Solving for *Interest* in a Present Value or Future Value Problem With or Without a Graphing Calculator

Consider the equation: $PV = PMT\left[\frac{1-(1+i)^{-n}}{i}\right]$

Given: PV = \$10,000 PMT = \$500 n = 30 **Solve for i.**

Step 1. Put known values into the equation. $10{,}000 = 500\left[\frac{1-(1+i)^{-30}}{i}\right]$

Step 2. Manipulate the equation to get all the i terms on one side equal to something.

$$\frac{10{,}000}{500} = \left[\frac{1-(1+i)^{-30}}{i}\right]$$

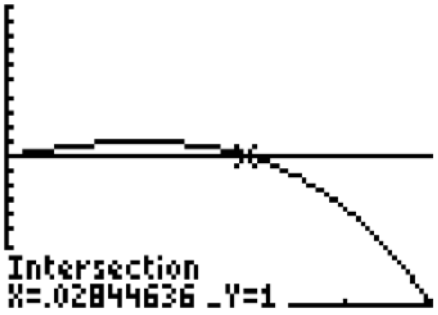
$$20 = \frac{1-(1+i)^{-30}}{i}$$

$$20i = 1-(1+i)^{-30}$$

$$1-20i = \frac{1}{(1+i)^{30}}$$

$$(1+i)^{30}(1-20i) = 1$$

Step 3. If you have a graphing calculator, plot **$y = (1+i)^{30}(1-20i)$** and **$y = 1$** and find the intersection. Or, set your table to very small increments and find where y = 1 for your function, assuming i > 0.



X	Y1	Y2
.028	1.0075	1
.0281	1.0059	1
.0282	1.0042	1
.0283	1.0025	1
.0284	1.0008	1
.0285	.99907	1
.0286	.99733	1

X=.0284

Or Step 3. If you don't have a graphing calculator, you can still solve for **i** by iteration.

Notice that $\mathbf{(1 + i)^{30}}$ is always positive because it has an even exponent (also, in this case, i is positive). Therefore **(1 – 20i)** must also be positive for the product of the two to equal a positive number.

a. State that as: $1 - 20i > 0$

$20i < 1$

$i < \frac{1}{20}$ or $i < .05$

b. With a scientific calculator, evaluate the function $\mathbf{y = (1 + i)^{30}(1 – 20i)}$ for values of $i < .05$. The goal is to get the equation equal to 1.

i	$\mathbf{(1 + i)^{30}(1 – 20i)}$
.04	0.65
.03	0.97
.02	1.087
.029	0.9902
.028	1.0075
.0284	1.0008
etc.	depending on how close you need to get

$\mathbf{i \simeq 2.84\%}$

General form to solve either $PV = PMT\left[\frac{1-(1+i)^{-n}}{i}\right]$ or $PMT = PV\left[\frac{i}{1-(1+i)^{-n}}\right]$ for i

is $\mathbf{(1+i)^n\left[1-\left(\frac{PV}{PMT}\right)i\right] = 1}$ $\quad i < \frac{PMT}{PV}$

General form to solve either $FV = PMT\left[\frac{(1+i)^n-1}{i}\right]$ or $PMT = FV\left[\frac{i}{(1+i)^n-1}\right]$ for i

is $\mathbf{(1+i)^n - \left(\frac{FV}{PMT}\right)i = 1}$

(Note: In solving the FV equation for i with a scientific calculator, there is no defined boundary for i, so just start the iterations with i = .01. You're still trying to get the left side of the equation equal to 1.)