Chapter 3

Linear and Quadratic Functions

Section 1
Linear Functions, Their Properties, and Linear Models

When an equation of a line is written in slope-intercept form with function notation we call it a **linear function**

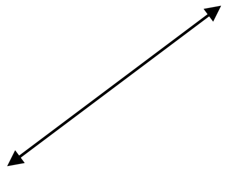
$f(x) = mx + b$ (m = slope, b = y-intercept)

Average Rate of change of a linear function is constant and its known as slope:

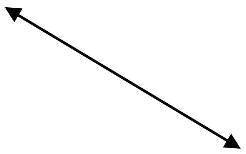
$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} \qquad \frac{y_1 - y_2}{x_1 - x_2}$$

Determining if increasing, decreasing, or constant is dependent on slope!

Increasing = positive slope



Decreasing = negative slope



Constant = zero slope

Modeling with a Linear Function

If the average rate of change is a constant m, a linear function f(x) can be used to model the relation between the two variables as follows:

$$f(x) = mx + b$$

Where b is the value of f at 0, that is f(0) = b

(y = #)

Example 1: (# 21 pg. 133)

Determine whether the given function is linear or nonlinear. If it is linear, determine the equation of the line.

X	Y
-2	4
-1	1
0	-2
1	-5
2	-8

$x \to +1, \ y \to -3$

$\hookrightarrow$ is linear

$m = \frac{4-1}{-2 - -1} \to \frac{3}{-1} = -3$

b

$y = -3x - 2$

Example 2: (#29 pg. 133)

