 - 2m$ linear

Linear Equations Non-Examples

$y = 5xy - 10$

$y = 3/x$ $y = \frac{3}{x}$

$3x^2 + 4y = 1$

$42y^2 + 21x^2 = 14$

$3y = 4x + 3z$

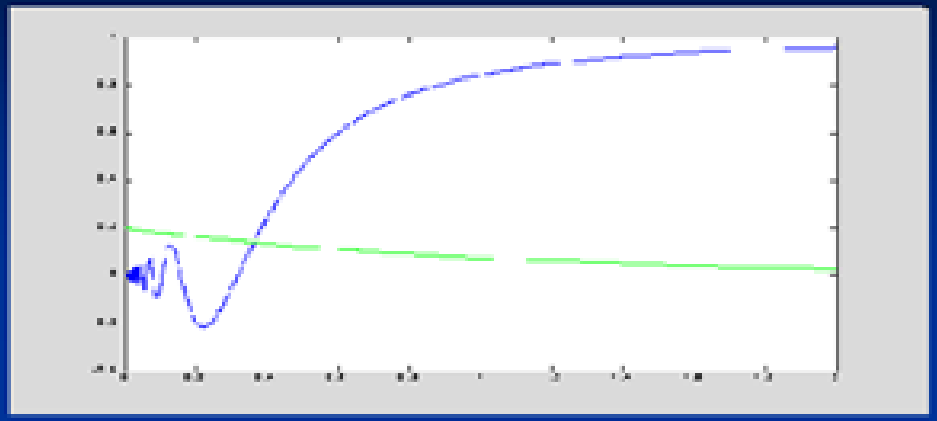
3 var.

$8m = 4 - 2m^2$

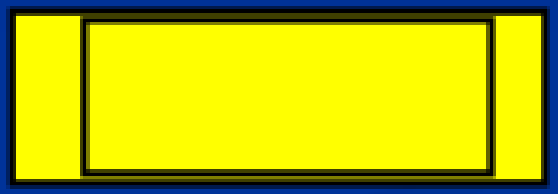
Your Turn: Ex or Non-Ex?

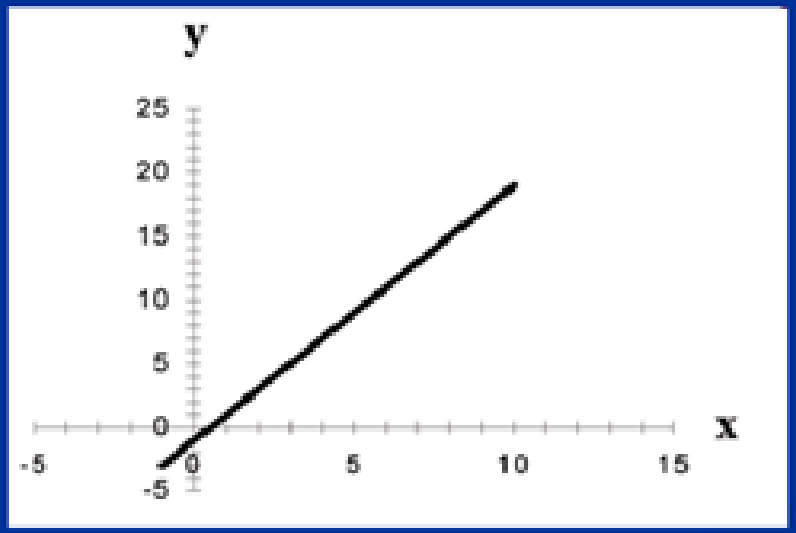
$y = 3x + x$	Linear
$4y = 3x + yx$	Non-linear
$x = 1/y$	Non-linear
$10^2y - 3x = 2$	Linear

Your Turn: Ex or Non-Ex?



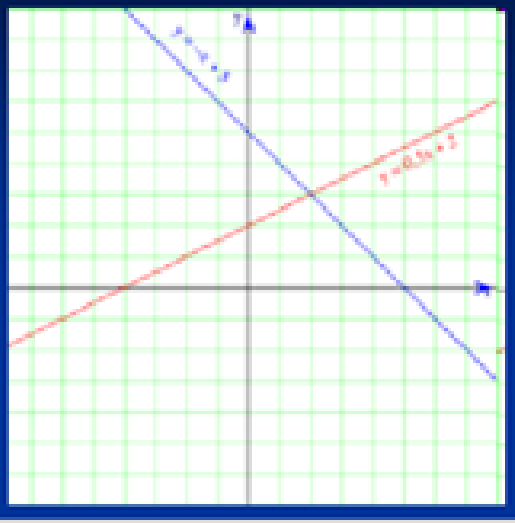
Non-linear



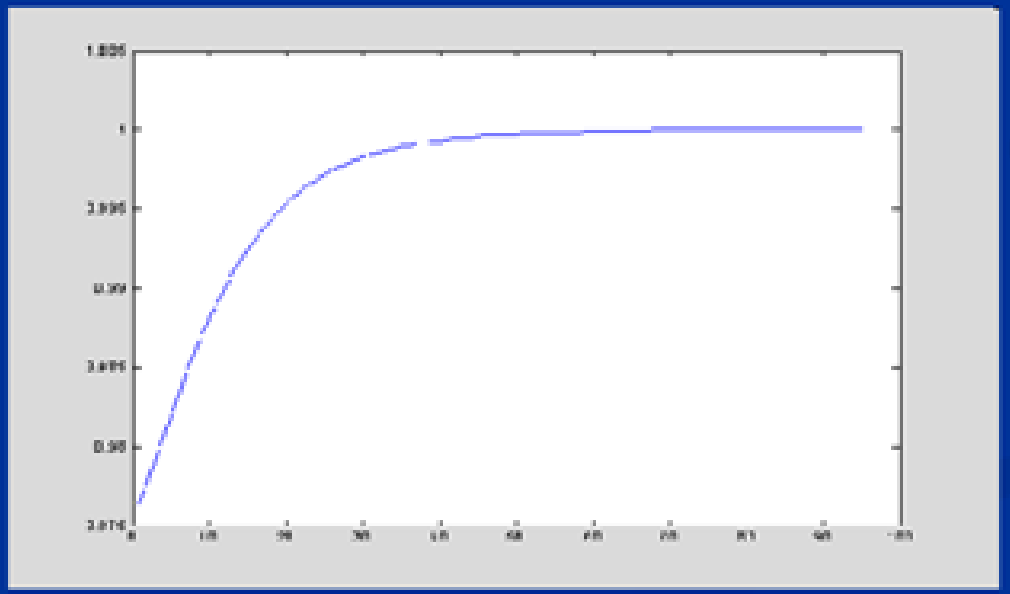


Linear

Your Turn: Ex or Non-Ex?



