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Following are some carefully chosen problems and activities to highlight science applications as well as resource management. These carefully chosen application problems gave my math students an opportunity to think about the environment and opened up discussions on ways to protect it and how to help conserve the resources we have.

In my **Finite Mathematics** (MA110a) classes, a sampling of the textbook application problems we discussed in detail are:

1. **Marine biology**. Marine life depends on the microscopic plant life that exists in the photic zone, a zone that goes to a depth where only 1% of surface light remains. In some waters with a great deal of sediment, the photic zone may go down only 15 to 20 feet. In some murky harbors, the intensity of light d feet below the surface is given approximately by

   $$\mathbf{I} = \mathbf{I}_0 e^{-0.23d}$$

   What percentage of the surface light will reach a depth of a) 10 feet? b)20 feet?

   Light intensity $\mathbf{I}$ relative to depth d (in feet) for one of the clearest bodies of water in the world, the Sargasso Sea, can be approximated by

   $$\mathbf{I} = \mathbf{I}_0 e^{-0.00942d}$$

   where $\mathbf{I}_0$ is the intensity of light at the surface. What percentage of the surface light will reach a depth of a) 50 feet? b) 100 feet?

   (facilitated a short discussion here about Guam's coral reefs and the initiatives put in place to protect them including the revegetation efforts)

2. **World population growth.** From the dawn of humanity to 1830, world population grew to one billion people. In 100 more years (by 1930) it grew to two billion, and three billion more were added in only 60 years (by 1990). In 2009, the estimated world population was 6.8 billion with a relative growth rate of 1.14%.
   a) Write an equation that models the world population growth, letting 2009 be year 0.
   b) Based on the model, what is the expected world population (to the nearest hundred million) in 2020? In 2030? *(interjected a short discussion here of the brown tree snake and its population growth in Guam as well as the effects on other species.)*
   c) If the world population is now 6.8 billion people and if it continues to grow at an annual rate of 1.14% compounded continuously, how long (to the nearest year) will it take before there is only 1 square yard of land per person? (The Earth contains approximately 1.68×10^{14} square yards of land.)

3. **Exponential Decay.** Cosmic-ray bombardment of the atmosphere produces neutrons, which in turn react with nitrogen to produce radioactive carbon-14 (^{14}C). Radioactive ^{14}C enters all living tissues through carbon dioxide, which is first absorbed by plants. As long as a plant or animal is alive, ^{14}C is maintained in the living organism at a constant level. Once the organism dies, however, ^{14}C decays according to the equation

$$\mathbf{A = A_0\, e^{-0.000124t}}$$

where A is the amount present after t years and A_0 is the amount present at time t = 0. If 500 milligrams of ^{14}C is present in a sample from a skull at the time of death, how many milligrams will be present in the sample in

a) 15,000 years? b) 45,000 years?

4. **Archaeology: carbon-14 dating.** The radioactive carbon-14 (^{14}C) in an organism at the time of its death decays according to the equation

$$\mathbf{A = A_0\, e^{-0.000124t}}$$

where t is time in years and A_0 is the amount of ^{14}C present at time t = 0. Estimate the age of a skull uncovered in an archaeological site if 10% of the original amount of ^{14}C is still present.

(Source: Finite Mathematics for Business, Economics, Life Sciences, and Social Sciences, 12th Edition, Raymond A. Barnett, Michael R. Ziegler and Karl E. Byleen)