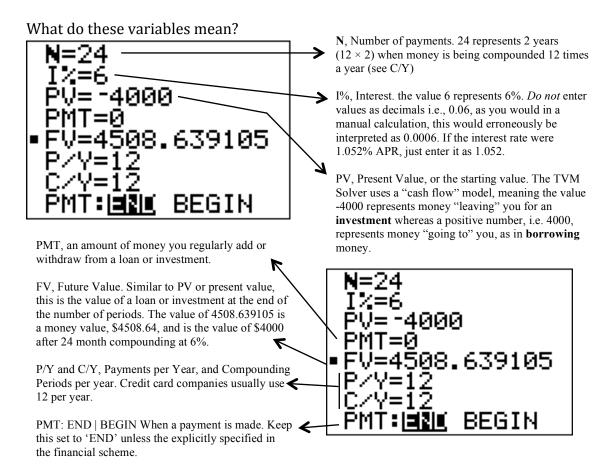# The Time Value of Money (TVM Solver App)
Using the TI-84 Plus / TI-84 C Silver Edition/ TI-83 Plus
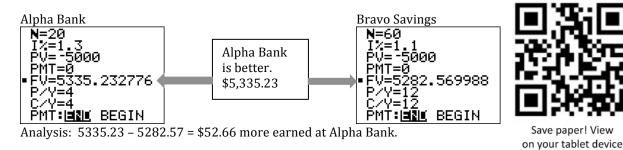
To access the TVM Solver, press the APPS key, choose 1:Finance…

What do these variables mean?

```
N=24
I%=6
PV= -4000
PMT=0
■FV=4508.639105
P/Y=12
C/Y=12
PMT:END BEGIN
```

N, Number of payments. 24 represents 2 years (12×2) when money is being compounded 12 times a year (see C/Y)

I%, Interest. the value 6 represents 6%. *Do not* enter values as decimals i.e., 0.06, as you would in a manual calculation, this would erroneously be interpreted as 0.0006. If the interest rate were 1.052% APR, just enter it as 1.052.

PV, Present Value, or the starting value. The TVM Solver uses a "cash flow" model, meaning the value -4000 represents money "leaving" you for an **investment** whereas a positive number, i.e. 4000, represents money "going to" you, as in **borrowing** money.

PMT, an amount of money you regularly add or withdraw from a loan or investment.

FV, Future Value. Similar to PV or present value, this is the value of a loan or investment at the end of the number of periods. The value of 4508.639105 is a money value, $4508.64, and is the value of $4000 after 24 month compounding at 6%.

P/Y and C/Y, Payments per Year, and Compounding Periods per year. Credit card companies usually use 12 per year.

PMT: END | BEGIN When a payment is made. Keep this set to 'END' unless the explicitly specified in the financial scheme.

```
N=24
I%=6
PV= -4000
PMT=0
■FV=4508.639105
P/Y=12
C/Y=12
PMT:END BEGIN
```

Example 1: Compound Interest on an investment

You can use the TMV Solver to solve the FV variable in the formula $FV = PV(1 + r)^n$.

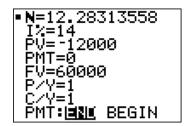Compare: which investment earns more, and by how much? You have $5000. Alpha Banking has a savings account that earns 1.3% and is compounded quarterly. Bravo Savings has a savings account that earns 1.1% and is compounded monthly. Assuming you neither add nor withdraw from the accounts, what will the investment of $5000 be worth after 5 years? -> *SOLVE FV*

Alpha Bank
```
N=20
I%=1.3
PV= -5000
PMT=0
■FV=5335.232776
P/Y=4
C/Y=4
PMT:END BEGIN
```

Alpha Bank is better. $5,335.23

Bravo Savings
```
N=60
I%=1.1
PV= -5000
PMT=0
■FV=5282.569988
P/Y=12
C/Y=12
PMT:END BEGIN
```

Save paper! View on your tablet device

Analysis: 5335.23 – 5282.57 = $52.66 more earned at Alpha Bank.

Example 2: Time needed for an investment to appreciate

A rare violin has an estimated value of $12,000. Its value history indicates that it appreciates at 14% per year. How many years will it take to appreciate to $60,000? -> *SOLVE N*

Set I% = 14, PV = -12000, PMT = 0, FV = 60000 P/Y = 1 and C/Y = 1

```
■N=12.28313558
  I%=14
 PV=-12000
 PMT=0
 FV=60000
 P/Y=1
 C/Y=1
 PMT:END BEGIN
```

PV is entered as -12000 because this is an **investment**, the money is "going away" from you into a violin as an investment vehicle. Set FV to 60000 and solve for N. The value 12.28313558 is years, so figuring the decimal, 0.28 as part of a 52 week year, (0.28 x 52 = 14.56 weeks) the final answer is about 12 years and 14 weeks.

Example 3: Find a Monthly Payment on a loan (Mortgage)

You want to buy a house valued at $312,000. Your lender will finance it for 25 years at a rate of 5.5% interest. What much will the monthly payments be?   -> *SOLVE PMT*

Set N = 300, I% = 5.5, PV = 312000, FV = 0 P/Y = 12 and C/Y = 12

```
  N=300
  I%=5.5
 PV=312000
■PMT=-1915.9529…
 FV=0
 P/Y=12
 C/Y=12
 PMT:END BEGIN
```
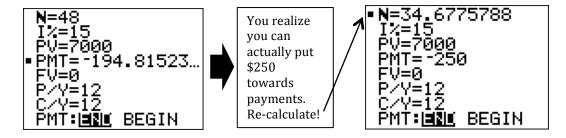
PV is entered as positive 312000 because this is a loan, the money is "coming to" you from a lender. Set FV to 0 because 0 represents a paid off loan.

Solve for PMT . The value -1915.9529 are dollars, and is negative because this is money "leaving you," to pay the lender. Your monthly payments will be about $1915.95.

Example 4: Credit Card, multi-step analysis

You have a credit card with a $7000 balance. The interest rate, as APR is 15%. What are your monthly payments if you want to pay off the card (be debt free!) in 4 years? -> *SOLVE PMT*

Set N = 48, I% = 15, PV = 7000, FV = 0 P/Y = 12 and C/Y = 12

```
  N=48
  I%=15
 PV=7000
■PMT=-194.81523…
 FV=0
 P/Y=12
 C/Y=12
 PMT:END BEGIN
```

You realize you can actually put $250 towards payments. Re-calculate!

```
■N=34.6775788
  I%=15
 PV=7000
 PMT=-250
 FV=0
 P/Y=12
 C/Y=12
 PMT:END BEGIN
```

Analysis: With 48 monthly payments of $194.81 totals $9350.88. Paying off a little more each month, $250 for 34 month is $8500. The last payment (because of the .6775788 decimal) is $167.63, added to the $8500 is a total of $8667.63 paid to the credit card company. Paying off sooner saves you $683.25.

Limitations to the TVM Solver: does not do simple interest calculations, nor continuous compounding