

Question Paper

Quantitative Methods I (131) – July 2004

- • Answer all questions.
- • Marks are indicated against each question.

1. If all the terms of an arithmetic progression are multiplied by a constant quantity the resulting terms will always form [< Answer >](#)
- (a) A geometric progression
 - (b) A harmonic progression
 - (c) An arithmetic progression
 - (d) Either a geometric progression or a harmonic progression
 - (e) Either a geometric progression or an arithmetic progression.
- (1 mark)
2. If the first term in a geometric progression is greater than 1 and the common ratio is less than 1, then the consecutive terms will be [< Answer >](#)
- (a) The consecutive terms will be in increasing order
 - (b) The consecutive terms will be in decreasing order
 - (c) The consecutive terms will be same
 - (d) All the consecutive terms will be less than 1
 - (e) All the consecutive terms will be greater than 1.
- (1 mark)
3. Which of the following is **not** an unbounded interval? [< Answer >](#)
- (a) The set of all real numbers greater than a specified real number
 - (b) The set of all real numbers less than a specified real number
 - (c) The set of all real numbers greater than or equal to a specified real number
 - (d) The set of all real numbers less than or equal to a specified real number
 - (e) The set of all real numbers greater than one real number and less than another real number.
- (1 mark)
4. A function is a rule or correspondence which always associates to [< Answer >](#)
- (a) Each number x in a set A a unique number $f(x)$ in a set B
 - (b) All the numbers in a set A the same number in a set B
 - (c) All the numbers in a set A a fixed positive number
 - (d) All the numbers in a set A a fixed negative number
 - (e) Each number x in a set A , two numbers in a set B .
- (1 mark)
5. For any function $f(x)$ the limit of $f(x)$ as x approaches a value a is [< Answer >](#)
- (a) Always equal to a
 - (b) Always a value greater than a
 - (c) Always a value less than a
 - (d) Always less than $f(a)$
 - (e) A value L , such that $f(x)$ approaches L as x approaches a .
- (1 mark)
6. For a function $f(x)$ the first derivative is positive and the second derivative is negative at $x = a$. This means that [< Answer >](#)
- (a) $f(x)$ is minimum at $x = a$
 - (b) $f(x)$ is maximum at $x = a$

- (c) $f(x)$ is increasing at an increasing rate at $x = a$
- (d) $f(x)$ is increasing at a decreasing rate at $x = a$
- (e) $f(x)$ is decreasing at an increasing rate at $x = a$.

(1 mark)

[< Answer >](#)

7. Which of the following is **false** with regard to the graphical method of solving linear programming problems?

- (a) It is applicable when there are two decision variables
- (b) The decision variables are represented by the horizontal and vertical axes
- (c) Straight lines are used to demarcate the feasible region
- (d) The feasible region shows the solutions that satisfy all the constraints
- (e) One of the corner points of the feasible region will always be at the origin.

(1 mark)

[< Answer >](#)

8. Which of the following is meant by the skewness of a distribution?

- (a) The absence of symmetry in the distribution
- (b) The consistency of the data in the distribution
- (c) The dispersion of the data in the distribution
- (d) The central tendency of the distribution
- (e) None of the above.

(1 mark)

[< Answer >](#)

9. In a positively skewed distribution

- (a) Majority of the observations are concentrated towards the higher end of the scale
- (b) Majority of the observations are concentrated towards the lower end of the scale
- (c) Majority of the observations are concentrated at the center of the distribution
- (d) The observations have the same frequency
- (e) The distribution of the data is symmetrical.

(1 mark)

[< Answer >](#)

10. $\log_a b + \log_a c = 0$

This implies that

- (a) $b = c$
- (b) $b = -c$
- (c) $b + c = 1$
- (d) $b - c = 1$
- (e) b and c are reciprocals.

(1 mark)

[< Answer >](#)

11. Which of the following is **true** with regard to the classical approach to probability?

- (a) Assumes that the outcomes are not equally likely
- (b) The probability of an event is determined after performing the experiment large number of times
- (c) The probability of an event is determined before performing the experiment
- (d) It assumes that all possible outcomes of the experiment are not known
- (e) The classical approach cannot be used to find out the probability of mutually exclusive events.

(1 mark)

[< Answer >](#)

12. If every item in a set of data is divided by a constant, then which of the following measures will remain **unchanged**?

- (a) Arithmetic mean
- (b) Geometric mean
- (c) Mode
- (d) Variance
- (e) Coefficient of variation.

(1 mark)

[< Answer >](#)

13. The reciprocal of the harmonic mean of a data set is equal to

- (a) Arithmetic mean
- (b) Sum of all the observations
- (c) Sum of the reciprocals of the observations

- (d) Average of the reciprocals of the observations
- (e) Product of the reciprocals of the observations.

(1 mark)

[< Answer >](#)

14. Which of the following is **false** with regard to the derivative of a function?

- (a) It indicates the rate of change of the function at a given point
- (b) The slope of the tangent to a function at a point is equal to the derivative of the function at the point
- (c) The derivative may be a function of the independent variable
- (d) The derivative of a linear function changes with the value of the independent variable
- (e) If the derivative of a function at a point is negative then it indicates that the function is decreasing at that point.

(1 mark)

[< Answer >](#)

15. The coefficient of variation cannot be meaningfully used to compare the variability of two or more sets of data, when

- (a) The standard deviation is zero for one or more sets of data
- (b) The standard deviation is 1 for one or more sets of data
- (c) The mean is zero for one or more sets of data
- (d) The mean is 1 for one or more sets of data
- (e) The mean and standard deviation are equal for one or more sets of data.

(1 mark)

[< Answer >](#)

16. Events **A** and **B** are dependent. The joint probability of the events **A** and **B** is

- (a) Equal to the product of the marginal probabilities of the events **A** and **B**
- (b) Not equal to the product of the marginal probabilities of the events **A** and **B**
- (c) Equal to the sum of the marginal probabilities of the events **A** and **B**
- (d) Equal to the difference between the marginal probabilities of the events **A** and **B**
- (e) Is always equal to 1.

(1 mark)

[< Answer >](#)

17. The derivative of a function **f(x)** at **x = a** is

- (a) Always equal to **f(a)**
- (b) Always equal to **a**
- (c) The rate of change in the value of the function at **x = a**
- (d) The limit of **f(x)** as **x** approaches **a**
- (e) The ratio of **f(a)** to **a**.

(1 mark)

[< Answer >](#)

18. A function **f(x)** is said to be monotonically increasing if

- (a) The first derivative of **f(x)** is a constant for all values of **x**
- (b) The first derivative of **f(x)** is negative for all values of **x**
- (c) The first derivative of **f(x)** is positive for all values of **x**
- (d) The first derivative of **f(x)** is zero for all values of **x**
- (e) The first derivative of **f(x)** is equal to 1 for all values of **x**.

(1 mark)

[< Answer >](#)

19. Which of the following is **false** with regard to linear programming problems?

- (a) The contribution of each unit of the decision variables towards the objective to be achieved is known
- (b) The consumption of resources by each unit of the decision variables is known
- (c) The values of the decision variables in the optimal solution will always be whole numbers
- (d) Linear programming is used either to maximize or to minimize the value of the objective function
- (e) The optimal solution to any linear programming problem is one of the possible feasible solutions.

(1 mark)

[< Answer >](#)

20. Which of the following is **false** with regard to the simplex method of solving linear programming problems?

- (a) It involves an iterative procedure for arriving at the optimal solution
- (b) Slack variables are used to represent the unused resources
- (c) Slack variables make zero contribution towards the objective to be achieved
- (d) The $Z_j - C_j$ values indicate the variable to leave solution
- (e) The $Z_j - C_j$ values indicate whether the solution is optimal or not.

(1 mark)

[< Answer >](#)

21. If two events **A** and **B** are independent then, the conditional probability of event **A** given that event **B** has occurred, is equal to

- (a) Joint probability of events **A** and **B**
- (b) Conditional probability of event **B** given event **A**
- (c) Marginal probability of event **B**
- (d) Marginal probability of event **A**
- (e) Zero.

(1 mark)

[< Answer >](#)

22. The standard deviation of a data set

- (a) Is expressed in the same unit as the observations in the data set
- (b) Is expressed in the square of the unit of the observations in the data set
- (c) Is expressed in the square root of the unit of the observations in the data set
- (d) Is expressed in a different unit from the unit in which the observations in the data set are expressed
- (e) Is always expressed as a percentage of the mean of the data set.

(1 mark)

[< Answer >](#)

23. The geometric mean between two given quantities is equal to

- (a) The sum of the arithmetic mean and harmonic mean between the two quantities
- (b) The difference between the arithmetic mean and harmonic mean between the two quantities
- (c) The geometric mean of the arithmetic mean and the harmonic mean between the two quantities
- (d) The product of the arithmetic mean and the geometric mean between the two quantities
- (e) The ratio of the arithmetic mean to the geometric mean between the two quantities.

(1 mark)

[< Answer >](#)

24. The appropriate average for a set of ratios using the denominators of the ratio data as weights is

- (a) Simple arithmetic mean
- (b) Weighted arithmetic mean
- (c) Simple harmonic mean
- (d) Weighted harmonic mean
- (e) Geometric mean.

(1 mark)

[< Answer >](#)

25. The sum of an arithmetic progression (A.P) consisting of **n** terms is zero. Which of the following is **true**? (t_1 represents the first term and t_n represents the **n**th term of the A.P.)

- (a) $t_1 = -t_n$
- (b) $t_1 = t_n$
- (c) $t_1 / t_n = 0$
- (d) $t_1 / t_n > 1$
- (e) $t_n / t_1 > 1$.

