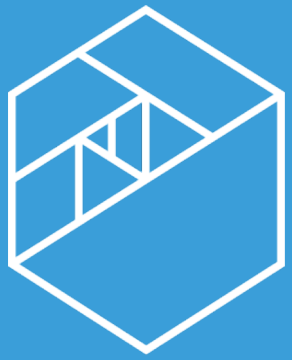


Lesson 1:
Line Equation

Introduction

METIS

Lecture Overview:

Goals of the lecture:

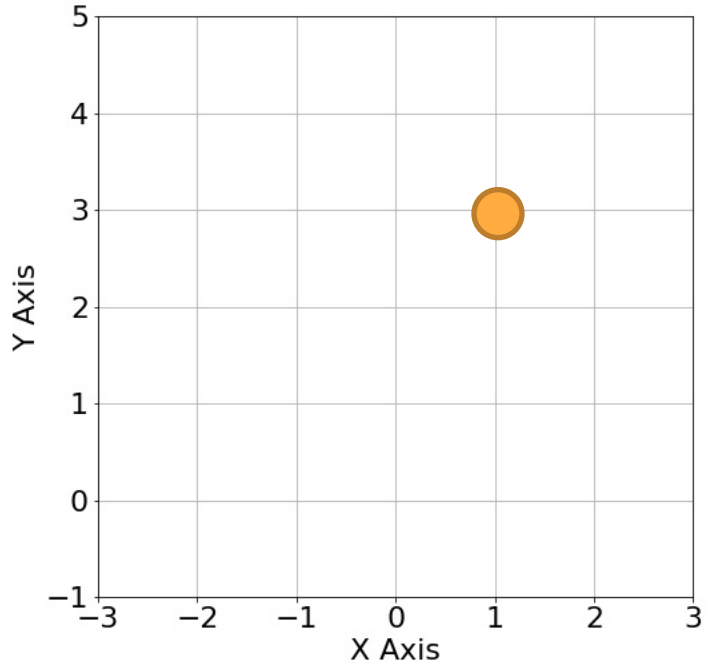
1. Understand the Line Equation

Line Equation

METIS

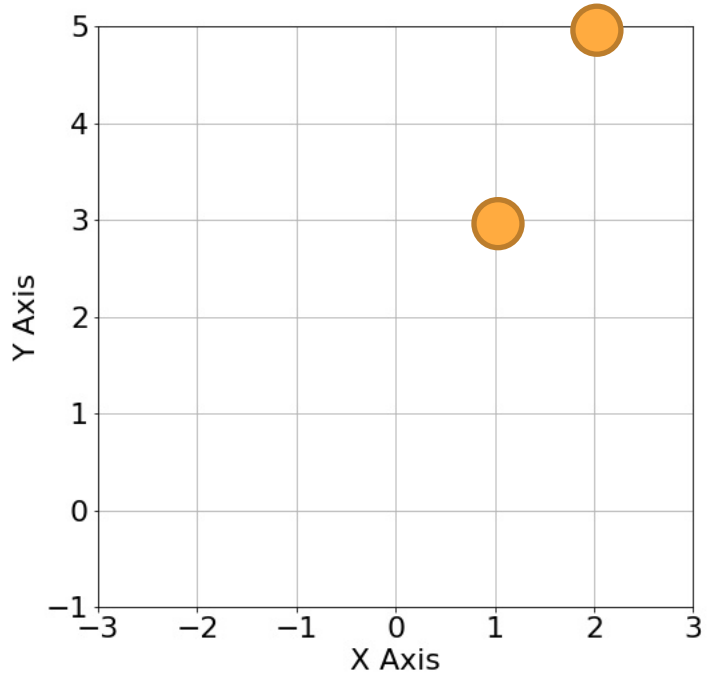
Coordinates in 2 Dimensions

- $p_1 = (1,3)$



Coordinates in 2 Dimensions

- $p_1 = (1,3)$
- $p_2 = (2,5)$



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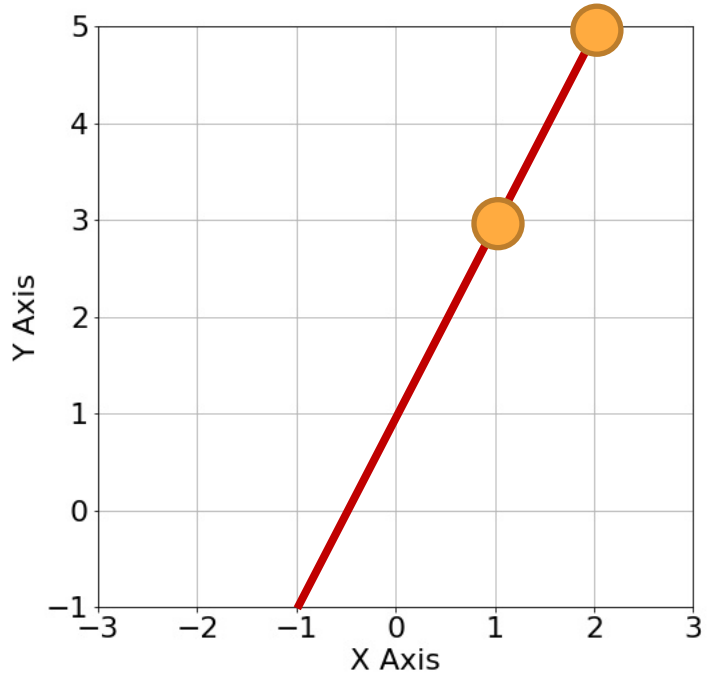
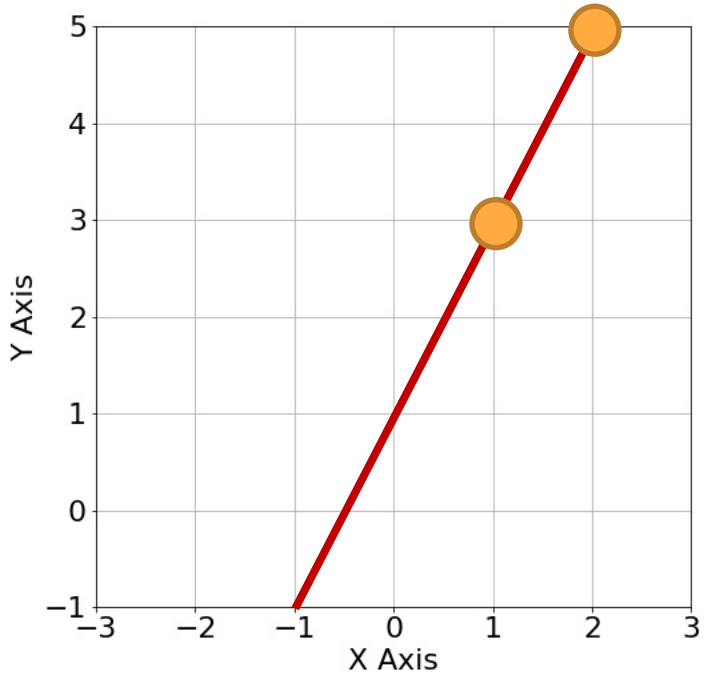


