

BUSINESS MATHEMATICS
XII - STANDARD
MODEL QUESTION PAPER
(ENGLISH VERSION)

Time Allowed : 3 Hours

Maximum Marks : 200

Section - A

N.B. : (i) Answer all the 40 questions

(ii) Each question carries one mark

(iii) Choose and write the correct answer from the four choices given.

40 x 1 = 40

- 1) The Adjoint of $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$ is
(a) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ (b) $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$ (c) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (d) $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$
- 2) If $AB = BA = |A| I$ then the matrix B is
(a) the inverse of A (b) the transpose of A
(c) the Adjoint of A (d) 2A
- 3) If $A = \begin{pmatrix} 2 & 3 & 1 \\ 3 & 4 & 1 \\ 3 & 7 & 2 \end{pmatrix}$ then $A^{-1} A$ is
(a) 0 (b) A (c) I (d) A^2 .
- 4) The rank of a non singular matrix of order $n \times n$ is
(a) n (b) n^2 (c) 0 (d) 1
- 5) The relation $R = \begin{matrix} & a & b \\ a & \begin{pmatrix} 0 & 1 \end{pmatrix} \\ b & \begin{pmatrix} 1 & 0 \end{pmatrix} \end{matrix}$ is
(a) Reflexive (b) Symmetric (c) Transitive (d) Reflexive and symmetric
- 6) Equation of the directrix of $x^2 = 4ay$ is
(a) $x + a = 0$ (b) $x - a = 0$ (c) $y + a = 0$ (d) $y - a = 0$
- 7) The semi major and semi minor axes of $\frac{x^2}{16} + \frac{y^2}{25} = 1$ is
(a) (4, 5) (b) (8, 10) (c) (5, 4) (d) (10, 8)
- 8) The sum of focal distances of any point on the ellipse is equal to length of its
(a) minor axis (b) semi minor axis (c) major axis (d) semi major axis
- 9) Eccentricity of the rectangular hyperbola is
(a) 2 (b) 1/2 (c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$

- 10) For the cost function $c = \frac{1}{10}e^{2x}$, the marginal cost is
 (a) $\frac{1}{10}$ (b) $\frac{1}{15}e^{2x}$ (c) $\frac{1}{10}e^{2x}$ (d) $\frac{1}{10}e^x$
- 11) Given the demand equation $p = -x + 10$; ($0 \leq x \leq 10$) where p denotes the unit selling price and x denotes the number of units demanded of some product. Then the marginal revenue at $x = 3$ units is
 (a) Rs. 5 (b) Rs. 10 (c) Rs. 4 (d) Rs. 30
- 12) If the rate of change of y with respect to x is 6 and x is changing at 4 units/sec, then the rate of change of y per sec is
 (a) 24 units/sec (b) 10 units/sec (c) 2 units/sec (d) 22 units/sec
- 13) The slope of the tangent at (2, 8) on the curve $y = x^3$ is
 (a) 3 (b) 12 (c) 6 (d) 8
- 14) The slope of the curve $x = y^2 - 6y$ at the point where it crosses the y axis is
 (a) 5 (b) -5 (c) $\frac{1}{6}$ (d) $-\frac{1}{16}$
- 15) $y = x^3$ is always
 (a) An increasing function of x (b) Decreasing function of x
 (c) A constant function (d) None of these
- 16) If $u = e^{x^2+y^2}$, then $\frac{\partial u}{\partial x}$ is equal to
 (a) y^2u (b) x^2u (c) $2xu$ (d) $2yu$
17. If $u = x^y$ ($x > 0$) then $\frac{\partial u}{\partial y}$ is equal to
 a. $x^y \log x$ b) $\log x$ c) $y^x \log x$ d) $\log y^x$
18. The cost function $y = 40 - 4x + x^2$ is minimum when
 a) $x = 2$ b) $x = -2$ c) $x = 4$ d) $x = -4$
19. If $f(x)$ is an odd function then $\int_{-a}^a f(x)dx$ is
 a) 1 b) $2a$ c) 0 d) a
20. The area bounded by the curve $y = e^x$, the x -axis and the lines $x = 0$ and $x = 2$ is
 a) $e^2 - 1$ b) $e^7 + 1$ c) e^2 d) $e^2 - 2$
21. If the marginal cost function $MC = 2 - 4x$, then the cost function is
 a) $2x - 2x^2 + k$ b) $2 - 4x^2$ c) $\frac{2}{x} - 4$ d) $2x - 4x^2$
22. The order and degree of $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{2}{3}} = \frac{d^2y}{dx^2}$ are
 a) 3 and 2 b) 2 and 3 c) 3 and 3 d) 2 and 2

