Instructions

i) The question paper has five parts A, B, C, D and E. Answer all the parts

ii) Part A carries 20 marks, Part B carries 12 marks, Part C carries 18 marks, Part D carries 20 marks and Part E carries 10 marks

iii) Write the question number properly as indicated in the question paper

PART -A

I. Choose the correct answer (each question carries one mark) 5×1=5

1. If A= $\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ and B= $\begin{bmatrix} -1 \\ 3 \end{bmatrix}$ then AB

   a) $\begin{bmatrix} 10 \\ 10 \end{bmatrix}$　　　　b) $\begin{bmatrix} 10 \\ 0 \end{bmatrix}$　　　　c) $\begin{bmatrix} -10 \\ 10 \end{bmatrix}$　　　　d) $\begin{bmatrix} 0 \\ 10 \end{bmatrix}$

2. How many different signals can be made by taking 3 different coloured flags at a time from 7 different coloured flags.

   a) 252　　　　b) 84　　　　c) 126　　　　d) 210

3. If P(A) = $\frac{3}{4}$, P(B)= $\frac{1}{2}$, P(A∩B)= $\frac{1}{4}$, then P(A/B).

   a) $\frac{1}{2}$　　　　b) $\frac{4}{3}$　　　　c) $\frac{1}{6}$　　　　d) $\frac{3}{8}$

4. Negation of $\sim p \to q$ is

   a) $\sim p \wedge q$　　　　b) $p \wedge q$　　　　c) $\sim p \wedge \sim q$　　　　d) $\sim p \vee q$

5. The duplicate ratio of 25:36 is

   a) 6:9　　　　b) 9:6　　　　c) 5: 6　　　　d) 8:27

6. If $sinA = \frac{1}{2}$ then $sin2A$ is

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

7. The equation of the parabola whose focus is $(0,-2)$ is

   a) $x^2 = 4y$　　　b) $x^2 = -4y$　　　c) $y^2 = 4x$　　　d) $y^2 = -4x$

8. If $y = a^5 + \frac{5^e}{log5}$, then $\frac{dy}{dx}$ is

   a) $5a^4 + \frac{5^e}{log5}$　　　b) 5　　　c) $5a^4 + \frac{e5^{e-1}}{log5}$　　　d) 0

9. Evaluate $\int cosec^2 (5x - 3)dx$

   a) $\frac{-cot\,(5x-3)}{5} + c$　　a) $\frac{cot\,(5x-3)}{5} + c$　　c) $\frac{cot\,(5x-3)}{-3} + c$　　d) $\frac{cot\,(5x-3)}{3} + c$

10. Evaluate $\int_1^2 \frac{1}{2x+3}$

    a) $log\left(\frac{5}{7}\right)$　　　b) $) log\left(\frac{5}{7}\right)$　　　c) $log\left(\frac{15}{7}\right)$　　　d) $log\left(\frac{5}{12}\right)$

II. Match the following   5×1=5

11.

i) If $[2 \quad x \quad 2]\begin{bmatrix}1\\4\\2\end{bmatrix} = [3]$ then x is   a) 5

ii) The value of n if $^nP_5 = 20 \, ^nP_3$ b) $\frac{1-\sqrt{3}}{2\sqrt{2}}$

iii) The mean proportion of $\frac{1}{16}$ and $\frac{1}{25}$ c) $\frac{1}{20}$

iv) The value of $\cos 105^0$ is   d) 3

v) value of $\lim\limits_{x\to0} \frac{tan10x}{sin2x}$ e) 8

        f) $\frac{-3}{4}$

III. Fill in the blanks by choosing appropriate answer from the given options

(15and 25, 25 and 35, $1, -cosec^2x + c, 6, \frac{-2}{3}, 2$)   5×1=5

12. If $\begin{vmatrix} 2x+2 & 3 \\ 2 & 1 \end{vmatrix} = 0$, then 'x' is _____

13. The value of x if $^9C_x + \, ^9C_7 = \, ^{10}C_{7,}$ is _____

14. Two numbers are in the ratio 3:5. If 5 is added to each these are in the ratio 2: 3 then the numbers are _____

15. The equation of latus rectum and of the parabola $3x^2 = -8y$ is   y= _____

16. The value of $\int_0^{\frac{\pi}{2}} sinx \, dx$ is _____

PART- B

IV. Answer any SIX questions   6×2=12

17. If $A = \begin{bmatrix} 2 & 3 & -1 \\ 1 & -1 & 0 \end{bmatrix}$ then find AA'.

18. Find the number of straight lines and triangles that can be formed out of 20 points of which 8 are collinear

19. The probability of occurrence of two events A and B are $\frac{1}{4}$ and $\frac{1}{2}$ respectively. The probability of their simultaneous occurrence is $\frac{7}{50}$. What is the probability that neither A nor B occurs?

