Problem 1

A bank states that it will loan money at 8% compounded monthly. What is the annual effective interest rate?

\[ r = 0.08 \]
\[ m = 12 \]
\[ \text{effective interest rate} = r = 0.08 \]

Problem 2

A bank states that it will loan money at 8% based on continuous compounding. What is the annual effective interest rate?

\[ r = 0.08 \]
\[ m = \infty \]
\[ \text{effective interest rate} = e^r - 1 \]

Problem 3

Mary decides to obtain a bank loan at 7% compounded monthly to purchase a house. If Mary finances $200,000, what is Mary's interest portion on her first monthly payment?

\[ r = 7\% \] (annual - nominal rate)
\[ r_{\text{month}} = \frac{7\%}{12} \]
\[ \text{interest amount} = 200,000 \times \frac{\frac{7}{12}}{100} \]

Problem 4

Jim wants to save money monthly in his money market stock account to purchase a new car 5 years from now. Jim figures he will need $18,000 at the time of purchase. How much money will Jim need to uniformly save every month if his money market account pays 4.8% compounded monthly.

\[ A = 18,000 \times (A/F, 4.8\%, 60) \]
\[ i = 0.048 \% \]
\[ A/F = 0.0155 \]

\[ A = 18,000 \times 0.0155 \]

or: \[ A = \frac{F}{(1+i)^n - 1} \]

\[ F = 18,000 \]

\[ i = 0.25\% \]
\[ A/F = 0.0155 \]

\[ A = 18,000 \times 0.0155 \]

\[ A = 272 \]
Problem 5

A $1K deposit is made each month for 6 months as shown in the cash flow diagram below. What is the future value of the deposits at the beginning of the 6-month period if interest is received at 1% per month?

\[ F = 1K \left( F/A, 1\%, 6 \right) \]
\[ = 1K \left( 6.152 \right) = 6152 \]

Problem 6

A $1K deposit is made each month for 7 months as shown in the cash flow diagram below. What is the future value of the deposits at the beginning of the 6-month period if interest is received at 1% per month?

\[ F = 1K \left( F/A, 1\%, 7 \right) + 1K \left( F/A, 1\%, 7 \right) = 1 \left( 0.0712 \right) + 1 \left( 7,214 \right) = 8,286 \]
\[ \text{OR: } F = 1K \left( F/A, 1\%, 8 \right) = 1K \left( 8,286 \right) = 8,286 \]
Problem 7

John obtained a 5 year $15,000 loan at 10% per year compounded monthly to purchase a car. What is John's effective interest rate and monthly payments?

\[ \text{a) } 11.06\%, \text{ } $411.23/\text{month} \quad \text{b) } 10.47\%, \text{ } $318.71/\text{month} \quad \text{c) } 9.98\%, \text{ } $297.66/\text{month} \quad \text{d) } 10.21\%, \text{ } $310.56/\text{month} \]

\[ \text{let } i_{\text{eff}} = \left(1 + \frac{0.10}{12}\right)^{12} - 1 = 10.47\% \]

\[ A = 15,000 \left( \frac{A/P}{12} \right)^60 \text{ } i = 3\% \quad A/P = 0.0208 \]

\[ A = 15,000 \times 0.02126 = $318 \]

Also you can use capital recovery equation for solution.

Problem 8

A what interest rate, when compounded monthly, will a $1000 investment double in 7 years?

\[ \text{a) } 7.25\% \quad \text{b) } 8.88\% \quad \text{c) } 9.94\% \quad \text{d) } 10.45\% \]

Method 1: Rule of 72

\[ i = \frac{72}{n} = \frac{72}{7} \approx 10.3\% \]

Method 2

\[ 2 \times 1000 = 1000 (F/P, i\%, 7 \times 12) \]

\[ 2 = 1 \times (F/P, i, 84) \]

two steps of interpolation between \( n = 80 \) to 85

\[ i = 10\% - 12\% \]

Problem 9

John obtained a $200,000 home loan at 6% interest compounded monthly. If John's monthly payment is $1,200, how long will it take for John to pay off his loan?

\[ \text{a) } 28 \text{ yrs, 7 months} \quad \text{b) } 28 \text{ yrs, 3 months} \quad \text{c) } 30 \text{ yrs, 1 months} \quad \text{d) } 27 \text{ yrs, 6 months} \]

\[ P = 200K \]

\[ A = P \left( \frac{A/P}{i\%, n} \right) \]

\[ 1,200 = 200,000 \left( \frac{A/P}{0.5\%, n} \right) \]

\[ \left( \frac{A/P}{0.5\%, n} \right) = 0.006, \quad n = 30 \text{ yrs} \]

Also use capital recovery equation computation.
Problem 10

What nominal interest rate when compounded monthly will generate the same future value as a $1000 investment, continuously compounded for 5 years at 7%?

\[ i_{\text{eff}} = e^{0.07} - 1 = (1 + \frac{r}{12})^{12} - 1 \]

\[ r = 7.0204\% \]

Problem 11

Mary can finance the purchase of a new $18,000 car by either receiving $1500 cash back and financing the balance at 8% interest per year compounded monthly for 5 years, or zero down at 2% interest/year compounded monthly for 5 years. What is the monthly payment for each loan type? Assume the cash back is used as a down payment on the car purchase.

- a) $388.21/mo for cash back, $366.57/mo for zero down
- b) $344.68/mo for cash back, $321.63/mo for zero down
- c) $334.55/mo for cash back, $315.50/mo for zero down
- d) $309.36/mo for cash back, $325.84/mo for zero down

Problem 12

A company had borrowed $2,000,000 at 6% interest compounded continually over a period of 10 years to provide for capital improvements. What are the company's annual payments on the loan?

- a) $ 298,119/year
- b) $ 317,390/year
- c) $ 306,756/year
- d) $ 322,840/year

Public by placing a notice in the local newspaper.