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## Exam II: Mathematical Foundations of Risk Measurement - 2015 Edition

PRMIA 8007

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## QUESTION NO: 1

Evaluate the derivative of  $\ln(1+x^2)$  at the point  $x = 1$

- A. 0.5
- B. 0
- C. 1
- D. 2

ANSWER: C

## QUESTION NO: 2

Consider an investment fund with the following annual return rates over 8 years: +6%, -6%, +12%, -12%, +3%, -3%, +9%, -9% .

What can you say about the annual geometric and arithmetic mean returns of this investment fund?

- A. The arithmetic mean return is zero and the geometric mean return is negative
- B. The arithmetic mean return is negative and the geometric mean return is zero
- C. The arithmetic mean return is equal to the geometric mean return
- D. None of the above

ANSWER: A

## QUESTION NO: 3

For the function  $f(x) = 3x - x^3$  which of the following is true?

- A.  $x = 0$  is a minimum
- B.  $x = -3$  is a maximum
- C.  $x = 2$  is a maximum

D. None of these

**ANSWER: D**

**QUESTION NO: 4**

I have \$5m to invest in two stocks: 75% of my capital is invested in stock 1 which has price 100 and the rest is invested in stock 2, which has price 125. If the price of stock 1 falls to

90 and the price of stock 2 rises to 150, what is the return on my portfolio?

- A. -2.50%
- B. -5%
- C. 2.50%
- D. 5%

**ANSWER: A**

**QUESTION NO: 5**

In a 2-step binomial tree, at each step the underlying price can move up by a factor of  $u = 1.1$  or down by a factor of  $d = 1/u$ . The continuously compounded risk free interest rate over each time step is 1% and there are no dividends paid on the underlying. Use the Cox, Ross, Rubinstein parameterization to find the risk neutral probability and hence find the value of a European put option with strike 102, given that the underlying price is currently

100.

- A. 5.19
- B. 5.66
- C. 6.31
- D. 4.18

**ANSWER: C**

**QUESTION NO: 6**

The first derivative of a function  $f(x)$  is zero at some point, the second derivative is also zero at this point. This means that:

- A.  $f$  has necessarily a minimum at this point
- B.  $f$  has necessarily a maximum at this point
- C.  $f$  has necessarily neither a minimum nor a maximum at this point
- D.  $f$  might have either a minimum or a maximum or neither of them at this point

**ANSWER: D**

## QUESTION NO: 7

What is the probability of tossing a coin and getting exactly 2 heads out of 5 throws?

- A.  $8/15$
- B.  $9/23$
- C.  $10/32$
- D. None of these

**ANSWER: C**

## QUESTION NO: 8

Calculate the determinant of the following matrix:

- A. 4.25
- B. -4.25
- C. 4
- D. 2

**ANSWER: D**

## QUESTION NO: 9

Kurtosis( $X$ ) is defined as the fourth centred moment of  $X$ , divided by the square of the variance of  $X$ . Assuming  $X$  is a normally distributed variable, what is Kurtosis( $X$ )?

- A. 0
- B. 3
- C. 2
- D. 1

**ANSWER: B**

## QUESTION NO: 10

Every covariance matrix must be positive semi-definite. If it were not then:

- A. Some portfolios could have a negative variance
- B. It could not be used to simulate correlated asset paths
- C. The associated correlation matrix would not be positive semi-definite
- D. All the above statements are true

**ANSWER: D**