**SAVINGS PLANS**

\[ A = \text{accumulated savings plan balance} \quad \text{n = number of payment periods per year} \]

\[ \text{PMT} = \text{regular payment (deposit) amount} \quad \text{Y = number of years} \]

\[ \text{APR} = \text{annual percentage rate (in decimal form if doing by hand)} \]

Note: Some calculators have finance calculation options. For example, on the TI-83, this is the Time Value of Money (TVM) Solver.

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### Example

Using TVM Solver (TI-83:FINANCE; TI-83+, TI-84:APPS)

1. Enter 12×15 or 180 = number of payment periods
2. Enter I% = 6
3. Enter PV = 0 = beginning amount in account
4. Enter PMT = 100 = monthly deposit
5. Enter FV = 0 = future value
6. Enter C/Y = 12 = number of compounding periods per year
7. Enter P/Y = 12 = number of deposits per year
8. Enter PMT = highlight END for end of month deposits
9. Arrow up to FV since we are looking for the accumulated amount after 15 years

- \( \text{FV} = -29081.87124 \) should appear, so the accumulated amount is \( \$29,081.87 \) which agrees with the formula calculation to the left.

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<table>
<thead>
<tr>
<th>Savings Plan with Regular Payments</th>
<th>Example</th>
<th>Using TVM Solver (TI-83:FINANCE; TI-83+, TI-84:APPS)</th>
</tr>
</thead>
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| \[ A = PMT \times \left( \frac{1 + \frac{\text{APR}}{n}}{\text{APR}} \right)^{\left( n \times Y \right)} - 1 \] | Begin with $0 in account, deposit $100 at the end of each month with an APR of 6% compounded monthly for 15 years. After 15 years, the accumulated amount is: \[ A = \$100 \times \left( \frac{1 + \frac{.06}{12}}{\frac{.06}{12}} \right)^{\left( \frac{12 \times 15}{12} \right)} - 1 \] \[ A = \$100 \times \frac{(.06)}{12} = \$29,081.87 \] | (1) Press 2nd \( x^{-1} \) (FINANCE) or APPS
(2) Choose 1: TVM Solver
(3) Enter N = 12×15 or 180 = number of payment periods
\[ \text{I%} = 6 \]
\[ \text{PV} = 0 = \text{beginning amount in account} \]
\[ \text{PMT} = 100 = \text{monthly deposit} \]
\[ \text{FV} = 0 = \text{future value} \]
\[ \text{P/Y} = 12 = \text{number of deposits per year} \]
\[ \text{C/Y} = 12 = \text{number of compounding periods per year (12 for monthly)} \]
\[ \text{PMT} = \text{highlight END for end of month deposits} \]
(4) Arrow up to FV since we are looking for the accumulated amount after 15 years
(5) Press ALPHA ENTER (SOLVE).

- The amount that appears is the accumulated amount. It is negative because the calculator considers it an outflow of cash.
- \( \text{FV} = -29081.87124 \) should appear, so the accumulated amount is \( \$29,081.87 \) which agrees with the formula calculation to the left. |

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### SAVINGS PLANS (continued)

<table>
<thead>
<tr>
<th>Savings Plan Payments</th>
<th>Example</th>
<th>Using TVM Solver (TI-83:FINANCE; TI-83+, TI-84:APPS)</th>
</tr>
</thead>
</table>
| \[
PMT = \frac{A \times APR}{\left[1 + \frac{APR}{n}\right]^{n \times t} - 1}
\] | To build an $80,000.00 fund (for your college education or down payment on your home, for example) over 18 years, your parents make regular, end-of-the-month deposits to an account with an APR of 6%. How much should your parents deposit monthly? | (1) Press 2nd $x^{-1}$ (FINANCE) or APPS  
(2) Choose 1: TVM Solver  
(3) Enter \(N = 12 \times 18\) or 216  
\(I\% = 6\)  
\(PV = 0\)  
\(PMT = 0\)  
\(FV = 80000\)  
\(P/Y = 12 = \text{number of payments per year}\)  
\(C/Y = 12 = \text{number of compounding periods per year (12 for monthly)}\)  
\(PMT = \text{highlight END for end of month deposits}\)  
(4) Arrow up to PMT  
(5) Press ALPHA ENTER (SOLVE).  
• PMT = 206.53 (rounded) |

So, your parents need to deposit $206.53 monthly to provide you with this fund.

| Total return at end of period: | You invest $5000 in a mutual fund which grows in value to $18,500 in 5 years. Your total return |  |
| \[
\text{new value} - \text{starting principal} \times 100
\]  
\[
\text{starting principal}
\]  
\[
\text{percent increase}
\] | \[
\frac{18500 - 5000}{5000} = 2.7 = 270\%
\]  
Your return on your investment after 5 years is 2.7 times the original value. | |

| Annual return: | Annual return |  |
| \[
\left(\frac{A}{P}\right)^\frac{1}{Y} - 1
\]  
\[
= \text{average rate of growth per year}
\] | \[
\left(\frac{18500}{5000}\right)^\frac{1}{5} - 1 = \sqrt[5]{3.7} - 1 \approx 0.299 \approx 29.9\%
\]  
Your investment has grown by an average of 29.9% each year. |  

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