Mini-Lecture 2.7

Variation

Learning Objectives:

- 1. Model and solve problems involving direct variation.
- 2. Model and solve problems involving inverse variation.
- 3. Model and solve problems involving combined or joint variation.

Preparing for Variation:

i) Solve:
$$45 = 9k$$
 ii) Solve: $12 = \frac{k}{5}$

Examples:

DEFINITION

Suppose we let x and y represent two quantities. We say that y varies directly with x, or y is directly proportional to x, if there is a nonzero number k such that

y = kx

The number k is called the **constant of proportionality.**

1. If y varies directly as x and y = 6 when x = -9, write a linear function relating the two variables.

2. Suppose that *y* is directly proportional to *x* and when x = -12, y = 5. Find *y* when x = 20.

3. Suppose the *C* varies directly as *n* and when C = 15.24, n = 12. Find *C* when n = 37.

Mini-Lecture 2.7

Variation

DEFINITION

Suppose x and y represent two quantities. We say that y varies inversely with x, or y is inversely proportional to x, if there is a nonzero number k such that

$$y = \frac{k}{x}$$

4. Suppose that *y* varies inversely with *x*. When x = 4, y = 12. Find *y* when x = 18.

When a variable quantity Q is proportional to the product of two or more other variables, we say that Q varies jointly with these quantities. For example, the equation y = kxz can be read as "y varies jointly with x and z." When direct and inverse variation occur at the same time, we have combined variation. For example, the equation $y = \frac{kx}{z}$ can be read as "y varies directly with x and inversely with z." The equation $y = \frac{kmn}{p}$ can be read "y varies jointly with m and n and inversely with p."

5. Suppose that *r* varies jointly with *s* and *t*. When r = 12, s = 8 and t = 3. Find *r* when s = 14 and t = 6.

6. The cost *C* of purchasing chocolate-covered almonds varies directly with the weight *w* in pounds. Suppose that the cost of purchasing 5 pounds of chocolate-covered almonds is \$22. What would it cost to purchase 6.5 pounds of chocolate-covered almonds?

Mini-Lecture 2.7

Variation

7. The force F of the wind on a flat surface positioned at a right angle to the direction of the wind varies jointly with the area A of the surface and the square of the speed v of the wind. A wind of 30 miles per hour blowing on a window measuring 3 feet by 4 feet has a force of 90 pounds. What is the force on a window measuring 6 feet by 5 feet caused by a wind of 40 miles per hour?