

UCLA ANDERSON SCHOOL OF MANAGEMENT
Daniel Andrei, Option Markets 232D, Fall 2012

MBA – Midterm

Thursday, November 8, 2012

Your Name: _____

Your Equiz.me email address: _____

Your Signature:¹ _____

- This exam is open book, open notes. You can use a calculator, but be sure to show or explain your work.
- You cannot use a computer. You are not allowed to communicate with anyone (verbally, in writing, or electronically), except for me, during the exam period.
- You may present calculations in non-reduced form (e.g., as “ $e^{0.095} - 1$ ”).
- If you are stuck on something, make an assumption, tell me what it is, and do the best you can. I give partial credit if you provide enough correct information.

TIME LIMIT: 1 hour and 15 minutes

TOTAL POINTS: 100

¹As a member of the UCLA Anderson academic community, the highest standards of academic behavior are expected of you. It is your responsibility to make yourself aware of these standards (specifically regarding plagiarism, individual work, and team work) and adhere to them.

By signing the exam: (i) you certify your presence, and (ii) you state that you neither gave nor received help on the exam.

1 (15 points) Answer the following questions.

- a. (5 points) The effective annual risk-free rate is 10%. What is the continuously compounded risk-free rate?

Risk-free rate

- b. (5 points) A bond costs \$73 today. It will pay \$100 in three years, with no interim cash flows. What is the continuously compounded annualized rate of return on the bond?

Rate of return

- c. (5 points) The continuously-compounded annual risk-free rate is 25%. What is the effective annual rate of return?

Effective annual rate of return

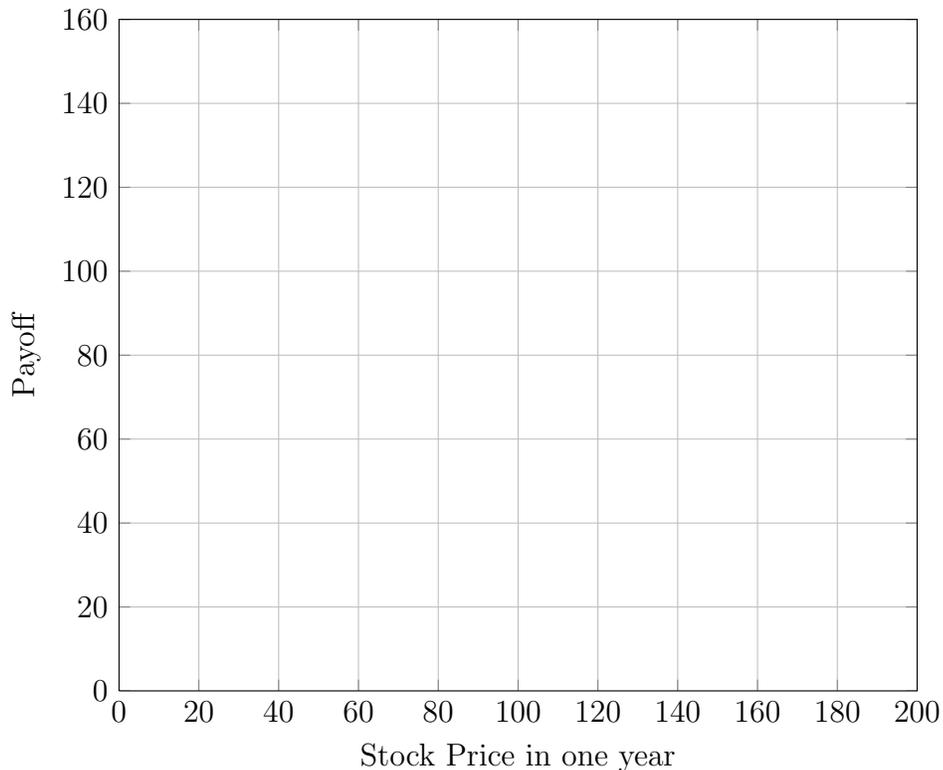
Assume the following for problem 2:

- a. The stock price is \$100.
- b. The **effective** annual risk-free rate is 10%. This means that if you invest \$1, after one year you will have \$1.1.
- c. Here are option prices for you to use as necessary (these are Black-Scholes prices for options with one year to maturity):

