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DERIVATIVES CFA LEVEL 1

Question 1: All else held equal, the value of a European call option is best characterized as having a:

- A. negative relationship with the price of the underlying.
- B. negative relationship with the volatility of the underlying.
- C. positive relationship with the time to expiration.

Question 2: All else being equal, which of the following European put options on the same underlying most likely has the highest value?

	Time to Expiration	Exercise Price
Option 1	2 months	\$52
Option 2	4 months	\$52
Option 3	4 months	\$58

- A. Option 1
- B. Option 2
- C. Option 3

Question 3: The value of a European put is directly related to the:

- A. risk-free rate.
- B. exercise price.
- C. value of the underlying.

Question 4: An investor gathers the following information about a call option:

Option premium	\$5
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Exercise price	\$25
Price of the underlying at initiation	\$15

At expiration, if the price of the underlying is \$30, the value of the call option to the call seller is:

- A. -\$5.
- B. \$0.
- C. \$10.

Question 5: An analyst gathers the following information:

Call price	\$10
Stock price	\$40
Exercise price	\$60
Interest rate	3%
Time to expiry	1 year

According to put-call parity, the price of the put is closest to:

- A. \$28.25.
- B. \$30.00.
- C. \$108.25.

Question 6: Two-year and three-year government benchmark zero-coupon bonds are priced at 96 and 93 (per 100 face value), respectively. The implied one-year forward rate in two years' time is closest to:

- A. 3.00%.
- B. 3.23%.
- C. 3.36%.

Question 7: According to put-call parity, the payoff of a European put option is equivalent to a payoff of a portfolio consisting of.

- A. a long asset, a short call and a long risk-free bond.

B. a short asset, a long call and a long risk-free bond.

C. a short asset, a short call and a short risk-free bond.

Question 8: An investor takes a long position in a risk-free bond and in a forward contract on a non-dividend-paying stock. The forward contract is priced at £50. The annual risk-free rate is 10%. A nine-month put option on the stock with an exercise price of £47 trades at £4. The price of a nine-month call option on the stock with an exercise price of £47 is closest to:

A. £6.79.

B. £7.22.

C. £7.30.

Question 9: Which of the following is most accurate?

A. A forward contract is traded on an organized exchange.

B. Forward contracts are more transparent than futures contracts.

C. The buyer of a forward contract agrees to buy the underlying asset at a fixed price on a future date.

Question 10: A commodities producer selling its inventory forward in anticipation of lower prices in the future is an example of a:

A. fair value hedge.

B. cash flow hedge.

C. net investment hedge.

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1. C	2. C	3. B	4. A	5. A	6. B	7. B	8. A	9. C	10. A
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Question 1: C

A. Incorrect. The value of a European call option is directly related to the price of the underlying.

B. Incorrect. The value of a European call option is directly related to the volatility of the underlying.

C. Correct. The value of a European call option is directly related to time to expiration. That is, all else held equal, the value of a European call option is higher the longer the time to expiration.

Derivatives: identify the factors that determine the value of an option and describe how each factor affects the value of an option

Question 2: C

A. Incorrect because the value of a European put option is directly related to the exercise price. Also, the value of a European put option can be either directly or inversely related to the time to expiration. The direct effect is more common. Option 1 and Option 2 have the same exercise price, but Option 2 has a longer time to expiration. So, Option 2 is more likely to have a higher value than Option 1. Option 2 and Option 3 have the same time to expiration, but Option 3 has a higher exercise price. So, Option 3 is most likely to have a higher value than Option 2.

B. Incorrect because the value of a European put option is directly related to the exercise price. Also, The value of a European put option can be either directly or inversely related to the time to expiration. The direct effect is more common. Option 1 and Option 2 have the same exercise price, but Option 2 has a longer time to expiration. So, Option 2 is more likely to have a higher value than Option 1. Option 2 and Option 3 have the same time to expiration, but Option 3 has a higher exercise price. So, Option 3 is most likely to have a higher value than Option 2.

