Name:________________________

Notesheet. Section 5.6: Exponential Functions as Mathematical Models

Math 1210

Definition 1. Consider a quantity Q that is growing (decreasing) over time, t. Then, we say a quantity exhibits exponential growth (decay) if

Challenge 2. Given that a quantity $Q(t)$ is described by the function

$$Q(t) = 300e^{0.02t}$$

where t is measured in minutes, answer the following questions.

(a) What is the growth constant?

(b) What quantity is present initially (that is, at $t = 0$).

(c) Compute the following values: $Q(10), Q(100), Q(1000)$

Challenge 3. Under ideal conditions, a certain bacteria population is known to double every three hours. Suppose that there are initially 100 bacteria.

(a) What is the size of the population after 15 hours?

(b) Write down an equation for $Q(t)$ in the form $Q(t) = Q_0 2^{kt}$ where $Q(0) = 100$ and $Q(15)$ is what you found above.

(c) Use your equation to estimate the size of the population after 20 hours.

(d) Using exponential and log tricks/rules, rewrite your equation in the form $Q(t) = Q_0 e^{k_{\text{new}} t}$.

Definition 4. Radioactive substances decay exponentially. The half-life of a radioactive substance is

Challenge 5. Carbon dating is the process using radioactive decay of Carbon 14 to determine the age of a fossil. Carbon 14 has a half-life of 5730 years. If we model its decay by an exponential decay function $Q(t) = Q_0 e^{kt}$ (remember decay means $k < 0$), what is its decay constant, k? After 11460 years (2 half lives), how fast is Carbon 14 decaying?

Challenge 6. You deposited $5,000 in a bank in 2013. It gains continuously compounded interest at 3% APY. How much money will you retrieve from the bank in 2019?