Linear

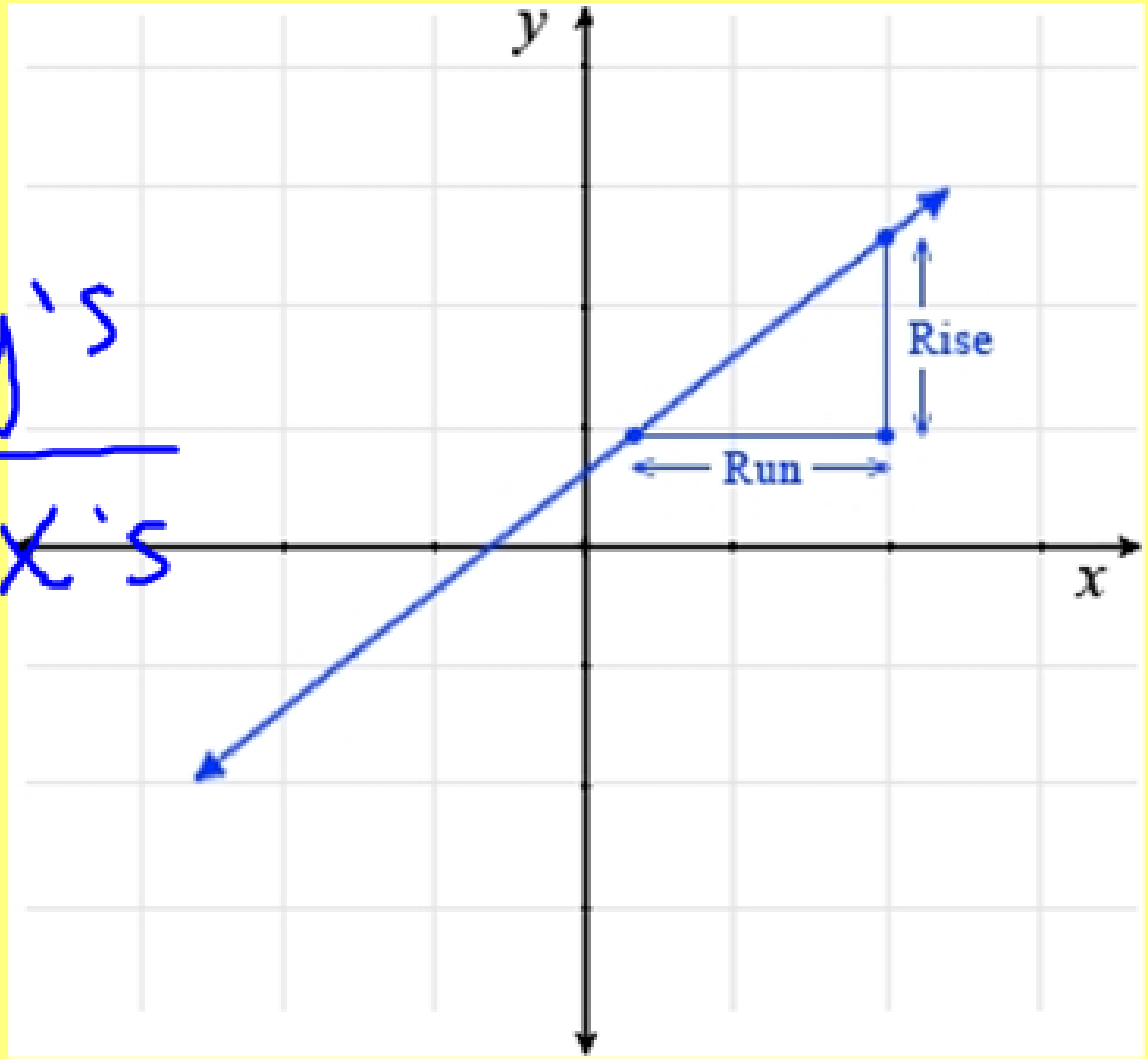


Non-linear

Lesson 6: Section 2.2 & 2.3

Slope! of Linear Equations

$$\frac{\text{Rise}}{\text{Run}} \quad \frac{y\text{'s}}{x\text{'s}}$$



Lesson 6: Section 2.2 & 2.3

Slope = m

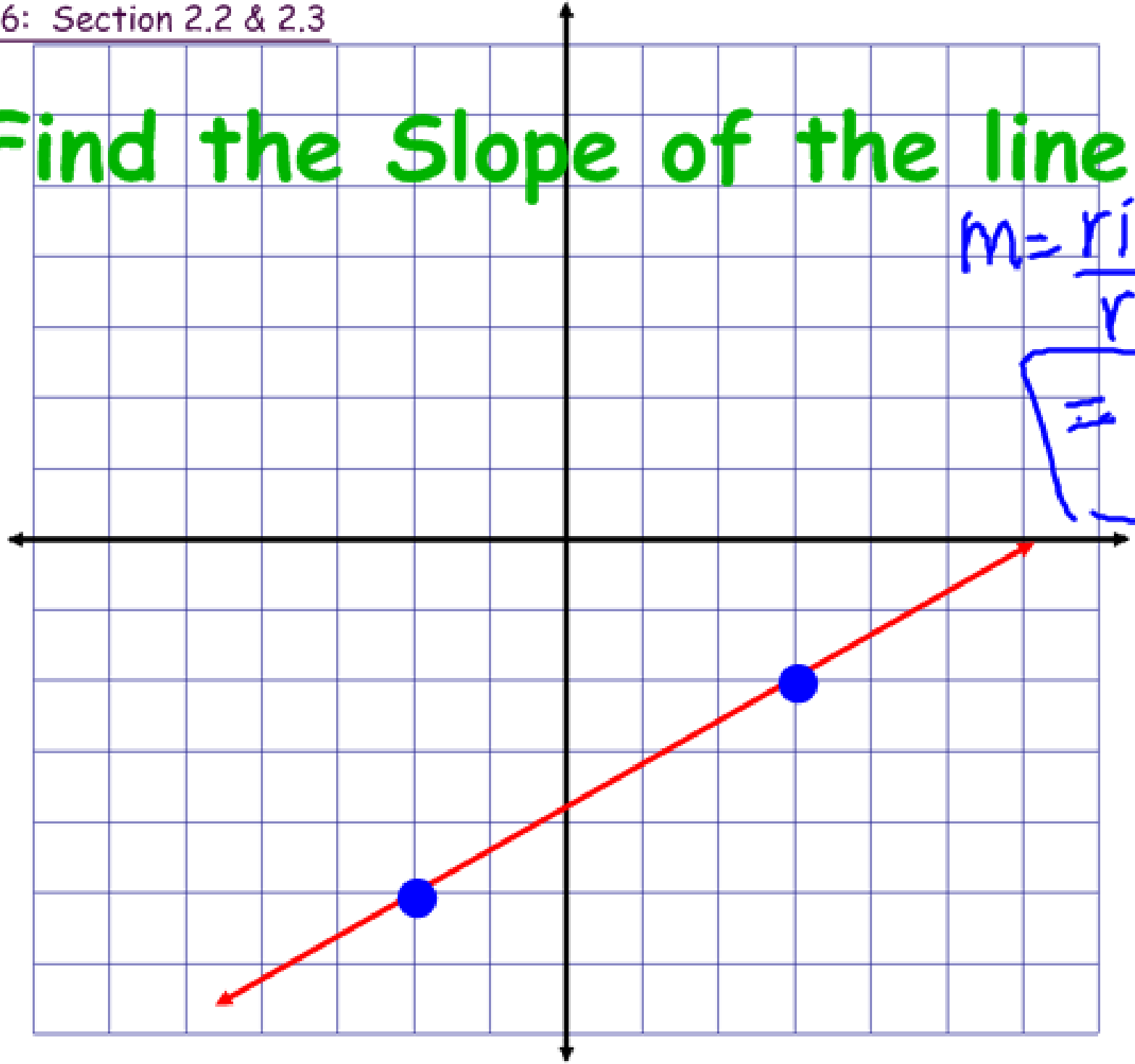
(x_1, y_1)

(x_2, y_2)

$$m = \frac{\text{Rise}}{\text{Run}}$$

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

Find the Slope of the line.