C. Correct because the value of a European put option is directly related to the exercise price. Also, The value of a put option can be either directly or inversely related to the time to expiration. The direct effect is more common. Option 1 and Option 2 have the same exercise price, but Option 2 has a longer time to expiration. So, Option 2 is more likely to have a higher value than Option 1. Option 2 and Option 3 have the same time to, but Option 3 has a higher exercise price. So, Option 3 is most likely to have a higher value than Option 2

Derivatives: identify the factors that determine the value of an option and describe how each factor affects the value of an option

Question 3: B

A. Incorrect because "the value of a European put is inversely related to the risk-free interest rate."

B. Correct because "the value of a European put option is directly related to the exercise price."

C. Incorrect because "the value of a European put option is inversely related to the value of the underlying."

Derivatives: identify the factors that determine the value of an option and describe how each factor affects the value of an option

Question 4: A

A. Correct because $-c_T = -\text{Max}(0, S_T - X)$ (payoff to the call seller), where $-c_T$ is the call value at expiration for the call seller, S_T is the price of the underlying at expiration, and X is the strike price. Therefore, the Correct calculation yields: $-\$5 = -\text{Max}(0, \$30 - \$25)$.

B. Incorrect because the call value at expiration for a call seller ($-c_T$) is not $\text{Max}(0, S_T - X) + C_0$, where S_T is the price of the underlying at expiration, X is the strike price, and c_0 is the option premium. Therefore, the incorrect calculation yields: $\$0 = -\text{Max}(0, \$30 - \$25) + \5 , which is the profit for the call option seller.

C. Incorrect because the call value at expiration for a call seller ($-c_T$) is not $\text{Max}(0, S_T - X) + C_0$, where S is the price of the underlying at expiration, X is the strike price, and c_0 is the option premium. Therefore, the incorrect calculation yields: $\$10 = \text{Max}(0, \$30 - \$25) + \5 . Instead, the correct formula is $-c_T = -\text{Max}(0, S_T - X)$ (payoff [value] to the call seller), which yields: $-\$5 = -\text{Max}(0, \$30 - \$25)$

Derivatives: determine the value at expiration and profit from a long or a short position in a call or put option

Question 5: A

A. Correct because $S_0 + p_0 = c_0 + X/(1+r)^T$. This relationship is known as put-call parity. Here S_0 is the spot price, P_0 is the put premium, X is the strike price and r is the interest rate.

$$S_0 + p_0 = c_0 + X/(1+r)^T$$

$$40 + p_0 = 10 + 60/1.03$$

$$p_0 = 10 + 60/1.03 - 40 = 28.25242718 \approx 28.25$$

B. Incorrect because $S_0 + p_0 = c_0 + X/(1+r)^T$. This relationship is known as put-call parity. In this response, X was not divided by $(1+r)^T$. Here S is the spot price, p_0 is the put premium, X is the strike price and r is the interest rate.

$$S_0 + p_0 = c_0 + X/(1+r) \quad 40 + p_0 = 10 + 60$$

$$p_0 = 10 + 60 - 40 = 30.00$$

C. Incorrect because $S_0 + p_0 = c_0 + X/(1+r)^T$. This relationship is known as put-call parity. In this response, S_0 was incorrectly added instead of subtracted from $c_0 + X/(1+r)^T$ to arrive at P_0 . Here S_0 is the spot price. P_0 is the put premium, X is the strike price and r is the interest rate.