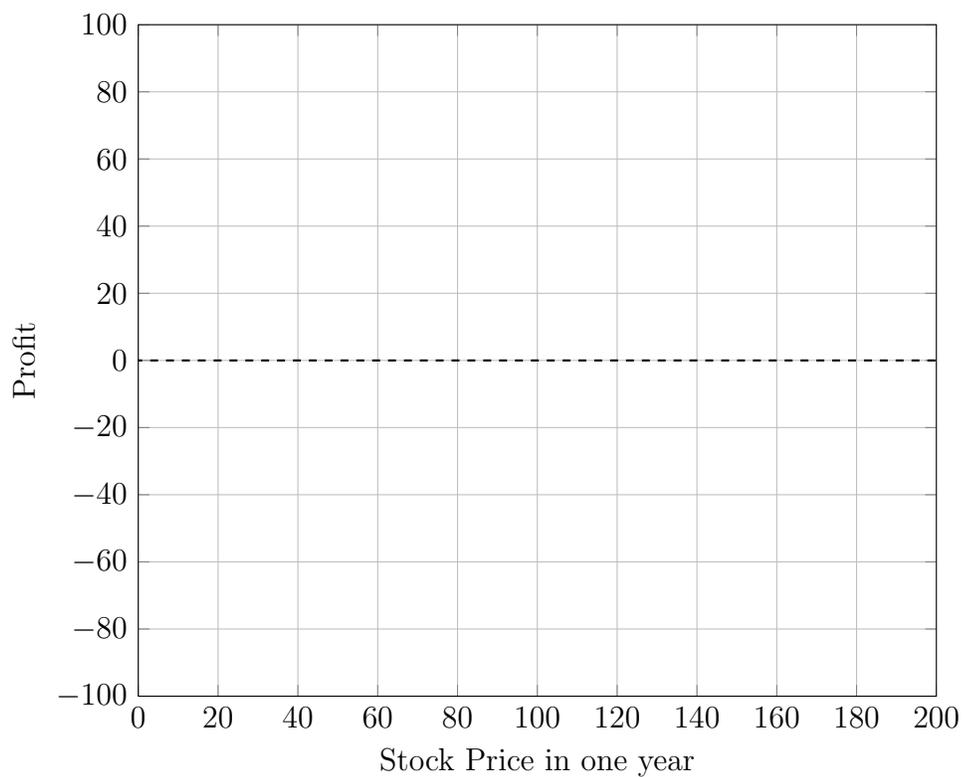
Strike	80	90	100	110	120
Calls	29.15	22.24	16.49	11.92	8.44
Puts	1.88	4.06	7.40	11.92	17.53

2 (30 points) Consider the following position, bought today and held for one year:

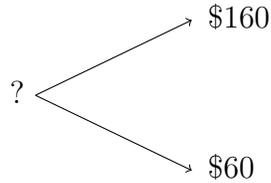
- buy one share of stock;
 - sell one 80-strike call;
 - buy one 120-strike call;
- a. (15 points) Draw a **payoff** diagram for this position. What is the height of the plot at \$140? Clearly indicate this point on the diagram.



- b. (15 points) Draw a **profit** diagram for this position after one year. At what point(s) does the graph cross the X-axis? Clearly indicate this point on the diagram.



3 (30 points) Below is a 1-period binomial stock price tree with $h = 1$. The risk-free rate is 10% (**continuously compounded**) and the dividend yield is zero. The risk-neutral probability of an up move is 0.6.



a. (10 points) What is the current stock price?

Stock price

b. (10 points) What is the price of a 70-strike European call?

European call price

c. (10 points) What is the price of a 70-strike American call?

American call price

4 (25 points) Suppose you hold an option portfolio with the following characteristics (the Greeks are those for a **long** position in each of the options):

Quantity	3	-4	-1
Strike	100	105	110
Price	5.5416	3.4447	2.0172
Delta	0.5488	0.4002	0.2706
Gamma	0.0305	0.0297	0.0255
Vega	0.3429	0.3346	0.2867
Theta	-0.0107	-0.0102	-0.0085
Rho	0.3701	0.2743	0.1878
Psi	-0.4116	-0.3001	-0.2029
Elasticity	9.9037	11.6171	13.4147

a. (5 points) Are these calls or puts or both? Explain.

b. (10 points) How many shares would you hold to delta-hedge this position?

Number of shares

- c. (10 points) If the underlying stock has a volatility of 30%, what is the volatility of the 105-strike option?

Volatility

Solutions to Midterm (MBA)

A general comment: if you got the wrong answer and failed to show your work, there was no way to give partial credit. Please keep this in mind for the final exam.

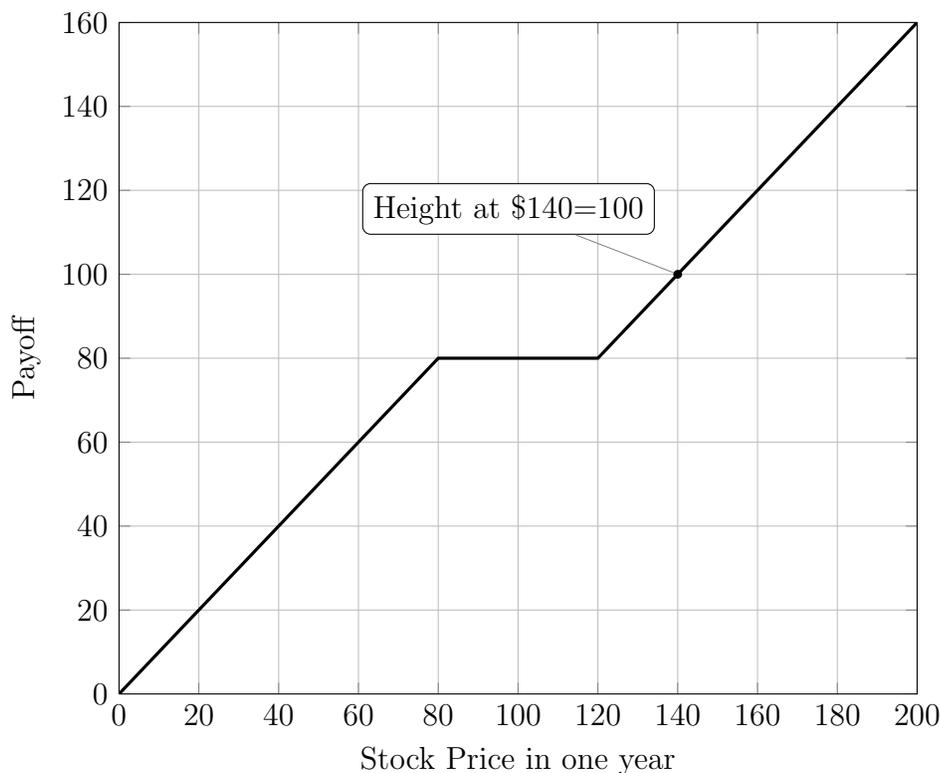
1 a. $\ln(1.1) = 0.09531$.

