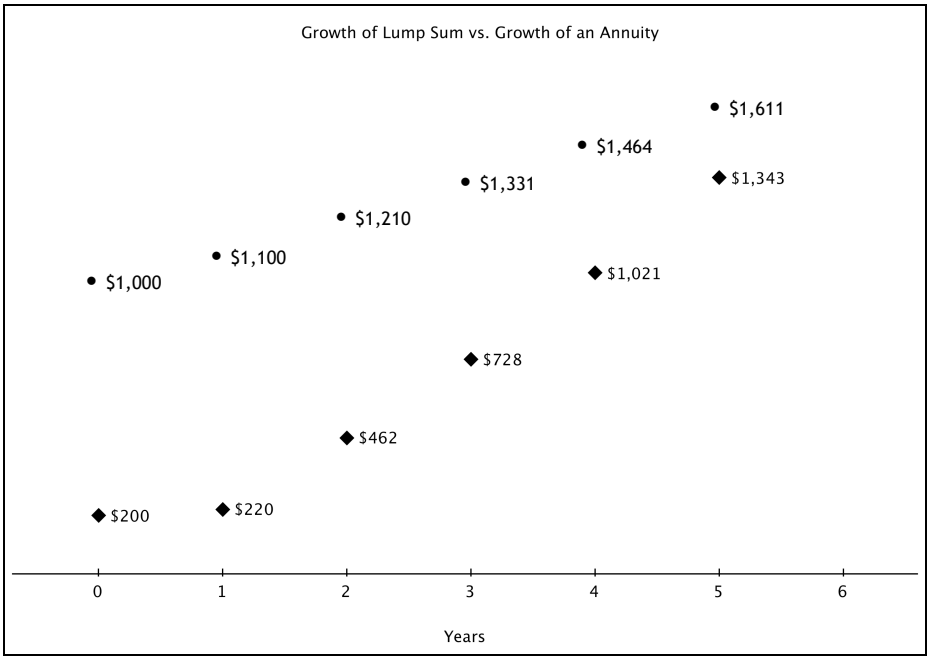
Decision Making in Finance: Building an Investment

VI.C Student Activity Sheet 6: Investing As You Go

An **annuity** is a financial product that accepts and grows funds and then, upon annuitization, pays out regular payments to the investor. Annuities are often used as retirement funds. Some annuities are funded with a lump-sum investment, while others are funded with an initial investment and additional regular deposits before retirement. What complicates the time value of money (TVM) of an annuity that you pay into is that the investment increases in value due to both compound interest and increasing principal.

The following graph shows the value of a lump-sum investment of $1,000 earning 10% compounded per year (•) versus an annuity with an initial investment of $200 earning 10% compounded per year with additional $200 deposits made each year (♦).



1. How is the process different for calculating the future value of each investment?

2. Refer to the future-value formula in Student Activity Sheet 3. How is the process different in calculating the future value of an annuity when compared to using the future-value formula?

3. An annuity can be thought of as a series of values connected by a common ratio. What common ratio connects the values of the annuity over time shown in the graph at the beginning of this activity sheet? How is the ratio related to the problem situation?

4. The following formula can be used to calculate the sum of a series connected by a common ratio, such as the previous annuity example.

$$S_n = \frac{a_1(1 - r^n)}{(1 - r)}, \text{ where}$$

a_1 = the first term in the series, n = the number of terms in the series, and r = the common ratio.

Use the formula to calculate the value of the annuity described in the graph, and compare the results after five years.

5. In Student Activity Sheet 5, you learned to use a TVM calculator to determine different variables related to TVM. In your prior work with the TVM calculator, you only considered lump-sum investments (and the payment variable was always 0).

Explore using the TVM calculator to determine the future value of the $200 annuity over five years, and compare your answer with the known future value of $1,343.12. List the values you assigned to each variable and explain why.

(***Note:*** Interest is typically paid at the end of the compounding period. In this case, you make payments at the beginning of each period. Therefore, you must change appropriate variable from END to BEGIN.)

Variable	Definition of Variable	Value in This Situation
N	number of compounding periods between the time of investment and the time of retirement	
I%	annual interest rate (as a percent)	
PV	principal, or present value	
PMT	amount of each regular payment	
FV	future value, or value of the investment at maturity	
P/Y	number of payments per year (usually the same as the number of compounding periods per year, ***C/Y***)	
C/Y	number of compounding periods per year	

6. Amy is 25 years old and has attended some retirement planning seminars at work. Knowing she should start thinking about retirement savings early, Amy plans to invest in an annuity earning 5% interest compounded annually. She plans to save $100 from her monthly paychecks so that she can make annual payments of $1,200 into the annuity. Use the TVM calculator to determine the future value of the investment after 35 years.

Variable	Definition of Variable	Value in This Situation
N	number of compounding periods between the time of investment and the time of retirement	
I%	annual interest rate (as a percent)	
PV	principal, or present value	
PMT	amount of each regular payment	
FV	future value, or value of the investment at maturity	
P/Y	number of payments per year (usually the same as the number of compounding periods per year, ***C/Y***)	
C/Y	number of compounding periods per year	

7. Amy seeks the advice of a financial planner, who recommends $850,000 for retirement. Will Amy's annuity plan provide the necessary funds for her retirement? If not, what could she do to increase the value of the investment at retirement? Of those actions, which does she have relative control over?

8. Amy finds another annuity that accounts for **monthly** compounding and **monthly** payments. The annuity pays 6% annual interest, compounded monthly. Use the TVM calculator to determine the monthly payments Amy needs to make over 40 years to have $850,000 at the time of her retirement.

Variable	Definition of Variable	Value in This Situation
N	number of compounding periods between the time of investment and the time of retirement	
I%	annual interest rate (as a percent)	
PV	principal, or present value	
PMT	amount of each regular payment	
FV	future value, or value of the investment at maturity	
P/Y	number of payments per year (usually the same as the number of compounding periods per year, ***C/Y***)	
C/Y	number of compounding periods per year	

9. REFLECTION: What recommendations would you make to Amy about her retirement goals and using an annuity to financially support those goals?

10. EXTENSION: Contact a financial planner or conduct research via the Internet to determine what recommendations might be available for a client such as Amy in today's financial environment. Prepare a report of your findings to share with the class.