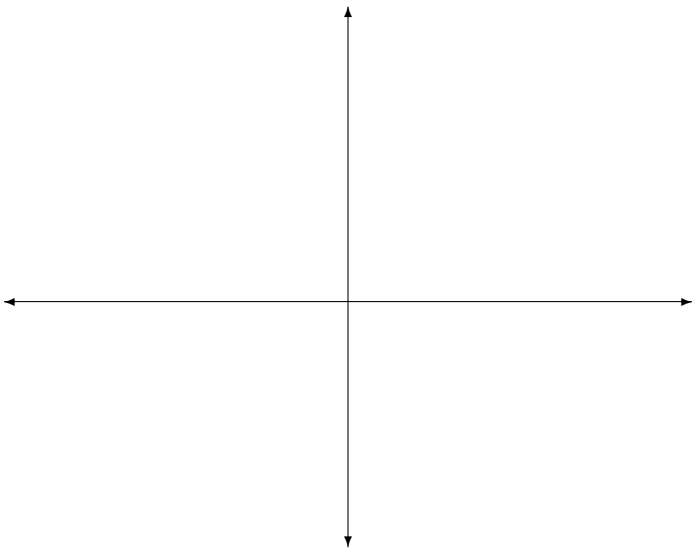
Lecture 2: Section 1.1
Slope and Equations of Lines

Complete the review material on pages 1 – 6 on your own, using your textbook (Sec. 1.1) as a guide.

Given nonvertical line L containing (x_1, y_1) and (x_2, y_2):

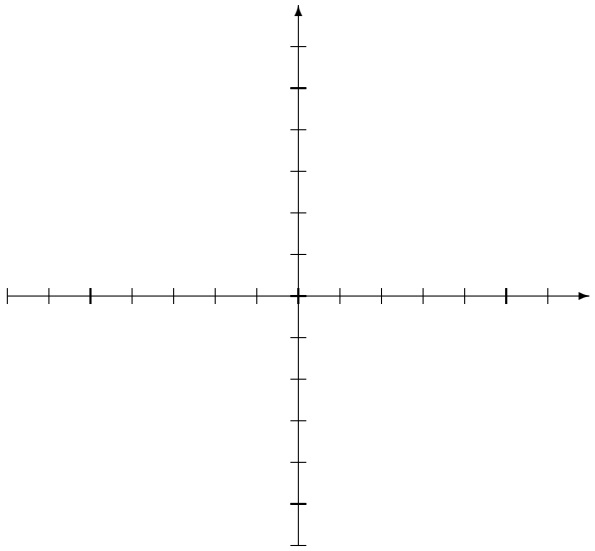


Def. If line L contains points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$, the slope of L is

Slope and the Graph of a Line

ex. Sketch the graph of the line through the point $(0, 0)$ with slope

A. -2 B. $\frac{4}{3}$



NOTE: Given line L with slope m:

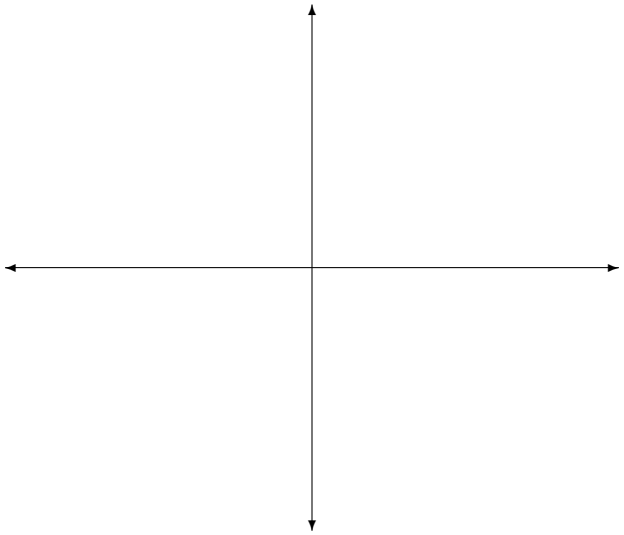
1) if $m > 0$,

2) if $m < 0$,

3) if $m = 0$,

What about a vertical line?

INTERCEPTS OF A GRAPH



Def. An x-intercept of a graph is a point (x-value) at which the graph crosses the x-axis.

To find,

A y-intercept of a graph is a point(y-coordinate) at which the graph crosses the y-axis.