b. $\frac{1}{3} \ln\left(\frac{100}{73}\right) = 0.1049$.

c. $e^{0.25} - 1 = 0.2840$.

2 a. The payoff is below. The height at \$140 is given by

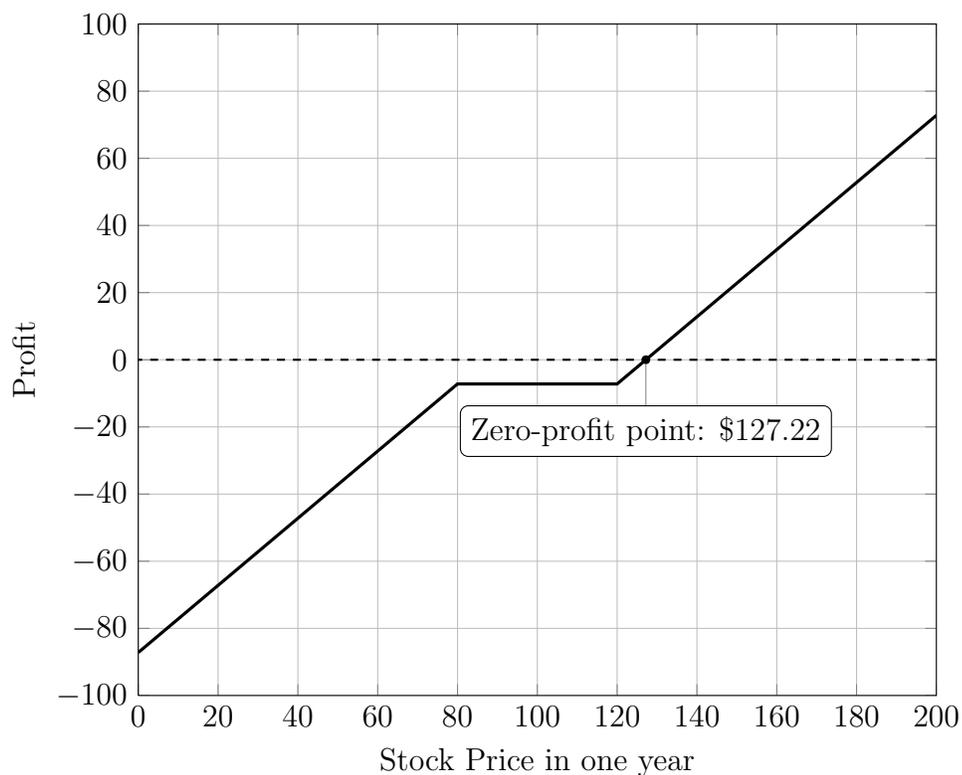
$$S_1 - \max(0, S_1 - 80) + \max(0, S_1 - 120) = 140 - 60 + 20 = \$100$$



b. The profit is below. The cost of the position is

$$\text{Cost} = \$100 - \$29.15 + \$8.44 = \$79.29$$

The future value of the cost is $1.1 \times 79.29 = 79.29 + 7.929 = \87.22 . At $S_1 = \$120$, the payoff is \$80, hence the profit is $\$80 - 87.22 = -\7.22 . Since the payoff line goes up at a slope of one, the X-axis intercept is $S_1 = 127.22$.



- 3 a. The current stock price is $e^{-r}[0.6 \times 160 + 0.4 \times 60] = 108.58$.
- b. The price of the 70-strike European call is $e^{-r}[0.6 \times 90 + 0.4 \times 0] = 48.86$.
- c. The price of an American call equals the price of a European call (the dividend yield is zero), that is, \$48.86.

- 4 a. They are calls because delta is positive. Also, the premium is decreasing with the strike.

- b. Sum the deltas:

$$\text{Position delta} = 3 \times 0.5488 + (-4) \times 0.4002 + (-1) \times 0.2706 = -0.225$$

So you would go long 0.225 shares.

- c. Option volatility is $0.30 \times 11.6171 = 3.4851$. That is 348%!