



BASIC MATHEMATICS

-11-

75 (NS)

(English Version)

- Instructions :**
1. The question paper has 5 parts namely, A, B, C, D and E. Answer ALL the Parts.
 2. Part – A carries 20 marks
Part – B carries 12 marks
Part – C carries 15 marks
Part – D carries 25 marks
Part – E carries 8 marks.
 3. For Part – A questions, only the first written answers will be considered for evaluation.
 4. In the Part – D, use graph sheet for the question number 40 on L.P.P.
 5. Write the question numbers properly as indicated in the question paper.
 6. For question having graph, alternate question is given at the end of the question paper in a separate section in the Part – F for **Visually Challenged Students**.

PART – A

I. Answer all the multiple choice questions :

(5 × 1 = 5)

1) If $A = \begin{bmatrix} 1 & 2 & 4 \\ -1 & 3 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -4 & -1 \\ 1 & 5 & -2 \end{bmatrix}$ then $(A + B)$ is

a) $\begin{bmatrix} 4 & 2 & -3 \\ 0 & 8 & 4 \end{bmatrix}$

b) $\begin{bmatrix} 4 & -2 & 3 \\ 0 & 8 & -4 \end{bmatrix}$

c) $\begin{bmatrix} -4 & 2 & 3 \\ 0 & -8 & 4 \end{bmatrix}$

d) $\begin{bmatrix} 4 & -2 & -3 \\ 0 & -8 & -4 \end{bmatrix}$



2) If ${}^nC_{10} = {}^nC_{15}$ then n is

a) 25

b) 29

c) 24

d) 23

3) The probability of getting a black card from a pack of 52 cards is

a) $\frac{3}{4}$

b) $\frac{1}{52}$

c) $\frac{1}{4}$

d) $\frac{1}{2}$

4) The value of $4\cos^3 10^\circ - 3\cos 10^\circ$ is

a) $\frac{\sqrt{3}}{2}$

b) $\frac{2}{\sqrt{3}}$

c) $\frac{1}{\sqrt{3}}$

d) $\frac{1}{2}$

5) The value of $\int 4\sec^2 x \, dx$ is

a) $4\sec x + c$

b) $4\sin x + c$

c) $4\tan x + c$

d) $4\cot x + c$



II. Match the following :

(5 × 1 = 5)

- 6) i) The value of $\begin{vmatrix} 3200 & 3201 \\ 3202 & 3203 \end{vmatrix}$ is a) 27
- ii) If ${}^5P_r = 60$, then r is b) 12
- iii) If $5 : 20 = 3 : x$ then the value of x is c) $\frac{y}{x}$
- iv) The value of $\lim_{x \rightarrow 3} \left(\frac{x^3 - 27}{x - 3} \right)$ is d) $\frac{x}{y}$
- v) If $x^2 - y^2 = a^2$ then $\frac{dy}{dx}$ is e) -2
- f) 3

III. For question numbers 7 to 11 choose the appropriate answers from the brackets given below :

(5 × 1 = 5)

(56, 9, $-\frac{3}{4}$, 1, 2, 4)

7) If $\begin{bmatrix} 2 & x & 2 \\ 4 & & 2 \end{bmatrix} = [3]$ then the value of x is _____

8) The number of triangles that can be formed from the 8 non collinear points is _____



9) The third proportional of 4 and 6 is _____

10) The value of $\lim_{x \rightarrow 0} \left(\frac{\sin 4x}{\sin 2x} \right)$ is _____

11) The value of $\int_0^{\pi/2} \sin 2x \, dx$ is _____

IV. Answer the following questions :

(5 × 1 = 5)

12) Negate : $\sim p \rightarrow q$

13) If $a : b = 2 : 3$, $b : c = 5 : 7$ and $c : d = 3 : 1$ then find $a : d$.

14) If $\tan A = \frac{1}{\sqrt{3}}$ then find $\tan 2A$.

15) Differentiate $3x^2 + 4y^2 = 10$ w. r. t. x .

