

(GCF-14, GCF-15, GCF-16, GCF-17 & GCF-17-A, VCF-3, VDCF-3)

DATE: 12.06.2023

MAXIMUM MARKS: 100

TIMING: 3 Hours

BUSINESS MATHEMATICS, REASONING & STATISTICS

1. If $y = \sqrt{\frac{1-x}{1+x}}$
- Find the value of $(1-x^2) \frac{dy}{dx}$
- (a) y
(b) y^2
(c) $-y$
(d) $-y^2$
2. The gradient of the curve $y = 2x^3 - 3x^2 - 12x + 8$ at $x = 0$ is : –
- (a) -12
(b) 12
(c) 0
(d) None
3. If $A = \{1, 2, 3\}$ and $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2)\}$ is a relation on A, then which one of the following is correct?
- (a) R is reflexive, symmetric and transitive.
(b) R is reflexive, symmetric but not transitive.
(c) R is reflexive, transitive but not symmetric.
(d) R is reflexive, but neither symmetric nor transitive.
4. Solve: $\frac{3x-4}{2} \geq \frac{x+1}{4} - 1$
- (a) $x \geq 8$
(b) $x \leq 8$
(c) $x \geq 1$
(d) $x \leq 1$
5. If α, β be roots of $2x^2 - 4x - 1 = 0$, find the value of $\alpha^3 + \beta^3$?
- (a) 11
(b) -11
(c) 22
(d) -22
6. Solve $x^3 - 6x^2 + 5x + 12 = 0$
- (a) $1, 3, 4$
(b) $-1, 3, 4$
(c) $1, 6, 2$
(d) $1, -6, -2$

7. In an examination 40% students failed in Mathematics, 30% failed in English and 10% failed in both. The percentage of students who passed in both subject is -
(a) 20%
(b) 40%
(c) 60%
(d) 15%
8. The ages (in years) of A and B are in the ratio 5:7. If A were 9 years older and B 9 years younger, the age of A would have been twice the age of B. The present age of B is -
(a) 12 years
(b) 15 years
(c) 21 years
(d) 24 years
9. If Rs. 1380 is divided among A, B and C in such a way that A receives 5 times as much as B's share and is 3 times as much as C's share, then C's share is
(a) Rs. 300
(b) Rs. 600
(c) Rs. 900
(d) Rs. 180
10. Value of $\frac{2a^{1/2} \times a^{2/3} \times 6a^{-7/3}}{9a^{-5/3} \times a^{3/2}}$ if $a=4$
(a) $\frac{1}{3}$
(b) $\frac{1}{2}$
(c) $\frac{1}{4}$
(d) $\frac{1}{9}$
11. 18 litre of pure water was added to vessel containing 80 litre of pure milk. 49 litre of the resultant mixture was then sold and some more quantity of pure milk and pure water was added to the vessel in the respective ratio of 2 : 1. If the resultant respective ratio of milk and water in the vessel was 4 : 1, what was the quantity of pure milk added in the vessel? (in litre)
(a) 4 litre
(b) 8 litre
(c) 10 litre
(d) 12 litre
12. There is 240 litres of a mixture of alcohol and spirit in a pot. Quantity of alcohol is 26%. How much alcohol be mixed to change the quantity to 60%.
(a) 204 ltr.
(b) 160 ltr.
(c) 90 ltr.
(d) 180 ltr.

13. Raman starts walking in the morning facing the Sun. After sometime, he turned to the left later again he turned to his left. At what direction is Raman moving now ?
(a) East
(b) West
(c) South
(d) North
14. Suresh introduces a man as "He is the son of the woman who is the mother of the husband of my mother". How is Suresh related to the man?
(a) Uncle
(b) Son
(c) Cousin
(d) Grandson
15. Which of the following elements should come in a place '?' ?
IR10 KP12 MN14 OL16 ?
(a) RS19
(b) RI19
(c) QR19
(d) QJ18
16. A question and two statements numbered I and II are given below it. You have to decide whether the data provided in the statements are sufficient to answer the question.
How many sons does X have?
Statements:-
I. E and W are only two brothers of P.
II. P is the only daughter of Q and X.
(a) Only statement I is sufficient
(b) Only statement II is sufficient
(c) Both statement I and II are sufficient
(d) Both statement I and II are not sufficient
17. Ravi's father has a son Rohit who has an aunt Laxmi who has a husband Rao whose father-in-law is Mohan. What is the relation of Mohan to Ravi ?
(a) Nephew
(b) Grandfather
(c) Son
(d) Uncle

