MONT 104N – Modeling the Environment
Exponential Modeling Examples
October 23, 2019

(A) (*This is true*) The Syn 3.0 synthetic life organism is a bacterium whose genetic infor-
mation (DNA) was synthesized by humans in a lab and then inserted into the cells of an
existing strain of bacteria (after the "host's" DNA was removed). The resulting synthetic
bacterium was placed into a nutrient bath and it successfully divided (reproduced) in such
a way that the number of bacteria was *doubling every three hours.*

1) Is this situation explained by a linear model or an exponential model? Why?
2) Starting from a single bacterial cell, write down a formula for the number of Syn 3.0
   cells present x hours after the start of the experiment.
3) How many hours would go by before the number of bacteria reached 10,000?

(B) The radioactive isotope strontium-90 decays in such a way that if a sample contains c
grams at any time t, then after 1 year, the mass of the remaining strontium-90 is 97.6%
of the original amount (i.e. there are .976c grams left).

1) Is this a situation for a linear model or an exponential model? Why?
2) If a sample of strontium-90 consists of 100g of the material at time $t = 0$, how much
   will be left after 20 years?
3) How long does it take for the amount to decay to 50g (half the original amount? (This
   length of time is called the *half-life*.)