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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 MA161b class, we studied the **Trigonometric Functions and its Applications, Sequences, Series, and Probability**. Some of the textbook problems we discussed in class are the following:

1. **Tidal components**. The height of the tide at a particular point on shore can be predicted by using seven trigonometric functions (called tidal components) of the form

$$f(t) = \mathrm{a}\cos(bt + c).$$

   a. The principal lunar component may be approximated by

$$f(t) = a\cos(\frac{\pi}{6}\mathrm{t} - \frac{11\pi}{12}),$$

   where t is in hours and t = 0 corresponds to midnight.

   Sketch the graph of ***f*** if a = 0.5 meters.

   b. The principal solar diurnal component may be approximated by

$$f(t) = a\cos(\frac{\pi}{12}\mathrm{t} - \frac{7\pi}{12}).$$

   where t is in hours and t = 0 corresponds to midnight.
   Sketch the graph of ***f*** if a = 0.2 meters.
   (prompted a discussion about Guam as a coastal community and how it adapts to climate change)

2. **Water demand.** A reservoir supplies water to a community. During the summer months, the demand D(t) for water in ft^3/day is given by

$$\boldsymbol{D(t) = 2000 sin\frac{\pi}{90}t + 4000,}$$

   where t is time in days and t = 0 corresponds to the beginning of summer.

   Sketch the graph of D for $0 \le t \le 90$.

   a) When is the demand for water the greatest?
   (prompted a discussion of water as a scarce resource, facilitated a discussion so that students can put forth their own ideas for conserving water here on the island as well as how to properly dispose of and recycle waste materials.)

b) **Pinpointing a forest fire.** From an observation point **A,** a forest ranger sights a fire in the direction S35^{0}50'W. From a point B, 5 miles due west of A, another ranger sights the same fire in the direction S54^{0}10'E. Approximate to the nearest tenth of a mile, the distance of the fire from A.

3. **Insect population.** The sequence defined by $a_{k+1} = ca_k (1 - a_k)$ is used in the study of insect population growth. The constant ***c*** is called the Malthusian factor. Suppose that 1000a_k equals the number of insects after ***k*** time intervals. If initially $a_1 = 0.25$, describe the behavior of the insect population for each value of ***c***.

   a. c = 0.5 **b. *c = 1.5*** **c. *c = 2.75***

   The Malthusian factor c affects the population a_k of insects dramatically, and ***c*** can be interpreted as the degree of fertility of the insects.

   a) Conjecture how ***c*** will affect the insect population if 0 < c < 1.
   b) Test your conjecture using various values for ***c***.

4. **Temperature-humidity relationship**. On March 17, 2010, in Tucson Arizona, the temperature in degrees Fahrenheit could be described by the equation

$$T(t) = -12\cos\left(\frac{\pi}{12}t\right) + 60,$$

   while the relative humidity in percent could be expressed by

$$H(t) = 20\cos\left(\frac{\pi}{12}t\right) + 60,$$

   where t is in hours and t = 0 corresponds to 6am.

   (a) Construct a table that lists the temperature and relative humidity every three hours, beginning at midnight.
   (b) Determine the times when the maximums and minimums occurred for T and H.
   (c) Discuss the relationship between the temperature and relative humidity on this day.

(Source: Algebra and Trigonometry with Analytic Geometry, 13th Edition, Earl W. Swokowski and Jeffery A. Cole)