Line Equation

- $p_1 = (1,3)$
- $p_2 = (2,5)$

$$y = mx + b$$



Line Equation

- $p_1 = (1,3)$
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$$y = mx + b$$
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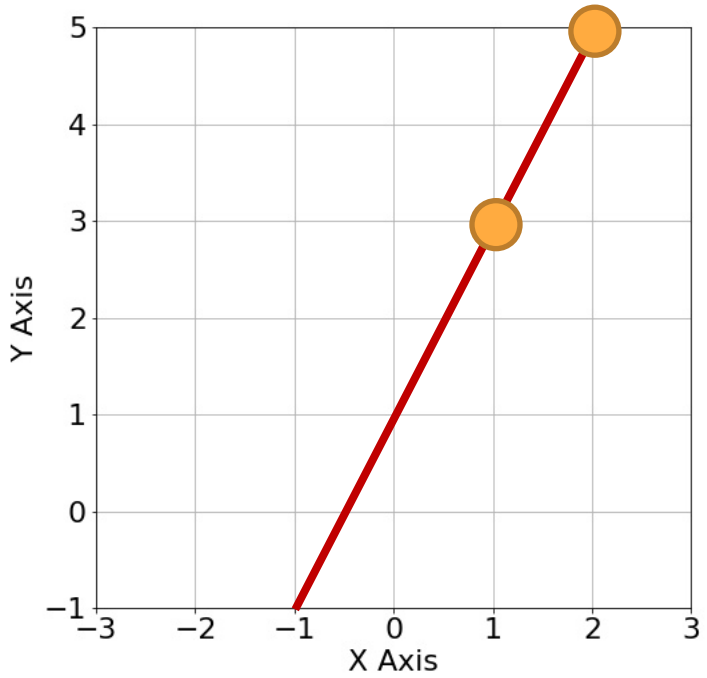

Line Equation

- $p_1 = (1,3)$
- $p_2 = (2,5)$

$$y = mx + b$$
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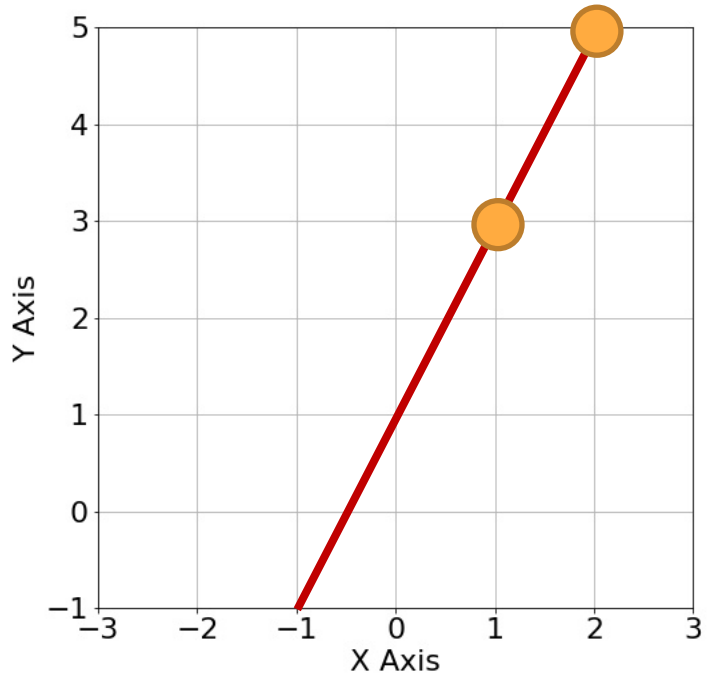
$$y = 2 \cdot 1 + 1 = 3$$



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$$y = mx + b$$
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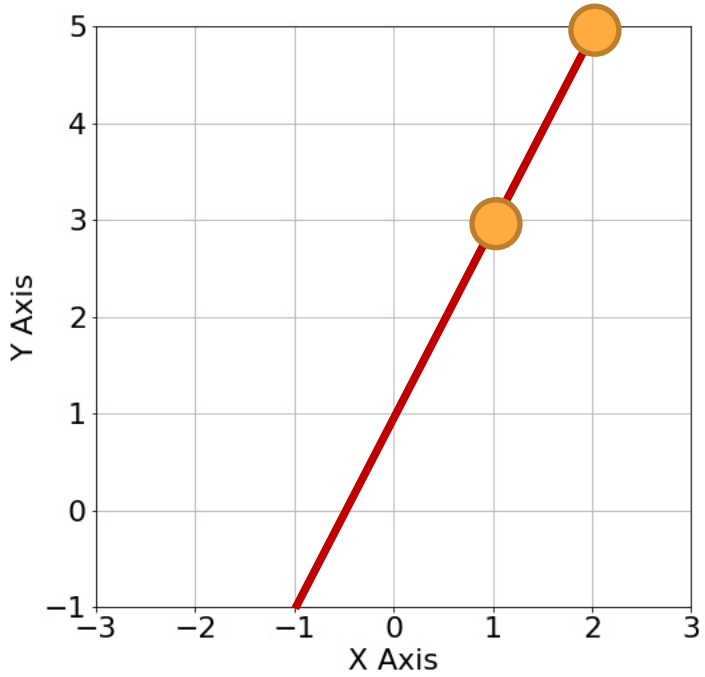
$$y = 2 \cdot 1 + 1 = 3$$
$$y = 2 \cdot 2 + 1 = 5$$



What is “b”?