(1 mark)

[< Answer >](#)

26. The smallest number that can be divided by each of a group of numbers without leaving a remainder is called

- (a) A factor of the quantities
- (b) The highest common factor of the quantities
- (c) The least common multiple of the quantities
- (d) The average of the quantities
- (e) The sum of all the quantities.

(1 mark)

27. The Bienayme-Chebyshev theorem is **not** applicable when the difference about the mean is [< Answer >](#)
- (a) 1.0 standard deviation (b) 1.5 standard deviations
(c) 2.0 standard deviations (d) 2.5 standard deviations
(e) 3.0 standard deviations.
- (1 mark)
28. In which of the following conditions, the graphical solution to a linear programming problem will **not** have multiple optimal solutions? [< Answer >](#)
- (a) One of the edges of the feasible region coincides with the horizontal axis
(b) One of the edges of the feasible region is parallel to the horizontal axis
(c) One of the edges of the feasible region coincides with the vertical axis
(d) One of the edges of the feasible region is parallel to the vertical axis
(e) None of the edges of the feasible region is parallel to the objective function.
- (1 mark)
29. Which of the following is **true** with regard to the simplex method of solving a linear programming problem on profit maximization? [< Answer >](#)
- (a) The values of slack variables indicate whether the solution is optimal or not
(b) At the optimal solution all the $Z_j - C_j$ values will be zero
(c) The values in the solution column indicate the variable to enter solution
(d) The values in the $Z_j - C_j$ row indicate the variable to leave solution
(e) The value at the bottom of the solution column indicates the profit in that solution.
- (1 mark)
30. In which of the following conditions two events, A and B, are said to be mutually exclusive? [< Answer >](#)
- (a) $0 < P(A \text{ or } B) < 1$ (b) $P(A \text{ or } B) = 1$
(c) $P(A) = P(B) = 1$ (d) $P(A/B) = 0$ and $P(B/A) = 0$
(e) $0 < P(A \text{ and } B) < 1$.
- (1 mark)
31. Which of the following is **true**? [< Answer >](#)
- (a) In a logarithmic function the logarithmic operation is applied on the dependent variable
(b) In a logarithmic function the base of the logarithm is always 10
(c) In a logarithmic function the independent variable cannot be negative
(d) In a logarithmic function the base of the logarithm can be any real number
(e) None of the above.
- (1 mark)
32. Which of the following is **not** an assumption underlying linear programming? [< Answer >](#)
- (a) The objective to be accomplished can be expressed as a linear function of the decision variables
(b) The constraints on the use of resources can be expressed as linear equations or inequations
(c) The amount of resources consumed by each unit of the decision variables is uncertain
(d) The decision variables can take non-negative values only
(e) The total consumption of a resource is the sum of the resources consumed by each decision variable.
- (1 mark)
33. The reciprocals of the terms in a harmonic progression are [< Answer >](#)
- (a) In geometric progression (b) In harmonic progression
(c) In arithmetic progression (d) Always in decreasing order
(e) Always in increasing order.
- (1 mark)
34. The set of whole numbers includes the set of [< Answer >](#)
- (a) Natural numbers (b) Rational numbers

- (c) Negative numbers (d) Complex numbers (e) Irrational numbers.
(1 mark)

[< Answer >](#)

35. According to the inverse property of addition

- (a) For every real number there exists another real number such that the sum of the two real numbers is equal to 1
(b) For every real number there exists another number such that the sum of the two real numbers is equal to 0
(c) The addition of zero to any real number is equal to that real number
(d) For every real number there exists another real number such that the product of the two numbers is equal to 1
(e) The product of any real number with 1 is equal to that real number.

(1 mark)

[< Answer >](#)

36. In a two dimensional plane the graph of a function of the form $y = a + bx$ is a

- (a) Circle (b) Curve (c) Square (d) Rectangle (e) Straight line.

(1 mark)

[< Answer >](#)

37. The accumulated amount at the end of t years, of a given amount of investment, under compound interest, is an example of

- (a) Linear function in one independent variable
(b) Linear function in two independent variables
(c) Logarithmic function
(d) Exponential function
(e) Inverse function.

(1 mark)

[< Answer >](#)

38. Which of the following are the conditions for applying the Baye's theorem for computing posterior probabilities of certain events?

- (a) The events must be non-mutually exclusive
(b) The events must be mutually exclusive
(c) The events must not be collectively exhaustive
(d) The events must be collectively exhaustive
(e) Both (b) and (d) above.

(1 mark)

[< Answer >](#)

39. The events **B**, **C** and **D** are mutually exclusive and collectively exhaustive; **A** is another event, which can jointly occur with **B**, **C** or **D**.

$$P(A \text{ and } B) + P(A \text{ and } C) + P(A \text{ and } D) =$$

- (a) 1.00 (b) $P(D)$ (c) $P(C)$ (d) $P(B)$ (e) $P(A)$.

(1 mark)

[< Answer >](#)

40. Which of the following is **true** with regard to the exponential function $y = m \cdot a^x$?

- (a) The exponential curve falls from left to right as the values increase along the X-axis if $m > 0$ and $0 < a < 1$
(b) The exponential curve falls from left to right as the values increase along the X-axis if $m > 0$ and $a > 1$
(c) The exponential curve is parallel to the X-axis if $m > 0$ and $0 < a < 1$
(d) The exponential curve is parallel to the X-axis if $m > 0$ and $a > 1$
(e) None of the above.

(1 mark)

[< Answer >](#)

41. Which of the following statements are **correct**?

- (a) 9 distinct numbers can be formed by arranging the digits **1, 2, 3, 4, 3, 2, 1** so that the odd digits always occupy the odd places. The letters of the word **committee** can be arranged in 90720 ways

- (b) 3 distinct numbers can be formed by arranging the digits **1, 2, 3, 4, 3, 2, 1** so that the odd digits always occupy the odd places. The letters of the word **committee** can be arranged in 181440 ways
- (c) 6 distinct numbers can be formed by arranging the digits **1, 2, 3, 4, 3, 2, 1** so that the odd digits always occupy the odd places. The letters of the word **committee** can be arranged in 362880 ways
- (d) 18 distinct numbers can be formed by arranging the digits **1, 2, 3, 4, 3, 2, 1** so that the odd digits always occupy the odd places. The letters of the word **committee** can be arranged in 45360 ways
- (e) None of the above.

(2 marks)

[< Answer >](#)

42. If a^2, b^2, c^2 are in arithmetic progression, then which of the following is **correct**?

- (a) $a + b + c = \frac{(a+b)(b+c)}{(c+a)}$
- (b) $a + b + c = \frac{2(a+b)(b+c)}{(c+a)}$
- (c) $a + b + 2c = \frac{2(a+b)(b+c)}{(c+a)}$
- (d) $2a + b + c = \frac{2(a+b)(b+c)}{(c+a)}$
- (e) $a + 2b + c = \frac{2(a+b)(b+c)}{(c+a)}$.

(3 marks)

[< Answer >](#)

43. Two drawings, each of three balls, are made from a bag containing 5 red and 8 black balls, the balls not being replaced before the second drawing. What is the likelihood that the first drawing will give 3 red balls and the second drawing will give 3 black balls?

- (a) 7/15 (b) 5/143 (c) 15/143 (d) 7/429 (e) 1/3.

(2 marks)

[< Answer >](#)

44. A box contains six balls of unknown colours. Three balls are drawn and found to be green. What is the probability that no green ball is remaining in the box?

- (a) 1 (b) 1/2 (c) 1/20 (d) 1/35 (e) 7/16.

(3 marks)

[< Answer >](#)

45. A fair die is thrown three times, and the sum of the three numbers obtained is 15. What is the probability that the number obtained in the first throw was 4?

- (a) 1/5 (b) 1/9 (c) 1/12 (d) 1/18 (e) 1/108.

(2 marks)

[< Answer >](#)

46. There are five male candidates and six female candidates for a job interview. They are randomly called one-by-one by the interviewer. Which of the following statements is correct?

- (a) The probability that the interviewer will call the males and females in an exactly alternating order is 0.00432 and the probability that the interviewer will call all the males first is 0.00432
- (b) The probability that the interviewer will call the males and females in an exactly alternating order is 0.00432 and the probability that the interviewer will call all the males first is 0.00216
- (c) The probability that the interviewer will call the males and females in an exactly alternating order is 0.00216 and the probability that the interviewer will call all the males first is 0.00216
- (d) The probability that the interviewer will call the males and females in an exactly alternating order is 0.00216 and the probability that the interviewer will call all the males first is 0.00432
- (e) The probability that the interviewer will call the males and females in an exactly alternating order is 0.00864 and the probability that the interviewer will call all the males first is 0.00864.

(2 marks)

[< Answer >](#)

47. There are fourteen marketing firms hiring fresh graduates. Ravi randomly found the recruitment ads of six of these firms and sent them his resume. Three of these marketing firms are in Mumbai. Which of

the following statements is correct?

- (a) The probability that Ravi did not apply to a marketing firm in Mumbai is 0.176 and the probability that two of the marketing firms to which Ravi applied are in Mumbai is 0.154
- (b) The probability that Ravi did not apply to a marketing firm in Mumbai is 0.11 and the probability that two of the marketing firms to which Ravi applied are in Mumbai is 0.001
- (c) The probability that Ravi did not apply to a marketing firm in Mumbai is 0.001 and the probability that two of the marketing firms to which Ravi applied are in Mumbai is 0.11
- (d) The probability that Ravi did not apply to a marketing firm in Mumbai is 0.33 and the probability that two of the marketing firms to which Ravi applied are in Mumbai is 0.154
- (e) The probability that Ravi did not apply to a marketing firm in Mumbai is 0.154 and the probability that two of the marketing firms to which Ravi applied are in Mumbai is 0.33.