16) Evaluate $\int \left(x^2 - \frac{6}{x} + 5e^x \right) dx$.



PART – B

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

(6 × 2 = 12)

- 17) In how many ways can the letters of the word "HOPPER" be arranged?
- 18) Find the number of parallelograms that can be formed from the set of 6 parallel lines intersecting another set of 4 parallel lines.
- 19) Two coins are tossed simultaneously. What is the probability of getting
 - a) Atleast one tail
 - b) Atmost one tail?
- 20) Divide ₹ 6,000 in the ratio 3 : 4 : 5.
- 21) 500 workers can finish a work in 8 days. How many workers will finish the same work in 5 days?
- 22) For ₹ 512.50 due 6 months at 15% p.a. Find the true present value and discounted value of the bill.
- 23) Find the equation of the parabola given that its focus is $(-4, 0)$ and directrix is $x = 4$.



24) Find the axis and length of the latus rectum of the parabola $x^2 = 16y$.

25) Evaluate $\int \frac{4x+3}{2x^2+3x+5} dx$.

26) Evaluate $\int_0^3 \left(\frac{x+3}{x+2} \right) dx$.

27) Find the area enclosed by the curve $y = x^2$, x -axis and the ordinates $x=0$ and $x=1$.

PART – C

VI. Answer **any five** of the following questions :

(5 × 3 = 15)

28) Solve :

$$3x + 2y = 8 \text{ and}$$

$$4x - 3y = 5$$

by Cramer's rule.

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

30) A person invests ₹ 15,000 partly in 3% stock at 75 and partly in 6% stock at 125. If the income from both is ₹ 675. Find his investment in 2 types of stocks.



- 31) The price of a T.V set inclusive of sales tax of 9% is ₹ 13,407. Find its marked price. If the sales tax is increased to 13%, how much more does the customer pay for the T.V?
- 32) Find $\frac{dy}{dx}$, given that $x = a \cos^4 \theta$, $y = a \sin^4 \theta$.
- 33) A ladder of 15 feet long leans against a smooth vertical wall. If the top slides downwards at the rate of 2 ft/sec. Find how fast the lower end is moving when the lower end is 12 ft away from the wall.
- 34) Evaluate $\int \frac{x+2}{(2x-1)(x-3)} dx$.

PART – D

VII. Answer **any five** questions :

(5 × 5 = 25)

- 35) Solve the linear equations by matrix method.

$$\begin{aligned}x + y - z &= 1 \\ 3x + y - 2z &= 3 \\ x - y - z &= -1\end{aligned}$$

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

- 37) Resolve $\frac{2x^2 + 10x - 3}{(x+1)(x-3)(x+3)}$ into partial fractions.

- 38) Show that $\sim(p \vee q) \rightarrow (\sim p \wedge \sim q)$ is a Tautology.



- 39) ABC company required 1000 hours to produce 1st 30 engines. If the learning effect is 90%. Find the total labour cost at ₹ 20/hour to produce a total of 120 engines.
- 40) Solve the following LPP graphically.
 Maximize : $Z = 5x + 3y$
 Subject to the constraints :
 $3x + 5y \leq 15,$
 $5x + 2y \leq 10,$
 $x \geq 0,$
 $y \geq 0.$
- 41) Prove that :

$$\frac{\sin 6A + \sin 2A + 2 \sin 4A}{\sin 7A + \sin 3A + 2 \sin 5A} = \frac{\sin 4A}{\sin 5A}.$$
- 42) Find the equation of the circle passing through the points $(1, -4)$, $(5, 2)$ and having its centre on the line $x - 2y + 9 = 0$.
- 43) Evaluate $\lim_{x \rightarrow 2} \left[\frac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x-2}} \right].$

PART - E

VIII. Answer **any two** of the following questions :

(2 × 4 = 8)

- 44) A flag staff stands upon the top of a building at a distance of 20 mts. The angles of elevation of the top of the flag staff and the building are 60° and 30° respectively. Find the height of the flag staff.
- 45) If $y = a \cos(\log x) + b \sin(\log x)$ show that $x^2 y_2 + x y_1 + y = 0.$



- 46) The total revenue function is given by $R=400x-2x^2$ and the total cost function is given by $C=2x^2+40x+4000$. Find
- The marginal revenue and marginal cost functions.
 - The output at which marginal revenue = marginal cost.

