

Question Paper

Quantitative Methods - I (131): April 2007

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

1. The sum of squares of deviations of a set of n observations from any number, say Z , is the least only when

[< Answer >](#)

- (a) $Z = 0$
- (b) $Z = 1$
- (c) $Z = -1$
- (d) $Z = \bar{x}$
- (e) $Z = x$.

(1 mark)

2. Consider a company with a staff of 60 person, who are distributed according to the value of annual compensation packages given under the following table.

[< Answer >](#)

Positions	Value of Annual Compensations x_i (Rs lac)	No. of Persons Working (w_i)
Senior Level Managers	4.50	08
Middle Rung Managers	2.75	12
Junior Executives	1.50	18
Supervisory Staff	0.75	22

Find the average annual compensation package for the entire staff.

- (a) 1.875
- (b) 2.375
- (c) 3.875
- (d) 4.375
- (e) 5.875.

(2 marks)

3. The following data relates the share price quotations of Reliance Industries Ltd., quoted in the first fortnight of May 2002.

[< Answer >](#)

188.75, 193.75, 217.50, 188.75, 183.75, 210.75, 182.50, 193.75, 189, 193.70, 207.50, 191.25, 197.50, 193.75, 183.75

The mode for the above data is:

- (a) 197.50
- (b) 183.75
- (c) 188.75
- (d) 193.75
- (e) 217.50.

(1 mark)

4. If each value of a series is multiplied by 5, then the coefficient of variation is reduced by

[< Answer >](#)

- (a) 0%
- (b) 10.0%
- (c) 0.1%
- (d) 5.0%
- (e) 0.2%.

(1 mark)

5. The percentage of items that fall within specific ranges under a symmetrical bell-shaped curve is

[< Answer >](#)

- I. About 99 per cent of the values will be in an interval ranging from 3 standard deviations below the mean to 3 standard deviations above the mean.
- II. About 95 per cent of the values will lie within ± 2 standard deviations from the mean.
- III. About 68 per cent of the values in the population will fall within ± 1 standard deviation from the mean.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (II) above
- (e) All (I), (II) and (III) above.

(1 mark)

6. Which of the following is/are the measure(s) of central value(s)?

[< Answer >](#)

- I. Octiles.
- II. Deciles.
- III. Percentiles.
- IV. Mean deviation.
- V. Variance.

- (a) Only (I) above
- (b) Only (IV) above
- (c) Both (IV) and (V) above
- (d) (I), (II) and (III) above
- (e) (I), (II) and (IV) above.

(1 mark)

7. Expression of geometric mean in terms of arithmetic mean and harmonic mean is:

[< Answer >](#)

- (a) $G.M = \sqrt{A.M \times H.M}$
- (b) $G.M \leq \sqrt{A.M \times H.M}$
- (c) $G.M \geq \sqrt{A.M \times H.M}$
- (d) $G.M = \sqrt{A.M \times H.M}$
- (e) $G.M \geq \sqrt{A.M \times H.M}$

(1 mark)

8. The standard deviation of the frequency distribution given below is:

[< Answer >](#)

Class Interval	50-52	53-55	56-58	59-61	62-64
Frequency	5	10	21	8	6

- (a) 11.16
- (b) 3.34
- (c) 124.54
- (d) 12.45
- (e) 5.68.

(2 marks)

9. The coefficient of variation for the following frequency distribution is (approximately):

[< Answer >](#)

Class Interval	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	10	16	34	38	24	18

- (a) 33%
- (b) 44%
- (c) 55%
- (d) 66%
- (e) 77%.

(3 marks)

10. The mean and the standard deviation of the step-deviation of a frequency distribution as given below are 135.3 and 9.6 respectively, the actual length of class intervals is

[< Answer >](#)

u_i	-4	-3	-2	-1	0	1	2	3	Total
f_i	2	5	8	18	22	13	8	4	80

- (a) 5
- (b) 6
- (c) 7
- (d) 8
- (e) 9.

(3 marks)

11. For a distribution the variance is given as 92.16, mean and mode are given as 160 and 140 respectively, then the median of the distribution is (approximately):

[< Answer >](#)

- (a) 153.33
- (b) 150.12
- (c) 155.26
- (d) 149.42
- (e) 157.83.

(2 marks)

12. The following details are available with regard to a data set: $\Sigma x = 27$, $\Sigma x^2 = 156$ and $N = 8$. If each observation in the data set is multiplied by 3 then the standard deviation of the resulting values in the data set will be equal to

[< Answer >](#)

- (a) 3.82
- (b) 4.12
- (c) 9.50
- (d) 8.54
- (e) 3.12.

(2 marks)

13. In solving the linear programming problem, if the type of constraint is less than or equal to type, then the extra variable called slack variable is added, then the coefficient of extra variables in the objective function of type Max. z is

[< Answer >](#)

- (a) 0
- (b) +1
- (c) -1
- (d) +M
- (e) -M.

(1 mark)

14. An engineering company is planning to diversify its operations during the year 2005-06. The company has allocated capital expenditure budget equal to Rs.5.15 crore in the year 2005 and Rs.6.50 crore in the year 2006. The company has five investment projects under consideration. The estimated net returns at the present value and expected cash expenditures on each project in the two years are as follows:

[< Answer >](#)

Project	Estimated net returns	Cash expenditure (in 1000 Rs.)	
		Year 2005	Year 2006
A	240	120	320
B	390	550	594
C	80	118	202
D	150	250	340
E	182	324	474

Assume that the return from a particular project would be in direct proportion to the investment in it, so that, for example if in a project say A, 20% (of 120 in 2005 and 320 in 2006) is invested, then the resulting net return in it would be 20% (of 240). This assumption also implies that individuality of the project should be ignored. In formulating this capital budgeting problem as an LP model to maximize the net return, the objective function is:

- (a) $\text{Max. } z = 240x_1 + 390x_2 + 80x_3 + 150x_4 + 182x_5$
- (b) $\text{Max. } z = 240x_1 + 120x_2 + 320x_3$
- (c) $\text{Max. } z = 120x_1 + 550x_2 + 118x_3 + 250x_4 + 324x_5$
- (d) $\text{Max. } z = 182x_1 + 324x_2 + 474x_3$
- (e) $\text{Max. } z = 320x_1 + 594x_2 + 202x_3 + 340x_4 + 474x_5$

(2 marks)

15. Which of the following is/are the characteristic(s) of the standard form of the linear programming problem? [< Answer >](#)
- I. All the constraints should be expressed as equations by adding slack or surplus and /or artificial variables.
 - II. The right-handed side of each constraint should be made non-negative.
 - III. The objective function should be of maximization type.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (III) above
- (e) All (I), (II) and (III) above.

(1 mark)

16. The vertices of the feasible region for a profit maximizing linear programming problem is bounded by the vertices (0, 0), (0, 8), (12, 0) and (6, 12). The profit function is $Z = 17x + 4y$. The maximum value of Z is [< Answer >](#)

- (a) 150
- (b) 204
- (c) 219
- (d) 286
- (e) 295.

