

# COMMON QUARTERLY EXAMINATION - 2023

**A**

Standard XII

Reg.No. 

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## BUSINESS MATHEMATICS & STATISTICS

Marks : 90

Part - I

20 x 1 = 20

Time : 3.00 hrs

I. Choose the correct answer:

- Which of the following is not an elementary transformation?
  - $R_i \leftrightarrow R_j$
  - $R_i \rightarrow 2R_i + 2C_j$
  - $R_i \rightarrow 2R_i - 4R_j$
  - $C_i \rightarrow C_i + 5C_j$
- If  $A = \begin{bmatrix} 2 & 0 \\ 0 & 8 \end{bmatrix}$ , then  $\rho(A)$  is \_\_\_\_\_.
  - 0
  - 1
  - 2
  - n
- If  $|A_{n \times n}| = 3$  and  $|\text{adj } A| = 243$ , then the value of n is \_\_\_\_\_.
  - 4
  - 5
  - 6
  - 7
- $\Gamma\left(\frac{7}{2}\right) =$  \_\_\_\_\_.
  - $\frac{\sqrt{\pi}}{8}$
  - $\frac{15}{8}\sqrt{\pi}$
  - $\frac{15\sqrt{\pi}}{2}$
  - $\frac{15}{8}$
- $\int \frac{2x^3}{4+x^4} dx$  is \_\_\_\_\_.
  - $\log |4+x^4| + c$
  - $\frac{1}{2} \log |4+x^4| + c$
  - $\frac{1}{4} \log |4+x^4| + c$
  - $\log \left| \frac{2x^3}{4+x^4} \right| + c$
- $\int_{-1}^1 x^3 e^{x^4} dx$  is \_\_\_\_\_.
  - 1
  - $2 \int_0^1 x^3 e^{x^4} dx$
  - 0
  - $e^{x^4}$
- Area bounded by the curve  $y = \frac{1}{x}$  between the limits 1 and 2 is \_\_\_\_\_.
  - log 2 sq.units
  - log 5 sq.units
  - log 3 sq.units
  - log 4 sq.units
- If the marginal revenue of a firm is constant, then the demand function is \_\_\_\_\_.
  - MR
  - MC
  - $C(x)$
  - AC
- The demand and supply function of a commodity are  $D(x) = 25 - 2x$  and  $S(x) = \frac{10+x}{4}$ , then the equilibrium price  $P_0$  is \_\_\_\_\_.
  - 5
  - 2
  - 3
  - 10

10. Order and degree of a differential equation are always \_\_\_\_\_  
 a) negative integers  
 b) integers  
 c) positive integers  
 d) none of these
11. The integrating factor of the differential equation  $\frac{dx}{dy} + Px = Q$  is \_\_\_\_\_  
 a)  $e^{\int Pdx}$   
 b)  $\int Pdx$   
 c)  $\int Pdy$   
 d)  $e^{\int Pdy}$
12. The P.I of  $(3D^2 + D - 14)y = 13e^{2x}$  is \_\_\_\_\_  
 a)  $\frac{x}{2}e^{2x}$   
 b)  $xe^{2x}$   
 c)  $\frac{x^2}{2}e^{2x}$   
 d)  $13xe^{2x}$
13.  $E f(x) =$   
 a)  $f(x-h)$   
 b)  $f(x)$   
 c)  $f(x+h)$   
 d)  $f(x+2h)$
14. Lagrange's interpolation formula can be used for \_\_\_\_\_  
 a) equal intervals only  
 b) unequal intervals only  
 c) both equal and unequal intervals  
 d) none of these
15.  $\Delta \nabla \equiv$  \_\_\_\_\_  
 a)  $\Delta - \Delta$   
 b)  $\nabla - \nabla$   
 c)  $\Delta - \nabla$   
 d)  $\nabla - \Delta$
16. Given  $E(X) = 5$  and  $E(Y) = -2$ , then  $E(X - Y)$  is \_\_\_\_\_  
 a) 3  
 b) 5  
 c) 7  
 d) -2
17. Which of the following is not possible in probability distribution?  
 a)  $\sum P(x) \geq 0$   
 b)  $\sum P(x) = 1$   
 c)  $\sum xP(x) = 2$   
 d)  $P(x) = -0.5$
18.  $E(X - E(X))^2$  is \_\_\_\_\_  
 a)  $E(X)$   
 b)  $E(X^2)$   
 c)  $V(X)$   
 d) S.D(X)
19. The order and degree of the differential equation  $\frac{d^4y}{dx^4} - \left(\frac{d^2y}{dx^2}\right)^4 + \frac{dy}{dx} = 3$   
 a) 4, 4  
 b) 4, 1  
 c) 4, 3  
 d) 2, 4
20. If  $P(A) = P(A, B)$ , then the system is \_\_\_\_\_  
 a) consistent and has infinitely many solutions  
 b) consistent and has a unique solution  
 c) consistent  
 d) inconsistent