23. The solution of $x dy + y dx = 0$ is

- a) $x + y = c$ b) $x^2 + y^2 = c$ c) $xy = c$ d) $y = cx$

24. The integrating factor of $\left(\frac{dy}{dx} + \frac{2y}{x} = x^3\right)$

- a) $2 \log x$ b) e^{x^2} c) $3 \log(x^2)$ d) x^2

25. The solution of $\frac{d^2y}{dx^2} - y = 0$ is

- a) $(A + B)e^x$ b) $(Ax + B)e^{-x}$ c) $Ae^x + \frac{B}{e^x}$ d) $(A + Bx)e^x$

26. $E =$

- a) $1 + \Delta$ b) $1 - \Delta$ c) $\nabla + 1$ d) $\nabla - 1$

27. When $h = 1$ $\Delta(x^2) =$

- a) $2x$ b) $2x-1$ c) $2x+1$ d) 1

28. If a discrete random variable has the probability mass function is

x	0	1	2	1
p(x)	k	2k	3k	5k

then the value of k is

- a) $\frac{1}{11}$ b) $\frac{2}{11}$ c) $\frac{3}{11}$ d) $\frac{4}{11}$

29. The mean and variance of a binomial distribution are

- a) np, npq b) pq, npq c) np, \sqrt{npq} d) np, nq

30) If X is a poisson variate with $P(X = 1) = P(X = 2)$, the mean of the Poission variate is equal to

- (a) 1 (b) 2 (c) -2 (d) 3

31) The normal distribution curve is

- (a) Bimodal (b) Unimodal (c) Skewed (d) none of these

32) The standard error of the sample mean is

- (a) Type I error
(b) Type II error
(c) Standard deviation of the sampling distribution of the mean
(d) Variance of the sampling distribution of the mean

33) If a random sample of size 64 is taken from a population whose standard deviation is equal to 32, then the standard error of the mean is

- (a) 0.5 (b) 2 (c) 4 (d) 32

- 34) Probability of rejecting the null hypothesis when it is true is
 (a) Type I error (b) Type II error
 (c) Sampling error (d) Standard error
- 35) The Z-value that is used to establish a 95% confidence interval for the estimation of a population parameter is
 (a) 1.28 (b) 1.65 (c) 1.96 (d) 2.58
- 36) A time series consists of
 (a) two components (b) three components (c) four components (d) none of these
- 37) Laspeyre's index formula uses the weights of the
 (a) base year quantities (b) current year quantities
 (c) average of the weights of number of years (d) none of these
- 38) Variation due to assignable causes in the product occur due to
 (a) faulty process (b) carelessness of operators
 (c) poor quality of raw material (d) all the above
- 39) Control charts in statistical quality consist of
 (a) three control lines (b) upper and lower control limits
 (c) the level of process (d) all the above
- 40) The range of correlation co-efficient is
 (a) 0 to ∞ (b) $-\infty$ to ∞
 (c) -1 to 1 (d) none of these

Section - B

N.B. : (i) Answer any 10 questions out of

15 questions given

(ii) Each question carries six marks

10 x 6 = 60

41. Find the inverse of $A = \begin{pmatrix} 2 & 3 & 4 \\ 3 & 2 & 1 \\ 1 & 1 & -2 \end{pmatrix}$, if it exists

42. Find the rank of the matrix $\begin{pmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{pmatrix}$

43. Find the equation of the hyperbola whose eccentricity is $\sqrt{3}$, focus is (1, 2) and the corresponding directrix is $2x + y = 1$.

44. If $y = \frac{1 - 2x}{2 + 3x}$ find $\frac{Ey}{Ex}$. Obtain the values of η when $x = 0$ and $x = 2$.

45. For the cost function $y = 3x \left(\frac{x+7}{x+5} \right) + 5$, prove that the marginal cost falls continuously as the output x increases

46. If $u = \log \sqrt{x^2 + y^2}$, show that $\left(\frac{\partial u}{\partial x} \right)^2 + \left(\frac{\partial u}{\partial y} \right)^2 = \frac{1}{x^2 + y^2}$

47. The elasticity of demand with respect to price for a commodity is a constant and is equal to 2. Find the demand function and hence the total revenue function, given that when the price is 1, the demand is 4.

48. Solve $\frac{dy}{dx} + y \cos x = \frac{1}{2} \sin 2x$

49. Solve $\left(\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 4y = 5 + e^{-x} \right)$

50. Find the missing term from the following data.

x	:	1	2	3	4
$f(x)$:	100	--	126	157

51. Apply Lagrange's formula to find y when $x = 5$ given that

x	:	1	2	3	4	7
y	:	2	4	8	16	128

52. A continuous random variable has the following p.d.f.

$$f(x) = kx^2, \quad 0 \leq x \leq 10$$

= 0 otherwise.

