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Exam Code: 8002

Exam Name: PRM Certification - Exam II: Mathematical Foundations of Risk Measurement

Version: Demo

QUESTION NO: 1

For a quadratic equation, which of the following is FALSE?

- A. If the discriminant is negative, there are no real solutions
- B. If the discriminant is zero, there is only one solution
- C. If the discriminant is negative there are two different real solutions
- D. If the discriminant is positive there are two different real solutions

Answer: C

QUESTION NO: 2

The natural logarithm of x is:

- A. the inverse function of $\exp(x)$
- B. $\log(e)$
- C. always greater than x , for $x > 0$
- D. 46

Answer: A

QUESTION NO: 3

When a number is written with a fraction as an exponent, such as $75^{1/2}$, which of the following is the correct computation?

- A. Take the square-root of 75 and raise it to the 5th power
- B. Divide 75 by 2, then raise it to the 5th power
- C. Multiply 75 by 2.5
- D. Square 75, then take the fifth root of it

Answer: A

QUESTION NO: 4

You invest \$2m in a bank savings account with a constant interest rate of 5% p.a. What is the value of the investment in 2 years time if interest is compounded quarterly?

- A. \$2,208,972
- B. \$2,210,342
- C. \$2,205,000
- D. None of them

Answer: A

QUESTION NO: 5

Solve the simultaneous linear equations: $x + 2y - 2 = 0$ and $y - 3x = 8$

- A. $x = 1, y = 0.5$
- B. $x = -2, y = 2$
- C. $x = 2, y = 0$
- D. None of the above

Answer: B

QUESTION NO: 6

Find the roots, if they exist in the real numbers, of the quadratic equation

- A. 4 and -2
- B. -4 and 2
- C. 1 and 0
- D. No real roots

Answer: D

QUESTION NO: 7

The sum of the infinite series $1 + 1/2 + 1/3 + 1/4 + 1/5 + \dots$ equals:

- A. 12
- B. Infinity
- C. 128
- D. 20

Answer: B

QUESTION NO: 8

Which of the following properties is exhibited by multiplication, but not by addition?

- A. associativity
- B. commutativity
- C. distributivity
- D. invertibility

Answer: C

QUESTION NO: 9

Identify the type and common element (that is, common ratio or common difference) of the following sequence: 6, 12, 24

- A. arithmetic sequence, common difference 2
- B. arithmetic sequence, common ratio 2
- C. geometric sequence, common ratio 2
- D. geometric sequence, common ratio 3

Answer: C

QUESTION NO: 10

What is the sum of the first 20 terms of this sequence: 3, 5, 9, 17, 33, 65, ...?

- A. 1 048 574

- B. 1 048 595
- C. 2 097 170
- D. 2 097 172

Answer: C

QUESTION NO: 11

What is the simplest form of this expression: $\log_2(165/2)$

- A. 10
- B. 32
- C. $5/2 + \log_2(16)$
- D. $\log_2(5/2) + \log_2(16)$

Answer: A

QUESTION NO: 12

For each of the following functions, indicate whether its graph is concave or convex:

$$Y = 7x^2 + 3x + 9$$

$$Y = 6 \ln(3x)$$

$$Y = \exp(-4x)$$

- A. concave, concave, concave
- B. concave, convex, convex
- C. convex, concave, concave
- D. convex, convex, concave

Answer: C

QUESTION NO: 13

You invest \$100 000 for 3 years at a continuously compounded rate of 3%. At the end of 3 years, you redeem the investment. Taxes of 22% are applied at the time of redemption. What is your approximate after-tax profit from the investment, rounded to \$10?

- A. \$9420
- B. \$7350
- C. \$7230
- D. \$7100

Answer: B

QUESTION NO: 14

Which of the provided answers solves this system of equations?

$$2y - 3x = 3y + x$$

$$y^2 + x^2 = 68$$

- A. $x = 1$; $y = \text{square root of } 67$
- B. $x = 2$; $y = 8$
- C. $x = 2$; $y = -8$
- D. $x = -2$; $y = -8$

Answer: C

QUESTION NO: 15

You intend to invest \$100 000 for five years. Four different interest payment options are available. Choose the interest option that yields the highest return over the five year period.