(1 mark)

17. The formulation of linear programming problem is given below. [< Answer >](#)

$$\text{Max. } Z = 2x_1 + 3x_2 + x_3$$

Subject to constraints:

$$4x_1 + 3x_2 + 2x_3 \leq 7$$

$$3x_1 - x_2 + 5x_3 \geq 9$$

$$x_1, x_2, x_3 \geq 0$$

In obtaining the dual of above LPP the subjective constraints can be written as:

- (a) $2y_1 - 3y_2 \geq 4$
 $3y_1 + y_2 \geq 3$
 $y_1 - 5y_2 \geq 2$
- (b) $4y_1 - 3y_2 \geq 2$
 $3y_1 + y_2 \geq 3$
 $2y_1 - 5y_2 \geq 1$
- (c) $4y_1 + 3y_2 + 2y_3 \geq 2$
 $3y_1 + y_2 + 5y_3 \geq 3$
- (d) $4y_1 - 3y_2 \geq 2$
 $y_1 + 2y_2 \geq 3$
 $-5y_1 + 3y_2 \geq 1$
- (e) $4y_1 + 3y_2 \geq 2$
 $3y_1 - y_2 \geq 3$
 $2y_1 + 5y_2 \geq 1.$

(2 marks)

18. In the following linear programming problem, the value of Max.Z is equal to

[< Answer >](#)

$$\text{Max. } Z = 3x_1 + 2x_2 + 5x_3$$

Subject to constraints

$$x_1 + 2x_2 + x_3 \leq 430$$

$$3x_1 + 2x_3 \leq 460$$

$$x_1 + 4x_2 \leq 420$$

$$x_1, x_2, x_3 \geq 0.$$

- (a) 890
- (b) 1050
- (c) 1110
- (d) 1220
- (e) 1350.

(3 marks)

19. The maximum number of basic solutions for the system of simultaneous equations :

[< Answer >](#)

$$4x_1 + 3x_2 + 2x_3 + x_4 = 18$$

$$2x_1 + x_2 + 7x_3 + 5x_4 = 13$$

Where $x_1, x_2, x_3, x_4 \geq 0$.

- (a) 2
- (b) 3
- (c) 4
- (d) 5
- (e) 6.

(2 marks)

20. Which of following statements is/are **false** regarding interpolation?

[< Answer >](#)

- I. It is a statistical technique.
- II. It is a method of statistical estimation.
- III. The figures obtained by interpolation are fairly correct as long as underlying assumptions hold good.
- IV. It allows us to make insertions.
- V. It allows us to forecast a value for some future date.

- (a) Only (II) above
- (b) Only (IV) above
- (c) Only (V) above
- (d) Both (I) and (III) above
- (e) Both (II) and (V) above.

(1 mark)

21. Which of the following is a method of solving interpolation problems?

[< Answer >](#)

- (a) Simplex method
- (b) Dual simplex method
- (c) Graphical method
- (d) Census method
- (e) Revised simplex method.

(1 mark)

22. A project requires an initial outlay of Rs.35 lakh and has the following cost flow projections:

[< Answer >](#)

Year	0	1	2	3	4
Cash flows (Rs. lakh)	35	15	10	10	20

Using interest factor tables and interpolation techniques find out the IRR of the project.

- (a) 19.82%
- (b) 35.10%
- (c) 34.90%
- (d) 10.06%
- (e) 15.73%.

(2 marks)

23. Which of the following is/are **true**?

[< Answer >](#)

- I. Linear approximation method is the only method, which can be used for interpolation.
 - II. Interpolation allows us to anticipate a value for some future date.
 - III. Extrapolation helps in completing the incomplete, lost or destroyed records.
 - IV. There must exist a functional relationship between an independent and dependent variable for interpolation to work.
- (a) Only (I) above
 - (b) Only (IV) above
 - (c) Both (I) and (II) above
 - (d) Both (III) and (IV) above
 - (e) All (I), (II), (III) and (IV) above.

(1 mark)

24. When the values are not equally distributed from the center of the curve, then which of the following is **true**?

[< Answer >](#)

- (a) The curve is symmetric
- (b) The curve is positively skewed
- (c) The curve is negatively skewed
- (d) The curve is either positively or negatively skewed
- (e) The curve is mesokurtic.

(1 mark)

25. Which of the following is a chronological classification?

[< Answer >](#)

- (a) Classification according to place, area and region
- (b) Classification according to lapse of time
- (c) Classification according to attributes of the subjects or items
- (d) Classification according to magnitude of numerical values
- (e) Classification according to place, area, region and magnitude of numerical values.

(1 mark)

26. Which one of the following is a positional average?

[< Answer >](#)

- (a) Moving average
- (b) Arithmetic mean
- (c) Progressive average
- (d) Quartiles
- (e) Harmonic mean.

(1 mark)

27. The histogram graphically shows

[< Answer >](#)

- I. Presence of outliers.
- II. Center of data.
- III. Skewness of data.
- IV. Spread of data.

- (a) Only (I) above
- (b) Only (II) above
- (c) Both (I) and (II) above
- (d) Both (III) and (IV) above
- (e) All (I), (II), (III) and (IV) above.

(1 mark)

28. In preparing frequency distribution tables, the number of classes may be equal to

[< Answer >](#)

- (a) The square of the number of data points
- (b) The square root of the number of data points
- (c) The number of data points
- (d) The cube of the number of data points
- (e) The cube root of the number of data points.

(1 mark)

29. Regarding populations and samples, which of the following statements is/are **false**?

[< Answer >](#)

- I. Statistic pertains to a population, parameter pertains to a sample.
- II. Studying sample is easier than studying the whole population.
- III. A representative sample contains the relevant characteristics of the population in the same proportion as they are included in that population.
- IV. A population is a collection of all the elements we are studying and about which we are trying to draw conclusions.

- (a) Only (I) above
- (b) Only (III) above
- (c) Both (I) and (II) above
- (d) Both (III) and (IV) above
- (e) (II), (III) and (IV) above.

(1 mark)

30. Which of the following indicates the skewness of a distribution?

[< Answer >](#)

- (a) Cumulative frequency curve
- (b) Histogram
- (c) Ogive
- (d) Frequency polygon
- (e) Pie diagrams.

(1 mark)

31. Classical probability approach **cannot** be adopted if which of the following situation(s) exists?

[< Answer >](#)

- I. If the outcomes are not independent.
- II. If the total number of outcomes is infinite.
- III. If each and every outcome is not equally likely.

- (a) Only (I) above
- (b) Both (I) and (II) above
- (c) Both (I) and (III) above
- (d) Both (II) and (III) above
- (e) All (I), (II) and (III) above.

(1 mark)

32. From a well-shuffled pack of cards, four cards are drawn at random. Find the probability that there is one card of each suit.

[< Answer >](#)

- (a) 0.0451
- (b) 0.0054
- (c) 0.1054
- (d) 0.2154
- (e) 0.2145.

(1 mark)

33. If E_1 and E_2 are independent events then which of the following is/are **true**?

[< Answer >](#)

I. E_1 and E_2' are independent.

II. E_1' and E_2 are independent.

III. E_1' and E_2' are independent.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (III) above
- (e) All (I), (II) and (III) above.

(1 mark)

34. Two unbiased dice are thrown, then the probability that the total of the numbers on the dice is any number from 5 to 12(both inclusive) is

[< Answer >](#)

- (a) 0
- (b) 1
- (c) $5/6$
- (d) $5/12$
- (e) $1/6$.