“b” a.k.a. intercept:

Point where a line crosses the y-axis

$$y = mx + b$$
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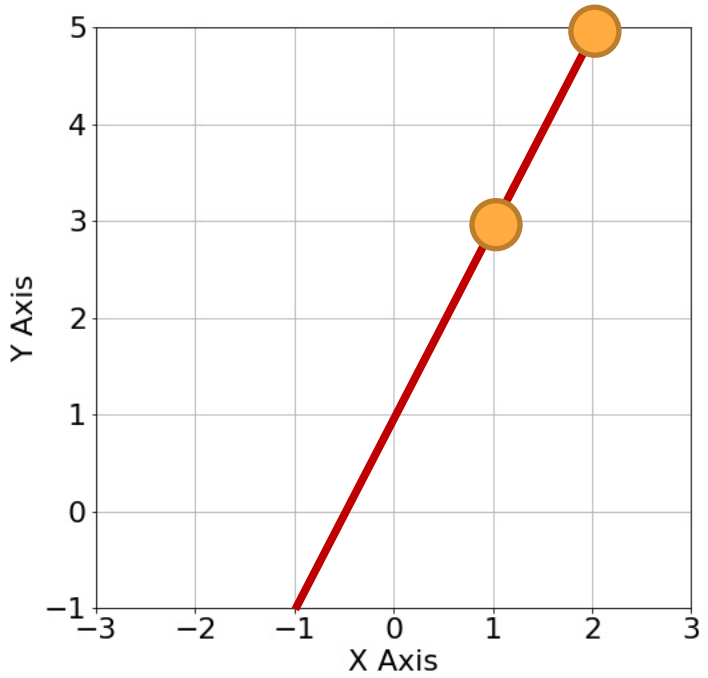

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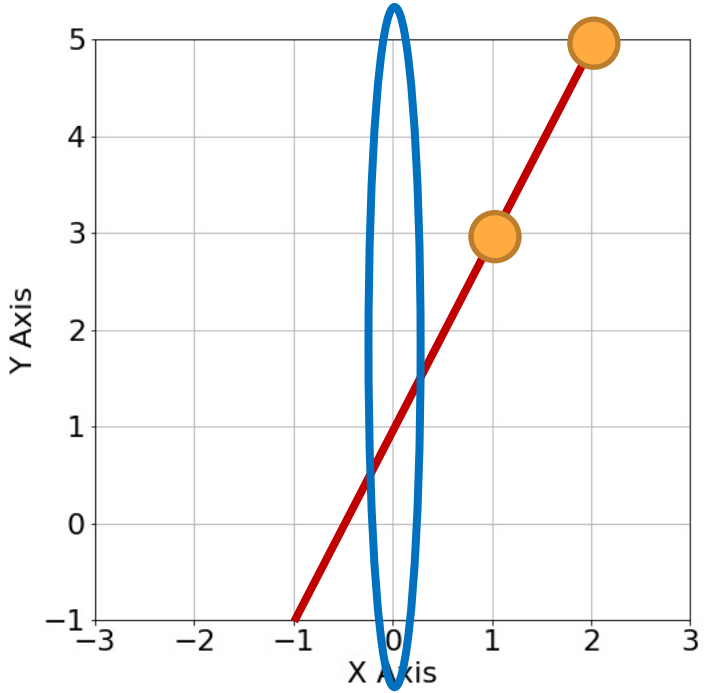

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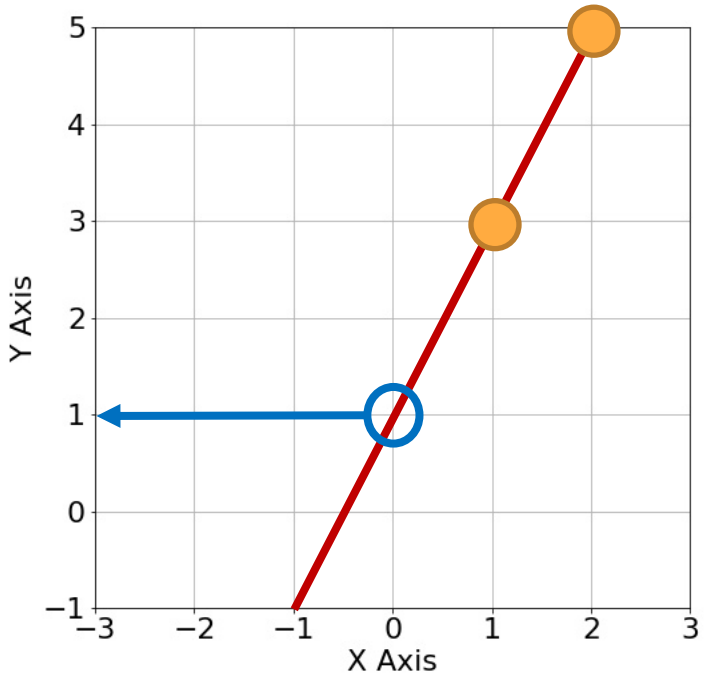
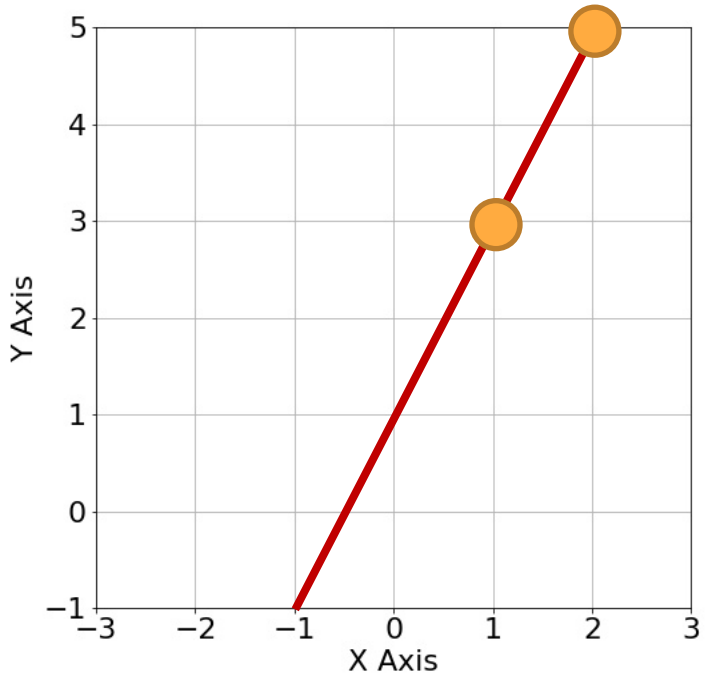


What is “m”?