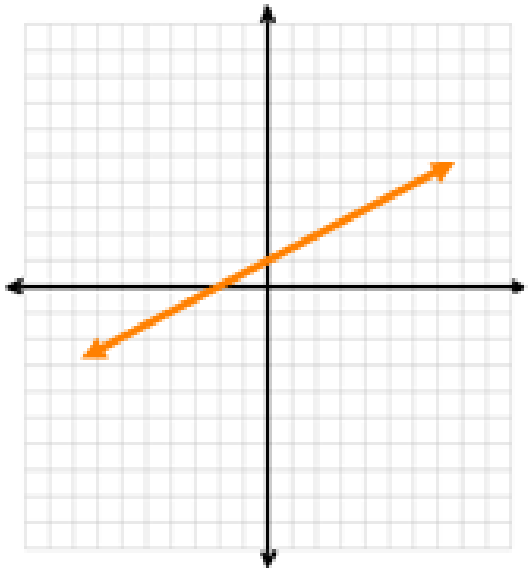
$m = \frac{\text{rise}}{\text{run}}$

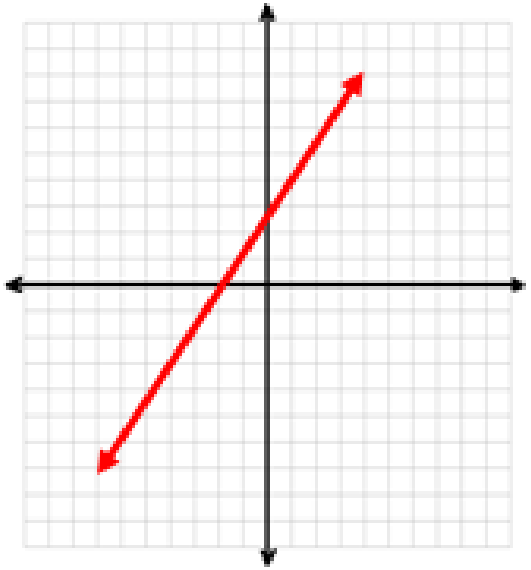
$= \frac{3}{5}$

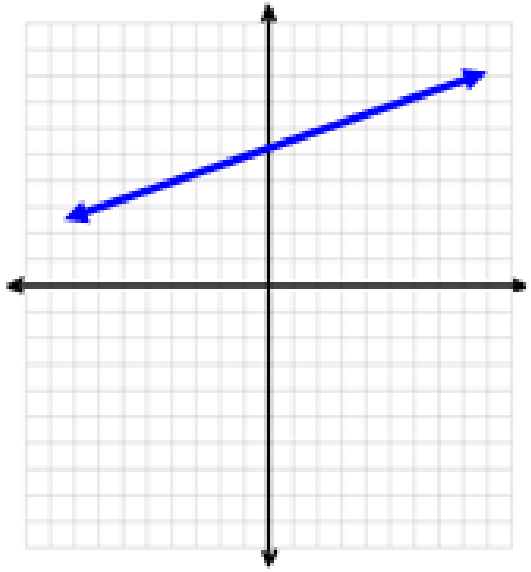
Postitive Slope Graphs

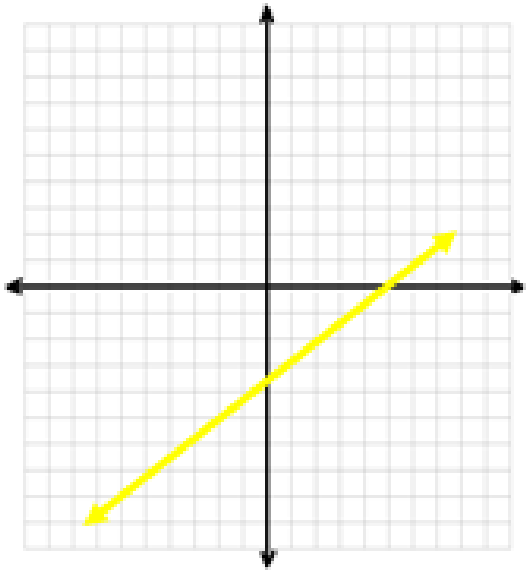
rise

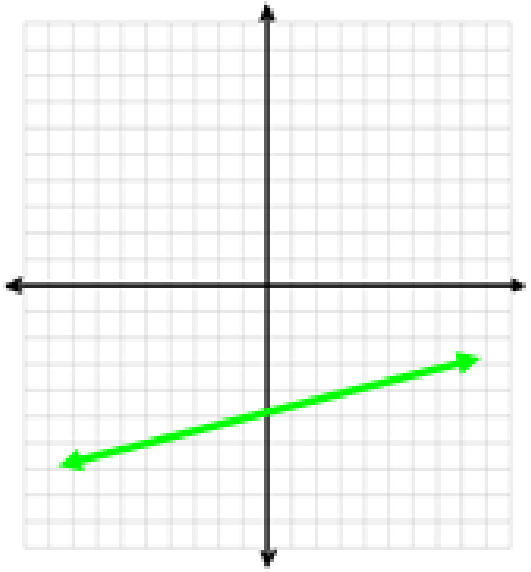
m>0







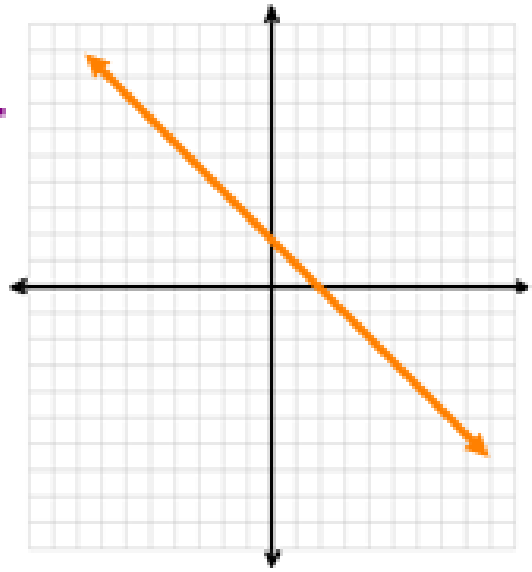


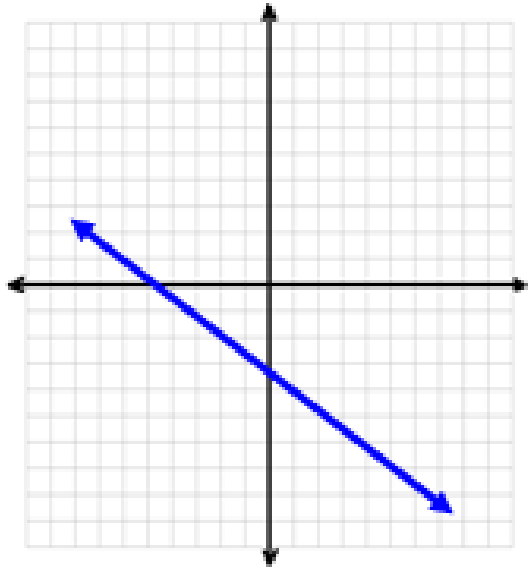