(1 mark)

35. An MCA student applies for a job in two firms X and Y. The probability of his being selected in firm X is 0.8 and being rejected at Y is 0.6. The probability of at least one of his applications being rejected is 0.7. What is the probability that he will be selected in one of the firms?

[< Answer >](#)

- (a) 0.9
- (b) 0.8
- (c) 0.7
- (d) 0.6
- (e) 0.5.

(3 marks)

36. Two dies, one red and the other blue are thrown. Let A be an event that the sum of the points on the faces is odd, and B be the event of at least one ace (number '1'). Then the probability of an event $\bar{A} \cap (A \cup B)$

[< Answer >](#)

- (a) 0
- (b) 1
- (c) 5/36
- (d) 3/13
- (e) 1/16.

(3 marks)

37. If A and B are mutually exclusive events, then

[< Answer >](#)

- (a) $P(A \cup B) = P(A) \cdot P(B)$
- (b) $P(A \cup B) = P(A) + P(B)$
- (c) $P(A \cup B) = P(A)$
- (d) $P(A \cup B) = P(A) / P(B)$
- (e) $P(A \cup B) = 0$

(1 mark)

38. A single letter is taken from the word 'PROBABILITY'. Then the probability that it is a vowel is

[< Answer >](#)

- (a) 0
- (b) 1
- (c) 5/11
- (d) 4/11
- (e) 3/11.

(1 mark)

39. If A and B are any two events, then the probability of occurrence of either A or B is given as:

[< Answer >](#)

- (a) $P(A + B)$
- (b) $P(A \cup B)$
- (c) $P(A \cap B)$
- (d) $P(A)P(B)$
- (e) $P(A/B)$

(1 mark)

40. If A, B and C are three events, then the probability of simultaneous events A, B and C can be expressed as:

[< Answer >](#)

- (a) $P(A \cap B \cap C) = P(A)P(A|B)P(A|C)$
- (b) $P(A \cap B \cap C) = P(A)P(B)P(C)$
- (c) $P(A \cap B \cap C) = P(A)P(B|A)P(C|A)$
- (d) $P(A \cap B \cap C) = P(A)P(B|A)P(C|A \text{ and } B)$
- (e) $P(A \cap B \cap C) = P(A)P(A|B)P(A|C \text{ and } B)$

(1 mark)

41. What is the probability that a leap year selected at random will contain 53 Thursdays?

[< Answer >](#)

- (a) $\frac{1}{7}$
- (b) $\frac{2}{7}$
- (c) $\frac{3}{7}$
- (d) $\frac{4}{7}$
- (e) $\frac{5}{7}$

(1 mark)

42. The probability of a person A winning a race is $\frac{1}{6}$ and the probability of a person B winning the same race is $\frac{1}{7}$, what is the probability that either of them will win?

[< Answer >](#)

- (a) $\frac{11}{21}$
- (b) $\frac{12}{21}$
- (c) $\frac{13}{42}$
- (d) $\frac{14}{22}$
- (e) $\frac{2}{3}$

(1 mark)

43. In a single throw of two dice, the probability of getting a total of 11 is

[< Answer >](#)

- (a) $\frac{1}{12}$
- (b) $\frac{1}{16}$
- (c) $\frac{1}{18}$
- (d) $\frac{1}{24}$
- (e) $\frac{1}{36}$

(1 mark)

44. Three mangoes and five apples are placed in a box. If two fruits are chosen at random, the probability that one is a mango and the other is an apple is

[< Answer >](#)

- (a) $\frac{3}{8}$
- (b) $\frac{5}{8}$
- (c) $\frac{2}{7}$
- (d) $\frac{15}{28}$
- (e) $\frac{17}{28}$

(1 mark)

45. If $X = 1 + \log_a bc$, $Y = 1 + \log_b ca$, $Z = 1 + \log_c ab$ then the value of $XYZ = ?$

[< Answer >](#)

- (a) $XY + XZ + YZ$
- (b) $XY - XZ - YZ$
- (c) $XY + XZ - YZ$
- (d) $XY - XZ + YZ$
- (e) $-XY + XZ + YZ$

(2 marks)

46. The value of $\log_2 \sqrt[5]{256^{\frac{-3}{4}} \sqrt[3]{2^{-1} \times 64^{-2} \times 16^{\frac{5}{2}}}}$ is

[< Answer >](#)

- (a) 1
- (b) 0
- (c) $-7/5$
- (d) $2/3$
- (e) 2.

(1 mark)

47. Evaluate $7 \log \frac{16}{15} + 5 \log \frac{25}{24} + 3 \log \frac{81}{80}$

[< Answer >](#)

- (a) 0
- (b) 1
- (c) $\log 2$
- (d) $\log 7$
- (e) $\log 5$

(2 marks)

48. If $X = \log_{2a} a$, $Y = \log_{3a} 2a$, $Z = \log_{4a} 3a$ then the value of $1 + XYZ$ is equal to

[< Answer >](#)

- (a) 0
- (b) $2YZ$
- (c) $2XZ$
- (d) $2XY$
- (e) $\log a$

(2 marks)

[< Answer >](#)

49. What is the value of $\lim_{x \rightarrow 1} \frac{x^{-5/3} - 1}{x^{-3/4} - 1}$?

- (a) 20/9
- (b) 5/3
- (c) 3/4
- (d) 1
- (e) 0.

(2 marks)

[< Answer >](#)

50. What is the value of $\lim_{x \rightarrow -\infty} \frac{5x^2 - 7x + 6}{x^2 + 8}$?

- (a) 1
- (b) 3
- (c) 4
- (d) 5
- (e) Does not exist.

(1 mark)

[< Answer >](#)

51. What is the value of $\lim_{x \rightarrow 0} \frac{(1+x)^2 - (1-x)^2}{(1+x)^3 - (1-x)^3}$?

- (a) 0
- (b) 1
- (c) 2
- (d) 3
- (e) 2/3.

(2 marks)

[< Answer >](#)

52. What is the value of $\lim_{x \rightarrow 4} \frac{3 - \sqrt{5+x}}{x-4}$?

- (a) 0
- (b) 1
- (c) 4
- (d) $\frac{1}{4}$
- (e) $-\frac{1}{6}$.

(3 marks)

[< Answer >](#)

53. What is the value of $\frac{d}{dx} \left[\frac{1}{x} - x \right]^3$?

- (a) $\frac{1}{x^3}$
- (b) $-\frac{3}{x^3} + \frac{3}{x^2}$
- (c) $-\frac{3}{x^3} + \frac{3}{x^2} + 3$
- (d) $-\frac{3}{x^4} + \frac{3}{x^2} - 3$
- (e) $-\frac{3}{x^4} + \frac{3}{x^2} + 3 - 3x^2$

(2 marks)

[< Answer >](#)

54. If $z = \log \left(y + \frac{x}{y^2} \right)$, then the value of $\frac{\partial z}{\partial y}$.

- (a) $\frac{y+2x}{y^3-x}$
- (b) $\frac{y^3-2x}{y^4+xy}$
- (c) $\frac{y-4x}{y+x}$
- (d) $\frac{x^2-y}{y^4-xy}$
- (e) $\frac{y-2x}{x+xy}$

(2 marks)

[< Answer >](#)

55. If $u = f(x, y) = 4x^2 + 3xy + y^2$ then the value of $\frac{\partial u}{\partial x}$ is equal to

- (a) $3x + 2y$
- (b) $4x + xy$
- (c) $8x + 3y$
- (d) $3y + y^2$
- (e) $4x + 3y$

(1 mark)

[< Answer >](#)

56. If $y = x^3 + 3x^2 - 6x$, then the value of $\frac{d^2y}{dx^2}$ for $x = 1$ is

- (a) 3
- (b) 6
- (c) 9
- (d) 12
- (e) 15.

