University of Texas at Austin

Quiz #11
Delta-gamma-theta approximation. Market making and delta hedging.

Problem 11.1. (5 points) Let the stock price $S = \{S(t); \geq 0\}$ satisfy the assumptions of the Black-Scholes model.

Consider a European put option on S whose current price is \$2.50. You are given that the current put delta equals -0.60, its gamma is 0.08, and its theta is -0.02 per day.

Assume that the continuously compounded risk-free interest rate is 0.06 per annum.

What is the delta-gamma-theta approximation for the put premium after three days if the stock price increases by \$2?

Problem 11.2. (10 points) Consider a non-dividend-paying stock whose current price is \$100. A market-maker writes a one-year call option on this stock and sells it for \$4.00. He then proceeds to delta-hedge his commitment by trading in the shares of the underlying stock.

The call option's delta is 0.75, its gamma is 0.08 and its theta is -0.02 per day.

The continuously compounded, risk-free interest rate is 0.04.

The stock price has risen to \$101 after one day. Use the delta-gamma-theta approximation to find the market maker's profit after one day.