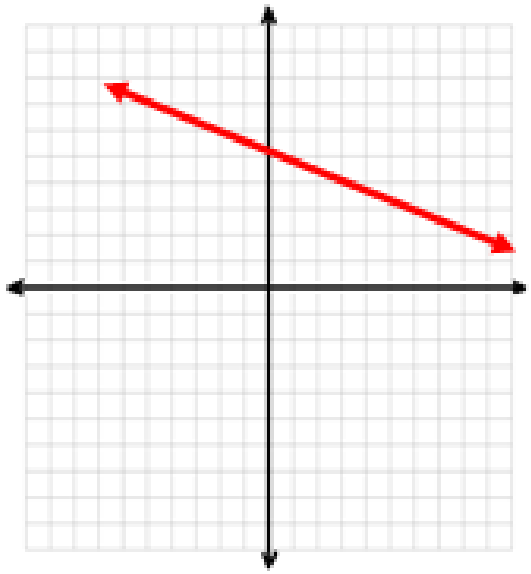
Negative Slope Graphs

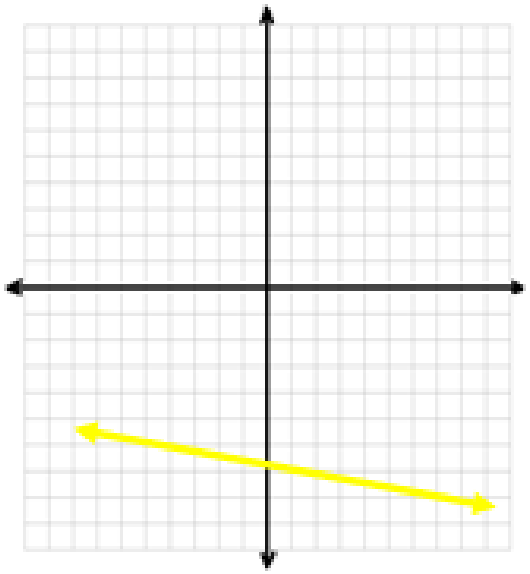
fall

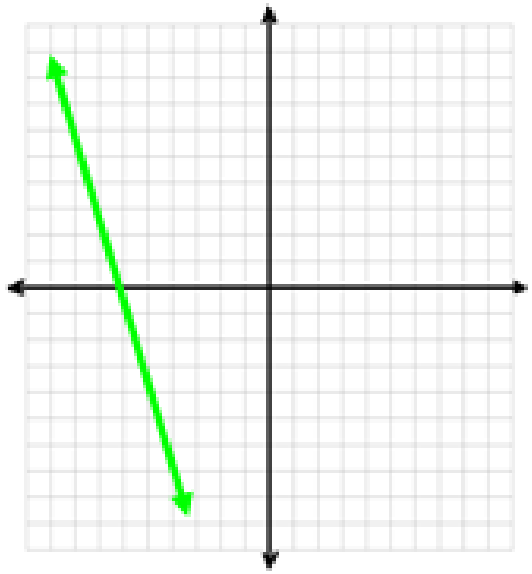
$m<0$







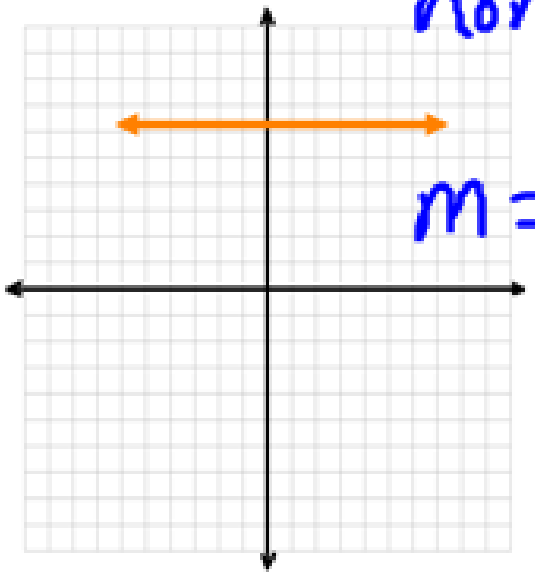


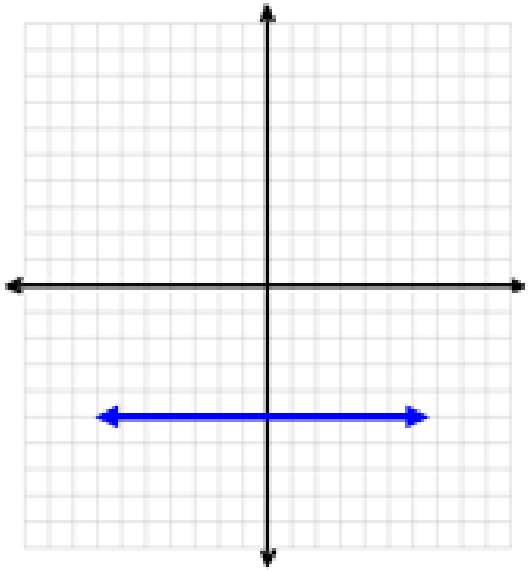


Slope=0 Graphs

Horizontal

$m = \frac{0}{6} = 0$





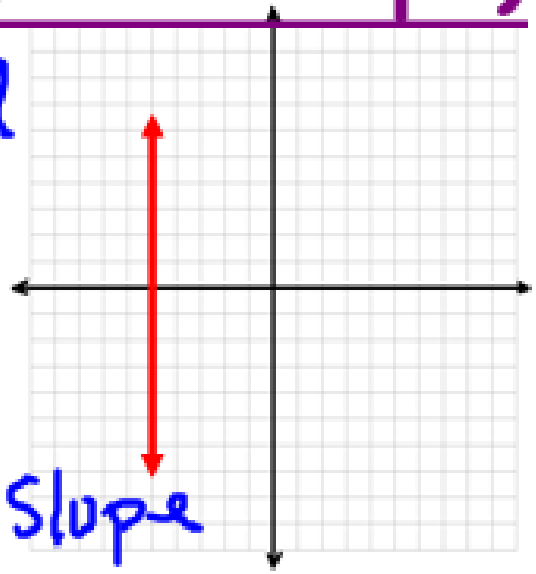
No Slope Graphs (Undefined Slope)

