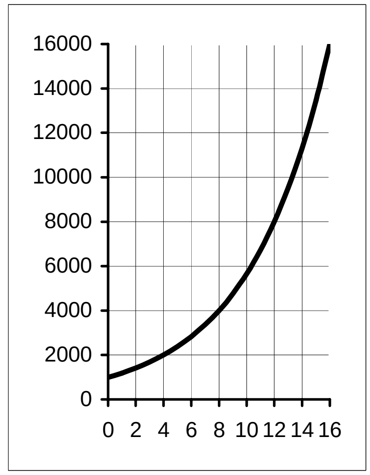
MA 180 Applications of Exponential Functions
Section 4.7

1. Bacteria in a culture are growing in such a way that the number of bacteria in the culture doubles every 4 hours. If there are 1000 bacteria present initially, then the table and graph illustrate the situation.

| t = time, in hours | N(t) = number of bacteria after t hours |
|---|---|
| 0 | 1000 |
| 4 | 2000 |
| 8 | 4000 |
| 12 | 8000 |




(a) Since the graph appears to be an exponential function, we shall try to find such a function to fit the data. There is more than one function that can be used, but we shall use a general exponential function with base e; that is a function of the form $N(t) = Ce^{kt}$ .

First we need to find the value of C. To do this, we evaluate N(t) at t = 0.

Next we need to find the value of k. To do this, we can use any other known point on the graph. For example, we can evaluate N(t) at t = 4. Logarithms will have to be used to find the value of k. The constant k, which should turn out to be positive, is called the ***growth constant*** in this situation.

Now that both C and k are known, the function can be written as:

(b) Use the function found in part (a) to determine how many bacteria are present after 13 hours.

(c) How many hours will it take (from time t = 0) for there to be 50,000 bacteria in the culture?

**OVER**→

2. 10 mg of a drug are given to a patient. Body processes cause the drug to be eliminated over time. Suppose that 8 mg of the drug are left in the body after 3 hours.

(a) Find an exponential function of the type $N(t) = Ce^{kt}$ that models this situation. Recall this means that the values of C and k must be found. The constant k, which should turn out to be negative, is called the ***decay constant*** in this situation.

(b) How many mg of the drug will remain in the body after 11 hours?

(c) After how many hours will only 1 mg of the drug remain in the body?

Summary:

1. The function $N(t) = N_0 e^{kt}$ can be used to model situations involving exponential growth or decay.

2. $N_0 = N(0)$ is the amount present at time t = 0.

3. If k is positive, the situation involves exponential growth and k is called the growth constant.

4. If k is negative, the situation involves exponential decay and k is called the decay constant.

**HW**

4.7 (p. 347)/ 1 – 7 odd, 8, 9, 11 (Answer for #8: 711,111)

4.8 (p. 355)/ 1, 3