Scoring is 2 points for each question. Question 25 will be scored at 4 points.

24) For the GBP put / USD call with a strike of 1.1700 listed in problem #22 of problem set #3, calculate the Pips Spot Delta and the Premium-Included Delta. (Note that these deltas are from the USD investor's viewpoint.) Then calculate the Percentage Spot Delta using the formula at the bottom of slide #19 in the week #4 lecture packet to confirm that the Premium-Included Delta and Percentage Spot Delta are equal.

The market information is listed below, and is the same as in problem #22

Spot rate	1.2140
Trade date	23-Feb-2023
Expiry date	23-Aug-2023
Spot date	27-Feb-2023
Delivery date	25-Aug-2023
USD deposit rate	4.75%
GBP deposit rate	3.75%
Implied volatility	11.35%

NOTE: Use ACT/360 when working with USD and ACT/365 when working with GBP interest rates. Also note that when working with "tau", the trade date to expiry date period, money market conventions do not apply. For that period use ACT/365.

Scoring is 2 points for each question. Question 25 will be scored at 4 points.

25) (This problem counts for 4 points.) Delta-Neutral Strike:
There is a strike rate where a call and put have offsetting deltas, $P_S + C_S = 0$

This is called the "delta-neutral" strike, since a combination of long call and long put both at this strike will have a net delta of zero (i.e., will be insensitive to the spot rate).

Use the Black-Scholes formula for Call + Put, differentiate with respect to the spot rate, set the result = 0 and derive a formula for the strike. Then use the market information below to calculate the strike:

Currency pair	NZDUSD (NZD is the New Zealand dollar)
Spot rate	0.6257
Trade date	2-Mar-2023
Expiry date	4-Sep-2023
Spot date	6-Mar-2023
Delivery date	6-Sep-2023
USD deposit rate	4.75%
NZD deposit rate	4.40%
Implied volatility	12.15%

NOTE: Use ACT/360 when working with USD and ACT/365 when working with NZD interest rates. Also note that when working with "tau", the trade date to expiry date period, money market conventions do not apply. For that period use ACT/365.

Scoring is 2 points for each question. Question 25 will be scored at 4 points.

For questions 26-29 please write a brief explanation of why you think the answer you chose is correct.

26) The EURUSD one week outright is 1.0625. Which of these one-week options has the largest delta in absolute value?

a) 1.0625 EUR put

b) 1.1600 EUR put

c) 1.0625 EUR call

d) 1.1600 EUR call

27) The EURJPY spot rate is 140.30. The one week outright is 140.24 and the three-month outright is 139.48 Which of these options have the highest gamma?

a) 139.48 EUR call expiring in one hour

b) 140.30 EUR call expiring in one hour

c) 140.24 EUR call expiring in one week

d) 139.48 EUR call expiring in three months

Scoring is 2 points for each question. Question 25 will be scored at 4 points.

28) An options trader wishes to take a short position in implied volatility (using a single vanilla option contract), but the trader would like to minimize the need to rebalance delta hedges as the spot market moves (i.e., to minimize any negative gamma). What can the trader do to best achieve these goals?

a) Sell a short-dated at-the-money option

b) Sell a long-dated at-the-money option

c) Sell a short-dated out-of-the-money option

d) Sell a long-dated deep out-of-the-money option

29) Could you ever earn positive time decay and be long volatility? Possibly, if you have the following combination of at-the-money options:

a) Long 1-month option and long 6-month option

b) Long 1-month option and short 6-month option

c) Short 1-month option and long 6-month option

d) Short 1-month option and short 6-month option

Scoring is 2 points for each question. Question 25 will be scored at 4 points.

30) Consider two options, both GBP calls, one struck at the forward rate and the other at the delta-neutral rate. Assume the implied volatility of both options is 11.55%, and assume the following market information:

Currency pair	GBPUSD
Spot rate	1.2030
Tau	0.62
GBP deposit rate	4.15%
USD deposit rate	4.60%

Assume both deposit rates are in continuously compounded terms, and that tau is valid for both time to option maturity and the appropriate discount factors.

What are the vega, volga and vanna of each option?