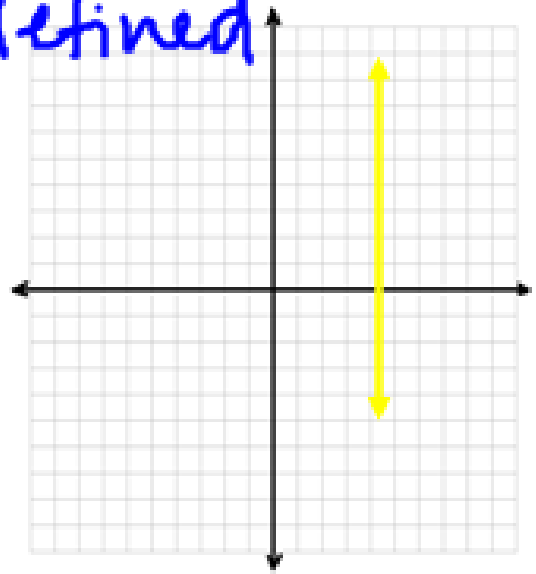
Vertical

$m = \frac{4}{0}$

$\emptyset$ no slope

Undefined





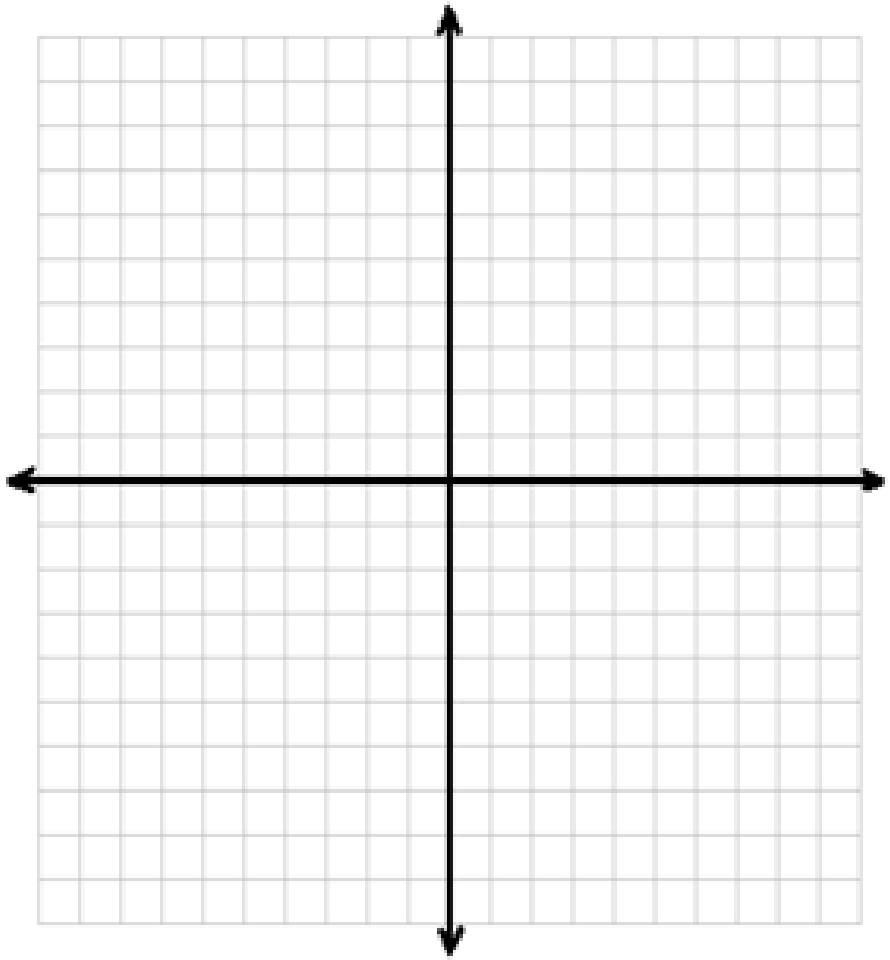
Find the Slope of the line that passes through the points $(3,4)$ and $(6,-8)$.

x_1 y_1 x_2 y_2

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

$$m = \frac{-8-4}{6-3} = \frac{-12}{3}$$

$$m = -\frac{4}{1} = -4$$



Parallel lines:

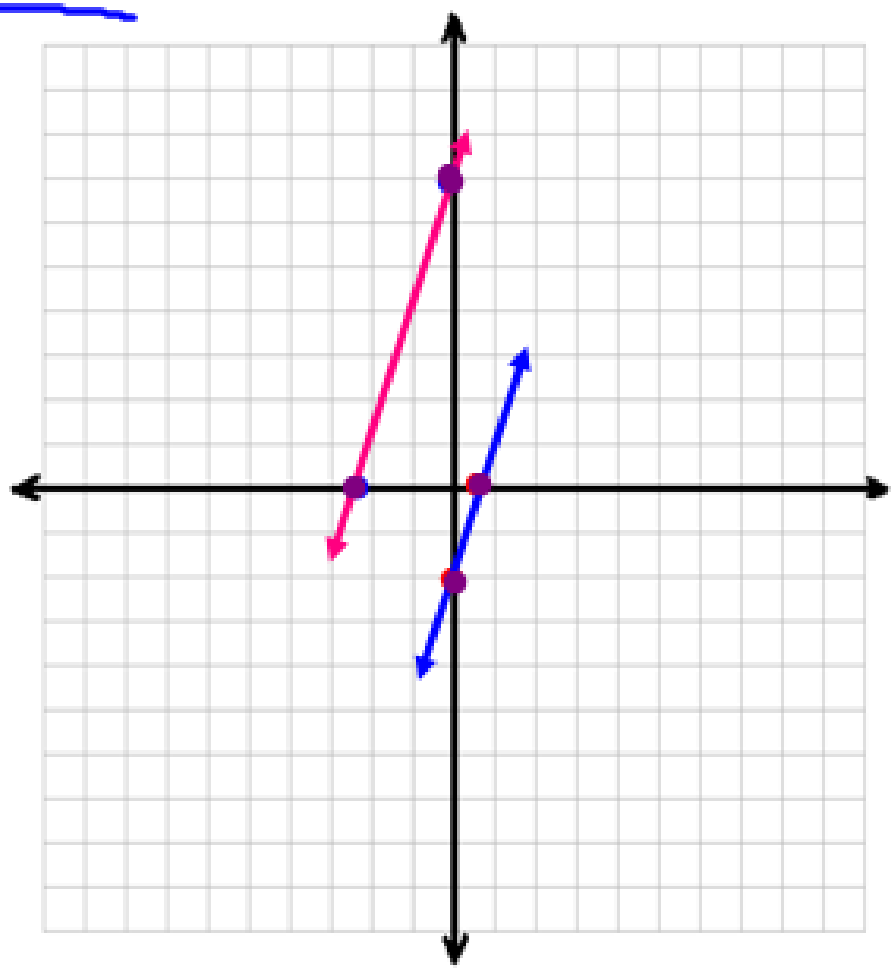
In a plane, non-vertical lines with the same slope are parallel.