$$S_0 + p_0 = c_0 + X/(1+r)^T$$

$$40 + p_0 = 10 + 60 / 1.03$$

$$p_0 = 10 + 60/1.03 + 40 = 108.252427 = 108.25.$$

Derivatives: explain put-call parity for European options

Question 6: A

A. Incorrect because it calculates the equivalent zero rate as:

$$Z_2 = (100 - DF_2)/2; \text{ or } (100 - 96)/2 = 2.0000\%$$

$$Z_3 = (100 - DF_3)/3; \text{ or } = (100 - 93)/3 = 2.3333\%$$

Accordingly,

$$(1.020000)^2 \times (1 + IFR_{2,1}) = (1.023333)^3$$

$$(1 + IFR_{2,1}) = (1.023333)^3 / (1.020000)^2$$

$$(1 + IFR_{2,1}) = (1.071646 / 1.04040)$$

$$1 + IFR_{2,1} = 1.030033$$

$$IFR_{2,1} = 1.030033 - 1 = 3.0033\% \approx 3.00\%.$$

B. Correct because a discount factor may also be interpreted as the price of a zero-coupon cash flow or bond. The price equivalent of a zero rate is the present value of a currency unit on a future date, known as a discount factor. The discount factor for period i (DF_i) is: $DF_i = 1/(1+z_i)$. Accordingly, the equivalent zero rate is:

$$DF_2 = 0.96 = 1/(1+z_2)^2; \text{ and } z_2 = 2.0621\%$$

$$DF_3 = 0.93 = 1/(1+z_3)^3; \text{ and } z_3 = 2.4485\%$$

The implied forward rate between period A and period B is denoted as $IFR_{A,B-A}$. It is a forward rate on a bond that starts in period A and ends in period B a general formula for the relationship between the two spot rates (Z_A, Z_B) and the implied forward rate ($IFR_{A,B-A}$):

$$(1+Z_A)^A \times (1 + IFR_{A,B-A})^{B-A} = (1 + Z_B)^B$$

$$(1.020621)^2 \times (1 + IFR_{2,3-2})^{3-2} = (1.024485)^3 (1 + IFR_{2,1}) = (1.024485)^3 / (1.020621)^2$$

$$(1 + IFR_{2,1}) = (1.075269 / 1.041667)$$

$$1 + IFR_{2,1} = 1.032258$$

$$IFR_{2,1} = 1.032258 - 1 = 3.2258\% \approx 3.23\%.$$

C. Incorrect because the implied forward rate is calculated as follows:

$$DF_2 = 0.96 = 1/(1+z_2)^2, \text{ and } z_2 = 2.0621\%$$

$$DF_3 = 0.93 = 1/(1+z_3)^3; \text{ and } z_3 = 2.4485\%$$

Accordingly,

$$IFR_{2,1} = (1.024485)^3 - (1.020621)^2$$

$$IFR_{2,1} = (1.075269 - 1.041667)$$

$$IFR_{2,1} = 0.033602 = 3.3602\% \sim 3.36\%$$

Derivatives: Explain how forward rates are determined for interest rate forward contracts and describe the uses of these forward rates.

Question 7: B

A. Incorrect because according to put-call parity. $P_0 = c_0 - S_0 + X/(1+r)^T$, long put = long call, short asset, long bond. Therefore, the payoff of a European put option is not equal to a payoff of a portfolio consisting of a long asset, a short call and a long risk-free bond.

B. Correct because according to put-call parity. $P_0 = c_0 - S_0 + X/(1+r)^T$, long put = long call, short asset, long bond. Therefore, the payoff of a European put option is equal to a payoff of a portfolio consisting of a short asset, a long call and a long risk-free bond.

C. Incorrect because according to put-call parity. $P_0 = c_0 - S_0 + X/(1+r)^T$ long put = long call, short asset, long bond. Therefore, the payoff of a European put option is not equal to a payoff of a portfolio consisting of a short asset, a short call and a short risk-free bond.