Determine k and evaluate (i) $P(0.2 \leq x \leq 0.5)$ (ii) $P(x \leq 3)$

53. A random sample of marks in mathematics secured by 50 students out of 200 students showed a mean of 75 and a standard deviation of 10. Find the 95% confidence limits for the estimate of their mean marks.

54. Calculate the correlation co-efficient from the following data.

x	:	12	9	8	10	11	13	7
y	:	14	8	6	9	11	12	3

55. Obtain the trend values by the method of Semi-Average

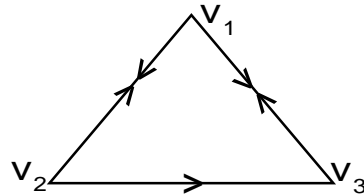
Year	1993	1994	1995	1996	1997	1998	1999	2000
Netprofit (Rs lakhs)	38	39	41	43	40	39	35	25

Section - C

- N.B.** i) Answer any Ten Question out of 15 questions given
 ii) Each question carries 10 marks

10 x 10 = 100

56. Given a directed route G;



Find the route matrix of G and using its powers, find whether G is strongly connected.

57. Suppose the inter-relationship between the production of two industries P and Q in a year (in lakhs of rupees) is

Producer	User		Final Demand	Total Output	
	P	Q			
P	15	10		10	35
Q	20	30		15	65

Find the outputs when the final demand changes to 12 for P and 18 for Q

58. Find the equation to the hyperbola which has the lines $x + 4y - 5 = 0$ and $2x - 3y + 1 = 0$ for its asymptotes and which passes through the point (1, 2).
59. Find the points on the curve $y = (x-1)(x-2)$ at which the tangent makes an angle 135° with the positive direction of the x - axis.
60. Find EOQ for the data given below. Also verify that carrying costs is equal to ordering costs at EOQ.

Item	Monthly Requirements	Ordering cost per order	Carrying cost Per unit
A	9000	Rs. 200	Rs. 3.60

61. The demand for a commodity X is $q_1 = 15 - p_1^2 - 3p_2$ Find the partial elasticities when $p_1=3$ and $p_2 = 1$.

62. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1 + \sqrt{\tan x}}$

63. The demand and supply functions under pure competition are $p_d = 16 - x^2$ and $P_s = 2x^2 + 4$. Find the consumers' surplus and producers' surplus at the market equilibrium price.

64. Suppose that the quantity demanded $Q_d = 42 - 4p - 4\frac{dp}{dt} + \frac{d^2p}{dt^2}$ and quantity supplied $Q_s = -6 + 8p$ where p is the price. Find the equilibrium price for market clearance.

65. Fit a straight line to the following data:

x :	4	8	12	16	20	24
y :	7	9	13	17	21	25

66. Find the mean and variance for the following probability distribution.

$$f(x) = \begin{cases} 2e^{-2x} & , x \geq 0 \\ 0 & , x < 0 \end{cases}$$

67. The diameter of shafts produced in a factory conforms to normal distribution. 31% of the shafts have a diameter less than 45mm. and 8% have more than 64mm. Find the mean and standard deviation of the diameter of shafts.

Given:

Z	0.5	1.41
Area	0.19	0.42

68. To test conjecture of the management that 60 percent employees favour a new bonus scheme, a sample of 150 employees was drawn and their opinioin was taken whether they favoured it or not. Only 55 employees out of 150 favoured the new bonus scheme. Test the conjecture at 1% level of significance.

69. Calculate Fisher's Ideal Index from the following data and show how it satisfies time reversal test and factor reversal test.

Commodity	Base year (1997)		Current year (1998)	
	Price	Quantity	Price	Quantity
A	10	10	12	8
B	8	12	8	13
C	12	12	15	8
D	20	15	25	10
E	5	8	8	8
F	2	10	4	6

70. From the following data construct \bar{X} and R chart and write your conclusion

Sample no	1	2	3	4	5	6	7	8	9
	46	41	43	37	37	37	44	35	37
	40	42	40	40	40	38	39	39	44
	48	49	46	47	46	49	43	48	48
Sample no	10	11	12	13	14	15	16	17	18
	45	48	36	40	42	38	47	42	47
	43	44	42	39	40	40	44	45	42
	49	48	48	48	48	48	49	37	49

(Given for $n = 3$, $A_2 = 1.02$, $D_3 = 0$, $D_4 = 2.58$)