$y = mx + b$

EXAMPLE:

$y = 3x + 7$

$y = 3x - 2$



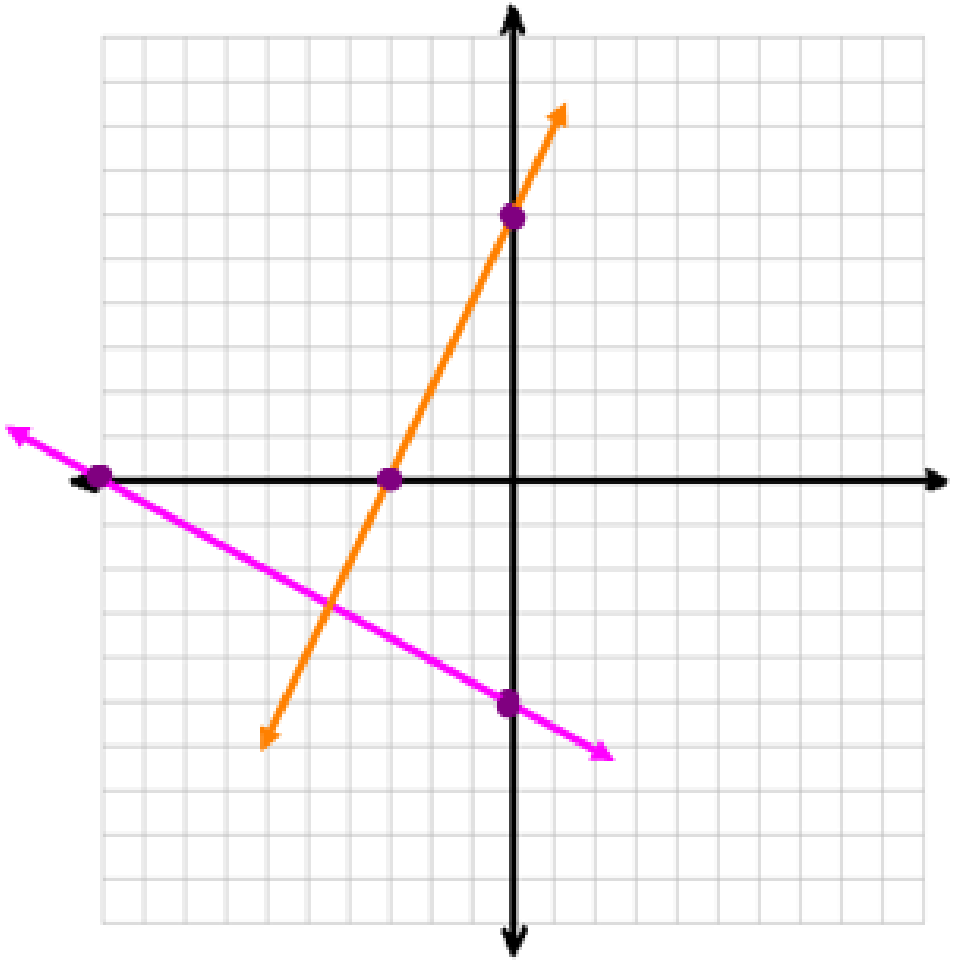
Perpendicular lines:

Two lines (NOT horizontal or vertical) are perpendicular if and only if the slopes are negative reciprocals of each other.

EXAMPLE:

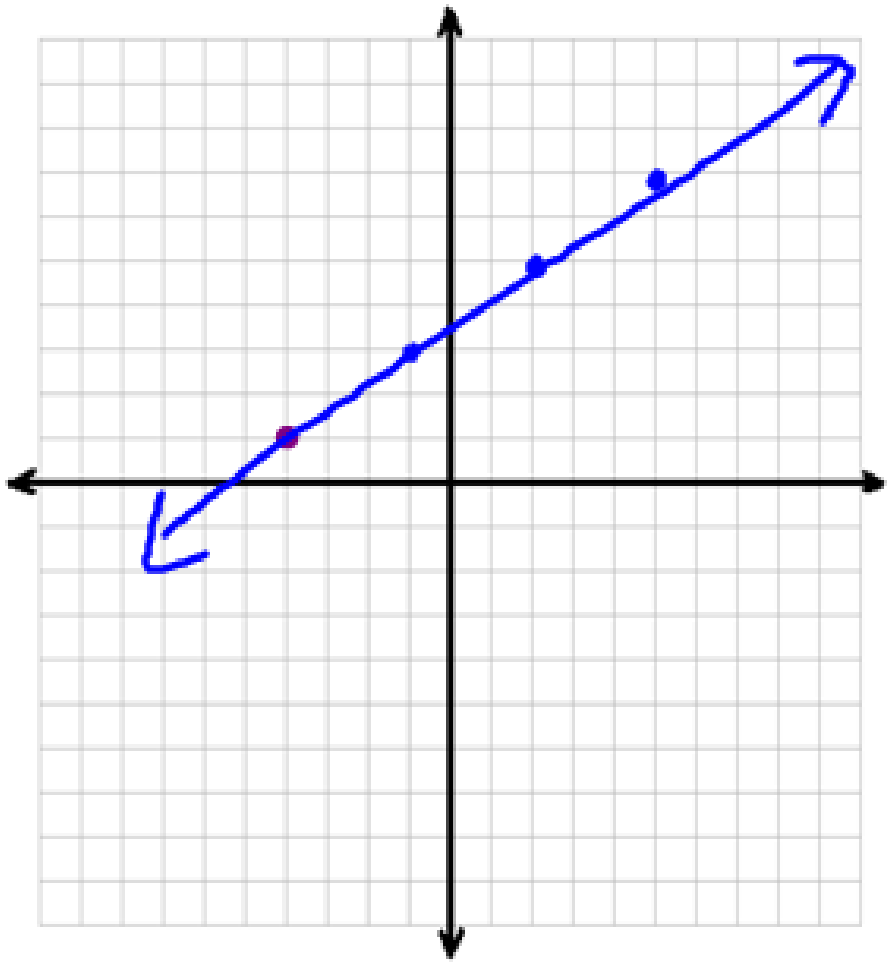
$y = 2x + 6$ $\quad m = 2 = \frac{2}{1}$

$y = (-1/2)x - 5$



Graph a line through (-4, 1) that is perpendicular to a line whose slope is (-3/2).