(1 mark)

[< Answer >](#)

57. The least common multiple of 24 and 45 is

- (a) 60
- (b) 72
- (c) 216
- (d) 360
- (e) 648.

(1 mark)

[< Answer >](#)

58. Which of the following statements is **false**?

- (a) A rational number can be expressed in decimal form
- (b) The set of real numbers does not include complex numbers
- (c) The set of natural numbers is an infinite set
- (d) 2 is a natural number but not a whole number
- (e) The set of integers include positive as well as negative numbers.

(1 mark)

[< Answer >](#)

59. The roots of the equation $2x^2 + x - 3$ are

- (a) 1, $-3/2$
- (b) 3, $1/2$
- (c) 2, $2/3$
- (d) 5, $-1/3$
- (e) 1, 2.

(1 mark)

[< Answer >](#)

60. $x = \frac{m^{(m-1)/n}}{n^{(n+1)/m}}; y = \frac{n^{(1-n)/m}}{m^{(m+3)/n}}$ and $z = \frac{m^{(5/n)}}{n^{(1+2n)/m}}$

The value of xyz is

- (a) $\frac{\sqrt[n]{m}}{\sqrt[n]{n}}$
- (b) $\frac{\sqrt[n]{m}}{\sqrt[n]{n}}$
- (c) $\frac{\sqrt[n]{n}}{\sqrt[n]{m}}$
- (d) $\frac{\sqrt[n]{n}}{\sqrt[n]{m}}$
- (e) $\sqrt[n]{m} \times \sqrt[n]{n}$.

(1 mark)

[< Answer >](#)

61. $\frac{5}{7}y - \frac{1}{2}x + \frac{1}{9}z = 3$
 $\frac{1}{3}x - \frac{3}{7}y + \frac{1}{3}z = 2$
 $\frac{1}{6}x - \frac{2}{7}y + \frac{5}{9}z = 4$

The value of z in the above simultaneous equations would be

- (a) 3
- (b) 6
- (c) 9
- (d) 12
- (e) 18.

(1 mark)

[< Answer >](#)

62. If ${}^{n-1}P_3 : {}^{n+1}P_3 = 5 : 12$ then the value of n is

- (a) 5
- (b) 6
- (c) 7
- (d) 8
- (e) 9.

(2 marks)

[< Answer >](#)

63. How many different arrangements can be made out of the letters MISSISSIPPI?

- (a) 6,300
- (b) 1,512
- (c) 3,628
- (d) 5,760
- (e) 4,528.

(1 mark)

64. A family of 4 males and 3 females is to be arranged in a row for a photograph. In how many ways can they be seated if all the females are to sit together? [< Answer >](#)

- (a) 120
- (b) 240
- (c) 720
- (d) 5040
- (e) 4320.

(1 mark)

65. In how many ways can the letters of the expression $x^3y^4z^5$ can be arranged when written at full length? [< Answer >](#)

- (a) 12!
- (b) 3!4!5!
- (c) 12!–3!4!5!
- (d) $\frac{12!}{3!4!5!}$
- (e) 12!(3!4!5!)

(1 mark)

66. The number of combinations of 18 things taking 15 at a time is [< Answer >](#)

- (a) 816
- (b) 489
- (c) 431
- (d) 256
- (e) 189.

(1 mark)

67. The fifth term of an A.P. is 1, whereas its thirty-first term is –77. Find its twentieth term. [< Answer >](#)

- (a) –47
- (b) –44
- (c) –50
- (d) 70
- (e) 73.

(2 marks)

68. The value of $\frac{\sqrt[8]{a^5} \times \sqrt[16]{a^5} \times \sqrt[8]{a^3} \times \sqrt[16]{a^3}}{\sqrt{a}}$ is equal to [< Answer >](#)

- (a) $\sqrt[4]{a}$
- (b) $\sqrt[3]{a}$
- (c) $\sqrt{a}$
- (d) a
- (e) a^2 .

(1 mark)

69. The sum of first 8 and 19 terms in an A.P are 64 and 361 respectively, the common difference of the series is

[< Answer >](#)

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5.

(1 mark)

70. How many terms of the series 1, 4, 16, must be taken to have their sum equal to 21845?

[< Answer >](#)

- (a) 5
- (b) 6
- (c) 7
- (d) 8
- (e) 9.

(2 marks)

Suggested Answers

Quantitative Methods - I (131): April 2007

1. Answer : (d) ≤

Reason : The sum of squares of deviations of a set on n observations ($x_1, x_2, \dots, x_n$) from any number, say Z, is least only when $Z = \bar{x}$. That is, $\sum (x_i - Z)^2$, which represents the sum of the squares of the deviations of x_i from any number Z, is the least when $Z = \bar{x}$.

2. Answer : (a) ≤

Reason :

Positions	Value of Annual Compensations x_i (Rs lac)	No. of Persons Working w_i	$x_i w_i$
Senior Level Managers	4.50	08	36
MiddleRung Managers	2.75	12	33
Junior Executives	1.50	18	27
Supervisory Staff	0.75	22	16.5
	$\sum x_i = 9.50$	$\sum w_i = 60$	$\sum x_i w_i = 112.5$

$$\bar{x}_w = \frac{\sum x_i w_i}{\sum w_i} = \frac{112.5}{60} = 1.875$$

Annual average compensation package for the entire staff = 1.875.

3. Answer : (d) ≤

Reason : since the share price 193.75 has occurred maximum number of times, the mode is 193.75.

4. Answer : (a) ≤

Reason : If each value of a series is multiplied by any constant, then the coefficient of variation is reduced by 0 percent

5. Answer : (e) ≤

Reason : The percentage of items that fall within specific ranges under a symmetrical bell-shaped curve is

- About 99 percent of the values will be in an interval ranging from 3 standard deviations below the mean to 3 standard deviations above the mean.
- About 95 percent of the values will lie within ± 2 standard deviations from the mean.
- About 68 percent of the values in the population will fall within ± 1 standard deviation from the mean.

Therefore option (e) is correct.

6. Answer : (d) ≤

Reason : Octiles, deciles, percentiles are the measures of central values. Mean deviation and variance are the measures of dispersions.