## Part - II

II. Answer any 7 questions. (Q.No.30 is compulsory)

7 x 2 = 14

21. Find the rank of the matrix  $\begin{bmatrix} 1 & -1 \\ 3 & -6 \end{bmatrix}$

22. If  $f'(x) = \frac{1}{x}$  and  $f(1) = \frac{\pi}{4}$ , then find  $f(x)$ .

23. If  $MR = 20 - 5x + 3x^2$ , find total revenue function.

24. Find the differential equation of the family of straight lines  $y = mx + c$ , when  $m$  is the arbitrary constant.

25. Find  $\Delta^2 e^x$

26. The discrete random variable X has the probability function.

x	1	2	3	4
P(X = x)	k	2k	3k	4k

Show that  $k = 0.1$

27. If  $f(x) = x^2 + 3x$ , then show that  $\Delta f(x) = 2x + 4$

28. Solve  $(D^2 - 3D - 4)y = 0$

29. Find the area bounded by the line  $y = x$ , the x-axis and the ordinates  $x = 1, x = 2$

30. Evaluate  $\int_0^1 e^{-4x} x^4 dx$

### Part - III

- III. Answer any 7 questions. (Q.No.40 is compulsory)

7 x 3 = 21

31. Show that the equations  $3x - 2y = 6, 6x - 4y = 10$  are inconsistent.

32. Solve the equations  $2x + 3y = 7, 3x + 5y = 9$  by Cramer's rule.

33. Evaluate  $\int (2 \cos x - 3 \sin x + 4 \sec^2 x - 5 \operatorname{cosec}^2 x) dx$

34. The rate of new product is given by  $f(x) = 100 - 90 e^{-x}$  where x is the number of days the product is on the market. Find the total sale during the first four days. ( $e^{-4} = 0.018$ )

35. Evaluate  $\int \frac{6x+7}{\sqrt{3x^2+7x-1}} dx$

36. Solve  $\frac{dy}{dx} + e^x + ye^x = 0$

37. Given  $y_3 = 2, y_4 = -6, y_5 = 8, y_6 = 9, y_7 = 17$ , calculate  $\Delta^4 y_3$

38. What are the properties of Mathematical expectation?

39. The following information is the probability distribution of successes.

No. of successes	0	1	2
Probability	$\frac{6}{11}$	$\frac{9}{22}$	$\frac{1}{22}$

Determine the expected number of success.

40. Solve  $\frac{dy}{dx} + \frac{y}{x} = xe^x$

### Part - IV

- IV. Answer all the questions.

7 x 5 = 35

41. a) An amount of ₹5,000/- is to be deposited in three different bonds bearing 6%, 7% and 8% per year respectively. Total annual income is ₹358/-. If the income from first two investments is ₹70/- more than the income from the third, then find the amount of investment in each bond by rank method.

(OR)

- b) Two types of soaps A and B are in the market. Their present market shares are 15% for A and 85% for B. Of those who bought A the previous year, 65% continue to buy it again while 35% switch over to B. Of those who bought B the previous year, 55% buy it again and 45% switch over to A. Find their market shares after one year and when is the equilibrium reached?

42. a) Evaluate  $\int \frac{\sqrt{x}}{2\sqrt{x} + \sqrt{7-x}} dx$

(OR)

- b) The elasticity of demand with respect to price P for a commodity is  $\eta_d = \frac{P + 2P^2}{100 - P - P^2}$ . Find the demand function where price is ₹5 and the demand is 70.

43. a) Solve the differential equation:  $\frac{dy}{dx} = \frac{3x - 2y}{2x - 3y}$

(OR)

b) Evaluate the integral as the limit of a sum  $\int_1^3 (2x + 3) dx$

44. a) The demand and supply functions under perfect competition are  $P_d = 1600 - x^2$  and  $P_s = 2x^2 + 400$  respectively. Find the consumer's surplus and producer's surplus.

(OR)

- b) Solve  $(D^2 - 3D + 2)y = e^{3x}$  which shall vanish for  $x = 0$  and for  $x = \log 2$

45. a) Find a polynomial of degree two which takes the values

x	0	1	2	3	4	5	6	7
y	1	2	4	7	11	16	22	29

(OR)

- b) A discrete random variable X has the following probability function.

Value of X = x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k <sup>2</sup>	2k <sup>2</sup>	7k <sup>2</sup> +k

- i) Find k  
 ii) Evaluate  $P(x < 6)$ ,  $P(x \geq 6)$  and  $P(0 < x < 5)$   
 iii) If  $P(X \leq x) > \frac{1}{2}$ , then find the minimum value of x.

46. a) The probability density function of a random variable X is  $f(x) = k e^{-|x|}$ ,  $-\infty < x < \infty$ . Find the value of k and also find the mean and variance for the random variable.

(OR)

- b) Using interpolation, find the value of f(x) when x = 15

x	3	7	11	19
f(x)	42	43	47	60

47. a) The marginal cost  $C'(x)$  and marginal revenue  $R'(x)$  are given by

$$C'(x) = 50 + \frac{x}{50} \text{ and } R'(x) = 60$$

The fixed cost is ₹200. Determine the maximum profit.

(OR)

- b) Evaluate:  $\int x \log x dx$

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