(2 marks)

[< Answer >](#)

48. In a trial the judge is 65 percent confident that Sunil has committed a crime. Ramesh is a witness who knows whether Sunil is innocent or guilty. However, Ramesh is Sunil's friend and will lie in the court with probability 0.25 if Sunil is guilty. He will tell truth if Sunil is innocent. What is the likelihood that Ramesh will not lie in the court?

- (a) 0.1625
- (b) 0.8375
- (c) 0.35
- (d) 0.75
- (e) 1.00.

(2 marks)

[< Answer >](#)

49. A number is randomly selected from the set of values $\{1, 2, \dots, 10000\}$ and is observed to be odd. What is the probability that it is divisible by 3?

- (a) 0.056
- (b) 0.6667
- (c) 0.1667
- (d) 0.3334
- (e) 0.50.

(2 marks)

[< Answer >](#)

50. A box contains 1000 pink balls numbered 1 through 1000, 1750 green balls numbered 1 through 1750. A ball is picked at random, and the number on it is found to be divisible by 3. What is the probability that the number on it is also divisible by 5?

- (a) 0.066
- (b) 0.333
- (c) 0.199
- (d) 0.801
- (e) 0.667.

(2 marks)

[< Answer >](#)

51. What is the sum of the following series?

$$p^2, (3p^2 + q), (5p^2 + 2q), \dots \dots \dots [(2n + 1)p^2 + nq]$$

- (a) $(n + 1)[2p^2 + n(2p^2 + q)]$
- (b) $\frac{n}{2}[2p^2 + n(2p^2 + q)]$
- (c) $\frac{(n + 1)}{2}[2p^2 + n(2p^2 + q)]$
- (d) $\frac{(n + 1)}{2}[p^2 + p(2p^2 + q)]$
- (e) $\frac{n}{2}[p^2 + n(2p + q)]$.

(2 marks)

[< Answer >](#)

52. What is the value of the following sum?

$$2y - \frac{y^2}{x} + \frac{y^3}{2x^2} - \frac{y^4}{4x^3}$$

$$(a) \frac{2y - 2y\left(\frac{y}{2x}\right)^4}{1 + \left(\frac{y}{2x}\right)}$$

$$(b) \frac{y - y\left(\frac{y}{2x}\right)^4}{1 + \left(\frac{y}{2x}\right)}$$

$$(c) \frac{y\left(\frac{y}{2x}\right)^4}{1 + \left(\frac{y}{2x}\right)}$$

$$(d) \frac{1 + \left(\frac{y}{2x}\right)}{2y + \left(\frac{y}{2x}\right)^4}$$

$$(e) \frac{2y + \left(\frac{y}{2x}\right)^4}{2 + \left(\frac{y}{2x}\right)}$$

(2 marks)

53. The sum of the first term through the tenth term of an arithmetic progression (A.P.) is 50 and the sum of the eleventh term through the twentieth term of the A.P. is 250.

[< Answer >](#)

What is the sum of the twenty-sixth term through the thirtieth term of the A.P.?

- (a) 50 (b) 300 (c) 550 (d) 250 (e) 500.

(3 marks)

54. What is the value of the following sum?

[< Answer >](#)

$$\log x + \log 2 + \log x^2 + \log 4 + \log x^3 + \log 8 + \dots + \log x^{10} + \log 1024$$

- (a) $\log 2x$ (b) 55 (c) $55 \log x$ (d) $55 \log (2x)$ (e) $5 \log (2x)$.

(3 marks)

55. A geometric progression (G.P.) has terms in the increasing order, which are all positive. The sum of the first six terms of the G.P. is nine times the sum of the first three terms. The eighth term of the G.P. is 640.

[< Answer >](#)

What is the sum of the sum of the first ten terms of the G.P.?

- (a) 1024 (b) 2560 (c) 1705 (d) 5120 (e) 5115.

(2 marks)

56. A committee of six members has to be formed from seven Indians and four Frenchmen.

[< Answer >](#)

Which of the following is/are **correct**?

- (a) If the committee contains exactly 2 Frenchmen then, the committee can be formed in 35 ways
 (b) If the committee contains exactly 2 Frenchmen then, the committee can be formed in 210 ways
 (c) If the committee contains at least 2 Frenchmen then, the committee can be formed in 210 ways
 (d) If the committee contains at least 2 Frenchmen then, the committee can be formed in 371 ways
 (e) Both (b) and (d) above.

(2 marks)

57. From twelve magazines a selection of five magazines must be made.

[< Answer >](#)

- (a) If one specific magazine is always included then, the number of ways in which the magazines can be selected is 495
 (b) If one specific magazine is always included then, the number of ways in which the magazines can be selected is 330
 (c) If one specific magazine is always excluded then, the number of ways in which the magazines can be selected is 792
 (d) If one specific magazine is always excluded then, the number of ways in which the magazines can

- be selected is 462
(e) Both (b) and (d) above.

(1 mark)

[< Answer >](#)

58. Which of the following is/are **correct**?

- (a) The number of ways in which the letters of the word **triangle** can be arranged is 40320, and the number of arrangements which will begin with **t** and end with **e** is 720
- (b) The number of ways in which the letters of the word **triangle** can be arranged is 560, and the number of arrangements which will begin with **t** and end with **e** is 300
- (c) The number of ways in which the letters of the word **article** can be arranged so that the vowels occupy the even numbered positions is 144
- (d) The number of ways in which the letters of the word **article** can be arranged so that the vowels occupy the even numbered positions is 24
- (e) Both (a) and (c) above.

(1 mark)

[< Answer >](#)

59. The variance of a data set is 16. If every item in the data set is multiplied by 2 then, what is the variance of the resulting data set?

- (a) 8
- (b) 16
- (c) 32
- (d) 64
- (e) 128.

(1 mark)

[< Answer >](#)

60. The sum of the observations in a data set containing 10 observations is 140 and the variance of the data set is 9. If 6 is added to every observation in the data set then, what will be the coefficient of variation of the resulting data set?

- (a) 6.4%
- (b) 60%
- (c) 15%
- (d) 21%
- (e) 45%.

(1 mark)

[< Answer >](#)

61. The following details are available with regard to a sample of ten observations:

Arithmetic mean of the first four observations = 20
Arithmetic mean of the remaining six observations = 15

$$\sum_{i=1}^{10} x_i^2$$

For the entire sample, $\sum_{i=1}^{10} x_i^2 = 2926$

What is the variance of the sample?

- (a) 2
- (b) 4
- (c) 6
- (d) 9
- (e) 36.

(1 mark)

[< Answer >](#)

62. A group of salesmen from the same industry consists of some sales men who have 6 years of experience and others who have 12 years of experience. Twenty-five percent of the salesmen in the group have 12 years of experience and their average salary is Rs.10,000 per month. The average salary for the entire group is Rs.7,000.

What is the average salary of the salesmen who have 6 years of experience?

- (a) Rs.5,000
- (b) Rs.4,000
- (c) Rs.8,000
- (d) Rs.6000
- (e) Rs.12,000.

(1 mark)

[< Answer >](#)

63. A data set contains the following observations:

10, 12, 8, 14, 15, 7, 17, 20

What is the harmonic mean of the data set?

- (a) 11.46
- (b) 1.43
- (c) 5.58
- (d) 12.5
- (e) 15.33.

(1 mark)

[< Answer >](#)

64. $(y - 8) = \frac{2}{3}(3x - 9)$

The equation of a straight line is

Which of the following statements is/are **correct**?

- (a) The intercept on the Y axis is 6 (b) The intercept on the Y axis is 2
(c) The slope of the straight line is 6 (d) The slope of the straight line is 2
(e) Both (b) and (d) above.

(1 mark)

65. For a class consisting of 60 students, a test on English was conducted. The marks obtained by the students are given below:

[< Answer >](#)

Marks obtained out of 125	Numbers of students
5 - 25	7
25 - 45	15
45 - 65	18
65 - 85	12
85 - 105	6
105 - 125	2

What is the median marks obtained by the students in the class?

- (a) 30.5 (b) 45 (c) 48.6 (d) 53.3 (e) 65.

(2 marks)

[< Answer >](#)

66. $\lim_{x \rightarrow 3} \frac{x^2 - 9}{\sqrt{4x - 3} - \sqrt{2x + 3}}$

- (a) 6 (b) 12 (c) 18 (d) 3 (e) 36.

(2 marks)

[< Answer >](#)

67. $y = \frac{8}{3}x^3 - 28x^2 + 48x + 320$

Which of the following statements is **correct**?

- (a) y is minimum at x = 1 and maximum at x = 6
(b) y is minimum at x = 2 and maximum at x = 5
(c) y is minimum at x = 4 and maximum at x = 3
(d) y is minimum at x = 5 and maximum at x = 4
(e) y is minimum at x = 6 and maximum at x = 1.

(2 marks)

[< Answer >](#)

68. The terms in a series are as given below:

4, 8, 16, 32, 64,

The ninth term of the series is

- (a) 256 (b) 512 (c) 1024 (d) 2048 (e) 4096.

(1 mark)

[< Answer >](#)

69. The formulation of a linear programming problem (LPP) is given below:

Maximize: $z = t + 4u + 5v$

Subject to: $2t + u + 3v \leq 36$

$$t + 2u + v \leq 42$$

$$t, u, v \geq 0$$

Which of the following is the optimal solution to the LPP?

(a) $t = 18, u = 0, v = 20$

(b) $t = 2, u = 15, v = 10$

(c) $t = 0, u = 6, v = 36$

(d) $t = 0, u = 18, v = 6$

(e) None of the above.

(3 marks)

[< Answer >](#)

70. The following details are available with regard to two populations, **A** and **B**:

Group	Number of observations	Mean	Standard deviation
A	30	10	4
B	20	15	6

What is the combined standard deviation for both the populations?

