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.

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

\[
PMT = \frac{200,000 \cdot \left( \frac{0.05}{12} \right)}{1 - \left( 1 + \frac{0.05}{12} \right)^{-360}} = \$1,073.64.
\]

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?

\[
T_{\text{half}} \approx \frac{70}{P} = \frac{70}{10} = 7 \text{ years.}
\]

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

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

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