“m” a.k.a. slope:

Indicates how steep the line is

$$y = mx + b$$
$$y = 2x + 1$$



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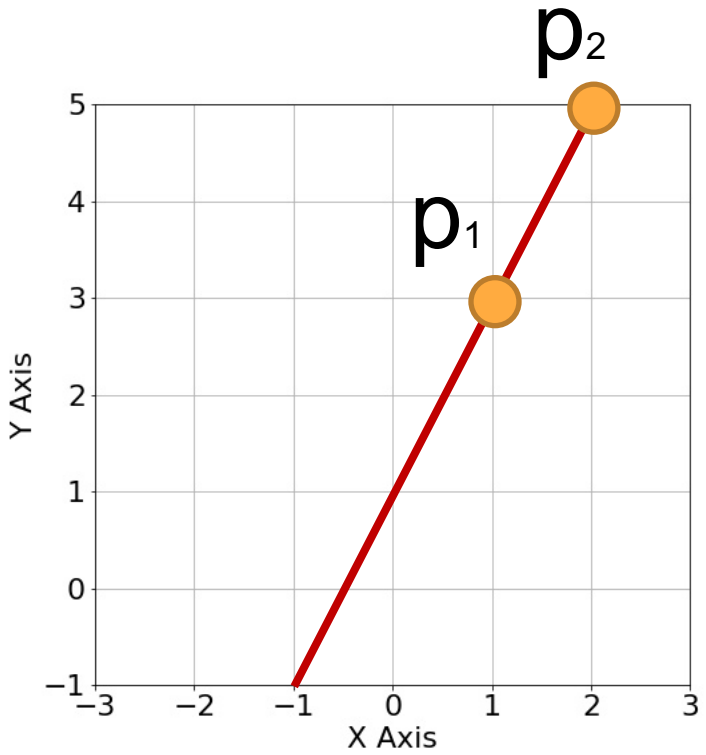
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$



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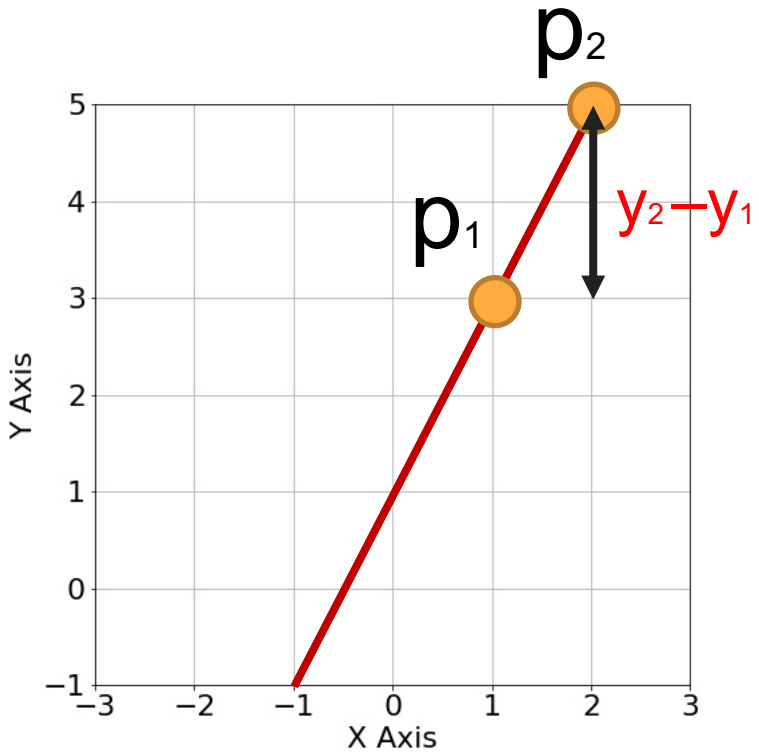

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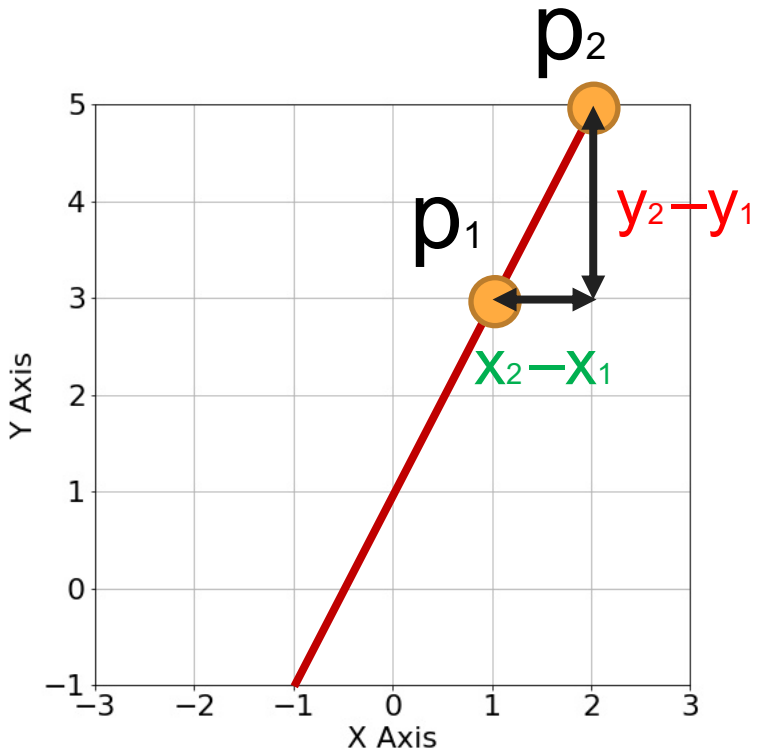