7. Answer : (a)

≤

Reason : Expression of geometric mean in terms of arithmetic mean and harmonic mean is

$$G.M. = \sqrt{A.M. \times H.M.}$$

8. Answer : (b)

≤

Reason :

C.I	f_i	x_i	$f_i x_i$	x_i^2	$f_i x_i^2$
50-52	5	51	255	2601	13005
53-55	10	54	540	2916	29160
56-58	21	57	1197	3249	68229
59-61	8	60	480	3600	28800
62-64	6	63	378	3969	23814
			2850	16335	163008

$$s^2 = \frac{\sum f_i x_i^2}{\sum f_i} - \left(\frac{\sum f_i x_i}{\sum f_i} \right)^2$$

$$= \frac{163008}{50} - \left(\frac{2850}{50} \right)^2$$

$$= 3260.16 - 3249$$

$$= 11.16$$

$$s = \sqrt{s^2} = \sqrt{11.16} = 3.34$$

9. Answer : (a)

≤

Reason :

C.I	x_i	$u_i = (x_i - A)/c$	f_i	$f_i u_i$	$f_i u_i^2$
10-20	15	-3	10	-30	90
20-30	25	-2	16	-32	64
30-40	35	-1	34	-34	34
40-50	45=A	0	38	0	0
50-60	55	1	24	24	24
60-70	65	2	18	36	72
			140	-36	284

$$\bar{x} = A + C \left(\frac{\sum f_i u_i}{\sum f_i} \right) = 45 + 10 \left(\frac{-36}{140} \right) = 42.43$$

$$s = C \sqrt{\frac{\sum f_i u_i^2}{\sum f_i} - \left(\frac{\sum f_i u_i}{\sum f_i} \right)^2} = 10 \sqrt{\frac{284}{140} - \left(\frac{-36}{140} \right)^2} = 14$$

$$\text{now coefficient of variation} = \frac{s}{\bar{x}} \times 100 = \frac{14}{42.43} \times 100 = 32.99\% \approx 33\%$$

10 Answer : (b)

≤

Reason : arriving at the actual class intervals in this case requires computation of the width of the class interval C, and then obtaining the value of the assumed mean A. According, the necessary computation are as follows:

u_i	f_i	$f_i u_i$	$f_i u_i^2$
-4	2	-8	32
-3	5	-15	45
-2	8	-16	32
-1	18	-18	18
0	22	0	0
1	13	13	13
2	8	16	32
3	4	12	36
		-16	208

$$s = C \sqrt{\frac{\sum f_i u_i^2}{\sum f_i} - \left(\frac{\sum f_i u_i}{\sum f_i} \right)^2}$$

$$9.6 = C \sqrt{\frac{208}{80} - \left(\frac{-16}{80} \right)^2}$$

$$9.6 = C \cdot 1.6$$

$$C = 9.6 / 1.6$$

$$C = 6$$

11 Answer : (a)

≤

Reason : the value of median can be estimated by using the empirical relationship

$$\text{Mean} - \text{Mode} = 3(\text{Mean} - \text{Median})$$

Substituting for mean and mode

$$160 - 140 = 3(160 - \text{Median})$$

$$\text{Median} = (480 - 20) / 3 = 153.33$$

12 Answer : (d)

≤

Reason : Original data set:

$$\sum x = 27 \quad \sum x^2 = 156 \quad N = 8$$

After modification:

$$\sum x = 3 \times 27 = 81$$

$$\sum x^2 = 9 \times 156 = 1404$$

$$\therefore \text{Standard deviation of the resulting data set} = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x}{N} \right)^2}$$

$$= \sqrt{\frac{1404}{8} - \left(\frac{81}{8} \right)^2}$$

$$= 8.54$$

13 Answer : (a) ≤

Reason : In solving the linear programming problem, if the type of constraint is less than or equal to type, then the extra variable called slack variable is added, then the coefficient of extra variables in the objective function of type Max.z/Min.z is 0.

14 Answer : (a) ≤

Reason : Let x_1, x_2, x_3, x_4 and x_5 = proportion of investment in project A, B, C, D and E respectively

$$\text{Then Max.z (net return)} = 240x_1 + 390x_2 + 80x_3 + 150x_4 + 182x_5$$

Therefore (a) is the right answer.

15 Answer : (e) ≤

Reason : Option (e) is the correct answer.

The use of the simplex method to solve an linear programming requires that the problem be converted into its standard form. The standard form of the linear programming problem should have the following characteristics:

- I. All the constraints should be expressed as equations by adding slack or surplus and /or artificial variables.
- II. The right-handed side of each constraint should be made non-negative.
- III. The objective function should be of maximization type.

16 Answer : (b) ≤

Reason : Substitute the different values of X and Y of the vertices of the feasible region and find maximum value of Z as follows:

$$z = 17x + 4y$$

$$\text{for } (0,0), z = 0$$

$$(0,8), z = 17(0) + 4(8) = 32$$

$$(12,0), z = 17(12) + 4(0) = 204$$

$$(6,12), z = 17(6) + 4(12) = 150$$

17 Answer : (b)

$\leq$

Reason : $\text{Max. } Z = 2x_1 + 3x_2 + x_3$

Subject to constraints:

$$4x_1 + 3x_2 + 2x_3 \leq 7$$

$$3x_1 - x_2 + 5x_3 \geq 9$$

$$x_1, x_2, x_3 \geq 0$$

the given problem is first written in the standard primal form as:

$$\text{Max. } Z = 2x_1 + 3x_2 + x_3$$

Subject to constraints:

$$4x_1 + 3x_2 + 2x_3 \leq 7$$

$$-3x_1 + x_2 - 5x_3 \leq -9$$

$$x_1, x_2, x_3 \geq 0$$

now the dual of this problem can be written as

$$\text{Min. } Z = 7y_1 - 9y_2$$

Subject to constraints:

$$4y_1 - 3y_2 \geq 2$$

$$3y_1 + y_2 \geq 3$$

$$2y_1 - 5y_2 \geq 1$$

$$y_1, y_2 \geq 0$$

18 Answer : (e)

≤

Reason :

Basic variables	C _B	X _B	X ₁	X ₂	X ₃	S ₁	S ₂	S ₃	Min Ratio (X _B /X _i)
S ₁	0	430	1	2	1	1	0	0	430/1 = 430
← S ₂	0	460	3	0	2	0	1	0	460/2 = 230 ←
S ₃	0	420	1	4	0	0	0	1	–
X ₁ =X ₂ =X ₃ =0	Z = 0		–3	–2	–5*	0	0	0	←Δj
							↓		
← S ₁	0	200	–½	2	0	1	½	0	200/2 = 100 ←
→ X ₃	5	230	3/2	0	1	0	½	0	–
S ₃	0	420	1	4	0	0	0	1	420/4 = 105
X ₁ =X ₂ =S ₂ =0	Z = 1150		9/2	–2*	0	0	5/2	0	← Δj
							↓		
X ₂	2	100	–¼	1	0	½	–¼	0	
X ₃	5	230	3/2	0	1	0	½	0	
S ₃	0	20	2	0	0	–2	1	1	
X ₁ =S ₂ =S ₃ =0	Z = 1350		4	0	0	1	2	0	←Δj ≥ 0

Since all Δj ≥ 0, the solution is

$$X_1 = 0$$

$$X_2 = 100$$

$$X_3 = 230$$

$$\text{Max.} = 1350.$$

19 Answer : (e)

≤

$${}^4C_2 = \frac{4!}{2!(4-2)!} = 6$$

Reason : The maximum number of basic solutions will be

Therefore (e) is the correct answer.