(a) 3.63

(b) 2.45

(c) 4.90

(d) 5.48

(e) 4.10.

(2 marks)

[< Answer >](#)

71. Which of the following is/are **correct**?

(a) If $y = \frac{x^2 - 12}{x - 4}$ then $\frac{dy}{dx} = \frac{x^2 - 8x}{x - 4}$

(b) If $y = x^2 \cdot \ln(x)$ then $\frac{dy}{dx} = (1 + 2x)\ln(x)$

(c) If $y = e^{3x^2 - 6x + 5}$ then $\frac{dy}{dx} = 6(x - 1)e^{3x^2 - 6x + 5}$

(d) If $y = \frac{9 - x^2}{9 + x^2}$ then $\frac{dy}{dx} = \frac{36x}{(9 + x)^2}$

(e) If $y = x^4 + 2e^x + 10$ then $\frac{dy}{dx} = 4x^3 + e^x$.

(3 marks)

[< Answer >](#)

72. A and B are two non-mutually exclusive and independent events.

$P(A) = 0.50$

$P(B) = 0.60$

What is the probability that neither event A nor event B will occur?

(a) 0.20

(b) 0.30

(c) 0.10

(d) 0.80

(e) 0.48.

(1 mark)

END OF QUESTION PAPER

Suggested Answers

Quantitative Methods - I (131) – July 2004

1. Answer : (c)

Reason : If all the terms of an arithmetic progression are multiplied by a constant the resulting terms will always form an arithmetic progression with the first term multiplied by the constant as well as the common difference multiplied by the constant. The resulting series will neither be in a geometric series or a harmonic series because nature of the resulting terms will not satisfy their requirements.

[TOP](#)

2. Answer : (b)

Reason : a. The consecutive terms of the G.P. will be in increasing order if the first term in a geometric progression is greater than one and the common ratio is more than 1.
b. The consecutive terms of the G.P. will be in decreasing order if the first term in a geometric progression is greater than one and the common ratio is less than 1.
c. If the first term in a geometric progression is greater than one and the common ratio is less than 1, then the consecutive terms will not be the same.
d. All the consecutive terms will be less than 1 if the first term as well as the common ratio is less than 1.
e. All the consecutive terms will be greater than 1 if the first term as well as the common ratio is more than 1. However a decreasing G.P. may still have all the terms greater than 1; this depends upon the number of terms in the G.P.

[TOP](#)

3. Answer : (e)

Reason : a. This interval is bounded on the lower side but unbounded on the upper side.
b. This interval is bounded on the upper side but unbounded on the lower side.
c. This interval is bounded on the lower side but unbounded on the upper side.
d. This interval is bounded on the upper side but unbounded on the lower side.
e. This interval is bounded on the upper as well as lower sides.

[TOP](#)

4. Answer : (a)

Reason : A function is a rule or correspondence which always associates to each number x in a set A , a unique number $f(x)$ in a set B .

[TOP](#)

5. Answer : (e)

Reason : For any function $f(x)$ the limit of $f(x)$ as x approaches a value a is a value L , such that $f(x)$ approaches L as x approaches a .

[TOP](#)

6. Answer : (d)

Reason : For a function $f(x)$ the first derivative is positive and the second derivative is negative at $x = a$. This means that $f(x)$ is increasing at a decreasing rate at $x = a$. For a function $f(x)$ to be minimum or maximum the first derivative should be equal to zero.

[TOP](#)

7. Answer : (e)

Reason : The following are true with regard to the graphical method of solving LPPs:

- a. It is applicable when there are two decision variables.
- b. The decision variables are represented by the horizontal and vertical axes.
- c. Straight lines are used to demarcate the feasible region.
- d. The feasible region shows the solutions that satisfy all the constraints.
- e. The corner points of the feasible region may not include the origin.

[TOP](#)

8. Answer : (a)

[TOP](#)

- Reason : a. The skewness of a distribution indicates the absence of symmetry in the distribution. [TOP](#)
- b. The consistency of the data in the distribution is indicated by the coefficient of variation. [>](#)
- c. The dispersion of the data in the distribution is indicated by the standard deviation.
- d. The central tendency of the distribution is indicated by the mean, median or mode.

9. Answer : (b)

Reason : In a positively skewed distribution the majority of the observations are concentrated towards the lower end of the scale. In a negatively skewed distribution majority of the observations are concentrated towards the higher end of the scale. In a skewed distribution the distribution of the data is not symmetrical. [TOP](#)

10. Answer : (e)

Reason :

- (a) $b = c$ cannot be implied from the given condition.
- (b) $b = -c$ cannot be implied from the given condition.
- (c) $b + c = 1$ cannot be implied from the given condition.
- (d) $b - c = 1$ cannot be implied from the given condition.
- (e) Let $\log_a b = k$ and $\log_a c = m$.
Hence $b = a^k$ and $c = a^m$
 $\log_a b + \log_a c = 0$ implies that $k + m = 0$.
 $\therefore k = -m$
 $\Rightarrow a^k = a^{-m} \Rightarrow a^k = 1/a^m \Rightarrow a^k \cdot a^m = 1 \Rightarrow b \cdot c = 1 \Rightarrow b = 1/c$ and vice versa.
Hence they are reciprocals. [TOP](#)

11. Answer : (c)

- Reason : (a) The classical approach to probability assumes that the outcomes are equally likely. [TOP](#)
- (b) In the relative frequency approach to probability the probability of an event is determined after performing the experiment large number times. [>](#)
- (c) (c) In the classical approach to probability the probability of an event is determined before performing the experiment.
- (d) The classical approach to probability assumes that all possible outcomes of the experiment are known.
- (e) The classical approach can be used to find out the probability of mutually exclusive events.

12. Answer : (e)

- Reason : (a), (b) and (c) If every item of the data set is divided by a constant then the arithmetic mean, geometric mean and mode will also be divided by the constant. [TOP](#)
- (d) The variance will be divided by the square of the constant. [>](#)
- (e) The standard deviation as well as mean will be divided by the constant. Hence coefficient of variation ((Mean/Standard deviation)100) will remain unchanged.

13. Answer : (d)

Reason : Harmonic mean = Reciprocal of the average of reciprocals of the observations. [TOP](#)

- (a) The reciprocal of the harmonic mean is not equal to the arithmetic mean. [>](#)
- (b) The reciprocal of the harmonic mean is not equal to the sum of all the observations.
- (c) The reciprocal of the harmonic mean is not equal to the sum of the reciprocals of the observations.
- (d) $\therefore$ The reciprocal of the harmonic mean is equal to average of the reciprocals of

the observations.

- (e) The reciprocal of the harmonic mean is not equal to the product of the reciprocals of the observations.

14. Answer : (d)

- Reason : (a) The derivative of a function indicates the rate of change of the function.
- (b) (b) The slope of the tangent to a function at a point is equal to the derivative of the function at that point.
- (c) The derivative of a function can be said to be a function of the independent variable if the expression of the derivative contains the independent variable.
- (d) (d) The derivative of a linear function is the slope of the linear function, which is a constant value for all values of the dependent variable.

If the derivative of any function at a point is negative then it indicates that the function is decreasing at that point.

15. Answer : (c)

- Reason : Coefficient of variation = (standard deviation / mean) $\times$ 100
- (a) A standard deviation equal to zero implies that there is no deviation in the data set. The same will be reflected by the c.v. provided mean is not equal to zero.
- (b) Even when the standard deviation is 1 the c.v. can be meaningfully used for comparison of variability provided mean is not equal to zero.
- (c) Hence it cannot be meaningfully used for comparison of variability when mean of one or more data sets is zero.
- (d) When the mean is equal to 1, the c.v. can be meaningfully used for comparison of variability.
- (e) When the mean and standard deviation are equal for one or more sets of data, the c.v. can be meaningfully used for comparison of variability.

16. Answer : (b)

- Reason : (a) & (b) For two dependent events **A** and **B**, the joint probability of the events **A** and **B** is not equal to the product of their marginal probabilities.
- (c) For two dependent events **A** and **B**, the joint probability of the events **A** and **B** is not equal to the sum of their marginal probabilities.
- (d) For two dependent events **A** and **B**, the joint probability of the events **A** and **B** is not equal to the difference between their marginal probabilities.
- (e) For two dependent events **A** and **B**, the joint probability of the events **A** and **B** is not always equal to 1.

17. Answer : (c)

- Reason : a. The derivative of a function $f(x)$ at $x = a$ may not be equal to $f(a)$.
- b. The derivative of a function $f(x)$ at $x = a$ may not be equal to a .
- c. The derivative of $f(x)$ at $x = a$ is the rate of change in the value of $f(x)$ at $x = a$.
- d. The derivative of a function $f(x)$ at $x = a$ is not the limit of $f(x)$ as x approaches a .
- e. The derivative of a function $f(x)$ at $x = a$ is not the ratio of $f(a)$ to a .

18. Answer : (c)

- Reason : a. If the first derivative of $f(x)$ is a constant for all values of x then it indicates that the function changes at a constant rate.
- b. A function $f(x)$ is said to be monotonically decreasing if the first derivative of $f(x)$ is negative for all values of x .
- c. A function $f(x)$ is said to be monotonically increasing if the first derivative of $f(x)$ is

positive for all values of x .

- d. If the first derivative of $f(x)$ is zero for all values of x then it indicates that the function has a constant value.
- e. This is not the condition for a monotonically increasing function.

19. Answer : (c)

Reason : The following are true for any LPP:

- a. The contribution of each unit of the decision variables towards to the objective to be achieved is known.
- b. The consumption of resources by each unit of the decision variables is known.
- c. The values of the decision variables in the optimal solution may be fractional numbers.
- d. Linear programming is used either to maximize or to minimize the value of the objective function.
- e. The optimal solution to any linear programming problem is one of the possible feasible solutions.

