Name: _____     Period: _____     Date: _____

# Calculating Population Growth Rate and Doubling Time

There are four variables that influence the growth rate of the human population.  Crude birth rate (**CBR**) and immigration are inputs and increase the population.  Crude death rate (**CDR**) and emigration are outputs and decrease the population.  The human population can be studied as a system of inputs and outputs; if the net input is greater than output, then the population expands.  All four variables are usually given per 1,000 which will simplify calculations quite a bit.  Let's take a look at a few equations.

**Global Population Growth Rate**: Since people do not immigrate or emigrate from the planet, we do not include those variables in calculating the growth rate of the world population.  The equation we use is:

Global Population growth rate: $\dfrac{(\text{CBR} - \text{CDR})}{10}$

**Sample problem**:  Worldwide, there were 20 births and 8 deaths per 1,000 in 2009.  Calculate the growth rate of the world in 2009.

**Growth rate of a single nation or region:**  Since people do migrate in and out of nations, we do include immigration and emigration into the equation.

Growth Rate for a nation or region= $\dfrac{(\text{CBR} + \text{I}) - (\text{CDR} + \text{E})}{10}$

**Sample problem**:   The tiny country of Fremont has a population of 100,000 people.  In 2009, there were  2,000 births, 500 deaths, 200 emigrants, and 100 immigrants.  What is the population growth rate (r) for 2009?

**Rule of 70 or Doubling time**:  If we know the growth rate (**r**)of a population and assume that it is constant, we can calculate the number or years it will take for the population to double, known as the doubling rate.  Because growth rates may change in future years, we can never calculate a country's doubling time with certainty.  We can say that a population will double in a certain number of years if the growth rate of the population remains constant.  The doubling time can be approximated mathematically using the formula called the rule of 70.

Doubling time( in years): $\dfrac{70}{\text{Growth rate (r)}}$

**Sample problem**: The small town of West Fremont has a population of 50,000.  If the growth rate of West Fremont is 2%, then how long will it take for the population of West Fremont to double?

1. North Fremont's population growth rate is 5%.  What is the doubling time for North Fremont?

2. New Fremont had a birthrate of 12 per 1,000 in 2010 and a death rate of 9 per 1,000.

   a. Calculate the growth rate of New Fremont.

   b. If the current population of New Fremont is 150,000, how long will it take the country to double its population using the current growth rate? (Round to the nearest whole number.)

3. Central Fremont has a crude birth rate of 24 per 1,000 and a crude death rate of 8 per 1,000.

   a. What is the natural annual increase of Central Fremont?

   b. At this rate of increase, how long will it take Central Fremont's population of 35,000 to double? (Round to the nearest whole number.)

4. In 2010, the crude birth rate in Lower Fremont was 25 and the crude death rate was 11.  If the population was 15,000 in 2010, and the population growth rate remains constant, when will the population reach 30,000?

5. In 2010, East Fremont had a population of 10 million people, a birth rate of 7.2%, and a death rate of 2.2%. If the birth and death rates remain constant, in what year will the population will be close to 40 million people?

6. In 2010, the population of Fremontville was 6 million and growing at a rate of 1.4% / year.  If the rate of population growth remains constant, in what year will the population reach 24 million people?