Exponential Growth & Decay

**a =**

**r =**

**t =**

**y =**

Half-Life

**y = a =**

Complete each of the following exponential growth questions.

1. The population of a small town in North Carolina is 4,000 and is growing at a rate of 3% per year. What will the population of the town be in 10 years?
2. James purchased a truck for $29,500. The value of the truck depreciates by 12% per year. What will be the value of the truck 8 years after the purchase?
3. In 1981, the Human Immunodeficiency Virus (HIV) was discovered. In 1987, it is estimated that 50,280 people in the United States were diagnosed with the infection. In 2000, that number grew to 264,405 people within the United States. Given this information, find the rate of growth for this infection.
4. How long will it take $30,000 to accumulate to $110,000 in a trust that earns a 10% annual interest?
5. How long does it take to double $1000 at an annual interest rate of 6.35%?
6. The house down the street has termites in the porch. The exterminator estimated that there are about 800,000 termites eating at the porch. He said that the treatment he put on the wood would kill 40% of the termites every day. How many termites will be eating at the porch in 36 hours?

Complete each of the following half-life questions.

1. An isotope of cesium (cesium-137) has a half-life of 30 years. If 1.0 mg of cesium-137 disintegrates over a period of 90 years, how many mg of cesium-137 would remain?
2. A 2.5 gram sample of an isotope of strontium-90 was formed in a 1960 explosion of an atomic bomb at Johnson Island in the Pacific Test Site. The half-life of strontium-90 is 28 years. In what year will only 0.625 grams of this strontium-90 remain?
3. Actinium-226 has a half-life of 29 hours. If 100 mg of actinium-226 disintegrates over a period of 58 hours, how many mg of actinium-226 will remain?
4. Thallium-201 has a half-life of 73 hours. If 4.0 mg of thallium-201 disintegrates over a period of 6.0 days and 2 hours, how many mg of thallium-201 will remain?

Compounded Growth (Interest)

**y =**

**P =**

**r =**

**n =**

**t =**

Continuous Growth (Interest)

**y =**

**P =**

**e =**

**r =**

**t =**

1. You invest $7000 in an account bearing 5% interest for ten years. How much will the account be worth if compounded:
   1. Quarterly?
   2. Monthly?
   3. Daily?
2. A long-term bond returns you $21,171.63 at the end of ten years. Assuming an interest rate of 4.5% compounded daily, what was the amount of your initial investment?
3. A credit card company charges 12.9% annual interest.
   1. If they compound interest monthly, how much will you owe for every dollar you do not pay off for a year?
   2. If they compound interest daily, how much will you owe for every dollar you do not pay off for a year?
4. Your bank is offering a savings account with a nominal rate of 1.5%, compounded continuously. If you deposit $1000 in 2010, what will your balance be in 2020?
5. How much money will be in a bank account after 1.5 years if you invested $400 at 7.6% compounded continuously?
6. How much time would it take to triple your principal in an account that pays 6.5% annual interest compounded continuously?
7. If you invest $2500 in an account, what is the balance in the account and the amount of interest after 4 years if you earn 0.7% compounded continuously?
8. A loan shark lends a gambler $1,000.00 to cover a debt. He charges 35% annual interest compounded continuously. How much does the gambler owe the loan shark at the end of:
   1. One year
   2. Two years

Complete the following problems on a separate sheet of paper. Show all work that is necessary.

1. How much money will you have in 8 years if you invest $4000 at 3½% compounded quarterly?
2. What interest rate do you need for a $5000 investment to double in 10 years?
3. How much money do you need to invest at 2 ¾ % in order to have $12,000 after 7 years?
4. How much money will you have in 6 months if you invest $1000 at 3% compounded monthly?
5. How much interest will you earn in 8 years if you invest $7500 at 4¼% compounded semi-annually?
6. In 1910, the population of Math Valley was 15,000. If the population is increasing at an annual rate of 2.4%, what was the population in 1965?
7. A herd of elk increased from 75 in 1998 to 310 in 2005. Find the annual percent of increase for this herd.
8. A certain species of bird is in danger of becoming extinct. There were 1500 birds in 2000 and they are decreasing at an annual rate of 6.5%.
   1. If this trend continues, how many birds will be left by 2010?
   2. How many birds would there have been in 1990?
9. You are investing $1500 at 5.2% compounded continuously. How much money will you have in 12 years?
10. How much money do you need to invest at 2.8% compounded continuously in order to have $25,500 at the end of 8 years?
11. If you deposit $4500 at 5% annual interest compounded quarterly, how much money will be in the account after 10 years?
12. If you deposit $4000 into an account paying 9% annual interest  compounded monthly, how long until there is $10000 in the account?
13. If you deposit $2500 into an account paying 11% annual interest  compounded quarterly, how long until there is $4500 in the account?
14. How much money would you need to deposit today at 5% annual interest compounded monthly to have $20000 in the account after 9 years?
15. If you deposit $6000 into an account paying 6.5% annual interest  compounded quarterly, how long until there is $12600 in the account?
16. If you deposit $5000 into an account paying 8.25% annual interest compounded semiannually, how long until there is $9350 in the  account?

Complete the following problems on a separate sheet of paper. Show all work that is necessary.

1. How much money will you have in 8 years if you invest $4000 at 3½% compounded quarterly?
2. What interest rate do you need for a $5000 investment to double in 10 years?
3. How much money do you need to invest at 2 ¾ % in order to have $12,000 after 7 years?
4. How much money will you have in 6 months if you invest $1000 at 3% compounded monthly?
5. How much interest will you earn in 8 years if you invest $7500 at 4¼% compounded semi-annually?
6. In 1910, the population of Math Valley was 15,000. If the population is increasing at an annual rate of 2.4%, what was the population in 1965?
7. A herd of elk increased from 75 in 1998 to 310 in 2005. Find the annual percent of increase for this herd.
8. A certain species of bird is in danger of becoming extinct. There were 1500 birds in 2000 and they are decreasing at an annual rate of 6.5%.
   1. If this trend continues, how many birds will be left by 2010?
   2. How many birds would there have been in 1990?
9. You are investing $1500 at 5.2% compounded continuously. How much money will you have in 12 years?
10. How much money do you need to invest at 2.8% compounded continuously in order to have $25,500 at the end of 8 years?
11. If you deposit $4500 at 5% annual interest compounded quarterly, how much money will be in the account after 10 years?
12. If you deposit $4000 into an account paying 9% annual interest  compounded monthly, how long until there is $10000 in the account?
13. If you deposit $2500 into an account paying 11% annual interest  compounded quarterly, how long until there is $4500 in the  account?
14. How much money would you need to deposit today at 5% annual interest compounded monthly to have $20000 in the account after 9 years?
15. If you deposit $6000 into an account paying 6.5% annual interest  compounded quarterly, how long until there is $12600 in the account?
16. If you deposit $5000 into an account paying 8.25% annual interest compounded semiannually, how long until there is $9350 in the  account?