COMMON QUARTERLY EXAMINATION - 2024 Reg. No.

XI - BUSINESS MATHS & STATISTICS

Time Allowed : 3.00 Hrs. *Maximum Marks: 90*

Part - I

I. Choose the correct answer: **20 x 1 = 20**

1. The number of Hawkins-Simon conditions for the viability of an input-output analysis is
   a) 1 b) 3 c) 4 d) 2
2. The inventor of input-output analysis is
   a) Sir Francis Galton b) Fisher
   c) Prof.Wassily W.Leontiet d) Arthur Caylay
3. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ then $|2A|$ is equal to
   a) $4\cos 2\theta$ b) 4 c) 2 d) 1
4. If any three rows or columns of a determinant are identical then the value of the determinant is
   a) 0 b) 2 c) 1 d) 3
5. The number of ways selecting 4 players out of 5 is
   a) 4 ! b) 20 c) 25 d) 5
6. If $nP_r = 720\ nC_r$, then r is equal to
   a) 4 b) 5 c) 6 d) 7
7. The middle term in the expansion of $\left(x+\frac{1}{x}\right)^{10}$ is
   a) $10C_4\left(\frac{1}{x}\right)$ b) $10C_5$ c) $10C_6$ d) $10C_7\ x^4$
8. The constant term in the expansion of $\left(x+\frac{2}{x}\right)^6$ is
   a) 156 b) 165 c) 162 d) 160
9. The centre of the circle $x^2 + y^2 - 2x + 2y - 9 = 0$ is
   a) (1,1) b) (–1,–1) c) (–1,1) d) (1,–1)
10. The focus of the parabola $x^2 = 16y$ is
    a) (4,0) b) (–4,0) c) (0,4) d) (0,–4)
11. Length of the latus rectum of the parabola $y^2 = -25x$
    a) 25 b) –5 c) 5 d) –25
12. The eccentricity of the parabola is
    a) 3 b) 2 c) 0 d) 1

13. The value of $\sin 15^\circ$ is

a) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ b) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ c) $\frac{\sqrt{3}}{\sqrt{2}}$ d) $\frac{\sqrt{3}}{2\sqrt{2}}$