Directions: Find odd One out of the following (18 - 19):

18. 4, 5, 7, 10, 14, 18, 25, 32
(a) 7
(b) 14
(c) 18
(d) 33
19. 156, 468, 780, 1094, 1404, 1716
(a) 468
(b) 780
(c) 1094
(d) 1716

20. A driver left his village and drove North for 20 km, after which he stopped for breakfast. Then he turned left and drove another 30 km, when he stopped for lunch. After some rest, he again turned left and drove 20 kms before stopping for evening tea. Once more he turned left and drove 30 kms to reach the town where he had supper. After evening tea in which direction did he drive ?
- (a) West
 - (b) East
 - (c) North
 - (d) South
21. Six persons M, N, O, P, Q and R are sitting in two row with three persons in each row, Both the row are in front of each other. Q is not at the end of any row. P is second the left of R. O is the neighbour of Q and diagonally opposite to P. N is the neighbour of R. Who is in front N ? (UPSC (CSAT) 2011)
- (a) R
 - (b) Q
 - (c) P
 - (d) M

Question 22: Seven friends T, U, V, W, X, Y and Z are sitting in a straight line facing north. W sits fifth to the right of T. W does not sit at any of extreme ends. Two people sit between Z and X. Y sits third to the left of U. Y sits exactly in the middle. Z is not an immediate neighbour of Y.

22. What is Z's position with respect to W ?
- (a) Second to the left
 - (b) Third to the right
 - (c) Fourth to the left
 - (d) Third to the left
23. If P is the husband of Q and R is the mother of S and Q. What is R to P ?
- (a) Mother
 - (b) Sister
 - (c) Aunt
 - (d) Mother-in-law
24. X and Y are the children of A. A is the father of X but Y is not his son. How is Y related to A?
- (a) Sister
 - (b) Brother
 - (c) Son
 - (d) Daughter

Number Series-

25. 1, 4, 10, 22, ?, 94
- (a) 46
 - (b) 48
 - (c) 49
 - (d) 47

26. 4, 9, 25, 49, ?, 169, 289, 361
(a) 120
(b) 121
(c) 122
(d) 164
27. If DELHI is coded 73541 and CALCUTTA as 82589662. How can CALICUT be coded?
(a) 5279431
(b) 5978213
(c) 8251896
(d) 8543962
28. If '+' means ' \div ', ' \div ' means 'x', 'x' means '-' and '-' means '+' what will be the value of the following expression ?
 $15 \div 5 \times 9 + 3 - 6 = ?$
(a) 78
(b) 72
(c) 28
(d) 30
29. If the maximum and minimum values of 10 observations are 40 and 10 then coefficient of range is
(a) $\frac{5}{3}$
(b) $\frac{3}{5}$
(c) 30
(d) None of these
30. Find the harmonic mean of the following numbers : $1, \frac{1}{3}, \frac{1}{5}, \dots, \frac{1}{2n-1}$
(a) $\frac{1}{n+1}$
(b) $\frac{1}{n-1}$
(c) $\frac{2}{n}$
(d) $\frac{1}{n}$
31. Age of applicants for life insurance and the premium of insurance-correlation are :
(a) positive
(b) negative
(c) zero
(d) None