[TOP](#)

20. Answer : (d)

Reason : The following are true with regard to the simplex method of solving linear programming problems:

- a. It involves an iterative procedure for arriving at the optimal solution.
- b. Slack variables are used to represent the unused resources.
- c. Slack variables make zero contribution towards the objective to be achieved.
- d. The $Z_j - C_j$ values indicate the variable to enter solution.
- e. The $Z_j - C_j$ values indicate whether the solution is optimal or not.

[TOP](#)

21. Answer : (d)

Reason : If two events A and B are independent then, the conditional probability of event A given event B is equal to marginal probability of event A because the occurrence of event B does not influence the occurrence of event A.

[TOP](#)

22. Answer : (a)

Reason : (a) The standard deviation of a data set is expressed in the same unit as the observations in the data set.

[TOP](#)

(b), (c), (d) and (e) are incorrect with regard to the standard deviation.

23. Answer : (c)

Reason : (c) The geometric mean between two given quantities is equal to the geometric mean of the arithmetic mean and the harmonic mean between the two given quantities.

[TOP](#)

(a), (b), (d) and (e) are all incorrect with regard to the geometric mean between two given quantities.

24. Answer : (b)

Reason : (a) Simple arithmetic mean is the appropriate average when the denominators are same and no weighting is required.

[TOP](#)

(b) Weighted arithmetic mean is appropriate when the denominators of the ratio data are used as weights.

(c) Simple harmonic mean is used when the numerators of the ratios are same.

(d) Weighted harmonic mean is appropriate when the numerators of the ratio data are used as weights.

_____ (e) Geometric mean is appropriate when the quantities vary over time.

25. Answer : (a)

[TOP](#)

Reason : The sum of n terms of an A.P., $S_n = \frac{n}{2} \{2a + (n-1)d\}$

$$= \frac{n}{2} \{t_1 + t_n\}$$

$$\begin{aligned} S_n = 0 & \Rightarrow \frac{n}{2} \{t_1 + t_n\} = 0 \\ & \Rightarrow t_1 + t_n = 0 \\ & \Rightarrow t_1 = -t_n. \end{aligned}$$

26. Answer : (c)

[TOP](#)

Reason : The least common multiple of a group of quantities can be divided by each quantity in the group without leaving any remainder. While, each number of the group can be divided by a factor, even by the highest common factor also. But that condition is not satisfied, if each number is divided by the average or the sum of all the quantities.

27. Answer : (a)

[TOP](#)

Reason : According to the Bienayme-Chebyshev rule, the percentage of data points lying within $\pm k$

standard deviation of the mean is at least $\left(1 - \frac{1}{k^2}\right) \times 100$.

If $k = 1$, then it will be 0 percent which is impossible. So this rule is not applicable for $k = 1$

28. Answer : (e)

[TOP](#)

Reason : A graphical solution to a linear programming problem will have multiple optimal solutions if the objective function is parallel to an edge of the feasible region which is in the direction of the optimal movement of the objective function. If none of the edges of the feasible region is parallel to the objective function then, the possibility of multiple optimal solution does not arise.

29. Answer : (e)

[TOP](#)

Reason : (e) is true because the value at the bottom of the solution column indicates profit. (b) is false because the $Z_j - C_j$ values indicate whether the solution is optimal or not. (b) is false because at the optimal solution all the $Z_j - C_j$ need not be zero. (c) is false because the values in $Z_j - C_j$ row indicate the variable to enter solution. (d) is false because the value to leave solution is indicated by the ratio of the values in solution column to the corresponding values in the column for the variable to enter solution.

30. Answer : (d)

[TOP](#)

Reason : Since the two events A and B are mutually exclusive, the happening of A precludes the occurrence of B and vice versa.

Hence $P(A/B) = 0$ and $P(B/A) = 0$

31. Answer : (c)

[TOP](#)

Reason : a. In a logarithmic function the logarithmic operation is applied on the independent variable.

b. In a logarithmic function the base of the logarithm may be any number other than 10.

c. In a logarithmic function the independent variable cannot be negative.

d. In a logarithmic function the base of the logarithm cannot be zero or negative numbers.

32. Answer : (c)

[TOP](#)

Reason : (a), (b), (d) and (e) are all assumptions underlying linear programming. However, (c) is not an assumption because linear programming assumes that the amount of resources

consumed by each unit of the decision variables is certain.

33. Answer : (c)

Reason : The reciprocals of the terms in harmonic progression are in arithmetic progression.

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34. Answer : (a)

- Reason :
- a. The set of whole numbers includes the set of natural numbers.
 - b. The set of whole numbers does not include the set of rational numbers.
 - c. The set of whole numbers does not include the set of negative numbers.
 - d. The set of whole numbers does not include the set of complex numbers.
 - e. The set of whole numbers does not include the set of irrational numbers.

[TOP](#) [<](#)
[>](#)

35. Answer : (b)

- Reason :
- a. This is not a property of the real numbers
 - b. According to the inverse property of addition for every real number there exists another number such that the sum of the two real numbers is equal to 0.
 - c. This is the identity property of addition.
 - d. This is the inverse property of multiplication.
 - e. This is the identity property of multiplication.

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36. Answer : (e)

Reason : In a two dimensional plane the graph of a function of the form $y = a + bx$ is a straight line.

[TOP](#) [<](#)
[>](#)

37. Answer : (d)

Reason : The accumulated amount at the end of t years, of a given amount of investment, under compound interest, is an example of exponential function.

[TOP](#) [<](#)
[>](#)

38. Answer : (e)

Reason : The events for which the Baye's theorem may be applied for computing posterior probabilities must be mutually exclusive and collectively exhaustive.

[TOP](#) [<](#)
[>](#)

39. Answer : (e)

Reason : If B, C and D are mutually exclusive and collectively exhaustive, and A is another event which can jointly occur with B, C or D, then
 $P(A) = P(A \text{ and } B) + P(A \text{ and } C) + P(A \text{ and } D)$.
This means that $P(A)$ is equal to the sum of all the joint probabilities which include event A.

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40. Answer : (a)

Reason : The exponential function falls from left to right as the values increase along the X-axis if $m > 0$ and $0 < a < 1$. Hence (a) is true. (b), (c) (d) and (e) are not true because they are not the characteristics of the exponential function.

[TOP](#) [<](#)
[>](#)

41. Answer : (d)

Reason : **The digits : 1, 2, 3, 4, 3, 2, 1**

Number of digits = 7

The odd digits 1, 3, 3, 1 can be arranged in their four places

(the odd positions) in $\frac{4!}{2! \cdot 2!} = 6$ ways(1)

After the odd digits have been filled in the odd positions, the remaining places will be the even positions and they will be filled with the even digits to complete each arrangement.

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∴ The even digits 2, 4, 2 can be arranged in their three places (in the even positions) in $\frac{3!}{2!} = 3$ ways(2)

Each of the ways in (1) can be associated with each of the ways in (2).

∴ The number of possible arrangements = $6 \times 3 = 18$.

The word : COMMITTEE

No. of letters = 9

No. of Ms = 2

No of Ts = 2

No of Es = 2

Remaining 3 letters are all different

∴ No. of possible arrangements = $\frac{9!}{2! 2! 2!} = 45,360$

42. Answer : (e)

Reason : a^2, b^2, c^2 are in A.P.

By adding adding **ad + ac + bc** to each term, we see that

$a^2 + ab + ac + bc, b^2 + ba + bc + ac, c^2 + ca + cb + ab$ are in A.P

or $(a + b)(a + c), (b + c)(b + a), (c + a)(b + c)$ are in A.P.

Dividing each term by $(a + b)(b + c)(c + a)$ we get,

$\frac{1}{b + c}, \frac{1}{c + a}, \frac{1}{a + b}$ are in A.P.

∴ $b + c, c + a, a + b$ are in H.P

$\therefore c + a = \frac{2(a + b)(b + c)}{b + c + a + b} = \frac{2(a + b)(b + c)}{a + 2b + c}$

or $a + 2b + c = \frac{2(a + b)(b + c)}{(c + a)}$

43. Answer : (d)

Reason : **1st drawing**

3 balls may be drawn from total $5 + 8 = 13$ balls in ${}^{13}C_3$ ways,

3 red balls may be drawn in 5C_3 ways.

∴ $P(3 \text{ red balls in } 1^{\text{st}} \text{ drawing}) = \frac{{}^5C_3}{{}^{13}C_3} = \frac{10}{286} = \frac{5}{143}$.

2nd drawing :

The balls taken in the first drawing are **not** replaced. If 3 red balls were drawn in the 1st drawing then the balls present before the 2nd drawing are 2 red and 8 black balls.

∴ At the second trial 3 balls may be drawn from $2 + 8 = 10$ balls in ${}^{10}C_3$ ways

3 black balls may be drawn in 8C_3 ways.