- A. a lump-sum payment of \$22 500 on maturity (in five years)
- B. an annually compounded rate of 4.15%
- C. a quarterly-compounded rate of 4.1%
- D. a continuously-compounded rate of 4%

Answer: C

QUESTION NO: 16

What is the 40th term in the following series: 4, 14, 30, 52, ...?

- A. 240
- B. 4598
- C. 4840
- D. 4960

Answer: C

QUESTION NO: 17

Let a, b and c be real numbers. Which of the following statements is true?

- A. The commutativity of multiplication is defined by
- B. The existence of negatives is defined by
- C. The distributivity of multiplication is defined by
- D. The associativity of multiplication is defined by

Answer: C

QUESTION NO: 18

Which of the following is not a sequence?

- A. , , , ... , , ...
- B. , , , , ...
- C. , , , , , , ...
- D. 30

Answer: D

QUESTION NO: 19

Which of the following statements is not correct?

- A. Every linear function is also a quadratic function.
- B. A function is defined by its domain together with its action.
- C. For finite and small domains, the action of a function may be specified by a list.
- D. A function is a rule that assigns to every value x at least one value of y .

Answer: D

QUESTION NO: 20

Which of the following statements is true?

- A. Discrete and continuous compounding produce the same results if the discount rate is positive.
- B. Continuous compounding is the better method because it results in higher present values compared to discrete compounding.
- C. Continuous compounding can be thought as making the compounding period infinitesimally small.
- D. The constant plays an important role in the mathematical description of continuous compounding.

Answer: C

QUESTION NO: 21

Let X be a random variable normally distributed with zero mean and let Y be a random variable normally distributed with zero mean and variance σ^2 . Then the correlation between X and Y is:

- A. negative
- B. zero
- C. not defined

D. positive

Answer: B

QUESTION NO: 22

A typical leptokurtotic distribution can be described as a distribution that is relative to a normal distribution

- A. peaked and thin at the center and with heavy (fat) tails
- B. peaked and thin at the center and with thin tails
- C. flat and thick at the center and with heavy (fat) tails
- D. flat and thick at the center and with thin tails

Answer: A

QUESTION NO: 23

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: 24

Over four consecutive years fund X returns 1%, 5%, -3%, 8%. What is the average growth rate of fund X over this period?

- A. 2.67%
- B. 2.75%

- C. 2.49%
- D. None of the above

Answer: A

QUESTION NO: 25

The quarterly compounded rate of return is 6% per annum. What is the corresponding effective annual return?

- A. 1.50%
- B. 6%
- C. 6.14%
- D. None of the above

Answer: C

QUESTION NO: 26

If the annual volatility of returns is 25% what is the variance of the quarterly returns?

- A. 0.1250
- B. 0.0156
- C. 0.0625
- D. None of the above

Answer: B

QUESTION NO: 27

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: 28

Suppose 60% of capital is invested in asset 1, with volatility 40% and the rest is invested in asset 2, with volatility 30%. If the two asset returns have a correlation of -0.5, what is the volatility of the portfolio?

- A. 36%
- B. 36.33%
- C. 26.33%
- D. 20.78%

Answer: D

QUESTION NO: 29

Which of the following statements concerning class intervals used for grouping of data is correct?

When grouping data, attention must be paid to the following with regards to class intervals:

1. Class intervals should not overlap
2. Class intervals should be of equal size unless there is a specific need to highlight data within a specific subgroup
3. The class intervals should be large enough so that they not obscure interesting variation within the group

- A. Statements 2 and 3 are correct
- B. Statements 1 and 2 are correct
- C. All three statements are correct
- D. Statements 1 and 3 are correct

Answer: B

QUESTION NO: 30

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: 31

Which of the following statements about variance and standard deviation are correct?

1. When calculated based on a sample of the population data, one has to correct for any bias in the result by using the number of degrees of freedom in the calculation
 2. Variance is in square root units of the underlying data, whereas standard deviation is in units of the underlying data
 3. When considering independent variables, variance is additive, while standard deviation is not
- A. All three statements are correct
 - B. Statements 1 and 2 are correct
 - C. Statements 1 and 3 are correct
 - D. Statements 2 and 3 are correct

Answer: C

QUESTION NO: 32

Which of the following statements about skewness of an empirical probability distribution are correct?

