46. Bacteria are growing exponentially in an environment of unlimited space and food. The doubling time is 1 hour.

   (a) If there are initially x milligrams of bacteria, express the mass of the bacteria as a function of time t.

   (b) Use your answer to (a) to write down an equation whose solution is the time at which there are $3x$ milligrams of bacteria. (Your answer should be something of the form, e.g. $3x = 5t^2$)

   (c) Solve for t.

   (d) Your answer to (c) should be between 1 and 2 hours. Check that it is. Do you understand why it has to be?

48. The level of radioactivity on the site of a nuclear explosion is decaying exponentially. The level measured in 1920 was found to be 0.7 times the level measured in 1910. What is the half-life?

52. Express 9^y as a power of 10. In other words, find x such that $9^y = 10^x$.

57. In the year 1900, in the country Acirema, there were 100 Lawyers and 3 million people. Every 10 years, the number of Lawyers doubles, and the population increases by 2 million. Let t be the number of years after 1900. Thus $t = 3$ corresponds to 1903.

Find the equation involving t whose solution tells you in which year 20 percent of the population are Lawyers. DO NOT SOLVE OR BEGIN TO SOLVE THIS EQUATION.

$0.2 = \cdots$

58. E. Coli bacteria are growing in a hamburger exponentially. Initially there are $100,000$ bacteria. After 15 minutes there are $150,000$. How many are there after an hour?