

Exponential Growth and Decay

1. The number of bacteria in a culture increases from 600 to 1800 in two hours. Assuming that the rate of increase is directly proportional to the number of bacteria present, find a formula for the number of bacteria at time t . also, how many bacteria will be present at the end of four hours?
2. Veterinarians use sodium pentobarbital to anesthetize animals. Suppose that to anesthetize a dog, 30 milligrams are required for each kilogram of body weight. If sodium pentobarbital is eliminated exponentially from the bloodstream and half is eliminated in four hours, approximate the single dose that will anesthetize a 20 kilogram dog for 45 minutes.
3. Radioactive strontium-90, with a half-life of 29 years, can cause bone cancer in humans. It is carried by acid rain, soaks into the ground, and is passed through the food chain. The radioactivity level in a particular field is estimated to be 2.5 times the safe level (S). For approximately how many years will this field be contaminated assuming no more strontium-90 is absorbed?
4. An outdoor thermometer registers a temperature of 40°F . Five minutes after it is brought into a room where the temperature is 70°F , the thermometer registers 60°F . When will it register 65°F ?
5. A metal plate that has been heated cools from 180 degrees Fahrenheit to 150 degrees Fahrenheit in 20 minutes when surrounded by air at a temperature of 60 degrees Fahrenheit. Use Newton's Law of Cooling to approximate its temperature at the end of one hour of cooling. When will the temperature be 100 degrees Fahrenheit?
6. The radioactive tracer ^{51}Cr has a half-life of 27.8 days. It is used in medical testing to locate the placenta in a pregnant woman. The tracer must be ordered from a medical supply company and it takes 2 days to arrive. If 35 units are required for the test, how much should be ordered?
7. How much money would I have after 10 years if I invest 10,000 dollars into an account that earns 4.13% interest and is compounded daily? Compounded continuously?
8. After 3 days, a sample of radon-222 decayed to 58% of its original amount. What is the half-life of radon-222? How long would it take the sample to decay to 10% of its original amount?