1. When sampling returns from a time series of asset prices, discretely compounded returns exhibit higher skewness than continuously compounded returns
2. When the mean is significantly less than the median, this is an indication of negative skewness
3. Skewness is a sign of asymmetry in the dispersion of the data

- A. All three statements are correct
- B. Statements 1 and 2 are correct
- C. Statements 1 and 3 are correct
- D. Statements 2 and 3 are correct

Answer: A

QUESTION NO: 33

Consider two securities X and Y with the following 5 annual returns:

X: +10%, +3%, -2%, +3%, +5%

Y: +7%, -2%, +3%, -5%, +10%

In this case the sample covariance between the two time series can be calculated as:

- A. 0.40729
- B. 0.00109
- C. 0.00087
- D. 0.32583

Answer: B

QUESTION NO: 34

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: 35

Find the first-order Taylor approximation $p(x)$ for the function: at the point .

- A. $-x$
- B. $-x+1$
- C. $x-1$
- D. $x+1$

Answer: B

QUESTION NO: 36

At what point x does the function $f(x) = x^3 - 4x^2 + 1$ have a local minimum?

- A. -0.666666667
- B. 0
- C. 2.66667
- D. 2

Answer: C

QUESTION NO: 37

What is the maximum value for $f(x) = 8 - (x+3)(x-3)$?

- A. 8
- B. -1
- C. 17
- D. None of these

Answer: C

QUESTION NO: 38

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: 39

What is the maximum value of the function $F(x, y) = x^2 + y^2$ in the domain defined by inequalities $x \geq 1$, $y \geq -2$, $y - x \leq 3$?

- A. 29
- B. -25
- C. 1
- D. 17

Answer: A

QUESTION NO: 40

You work for a brokerage firm that charges its client x per share. The volume of trade of a client of type A depends on the per share commission in the following manner. If the commission is x , the client of type A will trade $e-ax$ shares on average each week. What is the optimal commission x that maximizes the income from client A, noting that a is greater than zero?

- A. 1
- B. a
- C. $4a$
- D. a^2

Answer: C

QUESTION NO: 41

An indefinite integral of a polynomial function is

- A. always positive
- B. always increasing
- C. always less than the function itself
- D. none of the above

Answer: D

QUESTION NO: 42

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: 43

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

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

Answer: B

QUESTION NO: 44

A 2-year bond has a yield of 5% and an annual coupon of 5%. What is the Macaulay Duration of the bond?

- A. 2
- B. 1.95
- C. 1.86
- D. 1.75

Answer: B

QUESTION NO: 45

A 2-year bond has a yield of 5% and an annual coupon of 5%. What is the Modified Duration of the bond?

- A. 2
- B. 1.95
- C. 1.86
- D. 1.75

Answer: C

QUESTION NO: 46

A bond has modified duration 6 and convexity 30. Find the duration-convexity approximation to the percentage change in bond price when its yield increases by 5 basis points

- A. 10 basis point rise
- B. 24 basis fall
- C. 24 basis point rise
- D. 30 basis points fall.

Answer: D

QUESTION NO: 47

An underlying asset price is at 100, its annual volatility is 25% and the risk free interest rate is 5%. A European call option has a strike of 85 and a maturity of 40 days. Its Black-Scholes price is 15.52. The options sensitivities are: delta = 0.98; gamma = 0.006 and vega = 1.55. What is the delta-gamma-vega approximation to the new option price when the underlying asset price changes to 105 and the volatility changes to 28%?

- A. 17.33
- B. 18.75
- C. 19.23
- D. 20.54

Answer: D

QUESTION NO: 48

An underlying asset price is at 100, its annual volatility is 25% and the risk free interest rate is 5%. A European put option has a strike of 105 and a maturity of 90 days. Its Black-Scholes price is 7.11. The options sensitivities are: delta = -0.59; gamma = 0.03; vega = 19.29. Find the delta-gamma approximation to the new option price when the underlying asset price changes to 105

- A. 6.49
- B. 5.03
- C. 4.59
- D. 4.54

Answer: D

QUESTION NO: 49

You are given the following values of a quadratic function $f(x)$: $f(0)=0$, $f(1)=-2$, $f(2)=-5$. On the basis of these data, the derivative $f'(0)$ is ...