PART – F

(Only for Visually Challenged Students) (1 × 5 = 5)

- 40) Smaran being a manufacturer of nuts and bolts for industrial machinery. It takes 1 hour of work on machine A and 3 hours on machine B to produce a package of nuts while it takes 3 hours on machine A and 1 hour on machine B to produce a package of Bolts. He earns a profit of ₹ 2.50/package of nuts and ₹ 1/package of bolts. Form a linear programming problem to maximise his profit, if he operates each machine for atmost 12 hours a day.
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CANARA VIKAAAS PREUNIVERSITY COLLEGE, MANGALURU
BASIC MATHEMATICS - ANSWER KEY - 2024

PART - A

I. Choose the correct answer (Each question carries one mark)

5X1=5

1.b) $\begin{bmatrix} 4 & -2 & 3 \\ 0 & 8 & -4 \end{bmatrix}$

2. a) 25

3. d) $\frac{1}{2}$

4. a) $\frac{\sqrt{3}}{2}$

5. c) $4\tan x + c$

II. Match the following

5X1=5

6. i. e) -2

ii. f) 3

iii. b) 12

iv. a) 27

v. d) x/y

III. Choose appropriate answer from the answer given below)

5x1=5

7. $-3/4$

8. 56

9. 9

10. 2

11. 1

IV. Answer the following questions

5X1=5

12. $\sim p \wedge \sim q$

13. 10:7

14. $\sqrt{3}$

15. $\frac{dy}{dx} = -\frac{3x}{4y}$

16. $\frac{x^3}{3} - 6\log|x| + 5e^x + c$

PART - B

V. Answer any SIX of the following questions.

6x2=12

17. $\frac{6!}{2!} = 360$

18. ${}^6C_2 x^4 C_2 = 90$

19. a) $P(\text{at least 1 tail}) = 3/4$

b) $P(\text{at most 1 tail}) = 3/4$

20. $3x+4x+5x=6000$

$x=500$

Rs.1500, Rs.2000, Rs.2500

21. $500:x = 5:8$

$x = 800$ workers

22. $P = \frac{F}{1+tr} = \text{Rs.}476.74$

$DV = F(1-tr) = \text{Rs.}474.06$

23. $y^2 = -4ax$

$y^2 = -16x$

24. axis = y

Length of latus rectum = 16

25. Put $t = 2x^2 + 3x + 5$, $dt = 4x + 3$

$\int \frac{4x+3}{2x^2+3x+5} dx = \int \frac{1}{t} dt = \log|t| + c = \log|2x^2 + 3x + 5| + c$

26. $\int_0^3 \frac{x+3}{x+2} dx = \int_0^3 \frac{x+2}{x+2} dx + \int_0^3 \frac{1}{x+2} dx = x|_0^3 + \log|x+2|_0^3 = 3 + \log|5/2|$

27. $\int_0^1 y dx = \int_0^1 x^2 dx = \frac{x^3}{3} \Big|_0^1 = \frac{1}{3}$

PART – C

VI. Answer any FIVE of the following questions.

5x3=15

28. $\Delta = -17$, $\Delta_1 = -34$, $\Delta_2 = -17$

$x=2$, $y=1$

29. $BG = 27$,

$BG = \frac{F(tr)^2}{1+tr}$

$F = \text{Rs.}30900$

30. Part I

MV Income

75 3

x I_1

$I_1 = 0.04x$

$I_1 + I_2 = 675$

$x = \text{Rs.}5625$

$\text{Rs.}5625$ at 3%

$\text{Rs.}9375$ at 6%

Part II

MV Income

125 6

$15000 - x$ I_2

$I_2 = 0.048(15000 - x)$

31. $SP = (100+9)\%$ of MP

$MP = 12300$

If $ST = 13\%$

$SP = (100+13)\%$ of $12300 = \text{Rs.}13899$

32. Given that $x = a \cos^4 \theta$, $y = a \sin^4 \theta$

$$\frac{dx}{d\theta} = -4a \cos^3 \theta \times \sin \theta, \quad \frac{dy}{d\theta} = 4a \sin^3 \theta \times \cos \theta$$