20 Answer : (c)

≤

Reason : options (I), (II), (III), (IV) are true with regard to the interpolation. Option (v) is false because Extrapolation is used for forecasting purposes. Hence (c) is the answer.

21 Answer : (c)

≤

Reason : the correct answer is (c) . Therefore variety of methods that can be used for interpolation such as graphical method, linear approximation, etc.,

22 Answer : (a)

≤

Reason : let the IRR of the project be 'r'

$$\therefore 35 = \frac{15}{(1+r)^1} + \frac{10}{(1+r)^2} + \frac{10}{(1+r)^3} + \frac{20}{(1+r)^4}$$

for r = 20%,

$$\text{RHS} = \frac{15}{1.20} + \frac{10}{(1.20)^2} + \frac{10}{(1.20)^3} + \frac{20}{(1.20)^4} = 34.876$$

for r = 19%,

$$\text{RHS} = \frac{15}{1.19} + \frac{10}{(1.19)^2} + \frac{10}{(1.19)^3} + \frac{20}{(1.19)^4} = 35.574$$

$$\therefore r = 19 + \frac{35.574 - 35}{35.574 - 34.865} = 19.82\%$$

23 Answer : (b)

≤

Reason : The following statements are true.

1. There are a variety of methods that can be used for interpolation such as graphical method, linear approximation, etc.
2. Interpolation helps in completing the incomplete lost or destroyed records.
3. Extrapolation allows us to forecast or anticipate a value for some future date.
4. There must exist a functional relation between an independent and dependent variable for interpolation to work.

24 Answer: (d)

≤

Reason: When all the values are equally distributed from the center of the curve, then the curve is said to be symmetric curve.

When all the values are not equally distributed from the center of the curve, then the curve may be either positively skewed or negatively skewed depending upon the distribution of values.

25 Answer : (b)

≤

Reason : The classification according to place, area or region comes under geographical classification.

The classification according to lapse of time, e.g., weekly, monthly, yearly, etc., comes under chronological classification. Therefore (b) is the **correct** answer.

The classification according to attributes of the subjects or items, e.g., designation, qualification, knowledge etc., comes under qualitative classification.

The classification according to the magnitude of the numerical values, e.g., income, expenditure, weight, height etc., comes under quantitative classification.

26 Answer : (d)

≤

Reason : Moving average, progressive average and composite average are commercial averages.

Arithmetic mean and Harmonic mean are mathematical averages.

Median and quartiles are positional averages. Therefore (d) is the correct answer.

27 Answer : (e)

≤

Reason : The histogram graphically shows presence of outliers, center of the data, skewness of data, spread of data and also presence of multiple modes in the data.

28 Answer : (b) ≤

Reason : In preparing the frequency table, the number of classes may be equal to square root of the number of data points.

Suppose there are 30 data points then number of classes are equal to $\sqrt{30} = 6$ (approximately).

29 Answer : (a) ≤

Reason : parameter pertains to a population, statistic pertains to a sample.

30 Answer : (d) ≤

Reason : the skewness of the distribution is indicated by the frequency polygon.. Therefore (d) is the correct answer.

31 Answer : (e) ≤

Reason : Classical probability approach cannot be adopted if any of the following situation exists.

If the outcomes are not independent.

If the total number of outcomes is infinite.

If each and every outcome is not equally likely.

Therefore (e) is the correct answer.

32 Answer : (c) ≤

Reason : Exhaustive number of case = $\binom{52}{4}$

Favorable number of cases = $\binom{13}{1} \binom{13}{1} \binom{13}{1} \binom{13}{1}$

Probability that all the four cards drawn are spades =
$$\frac{\binom{13}{1} \binom{13}{1} \binom{13}{1} \binom{13}{1}}{\binom{52}{4}} = 0.1054$$

33 Answer : (e) ≤

Reason : If E_1 and E_2 are independent events then E_1, E_2' ; E_1', E_2 and E_1', E_2' are also independent.

34 Answer : (c) ≤

Reason : The cases favorable to getting a total of the numbers on dice is any number from 5 to 12 (both inclusive) are 30.

Therefore the required probability is $30/36 = 5/6$.

35 Answer : (a)

≤

Reason : let A and B denote the events that the person is selected in firms X and Y respectively.

$$P(A)=0.8 \Rightarrow P(\bar{A})=1-0.8=0.2$$

$$P(\bar{B})=0.6 \Rightarrow P(B)=1-0.6=0.4$$

$$\text{and } P(\bar{A} \cup \bar{B}) = P(\bar{A}) + P(\bar{B}) - P(\bar{A} \cap \bar{B}) = 0.7$$

now the probability that the persons will be selected in one of the two firms X or Y is given by:

$$\begin{aligned} P(A \cup B) &= 1 - P(\bar{A} \cap \bar{B}) \\ &= 1 - \{P(\bar{A}) + P(\bar{B}) - P(\bar{A} \cup \bar{B})\} \\ &= 1 - (0.2 + 0.6 - 0.7) \\ &= 0.9 \end{aligned}$$

36 Answer : (c)

≤

Reason : the sample space contains total 36 elementary events i.e., $n(S)=36$

A = the event that the sum of the numbers shown by the two dice is odd, which implies $n(A)=18$

$$\text{Therefore } P(A) = \frac{18}{36}$$

B = the event that at least one face is 1

$$= \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (3,1), (4,1), (5,1), (6,1)\}$$

$$\text{Therefore } P(B) = \frac{11}{36}$$

$A \cap B$ = the event that sum is odd and at least one face is an ace

$$= \{(1,2), (1,4), (1,6), (2,1), (4,1), (6,1)\}$$

$$P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

Now

$$\begin{aligned} P[\bar{A} \cap (A \cup B)] &= P[(\bar{A} \cap A) \cup (\bar{A} \cap B)] \\ &= P[(\bar{A} \cap B)] \\ &= P(B) - P(A \cap B) \\ &= \frac{11}{36} - \frac{6}{36} \\ &= \frac{5}{36} \end{aligned}$$

37 Answer : (b)

≤

Reason : If A and B are mutually exclusive events, then $P(A \cup B) = P(A) + P(B)$

38 Answer : (d) ≤

Reason : total no. of letter in the word 'probability' are 11
And the no. of vowels in the word 'probability' are 4

$$P(E) = \frac{n(A)}{n(s)} = \frac{4}{11}$$

39 Answer : (b) ≤

Reason : If A and B are any two events, then the probability of occurrence of either A or B is given as: $P(A \cup B)$. Therefore (b) is the correct answer.

40 Answer : (d) ≤

Reason : By using the property of conditional probability, the relation for the simultaneous occurrence of events A, B and C is $P(A \cap B \cap C) = P(A)P(B|A)P(C|A \text{ and } B)$
Therefore (d) is the correct answer.

41 Answer : (b) ≤

Reason : In a leap year there are 52 complete weeks and 2 consecutive extra days. The following are the possible combinations for these two extra days.