20. The ages of father and his son in the ratio 6:1 . After 14 years their age will be in the ratio 8:3 what are their present ages?

21. The BG on a certain on a certain bill due 6 months hence is ₹10,the rate of interest being 10% p.a.Find the face value of the bill and the true present value.

22. Find the fous and equation of latus rectum of the parabola $y^2 = -12x$

23. Find dy/dx if x=a cos(log t) and y=a log(cos t).

24. The Surface area of spherical soap bubble increasing at the rate of 0.6 cm²/sec. Find the rate at which its volume is increasing when its radius is 3cm

25. Find the area bounded by the curve $3x^2 = 4y$,y axis and the lines $y = 1$ and $y = 2$.

PART -C

V. Answer any SIX of the following questions   6×3=18

26. Solve using Cramer's Rule:

$3x + 2y = 8, 4x - 3y = 5$

27. How many 5 digit numbers can be formed using the digits 1, 2, 3, 5, 7, 8, 9 (no digits being repeated). How many of these are

    (a) divisible by 5

    (b) ending with 25

    (c) less than 50,000

28. 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 quantity of Y ,the ratio of X and Y becomes 7:9. Find the quantity of X in the jar.

29. The bankers gain on a bill is $\frac{1}{9}^{th}$ of the bankers discount, rate of interest is 10% p.a.Find the unexpired period of the bill.

30. A man invests equal sums of money in 4%, 5% and 6% stock, each stock being at par. If the total income of the man is 3,600. Find his total investment.

31. A shopkeeper sells an item at the price of ₹810 including ST of 8% what should a customer pay for the same item if the ST is reduced to 6%.

32. Evaluate $\int \frac{3}{(x+1)(x+2)} \, dx$

33. Evaluate $\int_0^{\frac{\pi}{2}} x \cos x \, dx$

34. Let the demand function of an article be $p = 75 - 2x$ and the cost function be $C(x) = 350 + 12x + \frac{x^2}{4}$. Find the number of units and the price at which the total profit is maximum.

PART -D

VI. Answer any FOUR following question   5×4=20

35. Verify A.adjA = adjA . A =$|A|I$ for the matrix
    $$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -3 & 1 \\ 3 & 1 & -2 \end{bmatrix}$$

36. Resolve $\frac{2x^2-4x+1}{(x-2)(x-3)^2}$ into partial fractions.

37. Verify the following proposition $[(p \to q) \wedge (q \to r)] \to (p \to r)$ is a tautology, contradiction or neither.

38. 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 hours at ₹15 per hour. Calculate the total labour hours and labour cost to manufacture 320 units.

39. Solve the LPP graphically: Maximize z = 5x + 3y subject to the constraints

    3x + 5y ≤ 15

    5x + 2y ≤ 10

    x ≥ 0, y ≥ 0

40. If A+B+C =180 then prove that

    sin 2A + sin2B + sin2C = 4 sinA sinB sinC

41. If y= a cos (log x)+b sin(log x) ,show that $x^2 y_2 + x y_1 + y = 0$.

PART-E

42. Prove that $\lim\limits_{x \to a} \left[\dfrac{x^n - a^n}{x-a}\right] = na^{n-1}$ for all rational values of n **(6 MARKS)**

OR

Show that the points $(2, -4), (3, -1), (3, -3)$ and $(0,0)$ are concyclic.

43. Thes shadow of a tower standing on a level plane is found to be 50 metres longer when sun's altitude is $30°$ than when it is $60°$. Find the height of the tower. **(4 MARKS)**

OR

Find the value of $(1.2)^4$ using binomial theorem upto 5 places of decimal