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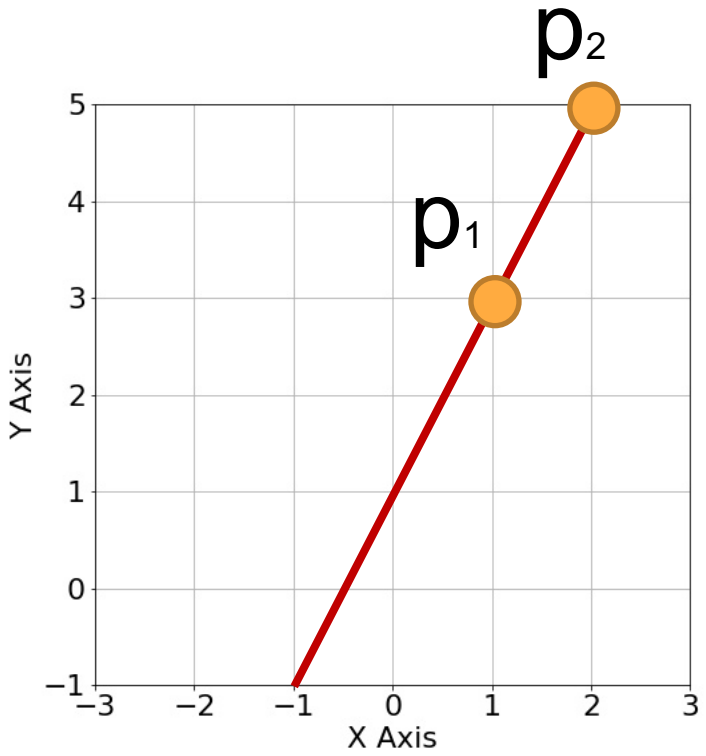
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

$$m = \frac{(5 - 3)}{(2 - 1)} = \frac{2}{1} = 2$$



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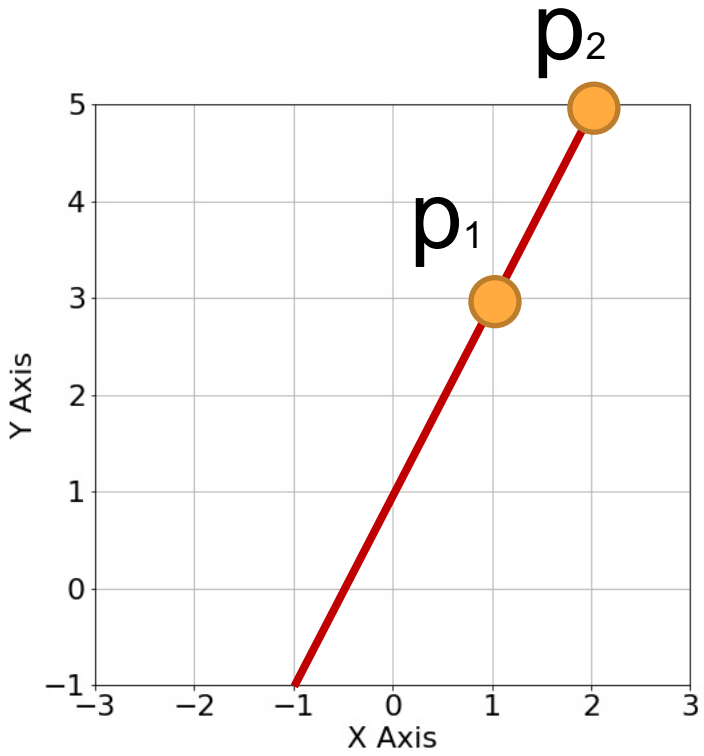
$$y = 2x + 1$$



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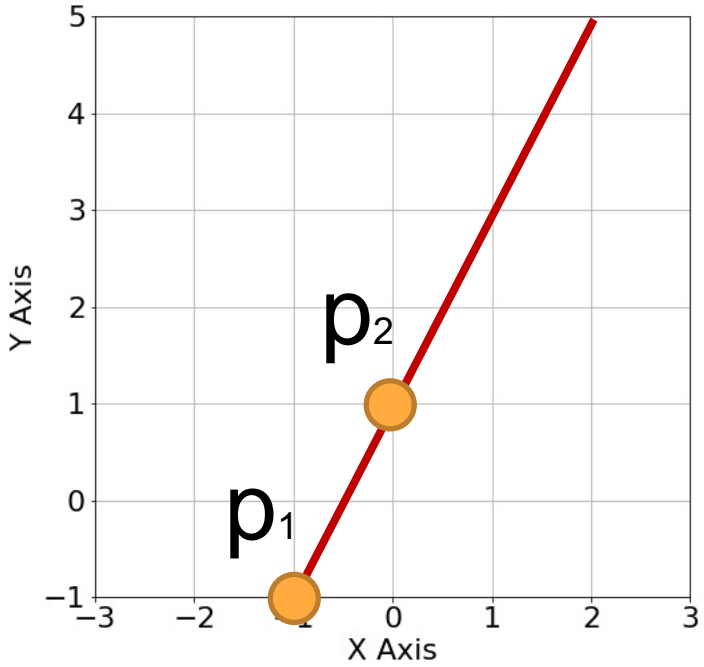

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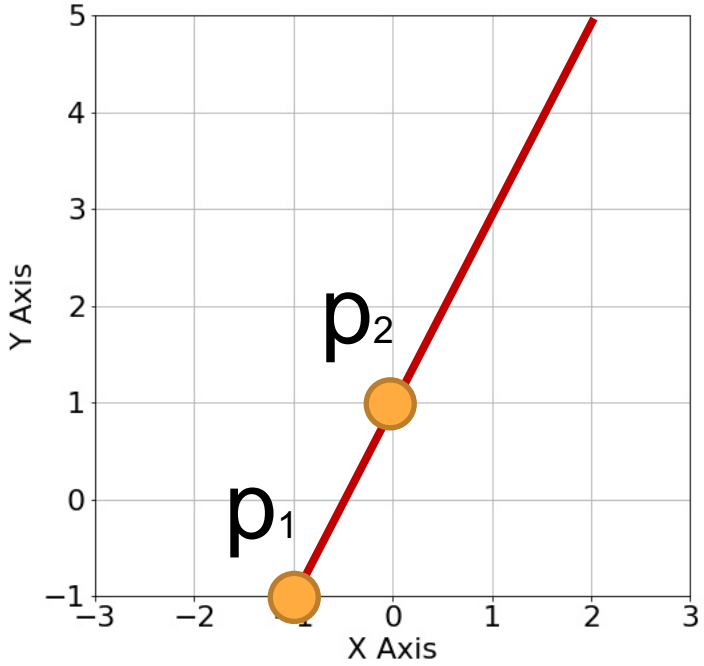
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