Derivatives: explain put-call parity for European options

Question 8: A

A. Correct because a long put and a short call are equivalent to a long risk-free bond and short forward position: $p_0 - c_0 = [X - F_0(T)](1+r)^{-T}$ as calculated below:

$$p_0 - c_0 = [X - F_0(T)](1+r)^{-T} \quad (4)$$

Rearranging for c_0

$$p_0 - c_0 = [X - F_0(T)](1+r)^{-T}$$

$$p_0 = \text{put} = £4$$

$$X = \text{exercise price} = £47$$

$$F_0(T) = \text{forward} = £50$$

$$r = \text{risk-free rate} = 10\%$$

$$p_0 - c_0 = [X - F_0(T)](1+r)^{-T} = c_0$$

$$\text{Thus, } c_0 = £4 - [£47 - £50](1.10)^{-0.75} = £6.79$$

B. Incorrect as calculated the exponent of * is mistakenly used without a negative sign.

$$p_0 - c_0 = [X - F_0(T)](1+r)^{+T}$$

$$p_0 - c_0 = [X - F_0(T)](1+r)^{-T} = c_0$$

$$p_0 = \text{put} = £4$$

$$X = \text{exercise price} = £47$$

$$F_0(T) = \text{forward} = £50$$

$$r = \text{risk-free rate} = 10\%$$

$$£4 - [£47 - £50](1.10)^{+0.75} = £7.22$$

The correct answer should be:

$$p_0 - c_0 = [X - F_0(T)](1+r)^{-T}(4)$$

$$p_0 = [X - F_0(T)](1+r)^{-T} - c_0$$

$$c_0 = £4 - [£47 - £50](1.10)^{-0.75} = £6.79$$

C. Incorrect as calculated the exponent of * is missed entirely.

$$p_0 - c_0 = [X - F_0(T)](1+r)$$

$$p_0 - [X - F_0(T)](1+r)^{+T} = c_0$$

$$p_0 = \text{put} = £4 \quad X = \text{exercise price} = £47$$

$$F_0(T) = \text{forward} = £50$$

$$r = \text{risk-free rate} = 10\%$$

$$£4 - [£47 - £50](1.10) = £7.30$$

The correct answer should be:

$$p_0 - c_0 = [X - F_0(T)](1+r)^{-T}(4)$$

$$p_0 - [X - F_0(T)](1+r)^{+T} = c_0$$

$$c_0 = £4 - [£47 - £50](1.10)^{-0.75} = £6.79$$

Derivatives: explain put-call forward parity for European options

Question 9: C

A. Incorrect because this is a characteristic of a futures contract and not a forward contract. A futures contract is a standardized derivative contract created and traded on a futures exchange in which two parties agree that one party, the buyer, will purchase an underlying asset from the other party, the seller, at a later date and at a price agreed on by the two parties when the contract is initiated and in which there is a daily settling of gains and losses and a credit guarantee by the futures exchange through its clearinghouse.

B. Incorrect because it is actually the opposite and futures contracts are more transparent than forward contracts. Futures markets are far more transparent than forward markets.

C. Correct because a forward contract is an over-the-counter derivative contract in which two parties agree that one party, the buyer, will purchase an underlying asset from the other party, the seller, at a later date at a fixed price they agree on when the contract is signed. opposite and futures contracts are transparent than forward markets contract is signed.

Derivatives: define forward contracts, futures contracts, swap, options (calls and puts), and credit derivatives and compare their basic characteristics

Question 10: A

A. Correct because a fair value hedge designation applies when a derivative is deemed to offset the fluctuation in fair value of an asset or liability. A commodities producer might sell its inventory forward in anticipation of lower future prices.

B. Incorrect because derivatives designated as absorbing the variable cash flow of a floating-rate asset or liability such as foreign exchange, interest rates, or commodities are referred to as cash flow hedges. A swap to a fixed rate for a floating-rate debt liability is another example of a cash flow hedge.

C. Incorrect because net investment hedges occur when either a foreign currency bond or a derivative such as an FX swap or forward is used to offset the exchange rate risk of the equity of a foreign operation.

Derivatives: compare the use of derivatives among issuers and investors