

Present Value of an Annuity

Finite Math

27 February 2017

Quiz

If you take out an auto loan and want to figure out your monthly payments, should you use the Future Value formula or the Present Value formula?

Combination Example

An interesting application of this in conjunction with sinking funds is saving for retirement.

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Example

The full retirement age in the US is 67 for people born in 1960 or later. Suppose you start saving for retirement at 27 years old and you would like to save enough to withdraw \$40,000 per year for the next 20 years. If you find a retirement savings account (for example, a Roth IRA) which pays 4% interest compounded annually, how much will you have to deposit per year from age 27 until you retire in order to be able to make your desired withdraws?

Now You Try It!

Example

Lincoln Benefit Life offered an ordinary annuity earning 6.5% compounded annually. If \$2,000 is deposited annually for the first 25 years, how much can be withdrawn annually for the next 20 years?

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Solution

\$10,688.87

Amortization

Amortization is the process of paying off a debt. The formula for present value of an annuity will allow us to model the process of paying off a loan or other debt. The reason the formula is the same is because receiving payments from your savings account is essentially the bank repaying you the money you loaned them by depositing it into a savings account.

Amortization

Example

Suppose you take out a 5-year, \$25,000 loan from your bank to purchase a new car. If your bank gives you 1.9% interest compounded monthly on the loan and you make equal monthly payments, how much will your monthly payment be?

Now You Try It!

Example

If you sell your car to someone for \$2,400 and agree to finance it at 1% per month on the unpaid balance, how much should you receive each month to amortize the loan in 24 months? How much interest will you receive?

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Solution

$$PMT = \$112.98, I = \$311.52$$

Amortization Schedule

Example

Construct the amortization schedule for a \$1,000 debt that is to be amortized in six equal monthly payments at 1.25% interest per month on the unpaid balance.

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
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Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1				

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03			

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50		

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2				

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03			

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48		

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	\$674.92

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	\$674.92
3	\$174.03	\$8.44	\$165.59	\$509.33

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	\$674.92
3	\$174.03	\$8.44	\$165.59	\$509.33
4	\$174.03	\$6.37	\$167.66	\$341.67

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	\$674.92
3	\$174.03	\$8.44	\$165.59	\$509.33
4	\$174.03	\$6.37	\$167.66	\$341.67
5	\$174.03	\$4.27	\$169.76	\$171.91

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	\$674.92
3	\$174.03	\$8.44	\$165.59	\$509.33
4	\$174.03	\$6.37	\$167.66	\$341.67
5	\$174.03	\$4.27	\$169.76	\$171.91
6	\$174.06	\$2.15	\$171.91	\$0.00

Amortization Schedule

Payment Number	Payment	Interest	Unpaid Balance Reduction	Unpaid Balance
0				\$1,000
1	\$174.03	\$12.50	\$161.53	\$838.47
2	\$174.03	\$10.48	\$163.55	\$674.92
3	\$174.03	\$8.44	\$165.59	\$509.33
4	\$174.03	\$6.37	\$167.66	\$341.67
5	\$174.03	\$4.27	\$169.76	\$171.91
6	\$174.06	\$2.15	\$171.91	\$0.00
Total	\$1,044.21	\$44.21	\$1,000	