$$m = \frac{(1 - (-1))}{(0 - (-1))} = \frac{2}{1} = 2$$



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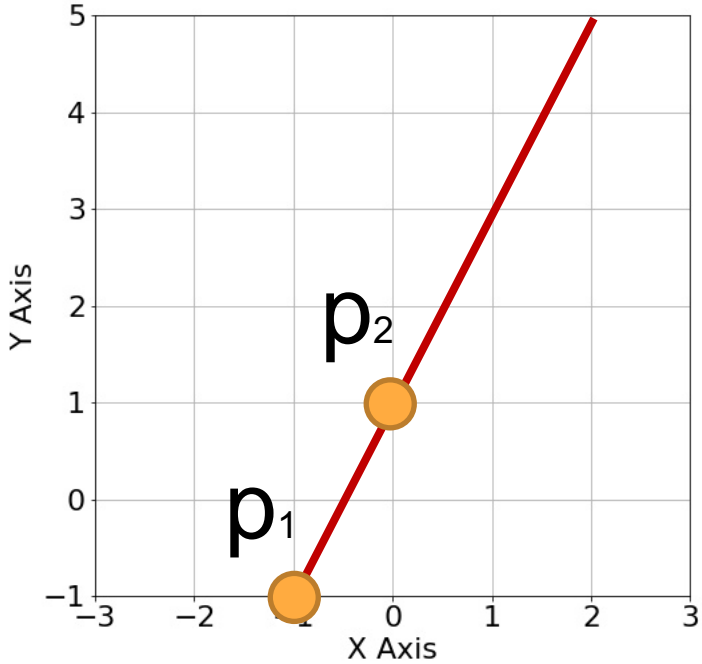


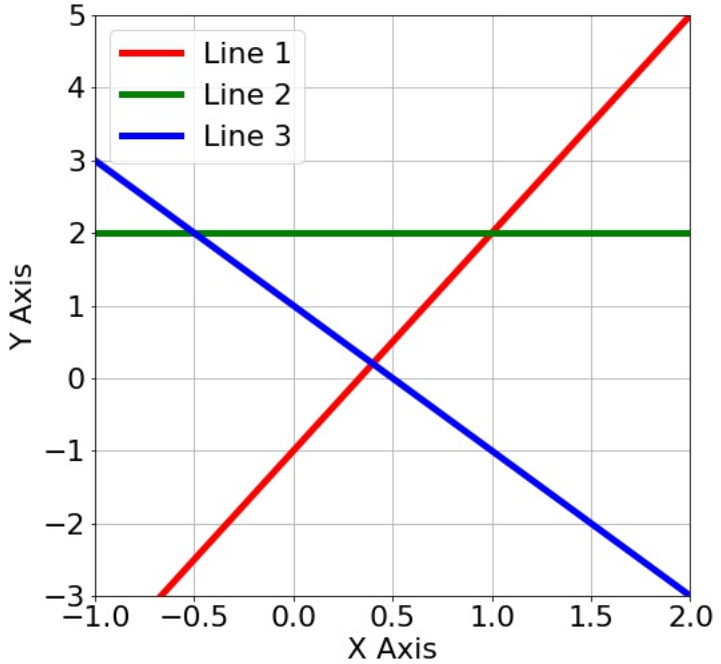
Problem 1:

Problem 1:

Calculate the line equation for the following lines. Helper equations:

$$y = mx + b$$

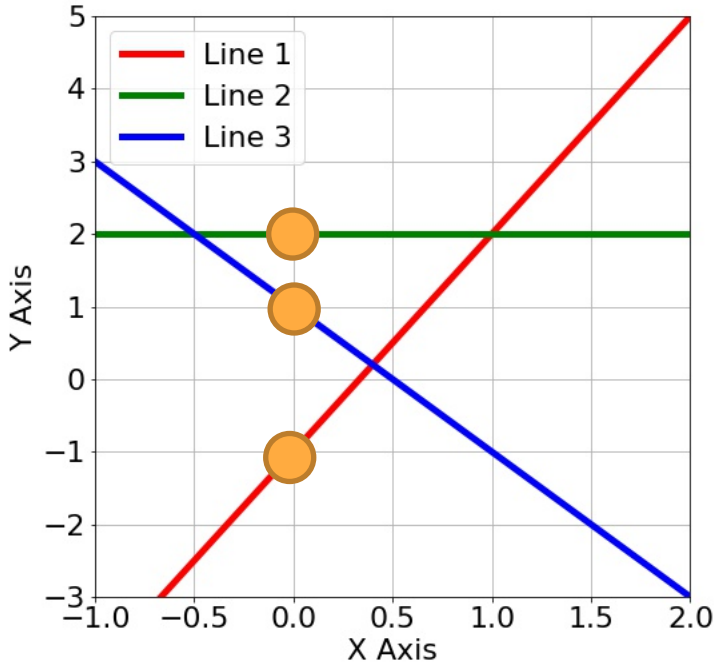
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$



Problem 1:

Let's first extract the intercept:

$$y = mx + b = mx - 1$$
$$y = mx + b = mx + 2$$
$$y = mx + b = mx + 1$$

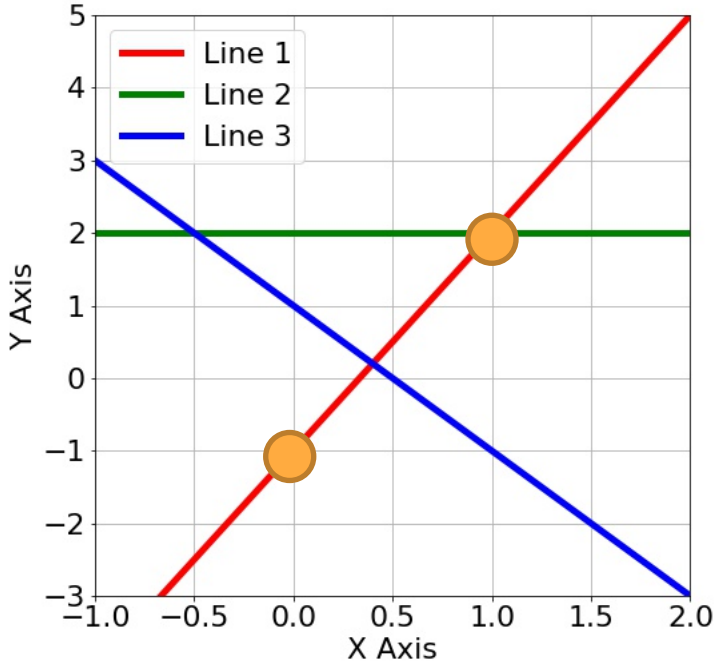


Exercise

Let's extract the slope:

