1. **(4 pts)** Calculate the monthly payment, if you have a home mortgage of 200,000 dollars, with a fixed APR of 5% for 30 years.

$$PMT = \frac{P \cdot \left(\frac{APR}{n}\right)}{1 - \left(1 + \frac{APR}{n}\right)^{-nY}}$$

$$PMT = \frac{\$200,000 \cdot \left(\frac{0.05}{12}\right)}{1 - \left(1 + \frac{0.05}{12}\right)^{-12 \cdot 30}} = \$1,073.64.$$

2. **(4 pts)** The doubling time of a city's population is 10 years. How long does it take for the population to quadruple? *(You do not have to show your work for this problem.)*

   If there are x number of people in the city now, there will be $2x$ in 10 years, and $2 \cdot 2x = 4x$ in 20 years; so the answer is 20 years.

3. **(4 pts)** Poaching is causing a population of elephants to decline by 10% per year. Use the approximate half-life formula to answer the following questions.

   (a) What is the approximate half-life for the population?

   $$T_{half} \approx \frac{70}{P} = \frac{70}{10} = 7\,years.$$

   (b) If there are 10,000 elephants today, how many will remain in 30 years?

   $$\text{new value} = \text{old value} \cdot \left(\frac{1}{2}\right)^{t/T_{half}}$$

   $$\text{new value} = 10,000 \cdot \left(\frac{1}{2}\right)^{30/7} = 513.$$

4. Use the magic penny parable to answer the following questions.

   (a) **(4 pts)** How much money (in dollars) will you have after 14 days?

$$\$0.01 \cdot 2^{14} = \$162.84.$$

   (b) **(Extra Credit: 4 pts)** How many days must elapse before you will have a total of $85,900,000$ dollars? *(Hint: proceed by trial and error.)*

   After plugging several numbers for x in $0.01 \cdot 2^x$ you should eventually get that

$$0.01 \cdot 2^{33} = 8.59 \cdot 10^7.$$

   So the answer is 33.