1. Sunday and Monday
2. Monday and Tuesday
3. Tuesday and Wednesday
4. Wednesday and Thursday
5. Thursday and Friday
6. Friday and Saturday
7. Saturday and Sunday

In order that a leap year selected at random should contain 53 Thursdays one of the two extra days must be Thursday. Since out of the above 7 possibilities, 4 and 5 are favorable events therefore $P(E) = 2/7$. Therefore (b) is the correct answer.

42 Answer : (c) ≤

Reason : Let the event of the person A winning $= E_1 \Rightarrow P(E_1) = \frac{1}{6}$

and the event of the person B winning $= E_2 \Rightarrow P(E_2) = \frac{1}{7}$

the event of either A or B winning $= E_1 \cup E_2$

Since E_1 and E_2 are mutually exclusive since both of them cannot win together. So the probability of any one of them winning is

$$P(E_1 \cup E_2) = P(E_1) + P(E_2)$$

$$= \frac{1}{6} + \frac{1}{7} = \frac{13}{42}$$

43 Answer : (c)

≤

Reason : The total possible set of numbers = $n(S) = 36$

The set of favorable event = $E = \{6, 5\}, \{5, 6\}$

The number of favorable event = $n(E) = 2$

$$\frac{n(E)}{n(S)} = \frac{2}{36} = \frac{1}{18}$$

Therefore the required probability = $P(E) = \frac{1}{18}$.

44 Answer : (d)

≤

Reason : Total number of ways two fruits can be picked from 8 fruits = $n(S) = {}^8C_2$

The total number of ways one mango and one apple is picked is $n(E) = {}^3C_1 \times {}^5C_1$

$$\frac{n(E)}{n(S)} = \frac{3 \times 5 \times 2}{8 \times 7} = \frac{15}{28}$$

Therefore the probability of the favorable event = $\frac{15}{28}$.

45 Answer : (a)

≤

Reason : Given $1 + \log_a bc = x$

$$\log_a a + \log_a bc = x$$

$$\log_a abc = x \text{ ----- (1)}$$

similarly

$$\log_b abc = y \text{ ----- (2)}$$

$$\log_c abc = z \text{ ----- (3)}$$

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \log_{abc} a + \log_{abc} b + \log_{abc} c$$

$$\Rightarrow \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \log_{abc} abc = 1$$

46 Answer : (c)

≤

$$\text{Reason : } \log_2 \sqrt[5]{\frac{-3}{256} \sqrt[3]{2^{-1} \times 64^{-2} \times 16^{\frac{5}{2}}}}$$

$$\log_2 \sqrt[5]{2^{-6} \sqrt[3]{2^{-3}}}$$

$$= \log_2 \sqrt[5]{2^{-6} 2^{-1}}$$

$$= \log_2 \sqrt[5]{2^{-7}}$$

$$= \log_2 2^{-7/5}$$

$$= \frac{-7}{5} \log_2 2 = \frac{-7}{5}$$

47 Answer : (c)

≤

$$\begin{aligned} \text{Reason : } & 7 \log \frac{2^4}{5 \times 3} + 5 \log \frac{5^2}{3 \times 2^3} + 3 \log \frac{3^4}{5 \times 2^4} \\ &= 7(4 \log 2 - \log 5 - \log 3) + 5(2 \log 5 - \log 3 - 3 \log 2) + 3(4 \log 3 - \log 5 - 4 \log 2) \\ &= \log 2 \end{aligned}$$

48 Answer : (b)

≤

$$\begin{aligned} \text{Reason : } 1 + x y z &= 1 + \log_{2a} a \times \log_{3a} 2a \times \log_{4a} 3a \\ &= 1 + \frac{\log a}{\log 2a} \cdot \frac{\log 2a}{\log 3a} \cdot \frac{\log 3a}{\log 4a} \\ &= \log_{4a} 4a + \log_{4a} a = \log_{4a} (4a)a = \log_{4a} (2a)^2 \\ &= 2 \log_{4a} 2a \\ &= 2 \log_{3a} 2a \cdot \log_{4a} 3a \\ &= 2 y z \end{aligned}$$

49 Answer : (a)

≤

$$\begin{aligned} \text{Reason : } \lim_{x \rightarrow 1} &= \frac{x^{-5/3} - 1^{-5/3}}{x^{-3/4} - 1^{-3/4}} \\ &\text{Divide Numerator and denominator by } x-1 \\ \lim_{x \rightarrow 1} &= \frac{\frac{x^{-5/3} - 1^{-5/3}}{x-1}}{\frac{x^{-3/4} - 1^{-3/4}}{x-1}} = \frac{-\frac{5}{3}(1)^{-5/3} - 1}{-\frac{3}{4}(1)^{-3/4} - 1} = \frac{-5/3}{-3/4} = \frac{20}{9} \end{aligned}$$

50 Answer : (d)

≤

Reason :

$$\lim_{x \rightarrow -\alpha} = \frac{x^2 \left(5 - \frac{7}{x} + \frac{6}{x^2} \right)}{x^2 \left(1 + \frac{8}{x^2} \right)} = \frac{5-0+0}{1+0} = 5$$

51 Answer : (e)

≤

Reason : Divide the Nr. and Dr. by $(1+x) - (1-x)$

$$\begin{aligned} \Rightarrow \lim_{x \rightarrow 0} &= \frac{\frac{(1+x)^2 - (1-x)^2}{(1+x) - (1-x)}}{\frac{(1+x)^3 - (1-x)^3}{(1+x) - (1-x)}} = \frac{\lim_{x \rightarrow 0} \frac{2(1-x)^{2-1}}{x}}{\lim_{x \rightarrow 0} \frac{3(1-x)^{3-1}}{x}} = \frac{2(1-0)^1}{3(1-0)^2} = \frac{2}{3} \end{aligned}$$

52 Answer : (e)

≤

Reason : Rationalize Nr

$$\begin{aligned}
 \lim_{x \rightarrow 4} &= \frac{3 - \sqrt{5+x}}{x-4} \times \frac{3 + \sqrt{5+x}}{3 + \sqrt{5+x}} \\
 \lim_{x \rightarrow 4} &= \frac{(3)^2 - (\sqrt{5+x})^2}{(x-4)(3 + \sqrt{5+x})} \\
 \lim_{x \rightarrow 4} &= \frac{9 - (5+x)}{(x-4)(3 + \sqrt{5+x})} \\
 \lim_{x \rightarrow 4} &= \frac{9 - 5 - x}{(x-4)(3 + \sqrt{5+x})} = \lim_{x \rightarrow 4} = \frac{4 - x}{(x-4)(3 + \sqrt{5+x})} \\
 \lim_{x \rightarrow 4} &= \frac{-(x-4)}{(x-4)(3 + \sqrt{5+x})} = \frac{-1}{3 + \sqrt{5+4}} = \frac{-1}{3 + \sqrt{9}} = \frac{-1}{6}
 \end{aligned}$$