32. The odds are 9:5 against a person who is 50 years living till he is 70 and 8:6 against a person who is 60 living till he is 80. Find the probability that at least one of them will be alive after 20 years:
- (a) $\frac{11}{14}$
- (b) $\frac{22}{49}$
- (c) $\frac{31}{49}$
- (d) $\frac{35}{49}$
33. When the two curves of ogive intersect, the point of intersection provides:
- (a) First Quartile
- (b) Second Quartile
- (c) Third Quartile
- (d) Mode
34. Coefficient of Variation if Median = 23, Mode = 29 and Variance = 100 is
- (a) 10%
- (b) 50%
- (c) 20%
- (d) None of these
35. If the standard deviation of 0, 1, 2, 3... 9 is k, than standard deviation of 10, 11, 12, 13,... 19 is
- (a) 10k
- (b) k+10
- (c) k
- (d) $k + \sqrt{10}$
36. The standard deviation calculated from a set of 32 observations is 5. If the sum of the observations is 80, what is the sum of the squares of these observations ?
- (a) 10
- (b) 1000
- (c) 100
- (d) 2000
37. Sum of deviation from mean for any set of observation is -
- (a) Negative
- (b) Positive
- (c) Zero
- (d) None of these
38. Laspeyre's index is based on
- (a) Base Year Quantities
- (b) Current Year Quantities
- (c) Average of base and current year Quantity
- (d) None of these

39. Chain index is equal to:
- (a) link relative of current year $\times \frac{\text{Chain index of the current year}}{100}$
 - (b) link relative of current year $\times \frac{\text{Chain index of the previous year}}{100}$
 - (c) link relative of previous year $\times \frac{\text{Chain index of the current year}}{100}$
 - (d) None of these
40. _____ is the entire upper part of the table which includes columns and sub-column and unit of measurement.
- (a) Stub
 - (b) Box-head
 - (c) Body
 - (d) Caption
41. A sum of money put at compound interest amounts in 2 years to Rs. 672 and in 3 years to Rs. 714. The rate of interest per annum is
- (a) 5.5%
 - (b) 6.0%
 - (c) 6.25%
 - (d) 6.75%
42. If the compound interest on a certain sum at $16\frac{2}{3}\%$ for 3 years is Rs. 1,270, find the simple interest on the same sum at the same rate and for the same period.
- (a) 1,050
 - (b) 1,020
 - (c) 1,080
 - (d) None of these
43. Assuming that the discount rate is 7% per annum, how much would you pay to receive Rs. 80 growing at 5%, annually, forever?
- (a) 3000
 - (b) 2500
 - (c) 4000
 - (d) 5000
44. If ${}^{n+2}C_r = {}^{n+2}C_{10-r}$ then nC_6 equals to
- (a) 8
 - (b) 28
 - (c) 56
 - (d) None of these

45. The number of straight lines can be formed out of 10 point of which 7 are collinear
(a) 24
(b) 21
(c) 25
(d) 26
46. If $F:R \rightarrow R$ is a bijection function given by $f(x) = (x-1)^3 + 2$ then $f^{-1}(x)$ is
(a) $(x-2)^{1/3} + 1$
(b) $(x-2)^{-1/3} + 1$
(c) $(x+2)^{1/3} - 1$
(d) None of these
47. How many words, with or without meaning can be formed by using all the letters of the word "MACHINE", so that the vowels occurs only the odd positions ?
(a) 1440
(b) 720
(c) 576
(d) 640
48. The value of furniture depreciates by 10% a year, if the present value of the furniture in an office is Rs. 21,870, calculate the value of furniture 3 years ago:-
(a) Rs. 30,000
(b) Rs. 35,000
(c) Rs. 40,000
(d) Rs. 50,000
49. How much amount is required to be invested every year so as to accumulate Rs. 4,00,000 at the end of 10 years, if interest is compounded annually at 10%
(a) Rs. 24506.18
(b) Rs. 25098.16
(c) Rs. 22506.18
(d) Rs. 21098.16
50. If $f(x) = 2x+7$ and $g(x) = x^2+7$, $x \in R$, then which value of x will satisfy $f \circ g(x) = 25$?
(a) -1, 1
(b) -2, 2
(c) $-\sqrt{2}, \sqrt{2}$
(d) None
51. Suppose the revenues of a company for five years are:-
- | Year | 2014 | 2015 | 2016 | 2017 | 2018 |
|----------|------|------|------|------|------|
| Revenues | 100 | 120 | 160 | 210 | 280 |
- Calculate compound annual growth rate.
(a) 27.74%
(b) 29.35%
(c) 25.43%
(d) 31.60%

