

Section 4.5

Exercise 1. Let $y(t) = A + e^{kt}$ where A and k are constants. Find k if $y(2) = 4$ and $y(4) = 6$.

Exercise 2. Given C and k 2 real numbers, show that $y(t) = C e^{kt}$ satisfies the differential equation

$$\frac{dy}{dt} = ky$$

Theorem: The only solutions of the differential equation

$$\frac{dy}{dt} = ky$$

are the exponential functions $y(t) = C e^{kt}$.

Exercise 3. A bacteria culture starts with 1000 bacteria and the growth rate is proportional the number of bacteria. After 2 hours, the population is 9000. Find the number of bacteria after 3 hours.

Exercise 4. A colony of bacteria grows at a rate proportional to its size. The initial population is 1,000 and at the end of 10 minutes, the population has increased by 3 percent. How long does it take the initial population to double. (Include units in your answer!).

Exercise 5. (Fall 2006) Some leftover Thanksgiving turkey is placed into a refrigerator at 0°C . The rate of cooling of the turkey is equal to half its temperature. After $\ln(9)$ hours, the turkey is taken out. What will be its temperature if its temperature initially was 57°C ?

Exercise 6. (Spring 2005) The atmospheric pressure is often modeled by assuming that the rate of change of the pressure p with respect to the altitude x (height above sea level) is given by $\frac{dp}{ds} = kp$, where k is a constant. The atmosphere pressure at sea level is 1000millibars and the pressure at 10km is 250millibars.

1. Express the pressure p in terms of k and x .
2. Compute k . You can give your answer in terms of logarithms.
3. At what altitude will the pressure be 500 millibars? You can give your answer in terms of logarithms.

Exercise 7. A curve passes the point $(0, 5)$ and has the property that the slope of the curve at every point P is twice the y coordinate of P . Find the equation of the curve.

Exercise 8. If \$5000 is invested at 4% interest. Find the amount due at the end of two years if the interest is compounded quarterly? weekly? continuously?

How long will it take to double if it is invested weekly?