Math 111 Worksheet #9 Solutions

1. Find the value of \$8000 invested into an account for 5 years with the following interest.

   (a) 6% simple interest

   After 5 years, the account has $A = 8000(1 + (.06)(5)) = 8000(1.3) = 10400$ dollars.

   (b) 6% compounded annually

   The account grows by 6% each year.
   After 5 years, the account has $A = 8000(1 + .06)^5 = 10705.80$ dollars.

   (c) 6% compounded monthly

   The account grows $\frac{6\%}{12} = .5\%$ each month and it compounds 60 times total (12 times each year).
   After 5 years, the account has $A = 8000(1 + \frac{.06}{12})^{60} = 8000(1 + .005)^{60} = 10790.80$ dollars.

   (d) 6% compounded daily

   The account grows $\frac{6\%}{365}$ each day and it compounds 1825 times total (365 times each year).
   After 5 years, the account has $A = 8000(1 + \frac{.06}{365})^{1825} = 10798.60$ dollars.

   **Which is the best account to invest in? What do think would happen if the account compounded every minute? Every second?

   Out of these accounts, you will earn the most interest with the 6% compounded daily.

   Looking at the pattern, it seems reasonable that if you compounded every minute, you would get more interest and if you compounded every second, you would get even more interest.

2. How much would you need to invest today to have \$25000 in an account 10 years from now if the account gives 4% compounded monthly?

   We need to find our principal value P.
   The account grows $\frac{4\%}{12}$ each month and it compounds 120 times total (12 times each year).

   After 10 years, you want to account to have \$25000. $\Rightarrow \quad 25000 = P(1 + \frac{.04}{12})^{120}$
   $25000 \approx P(1.490833)$
   $\Rightarrow \quad P \approx 16769.15$ dollars

   So, you need to put \$16,769.15 in the account today to have \$25000 ten years from now in the account.

3. How long would it take for \$500 to grow into \$750 in an account with 7% compounded quarterly?

Let t = number of years that we keep the \$500 in the account.
The account grows $\frac{7\%}{4} = 1.75\%$ each quarter and it compounds $4t$ times total (4 times each year for t years).
After t years, the account has \$750. $\Rightarrow \quad 750 = 500(1 + \frac{.07}{4})^{4t}$

$$750 = 500(1.0175)^{4t}$$

Dividing both sides by 500: $$1.5 = (1.0175)^{4t}$$

Take log of both sides: $$\log 1.5 = 4t \cdot \log 1.0175$$

$$\Rightarrow \quad t = \frac{\log\ 1.5}{4\log\ 1.0175} \approx 5.84 \text{ years}$$

So, it will take approximately 5.84 years to have \$500 grow into \$750 in this account.