Continuous Growth

Math621B December 6, 2021

Note: not all of these questions involve growth base-e. Watch for the key word!

1. The population of a certain town is 20,000 and is increasing **continuously** at a rate r=0.037 according to the law of natural growth. Find the population in 25 years.

2. The population of a certain town is 80,000 and has been increasing **continuously** for the past 20 years at the rate r=0.025. What was the population 20 years ago?

3. There were 1000 bacteria in a culture, and 4 hours later there are 4000. What is the continuous rate of increase per hour for the bacteria?

4. If the growth of a certain bacteria in a culture increases continuously at the rate r=0.24 per hour, how long will it take 50 bacteria to become 1,000,000?

5. In a certain chemical reaction the original concentration of 0.03 is reduced to 0.01 in 4 minutes.
    a. What is the continuous rate of decrease in the concentration per minute?
    b. What will the concentration be in 10 minutes?

6. A manufacturer of snow blowers determines that he will use this function to quote the wholesale price for his most popular product: $P(x) = 500 - 0.5e^{0.004x}$, where x is the number of snow blowers ordered.
    a. What will the price per snow blower be if a company orders 1000?
    b. The West Royalty Hardware Company orders 500 snow blowers and the Coady Tool Company orders 1500. What will be the difference in the unit price of these two orders?
    c. If the unit price quoted is $488, how many units were ordered?

7. Given the half-life of a radioactive substance is 10 minutes, how much will be left of a 5 gram sample after 20 minutes?

8. A radioactive substance decays from 3 grams to 2 grams in 1 hour. Find the half-life.

Answers:

1. 50437
2. 48522
3. 0.34657
4. 41.26 hrs
5. -0.2746 and 0.00192
6. $472.70 and $198.02 and 795
7. 1.25 g
8. 1.71 hrs