∴ $P(3 \text{ black balls in } 2^{\text{nd}} \text{ drawing}) = \frac{{}^8C_3 \div {}^{10}C_3}{{}^{120}} = \frac{56}{120} = \frac{7}{15}$

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P(3 red balls in 1st draw and 3 black balls in 2nd draw)

$$= \frac{5}{143} \times \frac{7}{15} = \frac{7}{429}.$$

44. Answer : (d)

Reason : There are 4 equally likely possibilities which reference to the remaining balls:

A. All the 3 remaining balls are green $P(A) = \frac{1}{4}$

B. 2 balls are green $P(B) = \frac{1}{4}$

C. 1 ball is green $P(C) = \frac{1}{4}$

D. No ball is green $P(D) = \frac{1}{4}$

If A was true then, probability of drawing three green balls in the first three draws

$$= \frac{{}^6C_3}{{}^6C_3} = 1 = P(3 \text{ green balls drawn} | A)$$

If B was true then, probability of drawing three green balls in the first three draws

$$= \frac{{}^5C_3}{{}^6C_3} = \frac{10}{20} = \frac{1}{2} = P(3 \text{ green balls drawn} | B)$$

If C was true then, $P(3 \text{ green balls drawn} | C) = \frac{{}^4C_3}{{}^6C_3} = \frac{4}{20} = \frac{1}{5}$

If D was true then, $P(3 \text{ green balls drawn} | D) = \frac{{}^3C_3}{{}^6C_3} = \frac{1}{20}$

$\therefore P(3 \text{ green balls drawn}) =$

$P(A). P(3 \text{ green balls drawn} | A) + P(B). P(3 \text{ green balls drawn} | B) + P(C). P(3 \text{ green balls drawn} | C) + P(D). P(3 \text{ green balls drawn} | D)$

$$= \left(\frac{1}{4} \times 1\right) + \left(\frac{1}{4} \times \frac{1}{2}\right) + \left(\frac{1}{4} \times \frac{1}{5}\right) + \left(\frac{1}{4} \times \frac{1}{20}\right) = \frac{1}{4} \times \frac{7}{4} = \frac{7}{16}$$

$$P(D | 3 \text{ green balls drawn}) = \frac{P(D \text{ and } 3 \text{ green balls drawn})}{P(3 \text{ green balls drawn})}$$

$$= \frac{\left(\frac{1}{4} \times \frac{1}{20}\right)}{\frac{7}{16}} = \frac{1}{80} \times \frac{16}{7} = \frac{1}{35}$$

45. Answer : (a)

Reason : Let T be the event of obtaining 15 in 3 throws.

If 15 should be obtained in three throws then the number that should be obtained in first throws must be 3, 4, 5, or 6.

Let A, B, C, D and E respectively be the events that 3, 4, 5, 6 and any other number(1 or 2) is obtained in the 1st throw.

$$\therefore P(A) = P(B) = P(C) = P(D) = \frac{1}{6}$$

$$P(E) = \frac{2}{6} = \frac{1}{3}$$

If **A** happens then in the remaining two throws the total must be 12 and this will happen as : (6,6)

$$\therefore P(T | A) = P(6 \text{ in } 2^{\text{nd}} \text{ throw}) \times P(6 \text{ in } 3^{\text{rd}} \text{ throw}) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

If **B** happens then in the remaining two throws the total must be 11 and this will happen as : (5,6) or (6,5)

$$\therefore P(T | B) = P(5 \text{ in } 2^{\text{nd}} \text{ throw and } 6 \text{ in } 3^{\text{rd}} \text{ throw}) + P(6 \text{ in } 2^{\text{nd}} \text{ throw and } 5 \text{ in } 3^{\text{rd}} \text{ throw})$$

$$= \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) = \frac{2}{36} = \frac{1}{18}$$

If **C** happens then in the remaining two throws the total must be 10 and this will happen as : (4,6), (6,4) or (5,5)

$$\therefore P(T | C) = \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) = \frac{3}{36} = \frac{1}{12}$$

If **D** happens then in the remaining two throws the total must be 9 and this will happen as : (3,6), (4,5), (5,4) or (6,3)

$$\therefore P(T | D) = \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) = \frac{4}{36} = \frac{1}{9}$$

If **E** happens then in the remaining two throws the total must be 14 or 13 (in order to get a total of 15 in 3 throws). But this is impossible because maximum that can be obtained in the 2nd and 3rd throws is 6 + 6 = 12.

$$\therefore P(T | E) = 0$$

$$\text{Now, } P(T) = P(T \text{ and } A) + P(T \text{ and } B) + P(T \text{ and } C) + P(T \text{ and } D) + P(T \text{ and } E)$$

$$= P(A) \cdot P(T | A) + P(B) \cdot P(T | B) + P(C) \cdot P(T | C) + P(D) \cdot P(T | D) + P(E) \cdot P(T | E)$$

$$= \left(\frac{1}{6} \times \frac{1}{36}\right) + \left(\frac{1}{6} \times \frac{1}{18}\right) + \left(\frac{1}{6} \times \frac{1}{12}\right) + \left(\frac{1}{6} \times \frac{1}{9}\right) + \left(\frac{1}{3} \times 0\right) = \frac{5}{108}$$

$$\therefore P(B|T) = \frac{P(B \text{ and } T)}{P(T)} = \frac{\left(\frac{1}{6} \times \frac{1}{18}\right)}{\frac{5}{108}} = \frac{1}{108} \div \frac{5}{108} = \frac{1}{5}$$

46. Answer : (c)

Reason : I. Males and Females will alternate in the following 2 ways:

A	M	F	M	F	M	F	M	F	M	F	F
----------	---	---	---	---	---	---	---	---	---	---	---

B	F	M	F	M	F	M	F	M	F	M	F
----------	---	---	---	---	---	---	---	---	---	---	---

In **A** the number of ways Male and Females can alternate, can be found out as:

$$= {}^5P_5 \times {}^6P_6 = 120 \times 720 = 86,400$$

In **B** the number of ways Males and Females can alternate = ${}^5P_5 \times {}^6P_6 = 120 \times 720 = 86,400$
A and **B** are mutually exclusive.

Total number of ways in which Males and Females can be called = ${}^{11}P_{11} = 3,99,16,800$

$$P(A) = \frac{86400}{39916800} = 0.00216$$

$$P(B) = \frac{86400}{39916800} = 0.00216$$

However in (A) exact alternation does not take place because the last two calls are for two Females. Since we are required to find out the exact alternation of Male and Females we cannot consider (A). So we have to consider (B) only.

$\therefore$ Probability that Male and Females will be called in exactly alternating sequence = 0.00216.

II. All the Males will be called first and all the Females will be called after the Males in

$${}^5P_5 \times {}^6P_6 = 86,400 \text{ ways}$$

Total no. of ways in which Males and Females can be called = ${}^{11}P_{11} = 3,99,16,800$

$$\therefore \text{Probability that Males will be called first} = \frac{86,400}{3,99,16,800} = 0.00216$$

47. Answer : (e)

Reason : No of ways in which 6 marketing firm ads will be selected from 14 marketing firm ads =

$${}^{14}C_6.$$

No. of ads of marketing firms in Mumbai = 3

No of ads of marketing firms **not** in Mumbai = $14 - 3 = 11$

No of ways in which 6 out of the 11 ads of marketing firms **not** in Mumbai are selected

$$= {}^{11}C_6$$

$$P(\text{Ravi did not apply to a marketing firm in Mumbai}) = \frac{{}^{11}C_6}{{}^{14}C_6} = \frac{462}{3003} = 0.154$$

P(2 of the marketing firms applied to by Ravi are in Mumbai)

$$= \frac{{}^{11}C_4 \times {}^3C_2}{{}^{14}C_6} = \frac{330 \times 3}{3003} = 0.33$$

48. Answer : (b)

Reason : Let the following notations be used:

A: Sunil has committed a crime

A': Sunil has **not** committed a crime

B: Ramesh will lie in the court.

B': Ramesh will speak truth in court
 (i.e. will **not** lie in the court)

Given : P(A) = 0.65

$$P(A') = 1 - 0.65 = 0.35$$

$$P(B|A) = 0.25$$

$$P(B|A') = 0$$

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$$\begin{aligned}
 P(B) &= P(A \text{ and } B) + P(A' \text{ and } B) \\
 &= P(A) \cdot P(B | A) + P(A') \cdot P(B | A') \\
 &= 0.65 \times 0.25 + 0.35 \times 0 \\
 &= 0.1625
 \end{aligned}$$

$$P(B') = 1 - P(B) = 0.8375.$$

49. Answer : (d)

Reason : **The number is odd and is divisible by 3**

No. of values which are **odd** and divisible by 3 =

No. of values divisible by 3 – No of values which are **even** and divisible by 3

$$= \frac{9999}{3} - \frac{9996}{6} = 3333 - 1666 = 1667$$

$$P(\text{Number is divisible by 3} | \text{Number is odd}) = \frac{P(\text{Number is odd and divisible by 3})}{P(\text{Number is odd})}$$

$$\text{No. of values which are odd} = 10,000 - \frac{10,000}{2} = 5,000$$

$$\therefore P(\text{Number is divisible by 3} | \text{Number is odd}) = \frac{\frac{1667}{5000} \cdot \frac{10000}{10000} \cdot C_1}{\frac{1667}{5000} \cdot \frac{10000}{10000} \cdot C_1} = \frac{1667}{5000} = 0.3334$$

50. Answer : (c)

$$\text{Reason : Number of values divisible by 3} = \frac{999}{3} + \frac{1749}{3} = 916$$

$$\text{Number of values divisible by both 3 and 5} = \frac{990}{15} + \frac{1740}{15} = 182$$

$$P(\text{The number is divisible by 3}) = \frac{\frac{916}{2750} \cdot C_1}{\frac{916}{2750} \cdot C_1} = \frac{916}{2750}$$

$$P(\text{The number is divisible by 3 and 5}) = \frac{\frac{182}{2750} \cdot C_1}{\frac{182}{2750} \cdot C_1} = \frac{182}{2750}$$

