Finance Mathematics

Part 1: Terms and their meaning.

Watch the video describing call and put options at http://www.youtube.com/watch?v=EfmTWu2yn5Q and use http://www.investopedia.com or a search. Look up the following terms. Be sure your definitions apply to financial terms. Give an appropriate, related example.

Stock:

Example:

Call Option:

Example:

Put Option:

Example:

Volatility of a stock:

Risk Free Interest Rate:

Common approximation:

Compounding:

Compound interest formula:

Continuous compound interest formula:

Part 2: Create an Excel workbook to calculate:

- Future value of an investment compounded n times per year at r% interest for t years.
- Same as above, but compounded continuously
- Graph each of the above versus time.

Use the Excel workbook you created to find the following:

a) The value of a savings account of $500 at an interest rate of 2.1% compounded monthly.

b) The same account with $250 at an interest rate of 4.2% compounded monthly.

    a. Explain the similarities and differences between the two parts above. Do they make intuitive sense? Why or why not?

c) The value of a savings account of $500 at an interest rate of 2.1% compounded weekly.

d) The same as above, except compounded continuously.

    a. Explain the similarities and differences between parts a, c, and d. Do your results make sense? Why or why not?

Suppose you wanted to have at least $1,000 by the time you graduated college, and assume the interest rate remains at 2.1%, compounded monthly, throughout the 4 years you are in school. Create an Excel worksheet to calculate the amount you'd have to start with, as well as the following:

a) The same situation, except the interest rate is 3.1%.

b) Suppose you want to have the same amount you'd get in the scenario in part a in the previous question, except you need the money in only 3 years. How much would you have to invest?

Part 3: Use the Financial Math Excel workbook (and the Other Values tab) to find the value of an option.

a) Suppose you feel a stock will go up in value, and you want to hold the cost of a stock with the option of purchasing later. Find the cost of a call option with a strike price of $110 on a stock priced at $110 over a maturity period of 3 years, assuming a risk-free interest rate of 3.5% and a market volatility of 20%.

b) Suppose instead you expect the stock to go down in value, and want to sell the stock at a later time at its current value. Use the parameters above to do the same calculation for the cost of a **put option**.

c) Which is greater (call or put)? Try changing the values of the stock price, strike price, time period, risk-free interest, and market volatility and compare the call and put option prices for each set of values. Is the one always greater?

d) Suppose the risk-free interest rate were 5% instead of 3.5%. Calculate the percent change in the call price for these conditions. Is it more or less than 1.5%?

e) Look at the graph "Rho: ΔOption Cost/ΔRisk Free Rate" under the tab "Other Graphs". This graph measures the rate of change between these two variables. If you enter the initial data and observe the graph, what does the shape tell you about the cost of the call option for interest rates between 0 and 20%? What happens to the cost of the call option when the interest rate rises above about 20%? Remember, this graph shows the rate of change, not the actual values.

f) Now look at the graph labeled "Vega: …" on the same tab. Notice the 20% factor in this graph, as well. Volatility measures the random, unpredictable nature of the market. Describe the market for options in terms of the volatility.

g) Look at the graphs under the tab “Option vs Time”. What do these graphs tell you as an investor in call options or as an investor of put options? Explain.

h) Turn to the tab labelled “Option vs. Stock”. The graphs show the cost of a share of an option versus the cost of the stock, the rate of change, and the rate of change of the rate of change. Why do the graphs have such different shapes?

i) Gamma seems to have a peak. Look at the other two graphs for the same x value (cost of stock). What is going on with the costs at this particular value?

j) Start with the original values given in part a, above. Change each of the variables (stock price won’t affect the graphs, since it’s the independent variables) by the same amount (say, each +10% and -10%). Which change has the biggest effect on option cost? As an investor, what would you be most concerned about in order to ensure the highest and safest return? [Fill in the table on the next page, then use the results to answer the question. Note: +5% means 100% + 5% = 105% of the original, i.e., multiply the original by 1.05, other increases or decreases are defined similarly.]

	Stock cost	Strike price	Risk free rate	Volatility	Contract time	Option Cost
Original value	110	110	3.5%	20%	3	
Stock + 5%						
Stock + 10%						
Stock - 5%						
Stock – 10%						
Strike + 5%						
Strike + 10%						
Strike - 5%						
Strike – 10%						
rate + 5%						
rate + 10%						
rate - 5%						
rate – 10%						
vol + 5%						
vol +10%						
vol - 5%						
vol – 10%						
time + 5%						
time + 10%						
time - 5%						
time – 10%						