Exponential Growth and Decay
Word Problems

$$y = p(1+r)^t \qquad\qquad\qquad y = p(1-r)^t$$

1. In1990, the tuition at a private college was \$15,000. During the next 9 years, tuition increased by about 7.2% each year.
a. Write a model giving the cost C of tuition at the college t years after 1990.
b. What is the tuition in 2010?
c. What year was the tuition about \$20,000?

2. Ten grams of Carbon 14 is stored in a container. The amount C (in grams) of Carbon 14 present after t years can be modeled by $C = 10(.99987)^t$.
a. Identify the initial amount, the growth factor, and the annual percent decrease.
b. How much Carbon 14 is present after 1000 years?

3. From 1991 through 1995, the number of computers per 100 people worldwide can be modeled by $C = 25.2(1.15)^t$ where t is the number of years since 1991.
a. Identify the initial amount, the growth factor, and the annual percent increase.
b. What is the number of computers per 100 people worldwide in 2000?

4. You purchase a stereo system for \$830. The value of the stereo system decreases 13% each year.
a. Write an exponential decay model for the value of the stereo system in terms of the number of years since the purchase.
b. What is the value of the system after 2 years?

5. The number of newly reported cases of tuberculosis T (in thousands) in the United States from 1991 to 1996 can be approximated by the equation $T = 28.5(0.9567)^t$, where t represents the number of years since 1990.
a. Identify the initial amount, the decay factor, and the annual percent decrease.
b. Find the number of newly reported cases in 2005.
c. In what year was the number of newly reported cases in the United States approximately 25,000?

6. A house was purchased for \$90,000 in 1995. If the value of the home increases by 5% per year, what is it worth in the year 2020?

7. A diamond ring was purchased twenty years ago for \$500. The value of the ring increased by 8% each year. What is the value of the ring today?

8. You have bought a new car for \$26,500. The value y of the car decreases by 18% each year.
a. Write an exponential decay model for the value of the car.
b. Use the model to find the value of the car after three years.
c. When will the car have a value of \$18,000?

9. From 1990 to 1997, the number of cellular telephone subscribers S (in thousands) in the United States can be modeled by $S = 5535.33(1.413)^t$ where t is the number of years since 1990.
a. Identify the growth factor and annual percent increase.
b. In what year was the number of cellular telephone subscribers about 31 million?
c. According to the model, in what year will the number of cellular telephone subscribers exceed 90 million?
d. Estimate the number of subscribers in 2002, 2005, and 2010.

$$y = p\left(1 + \frac{r}{n}\right)^{nt} \qquad\qquad y = pe^{rt}$$

10. You deposit $2000 in an account that earns 5% annual interest. Find the balance after five years if the interest is compounded
   a. annually   b. quarterly   c. monthly   d. continuously

11. A customer purchases a television set for $800 using a credit card. The interest is charged on any unpaid balance at the rate of 18% per year compounded monthly. If the customer makes no payment for one year, how much is owed at the end of the year?

12. If you deposited $1000 into a savings account earning 6% annual interest compounded quarterly, how much money do you have at the end of 3 years? What if it was compounded continuously?

14. The M.A.T.H. Company has a savings plan for their employees. If an employee makes an initial contribution of $2500 and the company pays 7.5% interest compounded daily, how much will the employee have after 10 years?

15. A local bank advertises two special savings accounts. You have $500 and you want to decide which offer is the best investment.
a. One account offers 4.9% compounded daily. Write a formula that gives the balance of this account at the end of one year.
b. The other account offers 5% compounded quarterly. Write a formula that gives the balance of this account at the end of one year.
c. Determine the balance of the account using the formula from part (a).
d. Determine the balance of the account using the formula from part (b).
e. Explain which account is the best investment and whether the interest rate or compounding period is of more importance.