OBJECTIVES

Calculate the future value of a multiple deposit investment.
Graph & Interpret the future value function.
Discover & Calculate the meaning and power of periodic

You will need:
• Student Notes
• Textbook
• Calculator
• Notebook Paper
• Formula Cheat Sheet
• Pen or Pencil
No Ear Buds!!!!

Cell Phones: Down & Dark
What do you want to buy or pay for in the future?

- You decide to put away $150 each month towards retirement. How much will you have in the account when you retire?

- Your Aunt leaves you money. You put it into a savings account. How much will it grow over the years?
Future value of a periodic deposit investment

periodic means regularly scheduled

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

\( B = \text{future value} \)

\( P = \text{periodic deposit amount} \)

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

\( n = \text{number of times interest is compounded annually} \)

\( t = \text{length of investment in years} \)
Future value of a periodic deposit investment

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

Where is this formula on the formula cheat sheet?
Rich and Laura are both 45 years old. They open an account at the Rhinebeck Savings Bank for their retirement in 20 years. They deposit $5,000 each year into an account that pays 1.25% interest, compounded annually.

What is the account balance when Rich and Laura retire?
Rich and Laura are both 45 years old. They open an account at the Rhinebeck Savings Bank for their retirement in 20 years. They deposit $5,000 each year into an account that pays 1.25% interest, compounded annually. What is the account balance when Rich and Laura retire?

\[ B = \text{future value} \]
\[ P = \text{periodic amount} \quad \$5,000 \]
\[ r = \text{rate (converted)} \quad 0.0125 \]
\[ n = \text{number of compounds} \quad 1 \]
\[ t = \text{years} \quad 20 \]

\[ B = \frac{P \left( \left( 1 + \frac{r}{n} \right)^{nt} - 1 \right)}{r} \]
Rich and Laura are both 45 years old. They open an account at the Rhinebeck Savings Bank with the hope that it will gain enough interest by their retirement at the age of 65. They deposit $5,000 each year into an account that pays 1.25% interest, compounded annually. What is the account balance when Rich and Laura retire?

\[ B = \text{future value} \]

\[ P = \text{periodic amount} \ $5,000 \]

\[ r = \text{rate (converted)} \ 0.0125 \]

\[ n = \text{number of compounds} \ 1 \]

\[ t = \text{years} \ 20 \]

\[ B = \frac{5000 \left( \left( 1 + \frac{0.0125}{1} \right)^{1 \cdot 20} - 1 \right)}{0.0125} \]
To enter it into the Nspire start with “control divide”

\[ B = \frac{5000 \left( \left( 1 + \frac{0.0125}{1} \right)^{1 \cdot 20} - 1 \right)}{0.0125} \]

Compare your answer to a neighbor.

$112,814.89$
Example 1 - You try it!

How much more would Rich and Laura have in their account if they decide to hold off retirement for an extra year?

The only change in the formula is $t=21$

\[
B = \frac{5000 \left( \left( 1 + \frac{.0125}{1} \right)^{1.21} - 1 \right) - .0125}{.0125} \]

\[
= 119,225.08
\]

\[
119,225.08 - 112,814.89 = $6,410.19
\]
Future value of a periodic deposit investment

periodic means regularly scheduled

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

\( I \) = Interest Earned

\( P \) = periodic deposit amount

\( r \) = annual interest rate (converted)

\( n \) = number of times interest is compounded annually

\( t \) = length of investment in years
Rich and Laura are both 45 years old. They open an account at the Rhinebeck Savings Bank for their retirement in 20 years. They deposit $5,000 each year into an account that pays 1.25% interest, compounded annually.

How much interest will Rich and Laura earn?

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

\[ I = \text{Interest Earned} \]

\[ P = \text{periodic amount} \quad $5,000 \]

\[ r = \text{rate (converted)} \quad 0.0125 \]

\[ n = \text{number of compounds} \quad 1 \]

\[ t = \text{years} \quad 20 \]
Rich and Laura are both 45 years old. They open an account at the Rhinebeck Savings Bank for their retirement in 20 years. They deposit $5,000 each year into an account that pays 1.25% interest, compounded annually.

How much interest will Rich and Laura earn?

\[
I = 5000 \left( \left( 1 + \frac{0.0125}{1} \right)^{1 \cdot 20} - 1 \right)
\]

\[
I = \frac{0.0125}{1} - 5000 \cdot 1 \cdot 20
\]

\[
I = \text{Interest Earned} \quad \$12,814.89
\]

\[
P = \text{periodic amount} \quad \$5,000
\]

\[
r = \text{rate (converted)} \quad 0.0125
\]

\[
n = \text{number of compounds} \quad 1
\]

\[
t = \text{years} \quad 20
\]

Example 2
Example 2 - You try it!

