Worksheet # 3

1. Find the following unknown quantities:
   (a) \( X = 25.2 \ a_{0.10\%} \)  
   (b) \( 5 = a_{6\%} \)  
   (c) \( Y = 30 \ s_{4\%} \)  
   (d) \( 45 = R \ a_{10\%} \)  
   (e) \( 100 = 4 \ \bar{s}_{2.08\%} \)

2. Page 67: \( \# 3-3, \ 3-4, \ 3-5, \ 3-6, \ 3-7(a) \).

3. Mario pays \$ 300 at the end of each month for 4 years to pay off his car loan. If the annual effective rate is 8%, what is the orginal amount of the loan?

4. What is the purchase price of an annuity which pays \$ 100 at the end of each month for 10 years if the interest rate is 8% converted quarterly?

5. Page 68: \( \# 3-18, \ 3-21, \ 3-35, \ 3-40, \ 3-42 \).

6. Lincoln Life Insurance donated \$ 200,000 at the beginning of 1999 to Purdue to establish a scholarship for hardworking actuary students. The scholarship, in the (level) amount \( P \), is then given annually at the end of each year (starting at end of 1999). The donation can be invested at an effective annual rate of 7.5 \%. Find the amount \( P \) so that the scholarship continues forever.

7. Find an expression for the present value of this perpetuity (assume an annual effective rate of \( i \)):

   \[ \begin{array}{cccccccc}
   30 & 30 & 20 & 20 & 20 & \cdots & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & \cdots & \infty
   \end{array} \]

8. The present value of a series of payments of 2 at the end of every 8 years forever is equal to 5. Calculate the effective rate of interest. (SHOW WORK)
   
   \( (A) \ .023 \quad (B) \ .033 \quad (C) \ .040 \quad (D) \ .043 \quad (E) \ .052 \)

9. Your parents took out a \$ 170,000 mortgage to buy a house. They repay the loan by making monthly payments of \( X \) for 30 years, with the first payment one month after the loan is given. If the interest rate is 8\% annual effective, calculate \( X \). If the monthly payments were instead put in a bank account earning the same interest rate as above, what will be the accumulated value of all the payments at the end of 30 years?

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**Answers**

1. (a) \( X = 169.09 \)   (b) \( i = 5.472\% \)   (c) \( Y = 123.65 \)   (d) \( R = 6.2095 \)   (e) \( n = 20 \)
2. Page 67: \( \# 3-3 \) \( 1098.41 \)  
   \( \# 3-4 \) \( 86.49 \)  
   \( \# 3-5 \) \( 22,240.32 \)  
   \( \# 3-6 \) \( a \) \( 5746.64 \)  
   \( b \) \( 11,487.56 \)  
   \( c \) \( 8443.70 \)  
   \( d \) \( 32.73 \)  
   \( e \) NO value of \( n \) works  
   \( \# 3-7(a) \) See solution sheet
3. 12,354.78  
4. 8261  
5. Page 68: (#3-18) 3896.14 (#3-21) 19140.80 (#3-35) 32.81 (#3-40) 0.20 (#3-42) 546.84  
6. $P = 15,000$
7. Here are three of infinity many correct answers:
   (i) $PV = 30a \nu + \frac{20}{i} \nu^3$  
   (ii) $PV = 10a \nu + \frac{20}{i} \nu^3$  
   (iii) $PV = 30 \nu^2 + 30 \nu^3 + \frac{20}{i} \nu^3$
8. $i = 0.04296$  (D)  
9. Monthly payments of $1214.47; FV=$ 1,710,629.90