

1. Suppose \$10,000 is invested at an annual interest rate of 5% compounded continuously.
 - a. How long will it take for the investment to double in value?
 - b. How long will it take for the investment to triple in value?

2. A recent college graduate decides he would like to have \$20,000 in five years to make a down payment on a home.
 - a. How much money will he need to invest today in order to have \$20,000 in five years, given that he can invest at an annual interest rate of 4% compounded continuously?
 - b. Suppose instead the best interest rate he can find is only 2.5% (instead of 4%). Now how much will he need to invest?
 - c. Suppose the interest rate is 4% again, but now he would like to have the \$20,000 in only four years. How much does he need to invest?

3. The half-life of caffeine is 5 hours. This means the amount of caffeine in your bloodstream is reduced by 50% every five hours. A grande French Roast has 330 mg of caffeine. Let $Q(t)$ denote the amount of caffeine in your system t hours after drinking your grande French Roast. (For simplicity, assume the entire drink is consumed instantly.)
 - a. How many milligrams of caffeine will be in your system after 5 hours? after 10 hours?
 - b. Let $Q(t) = Q_0 e^{-kt}$. Find Q_0 and k .
 - c. How many milligrams of coffee will be in your system after 2 hours?

4. A bacteria culture triples in size every 7 hours. Three hours from now, the culture will have 8000 bacteria. If $Q(t)$ denotes the number of bacteria at time t , then $Q(t) = Q_0 e^{kt}$. Find Q_0 and k .

5. The graph of $y = f(x)$ passes through the point $(0, 4)$. The slope of f at any point P is three times the y -coordinate of P . Find an expression for $f(x)$, and find $f(2)$.