52. If the rate of interests are 6%, 8% and 10% yearly for first, second and third year respectively, then the compound interest for 3 years on the amount Rs. 60,000 will be:-
(a) Rs. 19,446
(b) Rs. 15,556.80
(c) Rs. 16,602
(d) Rs. 75,556.80
53. A car that costs Rs. 6,00,000 is bought by paying Rs. 1,00,000 as down-payment and equal annual payments for three-years. What is the annual installment if the interest is paid at 8% on the remaining amount compounded annually?
(a) Rs. 1,94,016.75
(b) Rs. 2,94,016.75
(c) Rs. 1,61,013.75
(d) Rs. 1,74,016.75
54. A man invested $\frac{1}{3}$ of his capital at 7%, $\frac{1}{4}$ at 8% and the remainder at 10% Simple interest. If his annual income is Rs. 561, the capital is:
(a) Rs. 5400
(b) Rs. 6000
(c) Rs. 6600
(d) Rs. 7200
55. What is the number of ways of arranging the letters of the word "BANANA" so that no two N's appear together ?
(a) 40
(b) 60
(c) 80
(d) 100
56. The sides of a triangle are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. If the perimeter of the triangle is 52 cm, the length of the smallest side is :-
(a) 9 cm
(b) 18 cm
(c) 24 cm
(d) 12 cm
57. $\log (1^3 + 2^3 + 3^3 + \dots + n^3)$ is equal to :-
(a) $2 \log n + 2 \log (n+1) - 2 \log 2$
(b) $\log n + 2 \log (n+1) - 2 \log 2$
(c) $2 \log n + \log (n+1) - 2 \log 2$
(d) None
58. On a certain sum, the simple interest at the end of $6\frac{1}{4}$ year becomes $\frac{3}{8}$ of the sum. The rate of Percentage is:
(a) 7%
(b) 6%
(c) 5%
(d) $5\frac{1}{2}\%$

59. A person received the salary for the 1st Year is Rs. 5,00,000 per year and he received an increment of Rs. 15,000 per year then the sum of the salary he taken in 10 years.
- (a) Rs. 56,75,000
 - (b) Rs. 72,75,000
 - (c) Rs. 63,75,000
 - (d) None
60. A sum compounded annually become $\frac{25}{16}$ times of itself in 2 years, the rate of interest per annum is-
- (a) 5%
 - (b) 12.5%
 - (c) 25%
 - (d) 50%
61. If one root of the equation is $\sqrt{3} + 2$, form the equation.
- (a) $x^2 - 2\sqrt{3}x - 1 = 0$
 - (b) $x^2 - 3x + 1 = 0$
 - (c) $x^2 - 5x + 5 = 0$
 - (d) $x^2 - 4x + 1 = 0$
62. In simple interest if the principal is Rs. 2,000 and the Rate and time are the Roots of the equation $x^2 - 11x + 30 = 0$ then the simple interest is _____
- (a) Rs. 500
 - (b) Rs. 600
 - (c) Rs. 700
 - (d) Rs. 800
63. A certain sum of money triples itself in 8 years with simple rate of annual interest. In how many years it will be five times of itself?
- (a) 16 years
 - (b) 18 years
 - (c) 20 years
 - (d) None of these
64. The sum of digit in unit place of all the numbers, formed with the help of 3, 4, 5, 6 taken all a time is :-
- (a) 432
 - (b) 564
 - (c) 108
 - (d) 36
65. Insert 4 GM's between 9 and 288 :-
- (a) 27, 54, 108, 144
 - (b) 18, 36, 72, 144
 - (c) 36, 72, 144, 208
 - (d) 18, 27, 54, 108

