OBJECTIVES

Calculate the term of systematic savings.
Calculate the term of a systematic withdrawal.

You will need:

- Student Notes
- Calculator
- Textbook
- Notebook Paper
- Pen or Pencil
Planning for your financial future

• How long should I make regularly scheduled deposits to reach my goal?

• How long can I make withdrawals before running out of money?

• Today we will learn how to answer these questions.
Gary and Ann want to make monthly deposits of $400 into a savings account which offers 1.95% interest compounded monthly. How long will it take for the account balance to grow to $10,000?

Remember the future value of a periodic deposit formula:

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

- \( B \) = future value
- \( P \) = periodic deposit amount
- \( r \) = annual interest rate (converted)
- \( n \) = number of times interest is compounded annually
- \( t \) = length of investment in years
Gary and Ann want to make monthly deposits of $400 into a savings account which offers 1.95% interest compounded monthly. How long will it take for the account balance to grow to $10,000?

Determine the variables:

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

- \( B \) = future value \( 10,000.00 \)
- \( P \) = periodic deposit amount \( 400.00 \)
- \( r \) = annual interest rate (converted) \( 0.0195 \)
- \( n \) = number of times interest is compounded annually \( 12 \)
- \( t \) = length of investment in years \( t \)
Gary and Ann want to make monthly deposits of $400 into a savings account which offers 1.95% interest compounded monthly. How long will it take for the account balance to grow to $10,000?

Determine the variables:

\[
B = \text{future value } 10,000.00
\]

\[
P = \text{periodic deposit amount } 400.00
\]

\[
r = \text{annual interest rate (converted) } 0.0195
\]

\[
n = \text{number of times interest is compounded annually } 12
\]

\[
t = \text{length of investment in years } t
\]
Gary and Ann want to make monthly deposits of $400 into a savings account which offers 1.95% interest compounded monthly. How long will it take for the account balance to grow to $10,000?

Determine the variables:

\[
10000 = \frac{400 \left( \left( 1 + \frac{.0195}{12} \right)^{12t} - 1 \right)}{.0195 \frac{12}{12}}
\]

Use menu, 3, 1 to solve for \( t \).

\[ t = 2 \]

It will take 2 years to reach this goal.
Example 3 – You try it!

Phyllis has opened up a systematic savings account into which she deposits $200 per month compounded monthly at a rate of 1.26%. How long will it take for her account to reach $5000? Round your answer to the nearest tenth of a year.

Determine the variables:

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

- \( B \) = future value \( 5,000.00 \)
- \( P \) = periodic deposit amount \( 200.00 \)
- \( r \) = annual interest rate rate (converted) \( 0.0126 \)
- \( n \) = number of times interest is compounded annually \( 12 \)
- \( t \) = length of investment in years \( t \)
Example 3 – You try it!

Phyllis has opened up a systematic savings account into which she deposits $200 per month compounded monthly at a rate of 1.26%. How long will it take for her account to reach $5000? Round your answer to the nearest tenth of a year.

Determine the variables:

\[
5000 = \frac{200 \left( \left( 1 + \frac{.0126}{12} \right)^{12t} - 1 \right)}{.0126/12}
\]

\[B = \text{future value} \quad 5,000.00\]
\[P = \text{periodic deposit amount} \quad 200.00\]
\[r = \text{annual interest rate rate (converted)} \quad .0126\]
\[n = \text{number of times interest is compounded annually} \quad 12\]
\[t = \text{length of investment in years} \quad t\]
Example 3 – You try it!

Phyllis has opened up a systematic savings account into which she deposits $200 per month compounded monthly at a rate of 1.26%. How long will it take for her account to reach $5000? Round your answer to the nearest tenth of a year.

\[
5000 = \frac{200 \left( 1 + \frac{.0126}{12} \right)^{12t} - 1}{\frac{.0126}{12}}
\]

Use menu, 3, 1 to solve for \( t \).

