

22M:017, Extra Problems for Section 1.7

1. A population of bacteria is undergoing exponential growth with a doubling time of four hours. If the size of the original population is 20 grams, what will be the (exact) population size after 15 hours? (exact means that you should leave the answer in terms of logarithmic, exponential, functions without using a calculator).

2. A certain drug has the property that it undergoes exponential decay, and it is known that after 3 hours 80% of the drug remains in the patient. Find the half life for the amount of drug (find the exact half life, not a numerical approximation using a calculator or computer).

3. A savings account has an annual interest rate of 5% compounded continuously. How long does it take for an amount deposited in this account to double? (the exact amount of time).

4. A savings account in a bank offers an annual interest rate of 4%. How much should be invested now in order to have \$10000 in the account after (exactly) five years?

5. A certain radioactive substance is undergoing exponential decay and it is known that after 20 years, $\frac{4}{5}$ of the original amount remains. If the original quantity of the substance is 40 grams, find a function f such that $f(t)$ = amount of radioactive substance left after t years.

6. A bacteria culture is undergoing exponential growth with a doubling time of 5 hours. If the original size of the population was 20 grams, how big will the culture be two days after it was started?

7. A drug is such that it has a half life of 3 hours. If an individual is given a dose of m_0 milligrams, when will it be the case that 70% of the drug has been eliminated from the individual?

8. A drug is eliminated from the body of a patient by exponential decay. It is known that 70 days after administration 10% of the original dose remains in the patient. What

is the half-life of the drug?

9. A savings account with annual interest rate continuously compounded doubles in size every 20 years. How long (exactly) will it take for a deposit to triple in size?

10. It is known that, at early stages of lung adenocarcinoma (a cancer of the lung), it grows exponentially with a doubling time of 134 days. If a tumor of 3 mg. is detected, how long will it take, if no treatment is administered, for it to reach the size of one gram (1000 mg.)?

A population of bacteria is undergoing exponential growth in such a way that 5 hours after the culture is started the population has grown by 30%. Find the doubling time for this population.