SIMON FRASER UNIVERSITY
Department of Economics

Econ 815 — Prof. Kasa
Financial Economics, I — Fall 2015

PROBLEM SET 2 - Options
(Due November 5)

1. (10 points). Part of the appeal of options is that they can be combined to form very flexible payoff profiles. A couple examples were discussed in class. Here you are asked to consider a few more. For each, illustrate the expiration date payoff and profit from the position.

   (a) A *bullish vertical spread*, which is created by buying a call option with strike price K_1, and simultaneously selling a call option (on the same stock) with strike price $K_2 > K_1$. Why is it called a 'bullish' spread? (Hint: Remember that, all else equal, call options with lower strike prices are more expensive).

   (b) A *strangle*, which involves buying out-of-the-money call and puts on the same underlying stock (for the same expiration date). That is, if the current stock price is S, the call has strike price $K_c > S$ and the put has strike price $K_p < S$. (Hint: This is similar to a straddle, but is cheaper, since the options are purchased out-of-the-money).

   (c) A *collar*, which involves holding the underlying stock, while simultaneously buying an out-of-the-money put and selling/writing an out-of-the-money call. Why might this strategy be attractive? How does it compare to a bullish vertical spread?

2. (10 points). When deriving the Black-Scholes formula in class, we assumed the stock paid no dividends. In practice, stocks often do pay dividends. This question asks you to consider how this might modify the Black-Scholes formula. In particular, suppose the underlying stock pays out a constant 'dividend yield' at rate δ. That is, suppose that during the interval $[t, t+dt]$, holding the stock gives you a dividend payment of $\delta S_t dt$, where S_t is the stock price at time-t. Assuming all the other conditions of the Black-Scholes model continue to apply, how is the Black-Scholes formula altered by this new assumption? (Hint: Apply the same 'no arbitrage' logic as before, and derive a modified PDE describing the price of a call option on S_t. Show that this PDE can be converted to the 'heat equation' as usual, and derive an analytical expression for the call option price.) How does a change in the dividend payout rate affect the call option price? Explain intuitively.