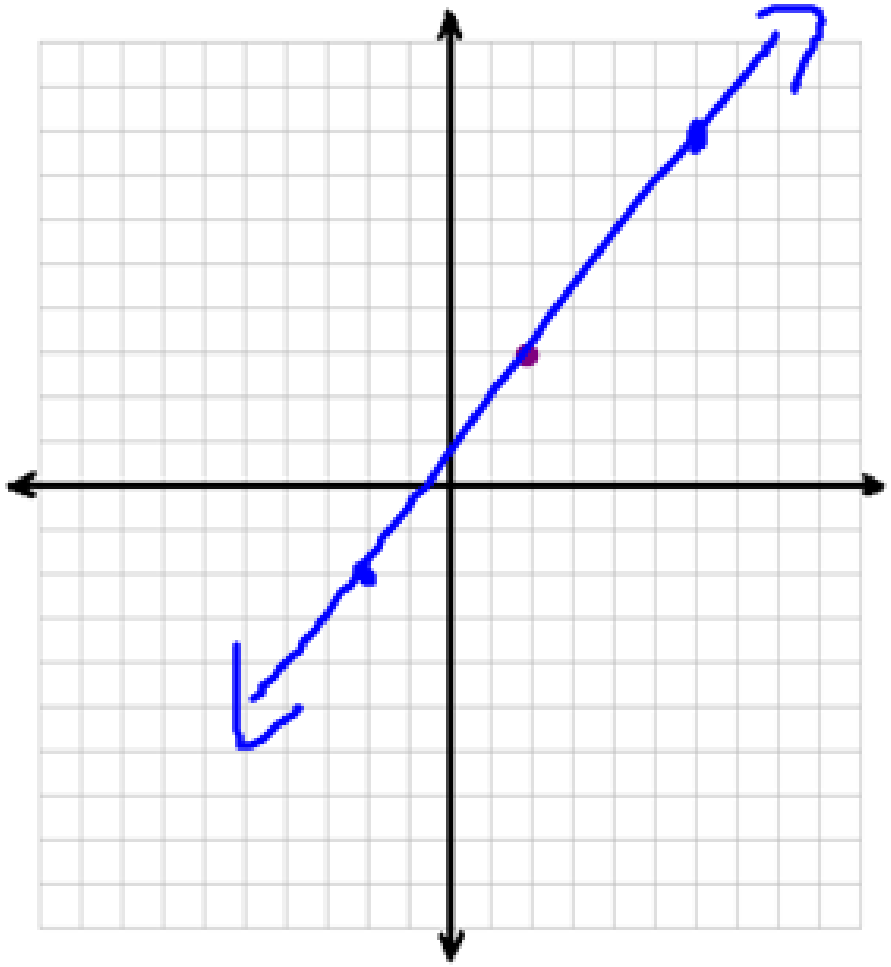
$m = \frac{2}{3}$



Graph a line through (2, 3) that is parallel to a line that has slope (5/4).

$m = \frac{5}{4}$

$= \frac{-5}{-4}$



Intercepts!!!

Football

- In football what is an interception?
- What needs to happen in order for an interception to occur?
  - The "interceptor" and the football need to be at the same place at the same time.

Some amazing interceptions…

- But first let me introduce you to our players…

The interceptor

Football

Quarterback

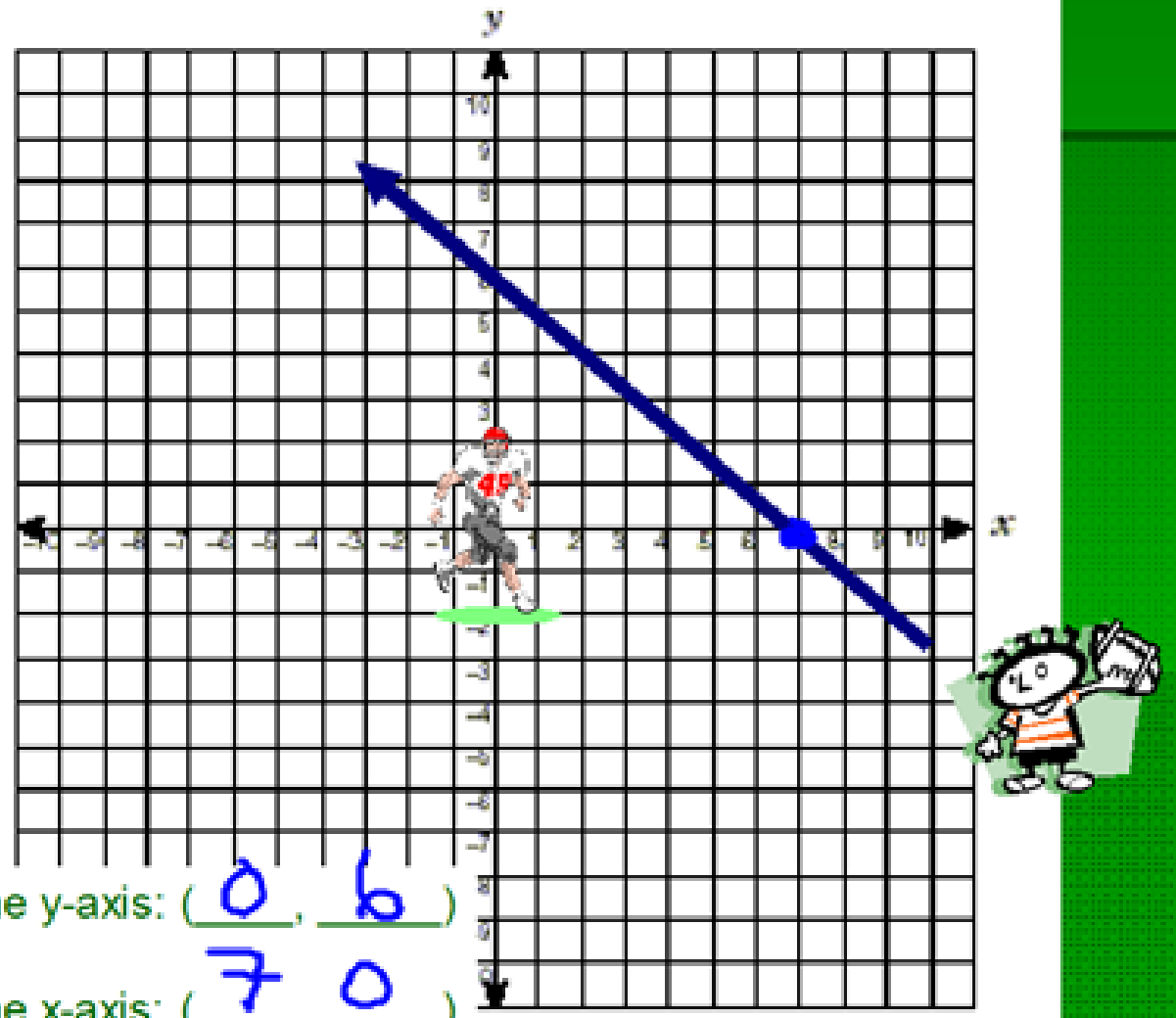
The "Interceptor"

- The Interceptor is the star player on the opposing team. He has 29 interceptions already this year.
- The only problem is that the "interceptor" can only run vertically or horizontally from his starting position.
- We are going to call his starting point the origin and his running path will be either up and down the y-axis, or right and left along the x-axis.

