Future & Present Value Annuities

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Nov 4-10:28 AM

Warm Up

If an investment earns 6.8% /a interest compounded biweekly and it is worth $1500 after 4 years, what was the amount of interest earned?

$P = A(1+i)^{-n}$

$P = 1500\left(1+\frac{0.068}{26}\right)^{-104}$

$P = \$1143.19$

Biweekly $= 26$

$A = 1500$

$i = \frac{0.068}{26}$

$n = 4(26) = 104$

$I = A - P = \$356.81$

May 25-13:00

Annuities

annuity: a series of payments or investments made at regular intervals.

simple annuity: an annuity in which the payments coincide with the compounding period.

ordinary annuity: an annuity in which the payments are made at the end of each interval.

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Annuities: Future Value

The future value of an annuity is the sum of all the regular payments and interest earned.

The formula is : $$FV = R\left(\frac{(1+i)^n - 1}{i}\right)$$

R - regular payments
i - interest rate per compounding period

FV- Future Value
n - # of compounding periods

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Example

Davenport invests $650 every 6 months at 4.6% /a compounded semi-annually for 25 years. How muchinterest will he have earned after the 25th year?

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

$$= 650\left(\frac{\left(1+\frac{0.046}{2}\right)^{50} - 1}{\frac{0.046}{2}}\right)$$

$$= 650\left(\frac{(1.023)^{50} - 1}{0.023}\right)$$

$$= \$59,837.37$$

Semi-annual = 2

$R = 650$

$i = \frac{0.046}{2}$

$n = 25(2) = 50$

$P = 650(50)$

$= \$32500$

$I = A - P = \$27,337.37$

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Example

Suppose you want to have $1000000 saved by thetime you retire at 60 years old. If you have a savings account that earns 5% /a compounded monthly, how much will you need to deposit each month?

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

$$\frac{FV(i)}{(1+i)^n - 1} = R$$

$$\frac{1000000\left(\frac{0.05}{12}\right)}{\left(1+\frac{0.05}{12}\right)^{516} - 1} = R$$

$$\frac{4166.\overline{6}}{7.546597382} = R$$

$$R = \$552.13$$

Monthly = 12

$FV = 1,000,000$

$i = \frac{0.05}{12}$

$n = (60-17)(12)$

$= 516$

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Annuities - Present Value

The present value of an annuity is the value of the annuity at the beginning of the term. It is the sum of all the present values of the payments.
The formula is:

$$PV = R\left(\frac{1-(1+i)^{-n}}{i}\right)$$

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Example

Smudger wants to buy a $1300 stereo system on credit and make monthly payments over 2 years. If the store is charging him 18% /a compounded monthly, what will his payments be?

$PV = R\left(\frac{(1-(1+i)^{-n})}{i}\right)$

Monthly = 12
$PV = 1300$
$i = \frac{0.18}{12} = 0.015$
$n = 2(12) = 24$

$\frac{PV(i)}{(1-(1+i)^{-n})} = R$

$\frac{1300(0.015)}{(1-(1.015)^{-24})} = R$

$\Rightarrow R = \$64.90$

$\frac{19.5}{0.300456085} = R$

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Example

Bunter pays $59 for a new netbook and borrowsthe remaining amount. He plans to make 10 monthly payments of $40 each. The first payment is due next month.

a) If the interest is 18% /a compounded monthly, what is the selling price?

b) How much interest will he have paid over the term of the loan?

a) $PV = 40\left(\frac{1-(1.015)^{-10}}{0.015}\right)$

$PV = \$368.89$

Selling price $= 368.89 + 59$
$= \$427.89$

Monthly $= 12$

$R = 40$

$i = \frac{0.18}{12} = 0.015$

$n = 10$

b) Payments made $= 10(40) = \$400$

Deposit $= \$59$ +

Total $= \$459$

$I =$ Total $-$ Selling price $= \$31.11$

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Homework

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