Lesson 10.3
Finance

Annuities
(investor makes regular deposits)

Savings
Future Value

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

Loan
Present Value

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

P = deposit made at the end of each compounding period
r = percent annual interest
n = number of times interest is compounded per year
t = number of years
1. At the end of each quarter, Emily makes a $500 payment into a mutual fund. If her investments earn 7.88% annual interest compounded quarterly, what will be the value of Emily's annuity in 20 years?

\[
P \left[ \left(1 + \frac{r}{n}\right)^{nt} - 1 \right] \frac{r}{n}
\]

\[A = \text{FV} = 500 \cdot \frac{\left(1 + \frac{.0788}{4}\right)^{80} - 1}{.0788/4}
\]

\[\text{FV} = 95,483.39\]

2. Carlos purchases a new pickup truck for $18,500. What are the monthly payments for a 4 year loan with a $2000 down payment if the annual interest rate is 2.9%?

\[
P \left[ 1 - \left(1 + \frac{r}{n}\right)^{-nt} \right] \frac{r}{n}
\]

\[16,500 = P \cdot \frac{\left[1 - (1 + \frac{.029}{12})^{-48}\right]}{.029/12}
\]

\[39,875 = P \cdot (1 - 0.8906)
\]

\[\$ 364.49 = P\]
3. If you make payments of $75 each month into an account that pays 4.5% interest monthly, how long will it take until you have $10,000?

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

\[ 10,000 = 75 \cdot \left[ (1 + \frac{.045}{12})^{12t} - 1 \right] \cdot \frac{.045}{12} \]

\[ 37.5 = 75 \cdot (1.00375^{12t} - 1) \]

\[ .5 = 1.00375^{12t} - 1 \]

\[ 1.5 = 1.00375^{12t} \]

\[ \log 1.5 = 12t \cdot \log 1.00375 \]

\[ 9.02 = t \]

4. Find the number of payments needed to pay back a loan with present value of $18,000 with a rate of 5.4% and monthly payments of $293.24.

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

\[ 18,000 = 293.24 \cdot \left[ 1 - (1 + \frac{.054}{12})^{-nt} \right] \cdot \frac{.054}{12} \]

\[ 81 = 293.24 \cdot [1 - (1.0045)^{-nt}] \]

\[ .276 = 1 - (1.0045)^{-nt} \]

\[ .724 = 1.0045^{-nt} \]

\[ \log .724 = -nt \log 1.0045 \]

\[ 72 = nt \]

12 payments per year for 6 years
Can use Apps/Finance button on your calculator to find future value and present value

Apps
Finance

TVM solver

N = number of payments
I% = interest (in percent)
PV = present value
PMT = payment amount (negative)
FV = future value
P/Y = # of pay periods per year
C/Y = # of compounding periods per year
1. At the end of each quarter, Emily makes a $500 payment into a mutual fund. If her investments earn 7.88% annual interest compounded quarterly, what will be the value of Emily's annuity in 20 years?

\[ N = 80 \]
\[ I = 7.88 \]
\[ PV = 0 \]
\[ PMT = -500 \]
\[ FV = \text{Alpha Solve} \]
\[ P/Y = 4 \]
\[ C/Y = 4 \]

2. Carlos purchases a new pickup truck for $18,500. What are the monthly payments for a 4 year loan with a $2000 down payment if the annual interest rate is 2.9%?

\[ N = 48 \]
\[ I = 2.9 \]
\[ PV = 16500 \]
\[ PMT = \text{Alpha solve} \]
\[ FV = 0 \]
\[ P/Y = 12 \]
\[ C/Y = 12 \]
3. If you make payments of $75 each month into an account that pays 4.5% interest monthly, how long will it take until you have $10,000?

\[ \begin{align*}
N &= \text{Alpha Solve} \\
I &= 4.5 \\
PV &= 0 \\
PMT &= -75 \\
FV &= 10000 \\
P/Y &= 12 \\
C/Y &= 12
\end{align*} \]

\[ \frac{108.3}{12} = 9.02 \text{ yrs} \]

4. Find the number of payments needed to pay back a loan with present value of $18,000 with a rate of 5.4% and monthly payments of $293.24.

\[ \begin{align*}
N &= \text{Alpha Solve} \\
I &= 6.4 \\
PV &= 18000 \\
PMT &= -293.24 \\
FV &= 0 \\
P/Y &= 12 \\
C/Y &= 12
\end{align*} \]

72 payments
Assignment
Lesson 10.3
77, 79, 81
Worksheet