Exponential Decay
Use What You've Learned

After watching the video, *Exponential Decay*, complete the following problems.

1. A new Microtosh laptop computer costs $3500 and depreciates with a decay rate of 3% *per month*.

   a. What will the computer be worth in six months? One way to solve this problem is to think recursively.

      i. What is the initial worth of the computer?

      ii. How would you find the value of the computer after one month?

      iii. You can write a recursive equation using two pieces of information. First, you need to know the initial value of the computer. Second, you need to know the repeated pattern. In this case, multiplying by 0.97. Using the terms *Now* and *Next*, write a recursive equation.

      iv. Use your recursive equation in (iii) to complete the table and find the value of the computer in six months.

# of months	0	1	2	3	4	5	6
Value							

   b. What will the computer be worth in six months? Another way to solve this problem is to think explicitly. In other words, if you know the number of months you can use the equation to directly find the value of the computer.

   c. Which type of equation might be used if you are finding the value of the computer after a couple months? Which type of equation might be used if you are finding the value of the computer after many years?

d. What is the computer worth after three years?

e. How do the explicit equation and recursive equation relate?

f. What is the decay rate *per year*?

2. Assume we have an exponential relationship with a decay rate of 15 percent.

a. Fill in the following table:

x	y
0	42,264
1	
2	
3	
100	

b. For which values of x is it easy to find y recursively? For which values of x would it be tedious to find y recursively?

c. What is the value of *a* in the equation $y = a\left(1 - r\right)^x$?

3. Every living thing contains a certain amount of a radioactive element called carbon-14. As soon as something dies, the carbon-14 gradually goes away. Its decay factor is approximately 0.9998790392, assuming time is measured in years.

   a. Assume we had 10 grams of carbon-14. How much would we have in 100 years?

   b. Assume an organism had C_0 grams when it died. How many grams would it have in 5730 years?

   c. We examine a bone that a merchant tells us is 2,000 years old. We determine that it has 90% of its original carbon-14. Is the bone older, younger, or about 2,000 years old?

4. We pass a gallon of sludgy water through a filter to purify it. Each inch of filter removes 30% of the contaminants. Assume that we start with 2000 grams of contaminant in the water.

   a. Write a recursive equation to find the grams of contaminant for each inch of filter.

   b. Find the number of contaminants in the water if the filter was one inch.

   c. Write the explicit equation that gives the amount of contaminant remaining in the water after it has passed through *x* inches of filter.

   d. Assume the water is safe to drink when there is less than 30 grams of contaminant in it. If we pass it through a one-foot long filter, is it drinkable?