

## UNIVERSITY OF TEXAS AT AUSTIN

## Quiz # 9

Option gamma. The delta-gamma-theta approximation.

Please, provide your complete solution to the following problem. Final answers without shown reasoning will get zero points.

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**Problem 9.1.** (5 points) Assume the Black-Scholes model. Let the current price of a non-dividend-paying stock be equal to \$80 per share. Its volatility is 0.20.

The continuously compounded risk-free interest rate is 0.04.

Consider a one-year, at-the-money European call option on the above stock. The current delta of the call option is 0.6179. What is the current gamma of the call option?

**Problem 9.2.** (5 points) Assume the Black-Scholes model. Let the current stock price be \$100. Consider an option on this stock such that its current price is \$3.65, its delta is  $-0.4182$ , and its gamma is 0.016. What will the approximate price of this option be should the stock price rise to \$104 in a small time interval?

**Problem 9.3.** (5 points) Assume the Black-Scholes model. Bertie Wooster was looking at stock-price and option data from yesterday. He decides to pose his friend Tuppy Glossop a riddle. Bertie tells Tuppy the following about yesterday's price of a stock and information on an option on this stock:

- the stock price yesterday was greater than \$77;
- the option's price was \$2.45;
- the option's delta was  $-0.1814$ ;
- the option's gamma was 0.04;
- the option's theta was 0.01 **per day**.

Tuppy is allowed to see today's stock price and today's option price. They turn out to be \$80 and \$2.20, respectively. What is Tuppy going to guess to be yesterday's stock price?