Lesson 6: Section 2.2 & 2.3

(x, y)

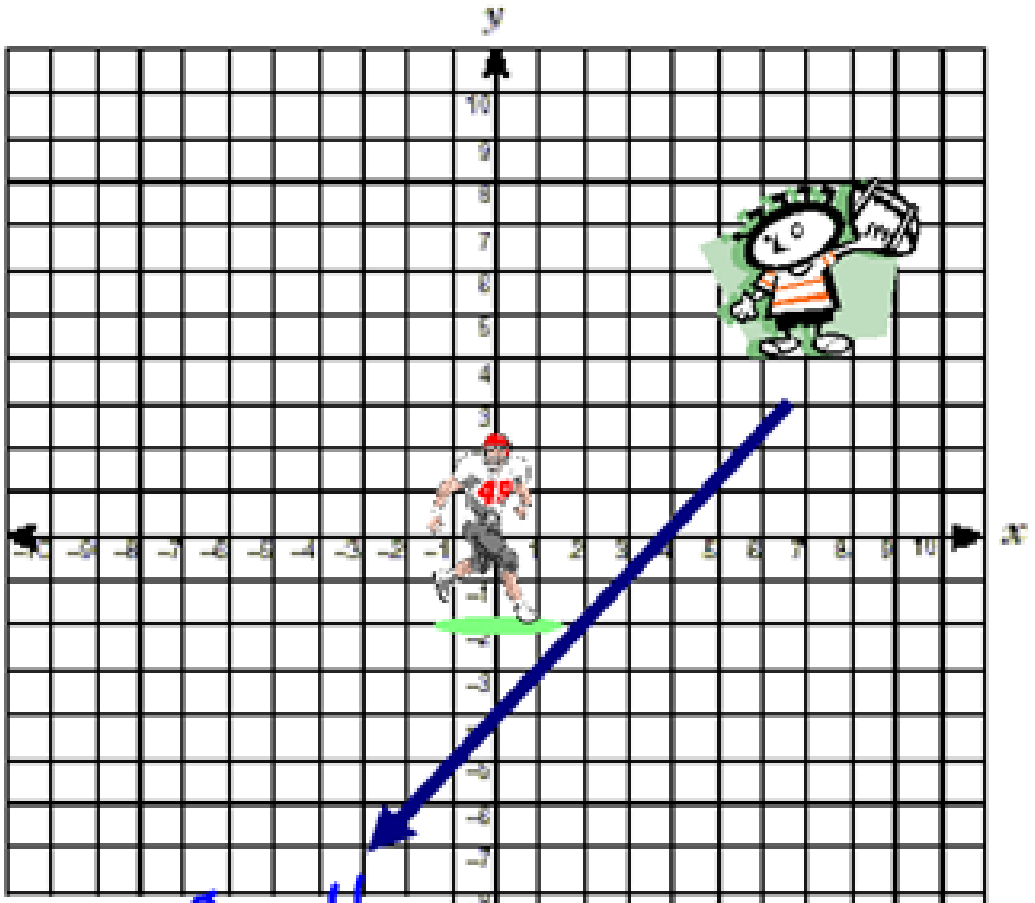
First Down and 10



Interception on the y-axis: (0, 6)

Interception on the x-axis: (7, 0)

Second Down and 12



Interception on the y-axis: (0 , -4)

Interception on the x-axis: (4 , 0)

Observations

- What is special about all of the interception points?
  - They all have a zero!
  - When the interception happens on the y-axis the zero is in the __x__ coordinate.
  - When the interception happens on the x-axis the zero is in the __y__ coordinate.

But how do we find the interception point without a picture?

- When looking for the y-interception, plug a zero in for ___x___ and solve for ___y___.
- When looking for the x-interception, plug a zero in for ___y___ and solve for ___x___.

Name the x- and y-intercepts for $3x + 4 = 7y$

- y-intercept…
  - Plug in a zero for x
  - Solve for y
- x-intercept…
  - Plug in a zero for y
  - Solve for x

y-int: $(0, \frac{4}{7})$

$3(0)+4=7y$

$\frac{4}{7}=\frac{7y}{7}$ $y=\frac{4}{7}$

x-int: $(-\frac{4}{3}, 0)$

$3x+4=7(0)$

$3x+4=0$

$-4\ -4$

$\frac{3x}{3}=\frac{-4}{3}$

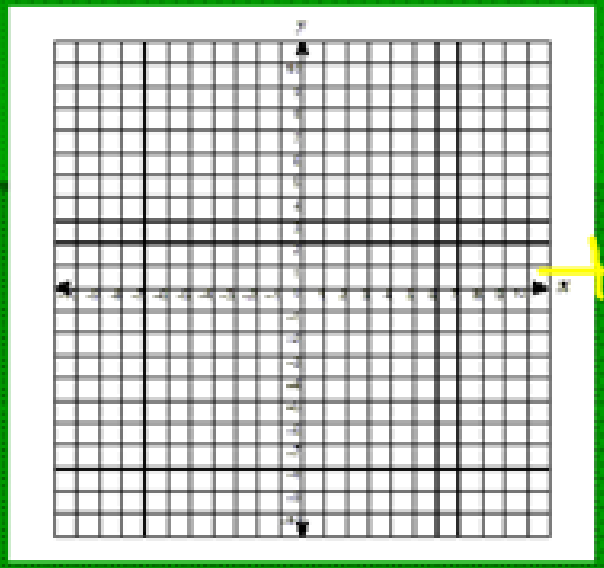
$x=-\frac{4}{3}$

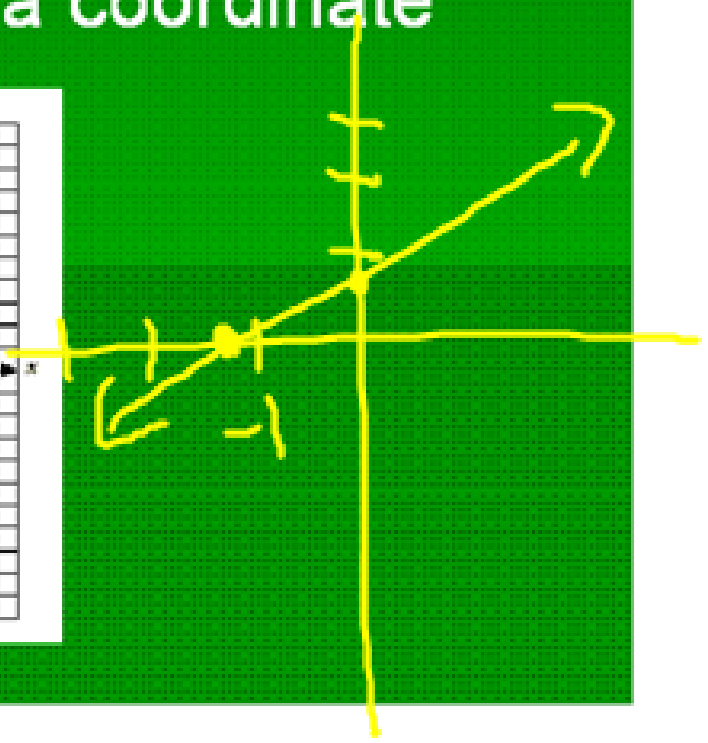
Graphing x- and y-intercepts

$(0, \frac{4}{3})$

$(-\frac{4}{3}, 0)$

- We've found two points, (x-intercept, 0) and (0, y-intercept).
- Now we can plot them on a coordinate plane.





Can the point of interception on the x-axis and the point of interception on the y-axis ever be the same point?

[0,0]

Can we draw a line if we only know one point?

NO

$2x + y = 3$

- When we only have one point (0,0), we need to pick another X and plug it into the equation to find Y. We now have another point to plot and can connect the points to make a line.

Lesson 6: Section 2.2 & 2.3

Objectives:

- ~ Find the Slope of a line
- ~ State whether an equation is Linear
- ~ Find x and y intercepts of a line
- ~ Graph a line by x and y intercepts

Can you?

Lesson 6: Section 2.2 & 2.3

Homework:

Journal 6 – Due at end of Math Lab

Assignment 6 – Due at the beginning of B1 class