1. If $1000 is invested at an 6% annual interest rate and interest is compounded monthly, find the balance in the account at the end of 8 years.

2. If $1000 is invested at an 6% annual interest rate and interest is compounded continuously, find the balance in the account at the end of 8 years.

3. If $1000 is invested at an 6% annual interest rate and interest is compounded monthly, how long will it take for the balance of the account to double? Express your answer in years and months. Round to the nearest month.

4. If $5000 is invested at a 6% annual interest rate and interest is compounded quarterly, how long will it take for the balance of the account to grow to $6000? Express your answer in years and quarters of a year. Round to the nearest quarter.

5. Suppose that we invest $1000 in an account that compounds interest continuously. What interest rate must the account pay if it triples the balance in the account every 10 years? Round to the nearest tenth of a percent.

6. If $1000 is invested at an 6% annual interest rate and interest is compounded continuously, how long will it take for balance of the account to triple? Round to the nearest tenth of a year.

7. Suppose that we invest $1000 in an account that compounds interest continuously. What interest rate must the account pay if it doubles the balance in the account every 6 years? Round to the nearest tenth of a percent.

8. If $5000 is invested at an 6% annual interest rate and interest is compounded continuously, how long will it take for balance of the account to reach $8000? Round to the nearest tenth of a year.

9. If interest in a savings account is compounded quarterly with a nominal annual rate of 4%, find the effective rate of interest.

10. If interest in a savings account is compounded monthly with a nominal annual rate of 4%, find the effective rate of interest.

11. If interest in a savings account is compounded continuously with a nominal annual rate of 4%, find the effective rate of interest.

12. If interest in a savings account is compounded monthly, what nominal annual rate would be required to produce a 5% effective rate of interest?

Solutions

1. \[ A = P(1 + \frac{r}{n})^{nt} \]

\[ A = P(1 + \frac{r}{n})^{nt} = 1000\left(1 + \frac{0.06}{12}\right)^{(12)(8)} \approx \$1614.14 \]

\[ A = ? \]

\[ P = \$1000.00 \]

\[ r = 0.06 \]

\[ n = 12 \]

\[ t = 8 \]
2. \( A = Pe^{rt} \)

\[
A = Pe^{rt} = 1000e^{0.06(8)} = 1616.07
\]

\( A = ? \)

\( P = 1000.00 \)

\( r = 0.06 \)

\( t = 8 \)

3. \( A = P\left(1 + \frac{r}{n}\right)^{nt} \)

\[
A = 2000
\]

\[
A = 2000 = 1000\left(1 + \frac{0.06}{12}\right)^{12t}
\]

\( A = \$2000 \)

\( P = \$1000 \)

\[
\frac{2000}{1000} = \frac{1000\left(1.005\right)^{12t}}{1000}
\]

\( r = 0.06 \)

\( n = 12 \)

\( t = ? \)

\[
\frac{2}{12\ln1.005} = \frac{12\ln1.005}{12\ln1.005}
\]

\( t \approx 11.581 \) or a little less than 11 years and 7 months.

4. \( A = P\left(1 + \frac{r}{n}\right)^{nt} \)

\[
A = 6000
\]

\[
A = 6000 = 5000\left(1 + \frac{0.06}{4}\right)^{4t}
\]

\( A = \$6000 \)

\( P = \$5000 \)

\[
\frac{6000}{5000} = \frac{5000\left(1.015\right)^{4t}}{5000}
\]

\( r = 0.06 \)

\( n = 4 \)

\( t = ? \)

\[
\frac{\ln1.2}{4\ln1.015} = \frac{(4\ln1.015)t}{4\ln1.015}
\]

\( t \approx 3.06 \)

After 3 years, the balance will be \( 5000\left(1 + \frac{0.06}{4}\right)^{4(3)} = 5978.09 \).

After \( 3\frac{1}{4} \) years, the balance will be \( 5000\left(1 + \frac{0.06}{4}\right)^{4(3.25)} = 6067.76 \).

5. \( A = Pe^{rt} \)

\[
A = 3000
\]

\[
A = 3000 = 1000e^{10r}
\]

\( A = 3000 \)

\( P = 1000 \)

\( t = 10 \)

\[
3 = e^{10r}
\]

\( \ln3 = \ln e^{10r} \)

\( \ln3 = 10r \)

\[
\frac{\ln3}{10} = \frac{10r}{10}
\]

\( r \approx 0.10986 \) or 11.0%
6. $A = Pe^{rt}$

$A = 3000$

$A = \frac{3000}{1000} = \frac{1000e^{0.06t}}{1000}$

$P = 1000$

$3 = e^{0.06t}$

$r = 0.06$

$\ln 3 = \ln e^{0.06t}$

$\ln 3 = 0.06t$

$t \approx 18.3102$ or a little more than 18.3 years

7. $A = Pe^{rt}$

$A = 2000$

$A = \frac{2000}{1000} = \frac{1000e^{6r}}{1000}$

$P = 1000$

$2 = e^{6r}$

$t = 6$

$\ln 2 = \ln e^{6r}$

$\ln 6 = 6r$

$r \approx 0.1155$ or 11.6%

8. $A = Pe^{rt}$

$A = 8000$

$A = \frac{8000}{5000} = \frac{5000e^{0.06t}}{5000}$

$P = 5000$

$1.6 = e^{0.06t}$

$r = 0.06$

$\ln 1.6 = \ln e^{0.06t}$

$\ln 1.6 = 0.06t$

9. $\left(1 + \frac{0.04}{4}\right)^4 - 1 \approx 0.04064041$

The effective rate of interest is about 4.06%.

10. $\left(1 + \frac{0.04}{12}\right)^{12} - 1 \approx 0.04074154292$

The effective rate of interest is about 4.07%.

11. $e^{0.04} - 1 \approx 0.04081077419$

The effective rate of interest is about 4.08%.

12. $\left(1 + \frac{r}{12}\right)^{12} - 1 = 0.05$

$\left(1 + \frac{r}{12}\right)^{12} = 1.05$

$1 + \frac{r}{12} = \sqrt[12]{1.05}$

$\frac{r}{12} = \sqrt[12]{1.05} - 1$

$r = 12\left(\sqrt[12]{1.05} - 1\right) \approx 0.048894854$

The nominal annual rate would need to be about 4.89%