# Finance Formulas for College Algebra (LCU - Fall 2013)

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## Formula 1: Amount of Money at Periodically Compounded Interest

***This formula is usually used for savings accounts or any investment where an amount is deposited one time into an account or investment. It will simply grow as it earns interest for the amount of time it is in the account.***

$$A = P\cdot(1 + r / n)^{n\cdot t}$$

*( A is the final amount, t is the number of years,*
*P is the amount originally invested,*
*n is the number of compounding periods per year,*
*r is the annual interest rate written as a decimal )*

Example: Suppose I invest $5,000 at 6% annual interest compounded monthly for 11 years.

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:

5000(1 + .06 ÷ 12)^(12 × 11)

If you enter the above numbers correctly on a calculator,
you should get an answer for A of $9,658.07

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## Formula 2: Amount of Money at Continuously Compounded Interest

***This formula is usually used for savings accounts or any investment where an amount is deposited one time into an account or investment. It will simply grow as it earns interest for the amount of time it is in the account. The only difference in this formula and the previous one is that money is compounded at every instant of time in this formula.***

$$A = P\cdot e^{r\cdot t}$$

*( A is the final amount, t is the number of years,*
*P is the amount originally invested,*
*r is the annual interest rate written as a decimal )*

Example: Suppose I invest $5,000 at 6% annual interest compounded continuously for 11 years.

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:

5000 e^(.06 ×11)

If you enter the above numbers correctly on a calculator,
you should get an answer for A of $9,673.96

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## Formula 3: Future Value of an Annuity Due (payments at the beginning of each regular period):

***This formula is usually used for retirement accounts or any investment where regular (usually monthly) payments are made at the beginning of each regular period for a fixed length of time.***

$$S_{AnnDue} = \frac{R \cdot (1 + r/n) \cdot ((1 + r/n)^{(n \cdot t)} - 1)}{(r/n)}$$

***S*** *is the future value of the annuity due,*
***R*** *is the amount of the regular payment per period,*
***r*** *is the annual interest rate written as a decimal*
***n*** *is the number of payment periods per year*
***t*** *is the number of years*

Example: Suppose I pay $200 at the beginning of each month into a retirement account paying 4.5% annual interest for 11 years into a retirement account with payments . How much will I have at the end of that time?

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:

200 × (1 + .045 ÷ 12) × ((1 + .045 ÷ 12)^(12 × 11) - 1) ÷ (.045 ÷ 12)

If you enter the above numbers correctly on a calculator, you should get an answer for S of $34,206.74

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## Formula 4: Future Value of an Ordinary Annuity (payments at the end of each regular period):

***This formula is usually used for retirement accounts or any investment where regular (usually monthly) payments are made at the end of each regular period for a fixed length of time.***

$$S_{OrdAnn} = \frac{R \cdot ( ( 1 + r / n)^{(n \cdot t)} - 1 )}{( r / n )}$$

***S*** *is the future value of the ordinary annuity,*
***R*** *is the amount of the regular payment per period,*
***r*** *is the annual interest rate written as a decimal*
***n*** *is the number of payment periods per year*
***t*** *is the number of years*

Example: Suppose I pay $200 at the beginning of each month into a retirement account paying 4.5% annual interest for 11 years. How much will I have at the end of that time?

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:

200 × ((1 + .045 ÷ 12)^(12 × 11) - 1) ÷ (.045 ÷ 12)

If you enter the above numbers correctly on a calculator, you should get an answer for S of $31,239.03

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## Formula 5: Present Value of an Annuity Due (payments at the beginning of each regular period):

***This formula is usually used to compare a savings account with an annuity. It tells you how much money you would need to put into an account in order to have the same amount of money if you paid regular payments (usually monthly) into an annuity. The interest rates, compounting periods and length of time are the same in the comparison.***

$$PV_{AnnDue} = \frac{R \cdot (1 + r/n) \cdot (1 - (1 + r/n)^{(-n * t)})}{(r/n)}$$

***PV*** *is the present value of the annuity due,*
***R*** *is the amount of the regular payment per period,*
***r*** *is the annual interest rate written as a decimal*
***n*** *is the number of payment periods per year*
***t*** *is the number of years*

Example: Suppose I withdraw $200 at the beginning of each month from an account paying 4.5% annual interest for 11 years. How much will the account need to have in it to be able to do this?

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:
200 × (1 + .045 ÷ 12) × (1 - (1 + .045 ÷ 12)^(–12 × 11)) ÷ (.045 ÷ 12)

If you enter the above numbers correctly on a calculator, you should get an answer for S of $20870.75

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## Formula 6: Present Value of an Ordinary Annuity (payments at the end of each regular period):

***This formula is usually used to compare a savings account with an annuity. It tells you how much money you would need to put into an account in order to have the same amount of money if you paid regular payments (usually monthly) into an annuity. The interest rates, compounding periods and length of time are the same in the comparison.***

$$PV_{OrdAnn} = \frac{R \cdot (1 - (1 + r/n)^{(-n*t)})}{(r/n)}$$

*PV is the present value of the ordinary annuity,*
*R is the amount of the regular payment per period,*
*r is the annual interest rate written as a decimal*
*n is the number of payment periods per year*
*t is the number of years*

Example: Suppose I withdraw $200 at the end of each month from an account paying 4.5% annual interest for 11 years. How much will the account need to have in it to be able to do this?

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:

200 × (1 - (1 + .045 ÷ 12)^(–12 × 11)) ÷ (.045 ÷ 12)

If you enter the above numbers correctly on a calculator,
you should get an answer for S of $20792.77

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## Formula 7: Loan Payments Calculator

***This formula is usually used to calculate loan payments to repay an amount borrowed (like car or house payments)***

$$R = \frac{B \cdot (r / n)}{(1 - (1 + r / n)^{-(n * t)})}$$

***B*** *is the amount borrowed,*
***R*** *is the amount of the regular payment per period,*
***r*** *is the annual interest rate written as a decimal*
***n*** *is the number of payment periods per year*
***t*** *is the number of years*

Example: Suppose I want to borrow $25,000 at 4.5% annual interest for 5 years to buy a used car. What will my monthly payments be?

This is how you would put the values into the formula to work it out with a TI 82/83/84/89calculator:

25000 × (.045 ÷ 12) ÷ (1 - (1 + .045 ÷ 12)^(–n × 12))

If you enter the above numbers correctly on a calculator,
you should get an answer for R of $466.08

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