$P(\text{The number is divisible by 5} | \text{The number is divisible by 3})$

$$= \frac{P(\text{The number is divisible by 3 and 5})}{P(\text{The number is divisible by 3})}$$

$$= \frac{182/2750}{916/2750} = 0.199$$

51. Answer : (c)

Reason : This is an A.P with

$$a = p^2$$

$$d = 2p^2 + q$$

$$\text{No. of terms} = n + 1$$

$$\text{Now, } S_n = \frac{n}{2} [2a + (n-1)d] = \frac{n}{2} [a + t_n]$$

$$\therefore \text{Here, } S_{n+1} = \frac{(n+1)}{2} [p^2 + (2n+1)p^2 + nq]$$

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$$= \frac{(n+1)}{2} [2p^2 + 2np^2 + nq]$$

$$= \frac{(n+1)}{2} [2p^2 + n(2p^2 + q)]$$

52. Answer : (a)

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Reason : This is a G.P with, $a = 2y$ and $r = -\frac{y}{2x}$, $n = 4$

$$S_n = \frac{a(1-r^n)}{1-r} = \frac{a-ar^n}{1-r}$$

$$\therefore S_4 = \frac{2y - 2y\left(-\frac{y}{2x}\right)^4}{1 - \left(-\frac{y}{2x}\right)} = \frac{2y - 2y\left(\frac{y}{2x}\right)^4}{1 + \left(\frac{y}{2x}\right)}$$

53. Answer : (d)

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Reason : Sum of 1st term through 10th term, $S_{10} = \frac{10}{2} [2a + (10-1)d] = 50$

$$\text{Or } 5(2a+9d) = 50$$

$$\text{Or } 2a+9d = 10 \dots\dots(A)$$

Sum of 1st term through 20th term, $S_{20} = S_{10} + \text{Sum of 11th term through 20th term}$

$$\text{Or } \frac{20}{2} [2a + (20-1)d] = 50 + 250$$

$$\text{Or } 10[2a + 19d] = 300$$

$$\text{Or } 2a + 19d = 30 \dots\dots(B)$$

Subtracting (A) from (B)

$$10d = 20$$

$$\text{or } d = \frac{20}{10} = 2$$

Putting $d = 2$, in (A) we get

$$2a + 9 \times 2 = 10$$

$$\text{or } a = \frac{10-18}{2} = -4$$

$$\therefore a = -4, d=2$$

$$\therefore \text{Sum of twenty sixth term through thirtieth term} = S_{30} - S_{25}$$

$$= \frac{30}{2} [2 \times -4 + (30-1)2] - \frac{25}{2} [2 \times -4 + (25-1)2]$$

$$= 15 [-8 + 58] - \frac{25}{2} [-8 + 48]$$

$$= 750 - 500 = 250.$$

54. Answer : (d)

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Reason : $S = \log x + \log 2 + \log x^2 + \log 4 + \log x^3 + \log 8 + \dots\dots\dots + \log x^{10} + \log 1024$
 $= (\log x + \log 2) + (\log x^2 + \log 2^2) + (\log x^3 + \log 2^3) + \dots\dots\dots + (\log x^{10} + \log 2^{10})$
 $= (\log x + \log 2) + (2\log x + 2\log 2) + (3\log x + 3\log 2) + \dots\dots\dots + (10\log x + 10\log 2)$

$$= (\log x + \log 2) + 2(\log x + \log 2) + 3(\log x + \log 2) \dots\dots\dots + 10(\log x + \log 2)$$

$$= \log(2x) + 2\log(2x) + 3\log(2x) + \dots\dots\dots + 10\log(2x)$$

This is an **A.P** with

First term , $a = \log(2x)$

Common difference, $d = \log(2x)$

Number of terms, $n = 10$

$$\therefore \text{Sum, } S = \frac{n}{2} [2a + (n-1)d] = \frac{n}{2} [a + t_n]$$

$$= \frac{10}{2} [\log(2x) + 10\log(2x)]$$

$$= 5 [11\log(2x)]$$

$$= 55 \log(2x)$$

55. Answer : (e)

Reason : $S_6 = 9S_3$

$$\frac{a(1-r^6)}{1-r} = \frac{9a(1-r^3)}{1-r}$$

$$\therefore 1-r^6 = 9(1-r^3)$$

$$\text{or } r^6 - 9r^3 + 8 = 0$$

$$\text{or } r^6 - 8r^3 - r^3 + 8 = 0$$

$$\text{or } r^6 - r^3 - 8(r^3 - 1) = 0$$

$$\text{or } r^3(r^3 - 1) - 8(r^3 - 1) = 0$$

$$\text{or } (r^3 - 8)(r^3 - 1) = 0$$

$$\Rightarrow r^3 = 8 \text{ or } r^3 = 1$$

$$\Rightarrow r = 2 \text{ or } r = 1$$

Since the G.P is increasing 'r' cannot be 1

$$\text{Given : } t_8 = 640$$

$$\text{Or } ar^{8-1} = 640$$

$$\text{Or } a.2^7 = 640$$

$$\text{Or } a = \frac{640}{128} = 5$$

$\therefore$ For the G.P $a = 5$, $r = 2$

$$\therefore \text{ Sum of first ten terms, } S_{10} = \frac{a(1-r^{10})}{1-r} = \frac{5(1-2^{10})}{1-2} = \frac{5(1024-1)}{2-1}$$

$$= 5115$$

56. Answer : (e)

Reason : If the committee should contain **exactly** 2 Frenchmen then we have to choose 2 French men and 4 Indians.

$$\therefore \text{Required number of ways} = {}^4C_2 \times {}^7C_4$$

$$= 210 \text{ ways}$$

If the committee should contain **at least** 2 French men then there should be 2, 3 or 4 Frenchmen and 4, 3 or 2 Indians respectively

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$$\begin{aligned}\therefore \text{Required number of ways} &= {}^4C_2 \times {}^7C_4 + {}^4C_3 \times {}^7C_3 + {}^4C_4 \times {}^7C_2 \\ &= 210 + 140 + 21 \\ &= 371 \text{ ways}\end{aligned}$$

Hence both (b) and (d) are correct.

57. Answer : (e)

Reason : If one specific magazine is to be **included** in every selection then we have to select 4 magazines out of the remaining 11.

$$\therefore \text{No. of ways} = {}^{11}C_4 = 330$$

If one specific magazine is to be **excluded** always then, we have to select the 5 books from the remaining 11

$$\therefore \text{No. of ways} = {}^{11}C_5 = 462$$

58. Answer : (e)

Reason : The no. of ways in which the letters in the word **triangle** can be arranged = ${}^8P_8 = 40320$

The no. of arrangements of the letters in the word **triangle** which will begin with **t** and end with **e** is = ${}^6P_6 = 720$

The no of ways in which the letters of the word **article** can be arranged so that the vowels occupy the even places

$$= {}^3P_3 \times {}^4P_4 = 3! \times 4! = 144.$$

59. Answer : (d)

Reason : Given: $S^2 = 16$

If every item in the data set is multiplied by 2 then the variance of the resulting data set = $16 \times 2^2 = 64$.

60. Answer : (c)

Reason : Mean of the existing data set = $\frac{\sum x}{n} = \frac{140}{10} = 14$

If 6 is added to every observation in the data set then,

Mean of the resulting data set = $14 + 6 = 20$

Variance of the resulting data set will remain unchanged at 9.

$$\begin{aligned}\therefore \text{Coefficient of variation of the resulting data set} &= \frac{S}{\bar{X}} \times 100 \\ &= \frac{\sqrt{9}}{20} \times 100 = 15\%.\end{aligned}$$

61. Answer : (b)

Reason : For the entire sample :

$$\sum_{i=1}^{10} x_i = (40 \times 20) + (6 \times 15) = 170$$

$$\therefore \bar{X} = \frac{170}{10} = 17$$

$$\begin{aligned}\therefore \text{Variance of the sample} &= \frac{1}{n-1} \left[\sum x^2 - n\bar{X}^2 \right] \\ &= \frac{1}{9} \left[2926 - (10 \times 17^2) \right] \\ &= 4.\end{aligned}$$

62. Answer : (d)

Reason : Let the following notations be used:

N_1 : No. of salesmen with 6 years experience

N_2 : No. of salesmen with 12 years experience

$\bar{X}_1$: Average salary of salesmen with 6 years experience

$\bar{X}_2$: Average salary of salesmen with 12 years experience

By the question:

$$\frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2} = 7000$$

$$\text{or } \frac{N_1}{N_1 + N_2} \bar{X}_1 + \frac{N_2}{N_1 + N_2} \bar{X}_2 = 7,000$$

$$\text{or } (1 - 0.25) \bar{X}_1 + (0.25 \times 10,000) = 7,000$$

$$\text{or } 0.75 \bar{X}_1 = 4,500$$

$$\text{or } \bar{X}_1 = 6,000$$

$\therefore$ Average salary of salesmen with 6 years experience = Rs.6,000.

