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Subject Code : 75 (NS)

BASIC MATHEMATICS

(Kannada and English Versions)

Time : 3 Hours 15 Minutes]

[Total No. of questions : 50]

[Max. Marks : 100

(English Version)

- Instructions :**
1. The question paper has 5 parts A, B, C, D and E. Answer all the Parts.
 2. Part – A carries 10 marks, Part – B carries 20 marks, Part – C carries 30 marks, Part – D carries 30 marks and Part – E carries 10 marks.
 3. Write the question number properly as indicated in the question paper.

PART – A

I. Answer all the ten questions :

(10 × 1 = 10)

- 1) If $A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$ then, find $3A$.
- 2) If $n_{c_4} = n_{c_5}$, find the value of n .
- 3) Write symbolically "If a quadrilateral is a square, then it is a rectangle".
- 4) Find the triplicate ratio of 2:3.
- 5) Write the formula for learning Index.
- 6) If $\sin A = \frac{1}{2}$, find $\cos 2A$.
- 7) Find the equation of the circle with centre $(-3, 2)$ and radius is 5 units.



8) Evaluate : $\lim_{x \rightarrow 4} \left(\frac{x^2 + 4}{1 - x} \right)$.

9) If $y = x^2 - 3x + 10$ then, find $\frac{dy}{dx}$.

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

PART - B

II. Answer **any ten** of the following questions :

(10 × 2 = 20)

11) If $A = \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$ prove that $A^2 - 4A - 5I = 0$, where I is unit matrix O is the null matrix.

12) In how many ways can 7 Mathematics books, 8 Statistics books and 4 Accountancy books can be arranged in a shelf, if the Mathematics books always together.

13) If $P(B) = \frac{1}{2}$, $P(A \cap B) = \frac{1}{4}$, then find $P(A|B)$.

14) If the truth values of the proposition p, q, r are T, T, F respectively, then find the truth value of compound proposition $p \rightarrow (q \wedge r)$.

15) What must be added to each term in the ratio 5:6, So that it becomes 8:9?

16) For ₹ 512.50 due 6 months at 15% p.a. Find the true present worth.



- 17) Derive the value for $\cos 75^\circ$.
- 18) Express $\cos 65^\circ \sin 15^\circ$ as sum or difference of two trigonometric functions.
- 19) Find the focus and the equation of directrix of the parabola $x^2 - 16y = 0$.
- 20) Evaluate : $\lim_{\theta \rightarrow 0} \frac{\sin 3\theta}{\tan 2\theta}$.
- 21) Find $\frac{dy}{dx}$ if $y = \cos(x^3)$.
- 22) The distance 's' feet travelled by a particle in time 't' seconds is given by $s = t^3 - 6t^2 + 15t + 2$. Find 't' when acceleration is zero.
- 23) Evaluate : $\int \frac{2x}{1+x^2} dx$.
- 24) Evaluate : $\int_1^2 \left(2x^2 + \frac{1}{x} \right) dx$.

PART - C

III. Answer **any ten** of the following questions :

(10 × 3 = 30)

- 25) Solve by using Cramer's rule : $5x - 7y - 3 = 0$, $7x - 5y - 9 = 0$.

26) Prove that :
$$\begin{vmatrix} 1+a & b & c \\ a & 1+b & c \\ a & b & 1+c \end{vmatrix} = 1+a+b+c.$$



- 27) Find the number of words that can be formed by using all the letters of the word "RAINBOW".
- a) How many of them begin with 'R' and end with 'W'?
 - b) How many of them end with 'BOW'?
- 28) The probability that a doctor gets Job in Army is $\frac{1}{2}$ and the probability that a doctor will not get a job in Navy is $\frac{2}{5}$. If the probability of getting atleast one job is $\frac{3}{4}$. What is the probability that he will get both jobs.
- 29) Three numbers are in the ratio 2:3:4. If sum of their squares is 1856. Find the numbers.
- 30) The banker's gain on a bill is $\frac{1}{5}$ th of the banker's discount and the rate of interest is 20% per annum. Find the unexpired period of the bill.
- 31) Which is the better investment, 7.5% stock at 125 or 5% stock at 75.
- 32) The price of a washing machine inclusive of sales tax is 13,530. If the sales tax is 10%. Find the basic price.
- 33) Find the equation of parabola vertex at the origin and passing through the point $p(5,2)$ and symmetric with respect to the y-axis.
- 34) If $y = e^{x+e^x+\dots+\infty}$ show that $\frac{dy}{dx} = \frac{y}{1-y}$.



- 35) The edge of a variable cube is increasing at the rate of 6 cm/min. How fast is the volume and its surface increasing when the edge is 10 cm long?
- 36) Divide the number 40 into two parts such that their product is maximum.
- 37) Evaluate : $\int \frac{1}{x(x+2)} dx$.
- 38) Evaluate : $\int x e^x dx$.

PART - D

IV. Answer any six questions :

(6 × 5 = 30)

39) If $A = \begin{bmatrix} 1 & 2 & -3 \\ 5 & 0 & 2 \\ 1 & -1 & 1 \end{bmatrix}$, then, verify $A \cdot \text{adj}A = \text{adj}A \cdot A = |A|I$.

40) Find the coefficient of x^8 in the expansion $\left(3x^2 - \frac{1}{2x}\right)^{10}$.

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

42) Show that the proposition $(p \wedge \sim q) \wedge (\sim p \vee q)$ is a contradiction.

43) Two taps can separately fill a tank in 12 minutes and 15 minutes respectively. The tank when full can be emptied by a drain pipe in 20 minutes. When the tank was empty, all the three were opened simultaneously. In what time will the tank be filled up?

44) XYZ Company supplies water tankers to the Government. The first water tanker takes 20,000 labour hours. The Government auditors suggest that there should be 90% learning effect rate. The management expects an order of 8 water tankers in the next year. What will be the labour cost, the company will incur at the rate of ₹ 20 per hour.

45) Solve the following LPP graphically :

$$\text{Maximize } Z = 10,500x + 9000y$$

Subject to the constraints

$$x + y \leq 50$$

$$2x + y \leq 80,$$

$$x \geq 0, y \geq 0.$$

46) In any ΔABC prove that $\sin 2A + \sin 2B - \sin 2C = 4 \cos A \cos B \sin C$.

47) If $xy + 6y = 2x$ show that $\frac{d^2y}{dx^2} = \frac{-24}{(x+6)^3}$.

48) Find the area bounded by the parabola $y^2 = 4x$ and the line $y = 2x - 4$.



PART - E

V. Answer **any one** of the following questions :

(1 × 10 = 10)

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

b) A person standing on the bank of a river observes that the angle subtended by a tree opposite bank is 60° , when he returns 40 metres from the bank, he finds the angle to be 30° . Find the height of the tree and the breadth of the river. (4)

50) a) If n is a rational number and 'a' is a non zero real number, then, prove that

$$\lim_{x \rightarrow a} \left(\frac{x^n - a^n}{x - a} \right) = n a^{n-1}$$

(where n is a positive integer, negative integer, fraction) (6)

b) Find the value of $(1.2)^5$ using Binomial theorem upto 4 places of decimals. (4)
