

## UNIVERSITY OF TEXAS AT AUSTIN

Quiz #12

Delta-gamma-theta approximation. Market making and delta hedging.

**Problem 12.1.** (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 12.2.** (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.