Use Example 1 - You Try It information.
How much more interest would Rich and Laura earn by retiring after 21 years?

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

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

\[
I = \text{Interest Earned} \quad P = \text{periodic amount} \quad \$5,000 \quad r = \text{rate (converted)} \quad 0.0125 \quad n = \text{number of compounds} \quad 1 \quad t = \text{years} \quad 21
\]
Example 2 - You try it!

Use Example 1 - You Try It information.
How much more interest would Rich and Laura earn by retiring after 21 years?

\[ I = \frac{5000 \left( \left( 1 + \frac{0.0125}{1} \right)^{1 \cdot 21} - 1 \right)}{0.0125} - 5000 \cdot 1 \cdot 21 \]

\[ I = \text{Interest Earned} \]

\[ P = \text{periodic amount} \quad $5,000 \]

\[ r = \text{rate (converted)} \quad 0.0125 \]

\[ n = \text{number of compounds} \quad 1 \]

\[ t = \text{years} \quad 21 \]

\[ I = \text{Interest Earned} \]

\[ P = \text{periodic amount} \quad $5,000 \]

\[ r = \text{rate (converted)} \quad 0.0125 \]

\[ n = \text{number of compounds} \quad 1 \]

\[ t = \text{years} \quad 21 \]

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\[ t = \text{years} \quad 21 \]

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\[ r = \text{rate (converted)} \quad 0.0125 \]

\[ n = \text{number of compounds} \quad 1 \]

\[ t = \text{years} \quad 21 \]

\[ I = \text{Interest Earned} \]

\[ P = \text{periodic amount} \quad $5,000 \]

\[ r = \text{rate (converted)} \quad 0.0125 \]

\[ n = \text{number of compounds} \quad 1 \]

\[ t = \text{years} \quad 21 \]
Linda and Rob open an online savings account that has a 1% annual interest rate, compounded monthly.

If they deposit $1,200 every month, how much will be in the account after 10 years?

\[ B = \text{future value} \]
\[ P = \text{periodic amount} \quad \$1,200 \]
\[ r = \text{rate (converted)} \quad 0.01 \]
\[ n = \text{number of compounds} \quad 12 \]
\[ t = \text{years} \quad 10 \]
Linda and Rob open an online savings account that has a 1% annual interest rate, compounded monthly. If they deposit $1,200 every month, how much will be in the account after 10 years?

\[
B = \text{future value} = \text{B}
\]
\[
P = \text{periodic amount} = $1,200
\]
\[
r = \text{rate (converted)} = 0.01
\]
\[
n = \text{number of compounds} = 12
\]
\[
t = \text{years} = 10
\]

\[
B = 1200 \left( 1 + \frac{0.01}{12} \right)^{12 \cdot 10} - 1
\]

\[
B = \frac{0.01}{12}
\]

$151,379.85$
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

B becomes “y” and the “nt” exponent becomes “x”

\[
y = \frac{1200 \left( \left( 1 + \frac{.01}{12} \right)^x - 1 \right)}{.01/12}
\]
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

You need to change the window to see the graph.
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

Menu, 4, 1 to change the table.
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

Change the settings:
X can be from 0 months to 60 months (5 years).
Y can be from $0 to $150,000.
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

Change the settings:
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

- **Trouble shooting:**
  Make sure the exponent is just an “*x*”
  - Make sure the start of the formula matches mine EXACTLY!  

\[
f_1(x) = \frac{1200 \cdot (1 + \frac{0.01}{12})^x - 1}{\frac{0.01}{12}}
\]
Construct a graph of the future value function that represents Linda and Rob’s account for each month. Use the graph to approximate the balance after 5 years.

**Example 4**

Menu, 5, 1 to trace
Move the mouse so that the “x” is 60 (or close to it)

Estimate is **73,900**
Please work on your assignment. It is due at the end of next class.

Read Pg: 109 to 112
Do Pg 113: #2-9, 11

Window Settings

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<td>-5</td>
</tr>
<tr>
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<td>600</td>
</tr>
<tr>
<td>Ymin</td>
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</tr>
<tr>
<td>Ymax</td>
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<td>16,500</td>
<td>100,000</td>
</tr>
</tbody>
</table>