PART-A

I.   Answer all the questions: $10 \times 1 = 10$

1. If $A = \begin{bmatrix} 4 & -1 \\ 0 & 3 \\ 2 & -3 \end{bmatrix}$ find $\dfrac{5A}{2}$

2. Find the number of diagonals of a polygon of 20 sides.

3. Symbolize the proposition "$33 \div 11 \neq 3$ or 8-6=2".

4. Find the compound ratio of 3:4 and 4:7.

5. Define learning curve.

6. Express cos 4A sin 2A into sum or difference of two trigonometric functions.

7. Find radius of the circle $3x^2 + 3y^2 - 6x + 4y + 1 = 0$.

8. Evaluate $\lim\limits_{x \to 0} \dfrac{\sin x^2}{x}$.

9. Differentiate $x^2 - y^2 = a^2$ w.r. to x.

10. Evaluate $\int 4\sec^2 x \, dx$

PART-B

II.   Answer any ten questions: $10 \times 2 = 20$

11. Solve for x and y, $x\begin{bmatrix} 2 \\ 1 \end{bmatrix} + y\begin{bmatrix} 3 \\ 5 \end{bmatrix} + \begin{bmatrix} 4 \\ 6 \end{bmatrix} = \begin{bmatrix} 12 \\ 17 \end{bmatrix}$

12. In how many ways can the letters of the ward 'HOPPER' be arranged?

13. Two coins are tosses simultaneously. What is the probability of getting :

    a) at most 1 tail   b) at least 1tail

14. Find the converse and contrapositive of the proposition "6 is an even number or $\sqrt{5}$ is not rational".

15. If $\dfrac{a}{b} = \dfrac{c}{d}$ then prove that $\dfrac{3a+5b}{3c+5d} = \dfrac{3a-5b}{3c-5d}$.

16. A banker pays Rs 4520 on a bill of Rs 5000, 140days before the legally due date. Find the rate of discount charged by the bankers.

17. If tan $(A-B)=\dfrac{1}{7}$, $\tan A = \dfrac{1}{2}$ show that $A+B=\dfrac{\pi}{4}$.

18. Prove that $\cos^4\theta - \sin^4\theta = 2\cos^2\theta - 1$.

19. Find the equation of the parabola if its Vertex is (0,0), axis is y-axis and passes through (-1, -3).

20. Discuss the continuity of the function $f(x) = \begin{cases} \dfrac{x^2-9}{x-3} & When \ x \neq 3 \\ 4 & When \ x = 3 \end{cases}$ at x = 3

21. If $y = \log\left(\dfrac{1-\cos x}{1+\cos x}\right)$, $prove \ that \ \dfrac{dy}{dx} = 2 cosec x$.

22. If $S = 5t^2 + 4t - 8$. Find the initial velocity and acceleration.

23. Evaluate : $\int x^2 e^x dx$.

24. Evaluate : $\displaystyle\int_{-\pi/4}^{\pi/4} \cos ec^2 x dx$

PART-C

III. **Answer any ten questions:** 10 × 3 = 30

25. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ prove that $A^2 - 4A + 5I$ is a null matrix of order 3 ×3.

26. Solve $\begin{vmatrix} 2+x & 3 & -4 \\ 2 & 3+x & -4 \\ 2 & 3 & -4+x \end{vmatrix} = 0$

27. Out of 4 officers and 10 clerks in an office a committee consisting of two officers and three clerks is to be formed. In how many wayes can this be done if i) any officers and any clerk can be included. ii) One particulars clerk must be on committee. iii) One particular officers cannot be on the committee.

28. Two cards are drown from a pack of playing cards, one after the other. Find the probability of getting a heart in first draw and diamond in the second draw if the cards are drawn. A) Without replacement   b) with replacement.

29. A jar contains two liquids X and Y in the ratio 7:5. When 6 liters of the mixture is drawn and the jar is filled with the same quality of Y, the ratio of X and Y becomes 7:9. Find the quantity X in the jar initially.

30. Mr. Govind buys a tape recorder for Rs 10,260 including sales tax. If the list price of the tape recorder is Rs 9500. Find the rate of sales tax charged?

31. The difference between BD and TD on a certain sum of money due in 6 months is Rs 27. Find the amount of the bill if the rate of interest is 6 % p.a

32. If a client buys shares worth Rs 90,000 and sells shares worth Rs 1,10,000 through a stock brokers, calculate the brokerage payable to the stock broker if the brokerage rate is 0.5% each side.

33. Find the value of k for which the line x + ky – 5 = 0 may touch the circle $x^2 + y^2 - 2x - 6y - 6 = 0$

34. If $x = a \cos^4 \theta$, $y = a \sin^4\theta$ show that $\dfrac{dy}{dx} = -\tan^2\theta$

35. Find the maximum and minimum value $x^3 - 9x^2 + 15x - 1$.

36. The volume of a spherical ball is increasing at the rate of 4π C.C/sec. Find the rate of increase of the radius when the volume is 288π C.C.

37. Evaluate : $\int \dfrac{x+2}{(2x-1)\ (x-3)}dx.$

38. Evaluate : $\int\limits_{0}^{1}\dfrac{e^{x}+1}{e^{x}}dx.$

PART-D

IV.   Answer any six of the following: $6 \times 5 = 30$

39. Find the term independent of x in $\left(\sqrt{x}+\dfrac{1}{3x^2}\right)^{10}$

40. Resolve into partial fraction: $\dfrac{1+2x}{(x+2)^2(x-1)}.$

41. Prove [(p→q)^ (q ^ r)]→ (p→r) is a Tautology.

42. Divide 1647 into three parts such that $\dfrac{3}{7}th$ of the first $\dfrac{2}{3}rd$ of the second and $\dfrac{4}{5}th$ of the third are

    equal.

43. A Motor Company Ltd., has observed that a 90% learning effect applies to all labour related costs. Whenever a new product is taken up for production, the anticipated production to 320 units for the coming year. The production is done in lots of 10 units each. Each lot requires 1000 hrs at Rs.15 /hr. Calculate the total labour hours and labour cost to manufacture 320 units.

44. The angles of elevation of the top of a tower from two points distant a and b (a<b) from its foot and the same straight line from it are 30^0 and 60^0. Show that the height of the tower is $\sqrt{ab}$.

45. Prove that $\cos20^0 \cos40^0 \cos80^0 \cos 60^0 = \dfrac{1}{16}.$

46. Solve by matrix method 3x – y + 12Z = 13, 2x +y – Z = 3, x+3y – 5Z = - 8.

47. If y = a cos (logx) + b sin (logx), show that $x^2 y_2 + xy_1 + y = 0.$

48. Find the area enclosed between the parabola $y^2 = x$ and the line x+y=2.

PART-E

V.   Answer any one of the following: $10 \times 1 = 10$

49. a) Evaluate $\lim\limits_{x\to a}\dfrac{x^n - a^n}{x-a} = na^{n-1}$ for all n.

    b) A company produces two types of leather belts A and B. A is if superior quality and B is of inferior quality. The respective profits are Rs 10 and Rs 5 per belt. The supply of raw material is sufficient for making 850 belts per day. For belt A, a special type of buckle is required and 500 are available per day. There are 700 buckles available for belt B per day. Belt A needs twice as much time as that required for belt B and the company can produce 500 belts if all of them were of type A. Formulate a LPP model.

50. a) Show that the points (2,-4), (0,0), (3,-1) and (3,-3) are concyclic .   (6+4)

    b) Using binomial theorem find the value of $(1.2)^5$ up to 4 places of decimals.