14. The value of $\cos^2 45^\circ - \sin^2 45^\circ$ is

a) $\sqrt{3}/2$ b) $1/2$ c) 0 d) $1/\sqrt{2}$

15. The value of $4\cos^3 40^\circ - 3\cos 40^\circ$ is

a) $\sqrt{3}/2$ b) $-1/2$ c) $1/2$ d) $1/\sqrt{2}$

16. If $\tan A = 1/2$ and $\tan B = 1/3$ then $\tan(2A + B)$ is equal to

a) 1 b) 2 c) 3 d) 4

17. If $f(x) = \begin{cases} x^2 - 4x & \text{if } x \geq 2 \\ x + 2 & \text{if } x < 2 \end{cases}$ then $f(5)$ is

a) –1 b) 2 c) 5 d) 7

18. If $y = e^{2x}$, then $\frac{d^2y}{dx^2}$ at $x = 0$ is

a) 4 b) 9 c) 2 d) 0

19. If $y = \log x$ then $y_2 =$

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

20. $\frac{d}{dx}(a^x) =$

a) $\frac{1}{x \log_e a}$ b) a^a c) $x \log_e a$ d) $a^x \log_e a$

Part - II

II. Answer any 7 questions. (Q.No.30 is compulsory) **7 x 2 = 14**

21. If $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, show that $A^2 - 4A + 5I_2 = 0$ and also find A^{-1}.

22. Solve by matrix inversion method : $2x + 3y + 5 = 0$; $x - 2y + 1 = 0$

23. Resolve into partial fraction : $\frac{9}{(x-1)(x+2)^2}$

24. Using Binomial theorem, expand $\left(x^2 + \frac{1}{x^2}\right)^4$

25. Find the locus of the point which equidistant from (2, –3) and (3, –4)

26. Find the centre and radius of the circle $x^2 + y^2 - 8x + 6y - 24 = 0$

27. Find the value of $\tan 75^\circ$.

28. Show that $\frac{\sin 2\theta}{1 + \cos 2\theta} = \tan\theta$

29. Find the domain for which the functions $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal.

30. Evaluate : $\lim_{x \to 2} \frac{x^3 + 2}{x + 1}$

Part - III

III. Answer any 7 questions. (Q.No.40 is compulsory) **7 x 3 = 21**

31. Solve : $\begin{vmatrix} 7 & 4 & 11 \\ -3 & 5 & x \\ -x & 3 & 1 \end{vmatrix} = 0$

32. If $A = \begin{pmatrix} 1 & 2 \\ 1 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 0 & -1 \\ 1 & 2 \end{pmatrix}$, then show that $(AB)^{-1} = B^{-1}A^{-1}$.

33. If $15C_{3r} = 15C_{r+3}$, find 'r'.

34. Expand $(2x + 3y))^5$ using Binomial theorem.

35. Find the acute angle between the lines $2x - y + 3 = 0$ and $x + y + 2 = 0$

36. The supply of a commodity is related to the price by the relation $x = \sqrt{5p - 15}$. Show that the supply curve is parabola.

37. Find the value of $\sin 15^\circ$.

38. Show that $\sin 20^\circ \sin 40^\circ \sin 80^\circ = \frac{\sqrt{3}}{8}$

39. If $f(x) = x^n$ and $f'(1) = 5$, then find the value of 'n'.

40. Find $\frac{dy}{dx}$, $x = ct$, $y = \frac{c}{t}$

Part - IV

IV. Answer all the questions. **7 x 5 = 35**

41. a) Solve by using matrix inversion method :

$3x - 2y + 3z = 8$; $2x + y - z = 1$; $4x - 3y + 2z = 4$

(OR)

b) In an economy, there are two Industries P_1 and P_2 and the following table gives the supply and the demand position in crores of rupees.

Production Sector	***Consumption Sector***		***Final Demand***	***Growth Output***
	P_1	**P_2**		
P_1	10	25	15	50
P_2	20	30	10	60

Determine the outputs when the final demand changes to 35 for P_1 and 42 for P_2

42. a) Show by the principle of Mathematical induction that $3^{2n} - 1$ is divisible by 8 for all $n \in N$

(OR)

b) If $(n+2)C_n = 45$, find n.

43. a) The slope of one of the best straight lines $ax^2 + 2hxy + by^2 = 0$ is twice that of the other, show that $8h^2 = 9ab$.

(OR)

b) Find the equation of the circle passing through the points (0,0), (1,2) and (2,0).

44. a) Prove that $\frac{\sin(180^\circ - \theta)\cos(90^\circ + \theta)\tan(270^\circ - \theta)\cot(360^\circ - \theta)}{\sin(360^\circ - \theta)\cos(360^\circ + \theta)\sin(270^\circ - \theta)\operatorname{cosec}(-\theta)} = -1$

(OR)

b) $\tan 20^\circ \tan 40^\circ \tan 80^\circ = \sqrt{3}$

45. a) If $y = \left(x + \sqrt{1+x^2}\right)^m$, then show that $(1 + x^2)y_2 + xy_1 - m^2y = 0$

(OR)

b) Differentiate : $\sqrt{\frac{(x-3)(x^2+4)}{3x^2+4x+5}}$ with respect to 'x'.

46. a) If $y = 500\, e^{7x} + 600\, e^{-7x}$ then show that $y_2 - 49y = 0$

(OR)

b) Show that $(\cos\alpha + \cos\beta)^2 + (\sin\alpha + \sin\beta)^2 = 4\cos^2\left(\frac{\alpha - \beta}{2}\right)$

47. a) Find the axis, vertex, focus, equation of directrix and the length of latus rectum for the parabola $x^2 + 6x - 4y + 21 = 0$

(OR)

b) Prove that $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \tan^{-1}\left(\frac{2}{9}\right)$