$$y = mx + b = 3x - 1$$
$$y = mx + b = mx + 2$$
$$y = mx + b = mx + 1$$

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{(2 - (-1))}{(1 - 0)} = 3$$



Exercise

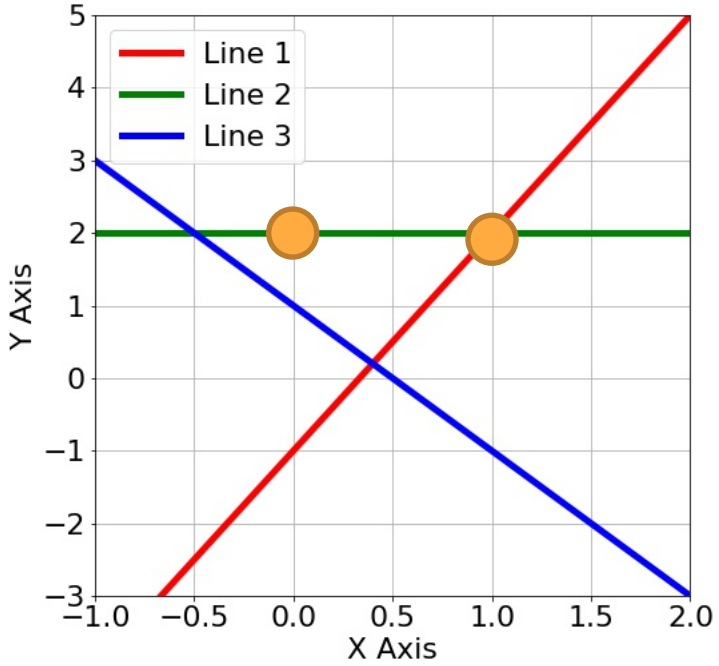
Let's extract the slope:

$$y = mx + b = 3x - 1$$

$$y = mx + b = 2$$

$$y = mx + b = mx + 1$$

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{(2 - 2)}{(1 - 0)} = 0$$



Exercise

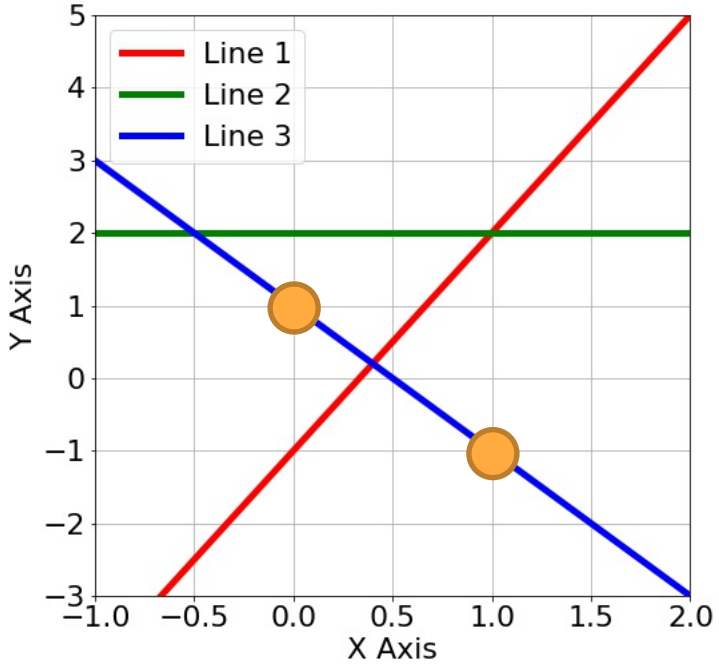
Let's extract the slope:

$$y = mx + b = 3x - 1$$

$$y = mx + b = 2$$

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

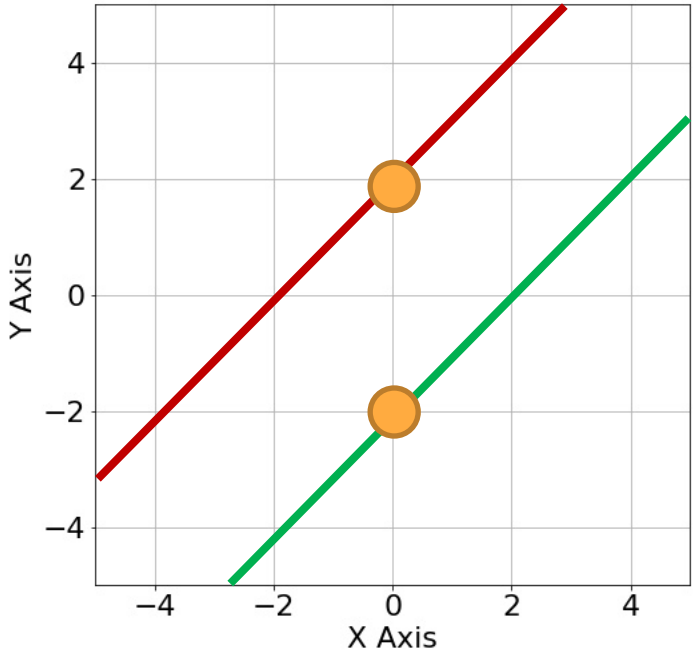
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{(-1 - 1)}{(1 - 0)} = -2$$



A few observations

Parallel lines have the same slope, but different intercept.