- A. in the interval $]-2.5,-2[$
- B. equal to -2
- C. in the interval $]-2,+[$
- D. in the interval $]-,-2.5]$

Answer: C

QUESTION NO: 50

Suppose that $f(x)$ and $g(x,y)$ are functions. What is the partial derivative of $f(g(x,y))$ with respect to y ?

- A. $f'(g(x,y))$
- B. $f(dg/dy)$
- C. $f(g(x,y)) dg/dy$
- D. $f'(g(x,y)) dg/dy$

Answer: D

QUESTION NO: 51

What is the total derivative of the function $f(x,y) = \ln(x+y)$, where $\ln()$ denotes the natural logarithmic function?

- A. $1 / (x+y)$
- B. $(x + y) / (x+y)$
- C. $-x/(x+y) - y/(x+y)$
- D. $\ln(x+y) x + \ln(x+y) y$

Answer: B

QUESTION NO: 52

What is the indefinite integral of the function $f(x) = \ln(x)$, where $\ln(x)$ denotes the natural logarithmic function?

- A. $x \ln(x) - x$
- B. $\ln(x) - x$
- C. $1/x$
- D. $\exp(x)$

Answer: A

QUESTION NO: 53

The Lagrangian of a constrained optimisation problem is given by $L(x,y,\lambda) = 16x+8x^2+4y-(4x+y-20)\lambda$, where λ is the Lagrange multiplier. What is the solution for x and y ?

- A. $x = -1, y = 0$
- B. $x = 0, y = 20$
- C. $x = 5, y = 0$
- D. None of the above

Answer: B

QUESTION NO: 54

Consider two functions $f(x)$ and $g(x)$ with indefinite integrals $F(x)$ and $G(x)$, respectively. The indefinite integral of the product $f(x)g(x)$ is given by

- A. $F(x)G(x)$
- B. $F(x)g(x) + f(x)G(x)$
- C. $F(x)g(x) - F(x)g'(x)dx$
- D. $f(x)G(x) - F(x)g'(x)dx$

Answer: C

QUESTION NO: 55

The fundamental theorem of analysis establishes a relation between

- A. First and second derivative of a function
- B. The derivative of a function and the slope of its graph
- C. Integration and differentiation of functions
- D. The derivative of a function and the derivative of its inverse function

Answer: C

QUESTION NO: 56

Bond convexity is closely related to ...

- A. The derivative of the bond's present value with respect to yield
- B. The second derivative of the bond's present value with respect to yield
- C. The integral of the bond's present value with respect to yield
- D. The sensitivity of the bond's present value with respect to yield

Answer: B

QUESTION NO: 57

In a quadratic Taylor approximation, a function is approximated by:

- A. a constant
- B. a straight line

- C. a parabola
- D. a cubic polynomial

Answer: C

QUESTION NO: 58

Which statement regarding the matrix below is true?

- A. It is not positive definite
- B. It is positive semi-definite
- C. It is positive definite
- D. It is negative definite

Answer: A

QUESTION NO: 59

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

- A. Some portfolios could have a negative variance
- B. One or more of its eigenvalues would be negative
- C. There would be no Cholesky decomposition matrix
- D. All the above statements are true

Answer: D

QUESTION NO: 60

The determinant of a matrix X is equal 2. Which of the following statements is true?

- A. $\det(2X) =$
- B. $\det(2X) = 2 \det(X)$
- C. $\det(2X) = \det(X)^2$

D. $\det(2X) = 4 \det(X)$

Answer: D

QUESTION NO: 61

What is the angle between the following two three dimensional vectors: $a=(1,2,3)$, $b=(-4,2,0)$?

- A. 90 degrees
- B. 180 degrees
- C. 57 degrees
- D. 45 degrees

Answer: A

QUESTION NO: 62

Calculate the determinant of the following matrix:

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

Answer: D

QUESTION NO: 63

Let A be a square matrix and denote its determinant by x. Then the determinant of A transposed is:

- A. x^{-1}

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