Section 2.2 – Mathematical Models

Problem Set 1

Write a mathematical formula to describe the following situations.

1. The time it takes one person to complete an assignment is half the time it takes another person.
2. The number of books in one library is four times the number in a second library.
3. The distance between two cities is six miles less than the distance between two other cities.
4. The total time that two students' work on a project is 1.5 hours.
5. The distance traveled by one car is five miles more than three times the distance traveled by a second car.

Find the following values.

6. **Ohm's Law** says describes the relationship between three parameters of a current flowing between two points. If I is the current, V is the voltage and R is the resistance then the relationship between the three parameters is

$$I = \frac{V}{R}$$

If the resistance in a circuit is 40 ohms and the voltage is 5.0 volts, what's the current?

7. **Charles's Law** describes the relationship between the volume and temperature of a gas. In English, it says that the ratio of those two parameters will always be a constant, i.e.

$$\frac{V}{T} = k$$

If V is the gas's volume and T is its temperature, what's the constant value for a pressure of 2.5 atmospheres at 212 °F?

8. **The average speed** of a moving object is given by

$$\frac{v_0 + v_1}{2}$$

Where v_0 is the initial speed and v_1 is the final speed. If an object starts at 12 mph and finishes at 56 mph, what was its average speed?

9. In economics **elasticity** describes how much demand changes when the price of an item changes. The relationship is described by

$$E = \frac{Q}{P}$$

Where E is the elasticity, Q is the percent change in the quantity demanded and P is the percent change in the price. What would the elasticity be if a change in quantity demanded of 12% corresponded to a change in price of 5%?

10. **Lennard-Jones Potential** The Lennard-Jones Potential describes the potential between two uncharged molecules as they approach each other. The potential, P, is given by the formula

$$P = 4e\left[\left(\frac{d}{r}\right)^{12} - \left(\frac{d}{r}\right)^{6}\right]$$

Where *r* is the distance between the molecules and *e* and *d* are constants that depend on the type of the molecule. For water, *d* = .316555 nanometers and e = .6501696 kilojoules per molecule. If the distance between two molecules is 1.5 nanometers, what's the value of the potential between them?