53 Answer : (e)

≤

Reason :

$$\begin{aligned}
 &\frac{d}{dx} \left[\frac{1}{x} - x \right]^3 \\
 &= \frac{d}{dx} \left[\frac{1}{x^3} - 3 \frac{1}{x^2} \times x + 3 \times \frac{1}{x} \times x^2 - x^3 \right] \\
 &= \frac{d}{dx} \left[x^{-3} - \frac{3}{x} + 3x - x^3 \right] \\
 &= \frac{d}{dx} (x^{-3}) - 3 \frac{d}{dx} (x^{-1}) + 3 \frac{d}{dx} (x) - \frac{d}{dx} (x^3) \\
 &= -3x^{-3-1} - 3(-1)x^{-1-1} + 3 \times 1 - 3x^2 \\
 &= -3x^{-4} + 3x^{-2} + 3 - 3x^2 \\
 &= \frac{-3}{x^4} + \frac{3}{x^2} + 3 - 3x^2
 \end{aligned}$$

54 Answer : (b)

≤

Reason :

$$\begin{aligned}
 \frac{\partial z}{\partial y} &= \frac{1}{y + \frac{x}{y^2}} (1 - x^2 y^{-3}) \\
 &= \frac{y^2}{y^3 + x} \left[\frac{y^3 - 2x}{y^3} \right] = \frac{y^3 - 2x}{y^4 + xy}
 \end{aligned}$$

55 Answer : (c)

≤

Reason :

$$\begin{aligned}u &= f(x, y) = 4x^2 + 3xy + y^2 \\ \frac{\delta u}{\delta x} &= \frac{\delta}{\delta x} (4x^2 + 3xy + y^2) \\ &= \frac{\delta}{\delta x} (4x^2) + \frac{\delta}{\delta x} (3xy) + \frac{\delta}{\delta x} (y^2) \\ &= 8x + 3y\end{aligned}$$

56 Answer : (d)

≤

Reason :

$$\begin{aligned}y &= x^3 + 3x^2 - 6x \\ \frac{dy}{dx} &= 3x^2 + 6x - 6 \\ \frac{d^2y}{dx^2} &= 6x + 6 \\ \left(\frac{d^2y}{dx^2} \right)_{x=1} &= 12\end{aligned}$$

57 Answer : (d)

≤

Reason : we first express them in terms of prime factors.

$$24 = 2 \times 2 \times 2 \times 3$$

$$45 = 3 \times 3 \times 5$$

from these we know that 2 should be present at least thrice, 3 should be present at least twice and 5 at least once. All these factors multiplied will give us our LCM.

It will be equal to 360.

58 Answer : (d)

≤

Reason : 2 is both natural number and whole number.

59 Answer : (a)

≤

Reason : the roots of the equation $2x^2 + x - 3$ is

$$\begin{aligned}& \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-1 \pm \sqrt{1^2 - 4(2)(-3)}}{4} \\ &= \frac{-1 \pm 5}{4} \\ &= 1, -3/2\end{aligned}$$

60 Answer : (b)

≤

Reason :

$$\begin{aligned}
 xyz &= \frac{m^{\frac{m-1}{n+1}} \cdot n^{\frac{1-n}{m+3}} \cdot \frac{5}{1-2n}}{n^{\frac{m}{m}} \cdot m^{\frac{n}{n}} \cdot n^{\frac{m}{m}}} \\
 &= \frac{m^{\left(\frac{m-1}{n+1} - \frac{m+3}{n} + \frac{5}{n}\right)}}{n^{\left(\frac{n+1}{m} - \frac{1-n}{m} + \frac{1-2n}{m}\right)}} \\
 &= \frac{m^{\frac{1}{n}}}{\frac{1}{n^m}} = \frac{\sqrt[n]{m}}{\sqrt[n]{n}}
 \end{aligned}$$

61 Answer : (c)

≤

Reason :

$$\begin{aligned}
 \frac{5}{7}y - \frac{1}{2}x + \frac{1}{9}z &= 3 \dots\dots\dots(i) \\
 \frac{1}{3}x - \frac{3}{7}y + \frac{1}{3}z &= 2 \dots\dots\dots(ii) \\
 \frac{1}{6}x - \frac{2}{7}y + \frac{5}{9}z &= 4 \dots\dots\dots(iii) \\
 \text{By doing (i) + (ii) + (iii) we get} \\
 \left(\frac{1}{9} + \frac{1}{3} + \frac{5}{9}\right)z &= (3 + 2 + 4) \\
 \text{Or,} \quad \quad \quad z &= 9
 \end{aligned}$$

62 Answer : (d)

≤

Reason :

$$\begin{aligned}
 {}^{n-1}P_3 : {}^{n+1}P_3 &= 5 : 12 \\
 12 \cdot {}^{n-1}P_3 &= 5 \cdot {}^{n+1}P_3 \\
 12(n-1)(n-2)(n-3) &= 5(n+1)n(n-1) \\
 \Rightarrow 12(n-2)(n-3) &= 5(n+1)n \\
 \Rightarrow 7n^2 - 65n + 72 & \\
 \Rightarrow (7n-9)(n-8) &= 0 \\
 \Rightarrow n = 8 \text{ or } 9/7
 \end{aligned}$$

Since n is a positive integer, n=9/7 is rejected. Therefore n=8

- 63 Answer : (a) ≤
Reason : The word contains 10 letters of which number of S's =4 and number of I's =4 and the rest all different.

Therefore the letters of the word can be arranged in $\frac{10!}{4!4!}=6300$.

- 64 Answer : (c) ≤
Reason : If M_1, M_2, M_3 , and M_4 denotes males, F_1, F_2 and F_3 denotes females, since the females are to sit together for a photograph consider them as one entity F. Then M_1, M_2, M_3, M_4 and F can be arranged in $5!$ ways. These females among themselves can be arranged in $3!$ ways. Since the two operations are independent, the total no. of arrangements is $5!3!=720$.

- 65 Answer : (d) ≤
Reason : $x^3y^4z^5$ at full length can be written as xxxyyyyyzzzzz
In this there are 3 x's , 4y's and 5 z's

Therefore the number of arrangements = $\frac{12!}{3!4!5!}$.

- 66 Answer : (a) ≤
Reason : We have to select 15 things out of 18 without giving any importance to their arrangement. That will be ${}^{18}C_{15}=816$.

- 67 Answer : (b) ≤
Reason : The fifth term of an A.P., $T_5 = a + 4d = 1$,
The thirty first term of the A.P. is $T_{31} = a + 30d = -77$
Solving the above equations we get $a = 13$ and $d = -3$.
The twentieth term is $T_{20} = a + 19d = 13 + 19 \times (-3) = -44$.

- 68 Answer : (d) ≤
Reason : Simplifying the given expression we get
$$a \left\{ \left(\frac{5}{8} + \frac{5}{16} + \frac{3}{8} + \frac{3}{16} \right) - \frac{1}{2} \right\} = a \frac{16}{16} = a$$

- 69 Answer : (b) ≤
Reason :

$S_8 = (2a + 7d)4 = 64$
Or, $2a + 7d = 16$ (i)
 $S_{19} = (2a + 18d) \frac{19}{2} = 361$
Or, $2a + 18d = 38$ (ii)
By (ii) – (i) we get
 $11d = 38 - 16 = 22$
Or, $d = 2$
So, the common difference is 2.

70 Answer : (d)

[≤](#)

Reason : Let the number be n

So the sum is

$$\frac{4^n - 1}{4 - 1} = 21845$$

$$4^n = 21845 \times 3 + 1 = 65536 = 4^8$$

Or, n = 8

So, the series should contain eight terms.

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