\( t = 2.1 \)

It will take 2.1 years to reach this goal.
Present Value of a Systematic Withdrawal

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

\( P \) = principal
\( W \) = periodic withdrawal amount
\( r \) = annual interest rate (converted)
\( n \) = number of times interest is compounded annually
\( t \) = length of investment in years
Laura and Rich deposited $100,000 into an annuity account that compounds interest monthly at a rate of 1.08%. Each month, they withdraw $500 from the account. How long will it take them until the account has a balance of $0?

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

Determine the variables:

- \(P = \) principal \[100,000.00\]
- \(W = \) periodic withdrawal amount \[500.00\]
- \(r = \) annual interest rate (converted) \[0.0108\]
- \(n = \) number of times interest is compounded annually \[12\]
- \(t = \) length of investment in years \[t\]

\[\text{Example 4}\]
Laura and Rich deposited $100,000 into an annuity account that compounds interest monthly at a rate of 1.08%. Each month, they withdraw $500 from the account. How long will it take them until the account has a balance of $0?

\[ 100000 = 500 \cdot \frac{1 - \left(1 + \frac{.0108}{12}\right)^{-12t}}{\frac{.0108}{12}} \]

Determine the variables:

- \( P \) = principal \( 100,000.00 \)
- \( W \) = periodic withdrawal amount \( 500.00 \)
- \( r \) = annual interest rate (converted) \( .0108 \)
- \( n \) = number of times interest is compounded annually \( 12 \)
- \( t \) = length of investment in years \( t \)
Laura and Rich deposited $100,000 into an annuity account that compounds interest monthly at a rate of 1.08%. Each month, they withdraw $500 from the account. How long will it take them until the account has a balance of $0?

\[
100000 = 500 \left(1 + \frac{0.0108}{12}\right)^{-12t} - \frac{1 - \left(1 + \frac{0.0108}{12}\right)^{-12t}}{\frac{0.0108}{12}}
\]

*Use menu, 3, 1 to solve for t.*

\[t = 18.4\]

It will take 18.4 years to empty out the account.
Example 4 – You try it!
Rameen deposited $40,000 into an account that compounds interest at a rate of 0.96% monthly. She has set up a direct withdrawal of $256 every month to pay off her student loan. She has a 15-year loan. Will she have enough money in the account to cover all of the required loan payments?

Determine the variables:  
$$P = W \cdot \frac{1 - \left(1 + \frac{r}{n}\right)^{nt}}{r}$$

- **P** = principal $40\,000$
- **W** = periodic withdrawal amount $256.00$
- **r** = annual interest rate (converted) 0.0096
- **n** = number of times interest is compounded annually 12
- **t** = length of investment in years **t**
Example 4 – You try it!

Rameen deposited $40,000 into an account that compounds interest at a rate of 0.96% monthly. She has set up a direct withdrawal of $256 every month to pay off her student loan. She has a 15-year loan. Will she have enough money in the account to cover all of the required loan payments?

Determine the variables: \[ 40000 = 256 \cdot \frac{1 - \left(1 + \frac{.0096}{12}\right)^{-12t}}{\frac{.0096}{12}} \]

\[ P = \text{principal } 40000 \]
\[ W = \text{periodic withdrawal amount } 256.00 \]
\[ r = \text{annual interest rate (converted) } 0.0096 \]
\[ n = \text{number of times interest is compounded annually } 12 \]
\[ t = \text{length of investment in years } t \]
Example 4 – You try it!

Rameen deposited $40,000 into an account that compounds interest at a rate of 0.96% monthly. She has set up a direct withdrawal of $256 every month to pay off her student loan. She has a 15-year loan. Will she have enough money in the account to cover all of the required loan payments?

Use menu, 3, 1 to solve for \( t \).

\[
40000 = 256 \cdot \frac{1 - \left(1 + \frac{.0096}{12}\right)^{-12t}}{.0096/12}
\]

\( t = 13.9 \)

It will take 13.9 years to empty out the account.
Please work on your assignment. It is due at the end of next class.

<table>
<thead>
<tr>
<th>Grade goes here</th>
<th>Read Pg: 129 to 135</th>
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<tbody>
<tr>
<td></td>
<td>Do Pg 137: #8-11, 14, 15</td>
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<tr>
<td></td>
<td>Pg 145: 14, 16, 17, 20-22</td>
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<td>Last First P_ A:2-10</td>
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