To find,

ex. Find the intercepts of the graph represented by the equation $2x - 3y = 12$.

EQUATIONS OF LINES

ex. Consider a line L which is parallel to the y-axis and which has x-intercept a. Find the equation of L.

POINT - SLOPE FORMULA

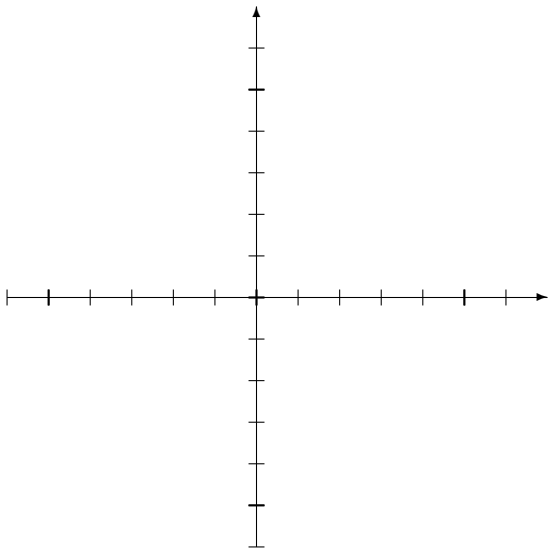
ex. Given line L with slope m containing the point (x_1, y_1). Write an equation of L.

SLOPE-INTERCEPT FORM OF A LINE

ex. Find the equation of the line with slope m and y-intercept b.

GENERAL FORM

ex. Sketch the graph of the line represented by the equation $2x - 3y = 12$.



PARALLEL AND PERPENDICULAR LINES

Given lines L_1 and L_2 with slopes m_1 and m_2

1) L_1 is parallel to L_2 if and only if

2) L_1 is perpendicular to L_2 (written $L_1 \perp L_2$) if and only if

ex. Find k so that the line L through $(2,\ 1)$ and $(k, -1)$ is perpendicular to $3x - 2y + 4 = 0$. Write the equation of L in general form.

Slope as a Rate of Change

If $\Delta x = 1$,

In general,

A Business Example

ex. Consider the following table of data, which expresses the relationship between

$x =$

and $C =$

for a certain product.

x	10	11	12	13
C	\$1225	\$1227.50	\$1230	\$1232.50

Does the relationship appear to be linear? If so, what is the slope?

1) Write the linear equation which **models** the relationship between the number of items, x, and the total cost, C.

2) Put the equation in slope-intercept form.

a) What does the C-intercept tell you?

b) What does slope tell you?

We can confirm this looking at more data for this product:

x	100	120	140	160
C	\$1450	\$1500	\$1550	\$1600

An Additional Application: Linear Depreciation

A company has purchased a piece of equipment for \$14,000. For income tax purposes, the machine **depreciates linearly** (its book value decreases at a constant rate) over its useful life of 8 years.

1) If its salvage value at the end of the 8 years is \$2000, find the equation which expresses the book (nondepreciated) value (V) of the machine in terms of t, the age of the machine in years. What is the book value of the machine after 4 years of use?

2) Interpret the slope and intercept of the equation.

Now You Try It!

1. Write the equation of the line through the point $(3, -1)$ and parallel to (a) the x-axis and (b) the y-axis. Find the slope of each line if possible.

2. Find the value of k so that the line through the points $(2, 3)$ and $(-4, 12)$ is perpendicular to the line $kx + 4y - 6 = 0$.

3. In a certain region, the number of deaths N in a week have been observed to be linearly related to the average concentration x, in mg/m^3, of sulphur dioxide in the air.

   (a) If there are 90 deaths when the concentration of sulphur dioxide is 100 mg/m^3, and 110 deaths when the concentration rises to 350 mg/m^3, write a linear equation expressing N in terms of x.

   (b) Use your answer from part (a) to find the number of deaths per week when the concentration is 250 mg/m^3.

   (c) What concentration of sulphur dioxide will be expected if there are 124 deaths per week? Use your formula from part (a) to answer.

4. The math department purchased a new copier for running exams for \$22,000. If the value of the machine depreciates linearly so that its trade-in value after 9 years is \$1750, write the linear equation expressing the value of the machine V in terms of its age t in years. What is the value of the machine after 4 years? When does the machine have no trade-in value?

5. Show that two distinct lines with equations $ax + by = c$ and $dx + ey = f$ are parallel if and only if $ae - bd = 0$.