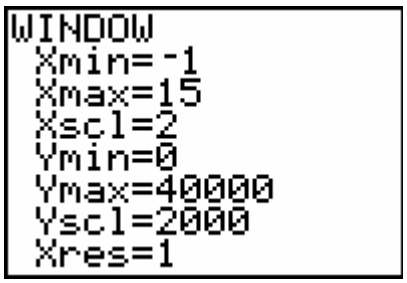
BIOLOGY

1. The number of bacteria in a culture at time t, in hours, is given by $n = 10000\left(\frac{3t^2+1}{t^2+1}\right)$.



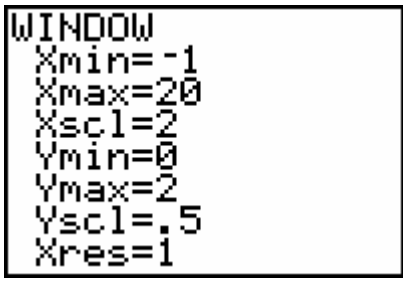
   a. Graph this function, using ZoomFit or the window settings to the right.

   b. As time increases, does the size of the bacteria colony seem to become stable?

   c. If the answer is yes, what is the stabilizing level?

   d. How long does it take for the number of bacteria to exceed 22,000? (Hint: graph y = 22000 as well, and find the point of intersection.)

2. A drug in the bloodstream has a concentration of $c(t) = \frac{at}{t^2+b}$ units at time $t \geq 0$ hours. The constants, a and b, depend on the particular drug.



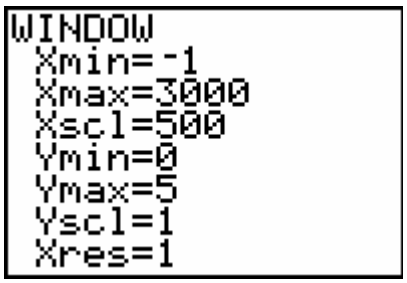
   a. Let a = 3 and b =1, and graph this using the window settings to the right.

   b. How long does it take the drug to reach its highest concentration in the bloodstream and what is this concentration?

   c. What happens to the drug concentration as time t becomes large?

   d. How long does it take for the drug concentration to drop below 0.2?

3. The mass, M, of 4 grams of radium after x years of radioactive decay is given by $M(x) = 4e^{-0.0004332x}$.



   a. Graph this function. Use the window settings to the right.
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   b. Estimate the point in time when there will be 3.5 grams of the substance left.

   c. Find the half-life of radium.

   d. How many grams will be left after 2300 years?

4. Carbon-14 decays exponentially. The percentage of Carbon-14, y, present after x years is given by the function,

$$y = 10^{2 - 0.00005235x}$$

a. Graph this function, using ZoomFit.

b. Find the half-life of Carbon-14. (Hint: graph $y = 50$ as well.)

b. What percentage of the original amount is left after 2000 years?

d. At what point will there be only 20% left?