Complete the following questions utilizing the concepts introduced in this unit.

1. A retirement account is opened with an initial deposit of $8,500 and earns 8.12% interest compounded monthly. What will the account be worth in 20 years? What if the deposit was calculated using simple interest? Could you see the situation in a graph? From what point one is better than the other?

2.  Graph the function [ f(x)=5(o.5)^{-x} ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20f%28x%29%3D5%28o.5%29%5E%7B-x%7D%20) and its reflection about the line y=x on the same axis, and give the x-intercept of the reflection. Prove that [ a^x=e^{x lna} ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20a%5Ex%3De%5E%7Bx%20lna%7D%20). [Suggestion: type [ y=5(0.5^{-x}) ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20y%3D5%280.5%5E%7B-x%7D%29%20) {- 7 < x < 2}  {0 < y < 7} in desmos, and then type its inverse function.]

3.  How long will it take before twenty percent of our 1,000-gram sample of uranium-235 has decayed? [See Section 6.6 Example 13]

The decay equation is [ A(t)=A_0e^{Kt} ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20A%28t%29%3DA_0e%5E%7BKt%7D%20), where t is the time for the decay, and *K* is the characteristic of the material. Suppose *T* is the time it takes for half of the unstable material in a sample of a radioactive substance to decay, called its half-life. Prove that [ K= \frac{ln0.5}{T}  ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20K%3D%20%5Cfrac%7Bln0.5%7D%7BT%7D%20%20) . What is *K*for the uranium-235? Show the steps of your reasoning. (T = 703,800,000 years)

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Part 2

The population of a culture of bacteria is modeled by the logistic equation

[P(t)= \frac{14,250}{1+29e^{-0.62t}](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20P%28t%29%3D%20%5Cfrac%7B14%2C250%7D%7B1%2B29e%5E%7B-0.62t%7D%20%20).

To the nearest tenth, how many days will it take the culture to reach 75% of its carrying capacity? What is the carrying capacity? What is the initial population for the model? Why a model like [P(t)=P_0 \ e^{Kt}](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20P%28t%29%3DP_0%20%5C%20e%5E%7BKt%7D%20) , where [P_0](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20P_0%20) is the initial population, would not be plausible? What are the virtues of the logistic model?

Go to [www.desmos.com/calculator](http://www.desmos.com/calculator) and type

y = 14250 / (1 + 29 . e-0.62 x).  {0 < x < 15}  {0 < y < 15000}

y = 14300  {0 < x < 15}

(you will find the command “[\div](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20%20%5Cdiv%20%20)” in the desmos calculator after selecting “14250”, or you type “/” after selecting “14250”, and you will also find the function “*exp*” ). Adjust the *x* and *y* axes settings to 0 < x < 15 and 0 < y < 15000. Plot the graph you have obtained (you can use a screenshot, save as image, and copy it into word). If you need, or if you want, go to the Course Forum and tell us something about this plotting task.

Your Discussion should be a minimum of 250 words in length and not more than 750 words.