

## UNIVERSITY OF TEXAS AT AUSTIN

HW Assignment 7Option Greeks.

Provide your final answer only to the following problem(s):

**Problem 7.1.** (2 pts) Call *theta* may also be called time decay. *True or false?*

**Problem 7.2.** (2 points) *Rho* measures the sensitivity of a portfolio to the changes in the applicable risk-free interest rate. *True or false?*

**Problem 7.3.** (5 pts) Which of the following gives the correct values for the delta and gamma of a single share of non-dividend-paying stock?

- (a)  $\Delta = 1, \Gamma = 1$
- (b)  $\Delta = 1, \Gamma = 0$
- (c)  $\Delta = 0, \Gamma = 1$
- (d)  $\Delta = 0, \Gamma = 0$
- (e) None of the above.

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Please, provide your **complete solutions** to the following problems. Final answers without correct justification will earn zero points.

**Problem 7.4.** (2 points) The Black-Scholes delta of a European call option is always between 0 and 1. *True or false? Why?*

**Problem 7.5.** (2 points) The Black-Scholes delta of a European put option is always between  $-1$  and  $0$ . *True or false? Why?*

**Problem 7.6.** (2 points) Consider a European call and an otherwise identical put. Then, the call rho is greater than the put rho. *True or false? Why?*

**Problem 7.7.** (2 points) In the Black-Scholes model,  $\Psi$  is the first-order sensitivity with respect to the volatility parameter. *True or false? Why?*

**Problem 7.8.** (2 points) In the Black-Scholes model, *volga* is the first-order sensitivity with respect to the volatility parameter. *True or false? Why?*

**Problem 7.9.** (2 points) Consider a European call and an otherwise identical put. Then, the call vega is strictly greater than the put vega. *True or false? Why?*

**Problem 7.10.** (2 points) In the Black-Scholes model, the put theta is **always** positive. *True or false? Why?*

**Problem 7.11.** (2 points) The call volatility is greater than or equal to the volatility of the underlying asset. *True or false?*

**Problem 7.12.** (15 points) Assume the Black-Scholes framework. The current stock price is \$50 per share. Its dividend yield is 0.01 and its volatility is 0.25.

The continuously compounded, risk-free interest rate is 0.05.

Consider a one-year, \$55-strike European put option on the above stock. What is the volatility of the put option?

**Problem 7.13.** (5 points) *Source: Sample MFE Problem #8.*

Consider a non-dividend-paying stock whose price  $\mathbf{S} = \{S(t), t \geq 0\}$  is modeled using the Black-Scholes model. Suppose that the current stock price equals \$40 and that its volatility is given to be 0.30.

Consider a three-month, \$41.5-strike European call option on the above stock. You learn that the current call delta equals 0.5.

What is the Black-Scholes price of this call option?

**Problem 7.14.** (5 points) Consider the following portfolio:

- 5 long options of type *I*,
- 4 long options of type *II*,
- 1 written option of type *III*.

The prices of the three options are 0.75, 1.00, and 1.50, respectively, while the option elasticities are 10, 7, and 2, respectively. What is the elasticity of the above portfolio?