Math 1311
Section 3.2
Linear Functions

A **linear function** is a function which has a constant rate of change, i.e. slope.
The slope is the amount of change in the function value when the independent variable increases by 1.
Suppose $y = f(x)$ is a function of x. Then:

$$slope\ m = \frac{change\ in\ y}{change\ in\ x} = \frac{change\ in\ function}{change\ in\ variable}$$

Equations
Slope – Intercept Form

- A linear function has formula $y = f(x) = mx + b$.
- m is the slope of the line.
- The point $(0, b)$ is the vertical (y) intercept.
- In practical terms, b represents the initial value of the output.

Point – Slope Form

- Suppose we know that a linear function has slope m and passes through the point (x_1, y_1), then the equation of the line can be written as $y - y_1 = m(x - x_1)$.
- From this equation, solving for y gives the equation of the linear function.

Example 1: Give the formula for the linear function described:

a. slope of 7 and y–intercept $(0, -2)$.

b. slope of -4 and passes through the point (2, -3).

c. passes through the points $(0, 4)$ and $(2, -6)$.

d. passes through the points $(-3, 5)$ and $(7, 24)$.

Example 2: Suppose that at the beginning of an experiment there are 500 bacteria present and that this number is decreasing at a rate of 75 bacteria per hour.

a. How can we tell that this relationship is linear?
b. Give a formula for N, the number of bacteria after h hours.

Example 3: A certain company manufactures widgets. Suppose that the cost of leasing the building, buying the equipment, but producing no widgets is \$14000. Suppose the total cost is \$20000 if 500 widgets are produced.

a. Assuming a linear relationship between total cost C and number of widgets produced n, find and interpret the slope of the function $C = f(n)$.
b. Give the formula for the function $C = f(n)$.
c. What is the total cost to when 785 widgets are produced.

Example 4: A certain jeweler makes a profit of \$160 when she sells 12 necklaces and \$300 when she sells 17 necklaces.

a. Assuming a linear relationship between profit P and the number of necklaces sold n, find and interpret the slope of the function $P = f(n)$.
b. Give the formula for the function $P = f(n)$.