**Problem Set 4.1**

1 – 3] For each of the following sequences, describe the sequence in words and then write standard recursive notation.

1) 100, 90, 80, 70, 60, 50, …  
   Each term is 10 less than the previous term.

   \[
   \begin{align*}
   a_1 &= 100 \\
   a_n &= a_{n-1} - 10; n \geq 1
   \end{align*}
   \]

2) 8, 16, 32, 64, 128, 256, …  
   Each term is double the previous term.

   \[
   \begin{align*}
   a_1 &= 8 \\
   a_n &= 2a_{n-1}; n \geq 1
   \end{align*}
   \]

3) 10, 100, 10,000, 100,000,000, 10,000,000,000,000,000, …  
   Each term is being squared.

   \[
   \begin{align*}
   a_1 &= 10 \\
   a_n &= (a_{n-1})^2; n \geq 1
   \end{align*}
   \]

4) Consider the sequence defined by \( \begin{align*} b_1 &= 8,000 \\
   b_n &= b_{n-1} \cdot 1.007 - 329, n > 1 \end{align*} \)

   a. Write the first 4 terms of the sequence (rounded to the nearest hundredth).

   \[
   b_1 = 8000, b_2 = 7777.27, b_3 = 7452.69, b_4 = 7175.25
   \]

   b. What is the 21st term of the sequence?

   \[
   b_{21} = 21641.194
   \]

5) Consider the sequence defined by \( \begin{align*} b_1 &= 180^\circ \\
   b_n &= \sin(b_{n-1}), n > 1 \end{align*} \)

   a. Write the first 4 terms of the sequence.

   \[
   180^\circ, 0, 0, 0
   \]

   b. What is the 1,000th term of the sequence?

   \[
   b_{1000} = 0
   \]
6) Jo Ann is learning Chinese. Currently she has memorized the meaning of 400 characters. Each month she forgets 10% of the characters she has learned (she remembers 90%) and learns 300 new characters.

a. Write standard recursive notation for the sequence that represents the number of characters she knows each month.

\[
\begin{align*}
\mathcal{a}_1 &= 400 \\
\mathcal{a}_n &= 0.9 \mathcal{a}_{n-1} + 300; \quad n \geq 1
\end{align*}
\]

b. If she continues to forget and learn as described above, what is the maximum number of characters she can learn? Explain why.

Since 10% of 3000 is 300, once she hits 3000 characters she will forget as many as she learns which will put her always knowing 3000 characters.