

6.3.D2 ~ Continuous Growth & Decay

For each quantity Q that is changing over time t , answer the following questions:

- What is the quantity at time $t = 0$?
- Is the quantity increasing or decreasing over time?
- What is the percent per unit time growth or decay rate?
- Is the growth rate continuous?

	1. $Q = 25e^{0.032t}$	2. $Q = 2.7(0.12)^t$	3. $Q = 158(1.137)^t$	4. $Q = 50e^{1.05t}$
a.				
b.				
c.				
d.				

- You inherit \$25,000 and deposit it into an account that earns 4.5% annual interest compounded quarterly.
 - Write an equation for the balance, B , as a function of time, t . (*Do not round the growth factor.*)
 - How much money will be in the account after 10 years?
 - If the interest in the account were compounded continuously at 4.5%, how much money would be in the account after 10 years?

An initial quantity Q_0 and a growth/decay rate are given. (a) Give a formula for Q as a function of time t . (b) Find the value of the quantity at $t = 10$, if we assume that the growth/decay rate is not continuous and continuous.

6. $Q_0 = 100$; growth rate of 5%

	Not continuous	Continuous
(a)		
(b)		

7. $Q_0 = 500$; decay rate of 7%

	Not continuous	Continuous
(a)		
(b)		

- At the start of a study, the size of a particular animal population was 4165. Write a function formula for the size of an animal population, P , in t years since the start of the study.
 - Escalating at a continuous rate of 12% each year.
 - Lessening at a constant rate of 345 animals every 52 weeks.
 - Climbing at a steady rate of 67 animals every twelve months.
 - Rising at a rate of 8.9% annually.
 - Diminishing at a continuous rate of 11% every July 31st.
 - Declining at a yearly rate of 13.4%.

9. World poultry production was 94.7 million tons in the year 2009 and increasing at a continuous rate of 1.1% per year. Assume that this growth rate continues.
 - a. Write an exponential function for world poultry production, P , as a function of the number of years, t , since 2009.
 - b. Use the function to estimate world poultry production in the year 2015.

10. A radioactive substance decays at a continuous rate of 14% per year, and 50 mg of the substance is present in the year 2009.
 - a. Write an exponential function for the amount present, A , t years after 2009.
 - b. How much will be present in the year 2019?

11. A population of 3.2 million grows at a constant percentage rate. What is the population one century later if there is:
 - a. An annual growth rate of 2%?
 - b. A continuous growth rate of 2%?

12. An investment of \$7000 earns interest at a continuous annual rate of 5.2%. What is the investment's value in 7 years?

13. Find the effective annual rate if \$1000 is deposited at 5% annual interest, compounded continuously.

14. Rank the following three bank deposit options from best to worst and explain your reasoning.
 - Bank A: 7% compounded daily
 - Bank B: 7.1% compounded monthly
 - Bank C: 7.05% compounded continuously