66. In a class of 120 students, 35% students can play only cricket, 45% students can play only table tennis and the remaining students can play both the games. In all how many students can play cricket?
- (a) 55
(b) 66
(c) 60
(d) 70
67. The numbers a, X, c are in A.P. if $X = 25$ and a, Y, c are in G.P. if $Y = 7$, then the value of (a, c) are:
- (a) 1, 16
(b) 1, 25
(c) 1, 36
(d) 1, 49
68. The value of $A^{\frac{1}{2}} \times A^{\frac{1}{4}} \times A^{\frac{1}{8}} \dots \infty$
- (a) zero
(b) Infinity
(c) $\frac{1}{2}$
(d) A
69. How many capital letters of English alphabets have same mirror image?
- (a) 9
(b) 10
(c) 11
(d) 12

Directions (Q. 70-72) : Read the following information carefully and answer the questions, given below :-

- (i) 'P ÷ Q' means P, is Son of Q
(ii) 'P × Q' means P, is Sister of Q
(iii) 'P + Q' means P, is Brother of Q
(iv) 'P - Q' means P, is Mother of Q
70. How is T related to S in the expression?
'T × R + V ÷ S' ?
- (a) Sister
(b) Mother
(c) Aunt
(d) Daughter
71. How is T related to S in the expression?
'T × R ÷ V - S' ?
- (a) Father
(b) Sister
(c) Daughter
(d) Aunt

72. How is V related to T in the expression?

' $T \div R + V \times S$ ' ?

- (a) Aunt
- (b) Nephew
- (c) Niece
- (d) Uncle

73. "The less than Ogive" is a:

- (a) U-shaped curve
- (b) J-shaped curve
- (c) S-shaped curve
- (d) Bell-shaped curve

74. Most of the commonly used frequency curves are:

- (a) Mixed
- (b) Inverted J-shaped
- (c) U-shaped
- (d) Bell-shaped

75. A Pie Diagram used to represent the following data:

Source	Customers	Excise	Income Tax	Wealth Tax
Revenue in millions	120	180	240	180

The Central Angles corresponding to Income Tax and Wealth Tax-

- (a) $(130^\circ, 90^\circ)$
- (b) $120^\circ, 90^\circ$
- (c) $60^\circ, 120^\circ$
- (d) $90^\circ, 60^\circ$

76. The most stable measure of central tendency is:

- (a) Mode
- (b) Median
- (c) Mean
- (d) G.M.

77. The sum of the squares of the deviations of the variable is _____ when taken about AM

- (a) Maximum
- (b) Zero
- (c) Minimum
- (d) None

78. Compute AM, GM and HM FOR 6, 8, 12, 36

- (a) 15.50, 12, 9.93
- (b) 9.93, 15, 8.65
- (c) 9.52, 14.35, 8.65
- (d) 18.25, 19, 7.54

79. If the relationship between x and y is given by $4x-6y=13$ and if the median of x is 16. Find median of y:

- (a) 7.50
- (b) 8.00
- (c) 8.50
- (d) None of these

80. Following are the wages of the labourers: Rs. 82, Rs. 56, Rs. 90, Rs. 50, Rs. 120, Rs. 75, Rs. 75, Rs. 80, Rs. 130, and Rs. 65. Find Q_1 , D_6 , P_{82} .
- (a) Rs. 62.75, Rs. 81.20, Rs. 120.20
 - (b) Rs. 45.35, Rs. 92.50, Rs. 135.20
 - (c) Rs. 56.25, Rs. 110.63, Rs. 85.30
 - (d) Rs. 78.50, Rs. 81.20, Rs. 150.75
81. For a moderately skewed distribution of marks in statistics for a group of 100 students, the mean mark and median mark were found to be 50 and 40. What is the modal mark?
- (a) 15
 - (b) 20
 - (c) 25
 - (d) 30
82. The A.M of square of first '2n' natural numbers is
- (a) $\frac{1}{6}(2n+1)(4n-1)$
 - (b) $\frac{1}{6}(2n-1)(4n-1)$
 - (c) $\frac{1}{6}(2n-1)(4n+1)$
 - (d) $\frac{1}{6}(2n+1)(4n+1)$
83. If the values of y are not affected by changes in the values of x, the variables are said to be:
- (a) Correlated
 - (b) Uncorrelated
 - (c) Both
 - (d) Zero
84. Correlation coefficient is _____ of the units of measurement:
- (a) Dependent
 - (b) Independent
 - (c) Both
 - (d) None
85. If $y = a + bx$, then what is the coefficient of correlation between x and y?
- (a) 1
 - (b) -1
 - (c) 1 or -1 according as $b > 0$ or $b < 0$
 - (d) None of these
86. If the plotted points in a scatter diagram lie from upper left to lower right, then correlation is:
- (a) Positive
 - (b) Zero
 - (c) Negative
 - (d) None of these

