Definition 1.1

For the population growth equation, $\frac{dP}{dt} = kP$, the constant k is given by

$$k =$$

Radioactive Decay

Veitchonium-12 decays exponentially with a decay rate of 5.2% per year. The rate of change of an amount N of this awesome radioactive isotipe is given by

$$\frac{dN}{dt} = -.052N$$

1. Find the function that satisfies the equation. Let N_0 represent the amount repsent at $t = 0$.
2. Suppose 500 grams of Veitchonium-12 is present at $t = 0$. How much will remain after 50 years?
3. After how long until half the 500 grams remain?

Radioactive Decay

Example 1.2

Radium is a radioactive element that decays exponentially. The half-life of radium is approximately 1600 years. If we began with 80 grams of radium, how many grams will remain 200 years from now?

Theorem 1.3

The ***decay rate*** k*, and the* ***half-life*** T*, are related by*

$$kT = \ln 2$$

$k =$ $T =$

Example 1.4

Find the decay rate k of Veitchonium-23 if the half-life is 4560 years.

Example 1.5

Dr. Willard Libby won a Nobel Price for developing radiocarbon dating; which is used by archelogists to determine the age of ancient objects. While alive, all plants and animals acquire and replenish carbon-14 based on their weight. In about 5750 years, half of the carbon-14 decays. In 1991, hikers discovered the well-preseved body of a man frozen in the Alps. Archelogists used radiocarbon dating a piece of his flesh to confirm that he lived in teh Stone Age. The flesh lost 47% of the carbon-14 that would have been found in a living man. Determine the age of the body.

Example 1.6

A very common financial question John and Jill want to tour the world but need to save money for the trip. A travel agent determines that in 5 years they need to have \$25,000. Interest is compounded continuously at 7%. What should the initial investment be?

Theorem 1.7

The ***present value*** P_0 *of an amount* P *due* t *years from now, at interest rate* k*, compounded continuously, is given by*

$$P_0 =$$