PART-A

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

1. Evaluate $\begin{vmatrix} 81 & 82 & 83 \\ 84 & 85 & 86 \\ 87 & 88 & 89 \end{vmatrix}$

2. Find x if $9_{c_x} + 9_{c_7} = 10_{c_7}$

3. Negate the proposition "If a triangle is a equilateral then its sides are equal and angles are equal".

4. Find the third proportional of 3 and 12.

5. Define "Bankers Discount".

6. Write the value of $\sin 15^0$.

7. Find the radius of the circle $3x^2 + 3y^2 - 6x - 12y - 2 = 0$.

8. Evaluate: $\lim_{x \to 2} \frac{x^3 - 8}{x - 2}$.

9. Differentiate: $\sin^3 \sqrt{x}$.

10. Evaluate: $\int_0^{\frac{\pi}{2}} \sin x \, dx$.

PART-B

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

11. If $\begin{bmatrix} 4 & 5 \\ 3 & 2 \end{bmatrix} + \begin{bmatrix} 2 & x-3 \\ y-4 & 1 \end{bmatrix} = \begin{bmatrix} 6 & 1 \\ 2 & 3 \end{bmatrix}$, find x and y.

12. There are 15 points in a plane of which 5 are collinear. Find the number of straight lines can be formed.

13. Two cards are drawn one after the other from a pack of 52 cards. Find the probability that they are both aces if the first card is replaced.

14. Write the converse and contrapositive of "if 2 straight lines are parallel then they do not intersect".

15. A ratio in the lowest form is 3:8. If the difference between the quantities is 25. Find the quantities.

16. BD and BG on a certain bill due after sometime are Rs.1250 and Rs.50 respectively.
    Find the face value.

17. A person purchased a scooter costing Rs.32450. If the rate of sales tax is 9% calculated the total amount payable by him.

18. Show that $\tan(45^0 + A) \cdot \tan(45^0 - A) = 1$

19. Find the equation of the parabola whose focus is (0,-6) and directrix is y=6.

20. Evaluate: $\lim_{\theta \to 0} \frac{\sin 5\theta}{\tan 2\theta}$.

21. If $x = \log t, y = \frac{1}{t}$ find $\frac{dy}{dx}$.

22. The distance 's' feet travelled by a particle in time 't' second is given by
    $s = t^3 - 6t^2 + 15t + 2$. Find 't' when velocity after 3 seconds.

23. Evaluate: $\int e^x (e^x + 2)^{5/2} dx$.

24. Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\sin x}{1 - \cos x} dx$

PART-C

III   Answer any 10 questions: $10 \times 3 = 30$

25. If $A = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix} \ verify \ A(adjA) = (adjA)A = |A|I$ and I is identity matrix of

    second order

26. Show that $\begin{vmatrix} x & y & y \\ y & x & y \\ y & y & x \end{vmatrix} = (x + 2y)(x - y)^2$ using properties of determinants.

27. Find the number of permutations of the letter of the word ENGINEERING. How many of these
    i) have all the 3E's together
    ii) all the vowels are not together
    iii) no two vowels are together.

28. What is the proability that a card drawn from a pack of playing cards is
    a) diamond or a heart
    b) Red colour or green
    c) spade or jack.

29. 5 carpenters can earn Rs.540 in 6 days, working 9 hours a day. How much will 8 carpenters earn in 12 days working 6 hours a day.

30. A bill for Rs.12900 was drawn on 3 feb 2004 at 6 months and discounted on 13 march 2004 at 8%p.a. For what sum was the bill discounted and how much did the banker gain in this transaction.

31. What is the market value of 9.5% stock when an investment of Rs.12,400 produce income Rs.1472.5.

32. Ananya went to the grocery shop to purchase biscuits for Rs.40, Rice for Rs.50 and wheat for Rs.50, sales tax on each item is 10%. How much should she pay to the shopkeeper.

33. Find the equation of the parabola whose vertex is (0,0), axis is y-axis and passes through $\left(\frac{1}{2}, 2\right)$.

34. If $x^x = y^y, show \ that \ \frac{dy}{dx} = \frac{y(y - x \log y)}{x(x - y \log x)}$.

35. Divide 64 into two parts such that the sum of the cubes of two parts is minimum.

36. The cost function $c = 500x - 20x^2 + \frac{x^2}{3}$ where the output when the marginal cost is equal to average cost.

37. Evaluate: $\int x \log 3x \ dx$

38. Integrate: $cosec^2 x \sqrt{1 + \cot x}$ w.r.t x

PART-D

IV   Answer any six questions: $6 \times 5 = 30$

39. Find the co-efficient of $\frac{1}{x^{17}}$ in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$.

40. Resolve into partial fractions: $\frac{2x+5}{(x+2)(x-1)^2}$

41. Prove $[(p \to q) \land (q \to r)] \to (p \to r)$ is a tautology.

42. Two taps fill a cistern separately in 20 min and 40 min respectively and the drain pipe can drain off 30 liters per min. If all the three pipes are opened the cistern fills in 72 min. What is the capacity of the cistern.

43. A company requires 1000 hours to produce the first 30 units engines. If the learning effect is 90%. Find the total labour cost at Rs.20 per hour to produce total of 120 engines.

44. Maximise: $Z = -x + 2y$ subject to the constraints

$x \geq 3; x + y \geq 5; \ x + 2y \geq 6; x, y \geq 0$.

45. Find the equation of the circle passing through the points (0,5) and (6,1) and has its centre on the

line $2x + 5y = 25$.

46. Prove that $\sin 20° \sin 40° \sin 60° \sin 80° = \frac{3}{16}$.

47. If $y = (x^2 + a^2)^6$ then show that $(x^2 + a^2)\frac{d^2y}{dx^2} - 10x\frac{dy}{dx} - 12y = 0$.

48. Find the area enclosed between the curve $y = 11x - 2y - x^2$ and the line $y = x$.

PART-E

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

49. a) Prove that $\lim_{x \to a} \left(\frac{x^n - a^n}{x - a}\right) = n. a^{n-1}$ for all 'n' belongs to rational number.

   b) Expand $(0.99)^5$ using Binomial theorem upto 4 decimals.

50. a) A sales person has the following record of sales for the month of jan, feb and
       March 2014 for 3 products A,B, C. He has paid a commission at fixed rate per
   unit but at varying rates for product A, B and C.

Months	Sales(units)			Commission(Rs)
	A	B	C	
January	9	12	2	800
February	15	5	4	900
March	6	10	3	950

   Find the rate of commission payable on A, B and C per unit sold by matrix method.
   b) The angle of elevations of the top of an unfinished tower at apoint distance

   120mt from its base is $45°$. How much higher must the tower be raised so that the angle of

   elevation of the same point may be $60°$.

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