$f(x) = 4x - 1$ $g(x) = -2x + 5$

a) Solve $f(x) = 0$

$4x - 1 = 0$

$4x = 1$

$x = 1/4$

b) Solve $f(x) > 0$

$4x - 1 > 0$

$4x > 1$

$x > 1/4$

c) Solve $f(x) = g(x)$

$4x - 1 = -2x + 5$

$6x - 1 = 5$

$6x = 6$

$x = 1$

d) Solve $f(x) \leq g(x)$

$4x - 1 \leq -2x + 5$

$6x - 1 \leq 5$

$6x \leq 6$

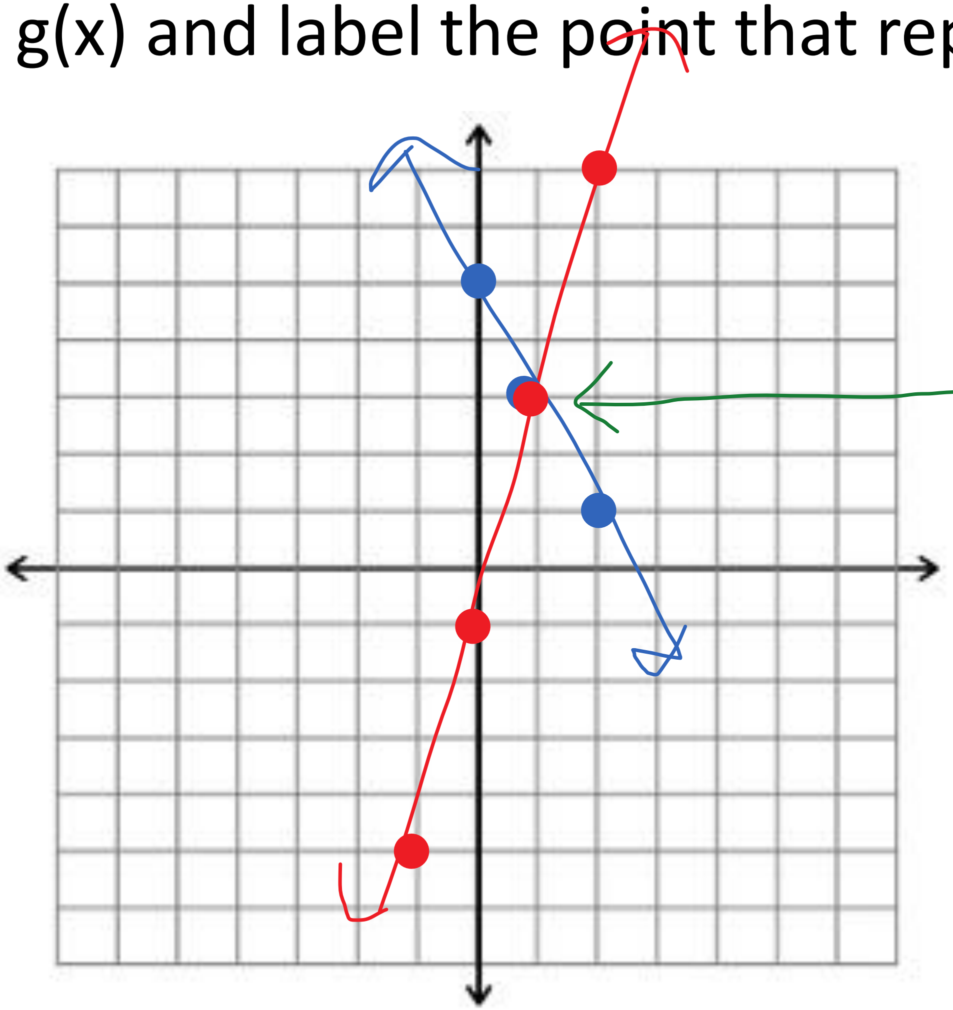
$x \leq 1$

Example 2 continued: (#29 pg. 133)

$f(x) = 4x - 1$ $\qquad\qquad$ $g(x) = -2x + 5$

↳ $m = 4$, $b = -1$ $\qquad\qquad$ ↳ $m = -2$, $b = 5$

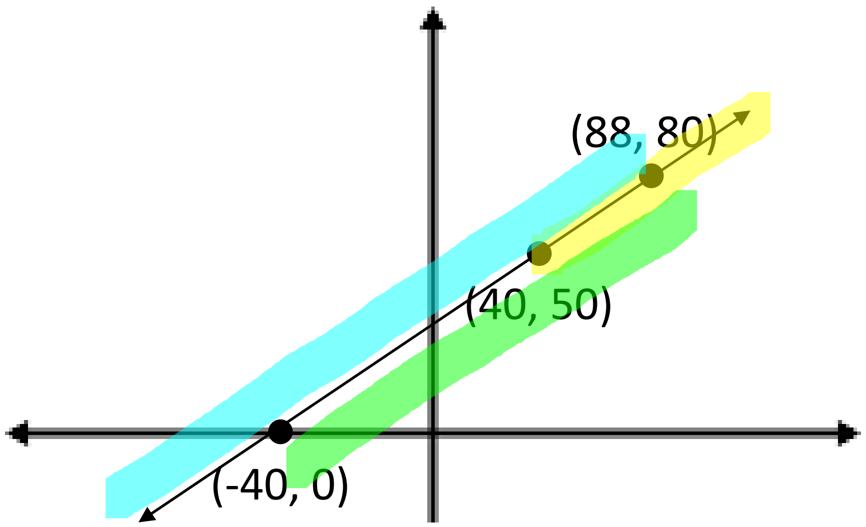
e) Graph $y = f(x)$ and $y = g(x)$ and label the point that represents the solution to the equation $f(x) = g(x)$.



(1, 3)

Example 3: (#31 pg. 133)

Use the following figure:



a) Solve $f(x) = 50$ $x = 40$

b) Solve $f(x) = 80$ $x = 88$

c) Solve $f(x) = 0$ $x = -40$

d) Solve $f(x) > 50$ $x > 40$

e) Solve $f(x) \leq 80$ $x \leq 88$

f) Solve $0 < f(x) < 80$ $-40 < x < 88$

Example 4: (#37 pg. 134)

Car Rentals

$C(x) = 0.25x + 35$; x = miles, C = cost

What is the cost if you drive 40 miles?

$C = .25(40) + 35$

$10 + 35$

$C = 45 \Rightarrow \$45$

If the cost of renting the truck is $80, how many miles did you drive?

$80 = .25x + 35$

$45 = .25x$

$180 = x \Rightarrow 180$ miles

Example 4 continued: (#37 pg. 134)

Car Rentals

$C(x) = 0.25x + 35$; x = miles, C = cost

Suppose you want the cost to be no more than \$100, what is the maximum number of miles that you can drive?

$100 \geq .25x + 35$

$65 \geq .25x$

$260 \geq x \Rightarrow$ @ most 260 miles

What is the implied domain of C?

$\{x > 0\}$

EXIT SLIP