87. Co-variance may be positive, negative or zero:
 (a) True
 (b) False
 (c) Both
 (d) None
88. The difference between the observed value and the estimated value in regression analysis is known as:
 (a) Error
 (b) Residue
 (c) Deviation
 (d) (a) or (b)
89. The two lines of regression meet at:
 (a) (\bar{x}, \bar{y})
 (b) (σ_x, σ_y)
 (c) (σ_x^2, σ_y^2)
 (d) (x, y)
90. If the regression coefficient of y on x, the coefficient of correlation between x and y and variance of y are $-3/4$, $-\sqrt{3}/2$ and 4 respectively, what is the variance of x?
 (a) $2/\sqrt{3}/2$
 (b) $16/3$
 (c) $4/3$
 (d) 4
91. Given below the information about the capital employed and profit earned by a company over the last twenty five years:
- | Particulars | Mean | SD |
|----------------------------|------|----|
| Capital employed (000 Rs.) | 62 | 5 |
| Profit earned (000 Rs.) | 25 | 6 |
- Correlation coefficient between capital and profit = 0.92. The sum of the Regression coefficients for the above data would be:
 (a) 1.871
 (b) 2.358
 (c) 1.968
 (d) 2.346
92. If $P(\bar{A} \cup \bar{B}) = 5/6$, $P(A) = 1/2$ and $P(B) = 2/3$, what is $P(A \cup B)$?
 (a) $1/3$
 (b) $5/6$
 (c) $2/3$
 (d) $4/9$

93. Two dice with face marked 1, 2, 3, 4, 5, 6 are thrown simultaneously and the points on the dice are multiplied together. The probability that product is 12 is:
- (a) $4/36$
 - (b) $5/36$
 - (c) $12/36$
 - (d) None
94. A box contains 5 white and 7 black balls. Two successive draws of 3 balls are made (i) with replacement (ii) without replacement. The probability that the first draw would produce white balls and the second draw would produce black balls are respectively:
- (a) $6/321$ and $3/926$
 - (b) $1/20$ and $1/30$
 - (c) $35/144$ and $35/108$
 - (d) $7/968$ and $5/264$
95. The probability that A speaks truth is $4/5$, while the probability for B is $3/4$. The probability that they contradict each other when asked to speak on a fact is:
- (a) $3/20$
 - (b) $1/5$
 - (c) $7/20$
 - (d) $4/5$
96. What is the probability that a leap year selected at random would contain 53 Saturdays?
- (a) $1/7$
 - (b) $2/7$
 - (c) $1/12$
 - (d) $1/4$
97. Variance of a random variable x is given by:
- (a) $E(x - \mu)^2$
 - (b) $E[x - E(x)]^2$
 - (c) $E(x^2 - \mu)$
 - (d) (a) or (b)
98. A Binomial distribution is _____. The parameter(s) are:
- (a) Biparametric, n and q
 - (b) Biparametric, n and p
 - (c) Uniparametric, p
 - (d) Uniparametric, q
99. In Binomial Distribution, $\mu = 4$, $\sigma^2 = 3$, then mode =
- (a) 4
 - (b) 4.25
 - (c) 4.5
 - (d) 4.1

100. A man tosses a fair coin 10 times, the probability that he has heads on the five tosses is:

(a) ${}^{10}C_5 \left(\frac{1}{2}\right)^{10}$

(b) $\left(\frac{1}{2}\right)^{10}$

(c) ${}^5C_1 \left(\frac{1}{2}\right)^{10}$

(d) $\left(\frac{1}{2}\right)^5$

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