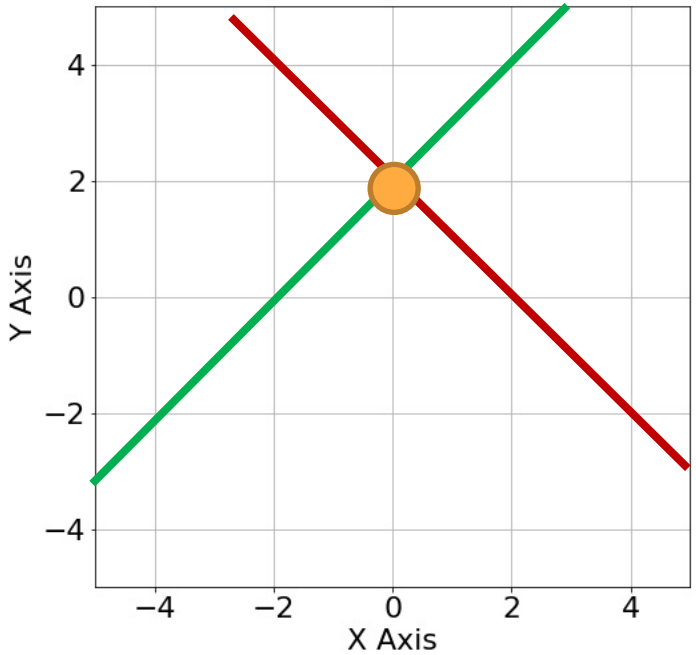
$$y = 1x + 2$$
$$y = 1x - 2$$



A few observations

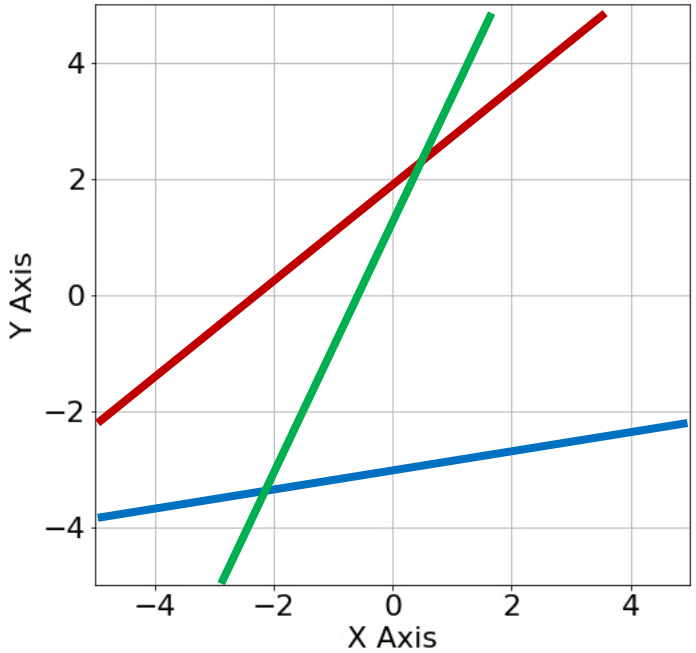
Lines that cross the y-axis at the same point have the same intercept, but different slope.

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



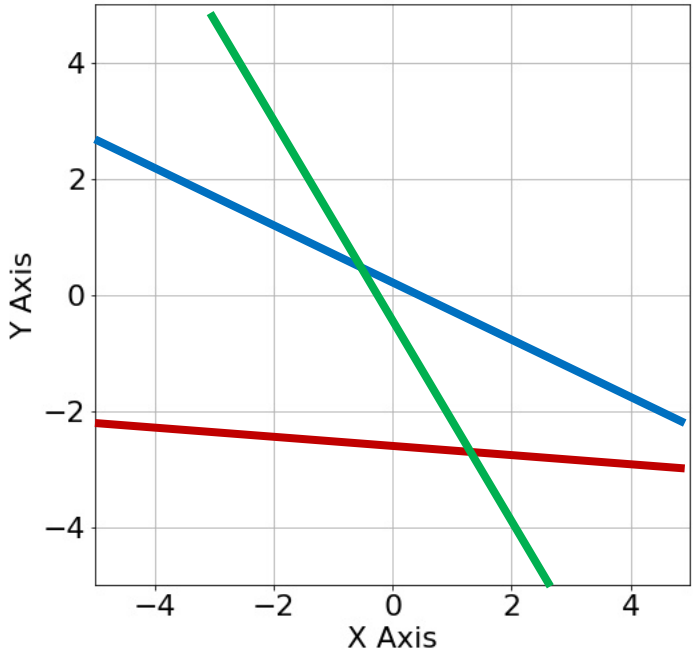
A few observations

All these lines have positive slope.



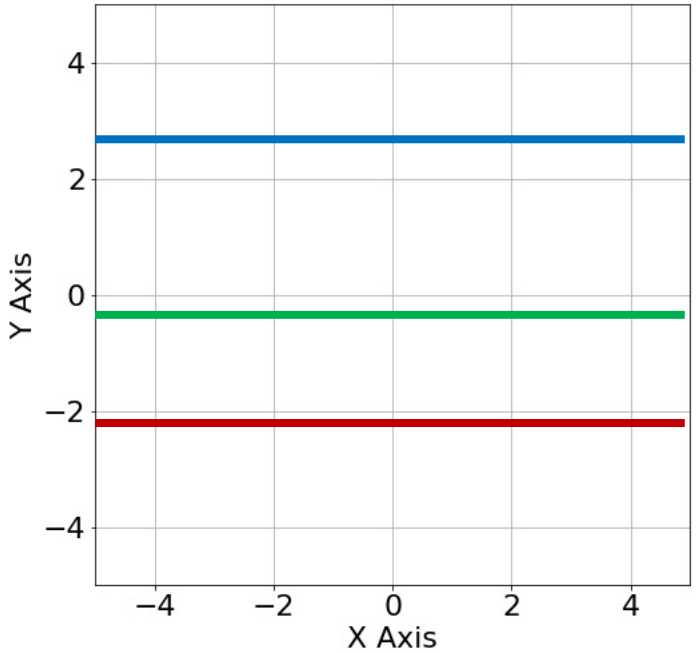
A few observations

All these lines have negative slope.



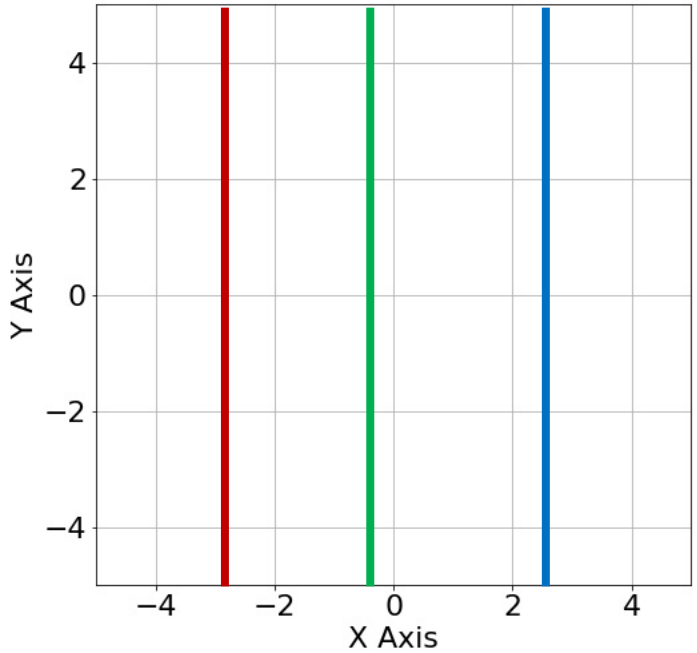
A few observations

These lines have a slope of 0.



A few observations

These lines have a slope of infinity.



Derivatives

Derivatives

Derivative = Slope

QUESTIONS?