63. Answer : (a)

$$\begin{aligned}\text{Reason : The Harmonic Mean (H.M)} &= \frac{N}{\sum_{i=1}^n \frac{1}{x_i}} \\ &= \frac{8}{\frac{1}{10} + \frac{1}{12} + \frac{1}{8} + \frac{1}{14} + \frac{1}{15} + \frac{1}{7} + \frac{1}{17} + \frac{1}{20}} \\ &= 8 \times \frac{4760}{3323} = 11.46.\end{aligned}$$

64. Answer : (e)

$$\text{Reason : } (y - 8) = \frac{2}{3}(3x - 9)$$

$$\text{Or } 3(y - 8) = 6x - 18$$

$$\text{Or } 3y - 24 = 6x - 18$$

$$\text{Or } 3y = 6x + 24 - 18$$

$$\text{Or } 3y = 6x + 6$$

$$\text{Or } y = \frac{6}{3}x + \frac{6}{3}$$

$$\text{Or } y = 2x + 2$$

$$\therefore \text{Slope} = 2$$

$$\text{Intercept on Y-axis} = 2.$$

65. Answer : (d)

Reason :

Marks	Frequency	Cumulative Frequency
5 – 25	7	7
25 – 45	15	22
45 – 65	18	40
65 – 85	12	52
85 – 105	6	58
105 – 125	2	60
	60	

Median position : $\frac{60+1}{2} = 30.5^{\text{th}}$ value

This falls in the class 45 – 65.

$$\text{Median} = \left[\frac{\left(\frac{N+1}{2} - (F+1) \right)}{f_m} \right] W + L_m$$

Now, $L_m = 45$, $N = 60$, $F = 22$, $W = 20$, $f_m = 18$

$$\therefore \text{Median} = \left[\frac{\left(\frac{60+1}{2} \right) - (22+1)}{18} \right] \times 20 + 45 = \left(\frac{30.5 - 23}{18} \right) \times 20 + 45 = 53.3 \quad (\text{approx.}).$$

66. Answer : (c)

Reason : $\lim_{x \rightarrow 3} \frac{x^2 - 9}{\sqrt{4x - 3} - \sqrt{2x + 3}}$

$$\begin{aligned}
 &= \lim_{x \rightarrow 3} \frac{(x+3)(x-3)}{\sqrt{4x-3} - \sqrt{2x+3}} \times \frac{\sqrt{4x-3} + \sqrt{2x+3}}{\sqrt{4x-3} + \sqrt{2x+3}} \\
 &= \lim_{x \rightarrow 3} \frac{(x+3)(x-3)(\sqrt{4x-3} + \sqrt{2x+3})}{(4x-3) - (2x+3)} \\
 &= \lim_{x \rightarrow 3} \frac{(x+3)(x-3)(\sqrt{4x-3} + \sqrt{2x+3})}{2x-6} \\
 &= \lim_{x \rightarrow 3} \frac{(x+3)(x-3)(\sqrt{4x-3} + \sqrt{2x+3})}{2(x-3)} \\
 &= \lim_{x \rightarrow 3} \frac{(x+3)(\sqrt{4x-3} + \sqrt{2x+3})}{2} \\
 &= \frac{(3+3)\sqrt{12-3} + \sqrt{6+3}}{2} \\
 &= \frac{6 \times 6}{2} = 18.
 \end{aligned}$$

67. Answer : (e)

Reason : $y = \frac{8}{3}x^3 - 28x^2 + 48x + 320$

$$\frac{dy}{dx} = \frac{8}{3} \times 3x^2 - 28 \times 2x + 48 = 8x^2 - 56x + 48$$

The common condition for both maxima and minima is $\frac{dy}{dx} = 0$

$$8x^2 - 56x + 48 = 0$$

$$\text{or } x^2 - 7x + 6 = 0$$

$$\text{or } x^2 - (6+1)x + 6 = 0$$

$$\text{or } x^2 - 6x - x + 6 = 0$$

$$\text{or } x(x-6) - (x-6) = 0$$

$$\text{or } (x-1)(x-6) = 0$$

$$\Rightarrow x = 1 \text{ or } x = 6$$

For **maxima** $\frac{d^2y}{dx^2} < 0$ and for **minima** $\frac{d^2y}{dx^2} > 0$

$$\frac{d^2y}{dx^2} = 16x - 56$$

$$\text{At } x = 1 : \frac{d^2y}{dx^2} = 16 \times 1 - 56 = -40 < 0$$

$\therefore Y$ is **maximum** at $x = 1$

$$\text{At } x = 6 : \frac{d^2y}{dx^2} = 16 \times 6 - 56 = 40 > 0$$

$\therefore Y$ is **minimum** at $x = 6$.

68. Answer : (c)

Reason : 4, 8, 16, 32, 64

This is a G.P with:

$$a = 4$$

$$r = 2$$

The 9th term of the series,

$$t_9 = ar^{9-1} = ar^8 = 4 \times 2^8 = 1024.$$

69. Answer : (d)

Reason : maximum : $Z = t + 4u + 5v + 0s_1 + 0s_2$

Subject to : $2t + u + 3v + s_1 + 0s_2 = 36$

$$t + 2u + v + 0s_1 + s_2 = 42$$

$$t, u, v, s_1, s_2 \geq 0$$

Contribution			1	4	5	0	0	Ratio
Variables			t	u	v	s ₁	s ₂	
Contribution	Variables	Solution						
0	s ₁	36	2	1	3	1	0	36/3=12
0	s ₂	42	1	2	1	0	1	42/1=42
	Z _j - C _j	0	-1	-4	-5	0	0	

Enter solution : Most negative Z_j - C_j value i.e. **v**

Leave solution : Minimum $\left(\frac{36}{3}, \frac{42}{1}\right)$ i.e **s₁**

Tableau 2

Contribution	1	4	5	0	0	Ratio
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Variables			t	u	v	s ₁	s ₂	
Contribution	Variables	Solution						
5	v	12	2/3	1/3	1	1/3	0	$12 \div \frac{1}{3} = 36$
0	s ₂	30	1/3	5/3	0	-1/3	1	$30 \div \frac{5}{3} = 18$
	Z _j - C _j	60	7/3	-7/3	0	5/3	0	

Enter solution : Most negative Z_j - C_j value i.e. **u**

Leave solution : Minimum $\left(\frac{12}{\frac{1}{3}}, \frac{30}{\frac{5}{3}} \right)$ i.e **s₂**

Tableau 3

Contribution			1	4	5	0	0
Variables			t	u	v	s ₁	s ₂
Contribution	Variables	Solution					
5	v	6	3/5	0	1	2/5	$-\frac{1}{5}$
4	u	18	1/5	1	0	-1/5	$\frac{3}{5}$
	Z _j - C _j	102	14/5	0	0	6/5	$\frac{7}{5}$

Since all the Z_j - C_j values are non-negative, the current solution is optimal.

∴ The optimal solution to the LPP is :

$$t = 0$$

$$u = 18$$

$$v = 6$$

70. Answer : (d)

$$\text{Reason : } n_A = 30 \quad \mu_A = 10 \quad \sigma_A = 4$$

$$n_B = 20 \quad \mu_B = 15 \quad \sigma_B = 6$$

$$\mu_c = \text{Combined mean} = \frac{n_A \mu_A + n_B \mu_B}{n_A + n_B} = \frac{(30 \times 10) + (20 \times 15)}{30 + 20} = \frac{600}{50} = 12$$

$$d_A = \mu_A - \mu_c = 10 - 12 = -2$$

$$d_B = \mu_B - \mu_c = 15 - 12 = 3$$

σ_c = Combined standard deviation

$$= \left[\frac{n_A \sigma_A^2 + n_B \sigma_B^2 + n_A d_A^2 + n_B d_B^2}{n_A + n_B} \right]^{\frac{1}{2}}$$

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$$\begin{aligned}
&= \left[\frac{(30 \times 4^2) + (20 \times 6^2) + [30(-2)^2] + (20 \times 3^2)}{30 + 20} \right]^{\frac{1}{2}} \\
&= \left[\frac{480 + 720 + 120 + 180}{50} \right]^{\frac{1}{2}} \\
&= \sqrt{30} \\
&= 5.48
\end{aligned}$$

71. Answer : (c)

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Reason : a. $Y = \frac{x^2 - 12}{x - 4}$

$$\begin{aligned}
\therefore \frac{dy}{dx} &= \frac{(x-4) \cdot \frac{d}{dx}(x^2 - 12) - (x^2 - 12) \cdot \frac{d}{dx}(x-4)}{(x-4)^2} \\
&= \frac{(x-4) \cdot 2x - (x^2 - 12) \cdot 1}{(x-4)^2} = \frac{x^2 - 8x + 12}{(x-4)^2}
\end{aligned}$$

Hence incorrect.

b. $Y = x^2 \cdot \ln(x)$

$$\begin{aligned}
\therefore \frac{dy}{dx} &= x^2 \frac{d}{dx}(\ln(x)) + (\ln(x)) \left(\frac{d}{dx}(x^2) \right) = x^2 \cdot \frac{1}{x} + \ln(x) \cdot (2x) = x + 2x \ln(x) \\
&= x(1 + 2\ln(x))
\end{aligned}$$

Hence incorrect.

c. $Y = e^{3x^2 - 6x + 5}$

Let $Z = 3x^2 - 6x + 5$

$\therefore Y = e^Z$

$$\therefore \frac{dy}{dx} = \frac{dy}{dz} \cdot \frac{dz}{dx} = e^Z \cdot (6x - 6) = 6(x-1)e^{3x^2 - 6x + 5}$$

Hence **correct**.

d. $Y = \frac{9 - x^2}{9 + x^2}$

$$\therefore \frac{dy}{dx} = \frac{(9+x^2) \frac{d}{dx}(9-x^2) - (9-x^2) \frac{d}{dx}(9+x^2)}{(9+x^2)^2} = \frac{(9+x^2)(-2x) - (9-x^2)(2x)}{(9+x^2)^2}$$

$$= \frac{2x[-9 - x^2 - 9 + x^2]}{(9 + x^2)^2} = \frac{2x(-18)}{(9 + x^2)^2} = \frac{-36x}{(9 + x^2)^2}$$

Hence incorrect.

e. $y = x^4 + 2e^x + 10$

$$\therefore \frac{dy}{dx} = 4x^3 + 2e^x$$

Hence incorrect.

72. Answer : (a)

Reason : Since **A** and **B** are non-mutually exclusive events they may occur together, and since they are independent events we can obtain the probability of their joint occurrence as

$$P(A \text{ and } B) = P(A) \cdot P(B) = 0.50 \times 0.60 = 0.30$$

$$\text{Now, } P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$= 0.50 + 0.60 - 0.30 = 0.80$$

$$\begin{aligned} \therefore \text{Probability that neither event } \mathbf{A} \text{ nor event } \mathbf{B} \text{ will occur} &= 1 - P(A \text{ or } B) \\ &= 1 - 0.80 \\ &= 0.20. \end{aligned}$$

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