Solutions

1. (5 points) (a) An investment offers 4% annual simple interest. You invest $100 in this investment. How long does it take for the value of this investment to double?

Solution: The value is $200 when it has doubled, so we have that

\[ 200 = 100(1 + 0.04t), \]

so

\[ 2 = 1 + 0.04t, \]

which has solution

\[ t = \frac{1}{0.04} = \frac{100}{4} = 25. \]

So it takes twenty five years to double in value.

(b) An investment offers 2% annual interest. You invest $100 in this investment for three years.

i. (2 points) What is the future value of this investment if it compounds yearly?

Solution:

\[ F = 100 \left(1 + \frac{0.02}{1}\right)^{3(1)} \]

ii. (3 points) What is the future value of this investment if it compounds weekly?

Solution:

\[ F = 100 \left(1 + \frac{0.02}{52}\right)^{3(52)} \]
2. (5 points) You know that you will need $1,000,000 to retire comfortably in 30 years. If the annual interest rate is $3\%$, how much should you invest each month in order to meet this goal?

**Solution:** Since we are making fixed monthly payments with the goal of having a specific amount of money in the future, this situation is a type of annuity. The desired future value is $FV = 1,000,000$, the monthly interest rate is $i = \frac{0.03}{12}$, and the number of payments is $n = 30(12)$. We therefore get that

$$1,000,000 = PMT \cdot \frac{(1 + \frac{0.03}{12})^{30(12)} - 1}{\frac{0.03}{12}}.$$

Solving for $PMT$, we get that

$$PMT = \frac{1,000,000}{\frac{(1 + \frac{0.03}{12})^{30(12)} - 1}{\frac{0.03}{12}}}.$$