$$\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta} = \frac{4a \sin^3 \theta \times \cos \theta}{-4a \cos^3 \theta \times \sin \theta} = -\frac{\sin^2 \theta}{\cos^2 \theta} = -\tan^2 \theta$$

33. Given that $\frac{dy}{dt} = -12 \text{ ft/sec}$, $x=12 \text{ feet}$, $\frac{dx}{dt}=?$

$$x^2 + y^2 = 15^2 \Rightarrow y=9$$

$$x^2 + y^2 = 15^2 \Rightarrow 2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 0$$

$$\frac{dx}{dt} = +9 \text{ feet/sec}$$

34. $\int \frac{x+2}{(2x-1)(x-3)} dx$

Consider, $\frac{x+2}{(2x-1)(x-3)} = \frac{A}{2x-1} + \frac{B}{x-3}$ 1

$$x+2 = A(x-3) + B(2x-1) \text{2}$$

by substituting $x=3$, $B=1$

By substituting $x=\frac{1}{2}$, $A=-1$

$$\int \frac{x+2}{(2x-1)(x-3)} dx = \int \frac{A}{2x-1} + \frac{B}{x-3} dx = -\int \frac{1}{2x-1} dx + \int \frac{1}{x-3} dx$$

$$= -\frac{\log(2x-1)}{2} + \log(x-3) + c$$

PART – D

VII. Answer any FIVE of the following questions.

5x5=25

35. $|A|=2$

Adjoint $A = \begin{bmatrix} -3 & 2 & -1 \\ 1 & 0 & -1 \\ -4 & 2 & -2 \end{bmatrix}$ $A^{-1} = \frac{1}{2} \begin{bmatrix} -3 & 2 & -1 \\ 1 & 0 & -1 \\ -4 & 2 & -2 \end{bmatrix}$

$$x=2, y=1, z=1$$

36. Given that $\left(3x^2 - \frac{1}{2x}\right)^{10}$

$$x = 3x^2, a = -\frac{1}{2x}, n = 10$$

$$T_{r+1} = {}^{10}C_4 x^{n-r} a^r$$

$$= {}^{10}C_4 (3x^2)^{10-r} \left(-\frac{1}{2x}\right)^r$$

Coefficient of $x^8 \Rightarrow r = 4$

$$T_{4+1} = {}^{10}C_4 (3x^2)^{10-4} \left(-\frac{1}{2x}\right)^4$$

$$\text{Coefficient of } x^8 \text{ is } {}^{10}C_4 (3)^6 \left(-\frac{1}{2}\right)^4 = 9568.125$$

37. $\frac{2x^2+10x-3}{(x+1)(x-3)(x+3)} = \frac{A}{x+1} + \frac{B}{x-3} + \frac{C}{x+3}$

$$2x^2 + 10x - 3 = A(x-3)(x+3) + B(x+1)(x+3) + C(x+1)(x-3)$$

$$\text{If } x=-1, A=11/8$$

$$\text{If } x=3, B=15/8$$

$$\text{If } x=-2, C=-5/4$$

$$\frac{2x^2+10x-3}{(x+1)(x-3)(x+3)} = \frac{11/8}{x+1} + \frac{15/8}{x-3} + \frac{-5/4}{x+3}$$

38.

p	q	$\sim p$	$\sim q$	$p \vee q$	$\sim(p \vee q)$	$\sim p \wedge \sim q$	$\sim(p \vee q) \rightarrow (\sim p \wedge \sim q)$
T	T	F	F	T	F	F	T
T	F	F	T	T	F	F	T
F	T	T	F	T	F	F	T
F	F	T	T	F	T	T	T

Given proposition is a tautology

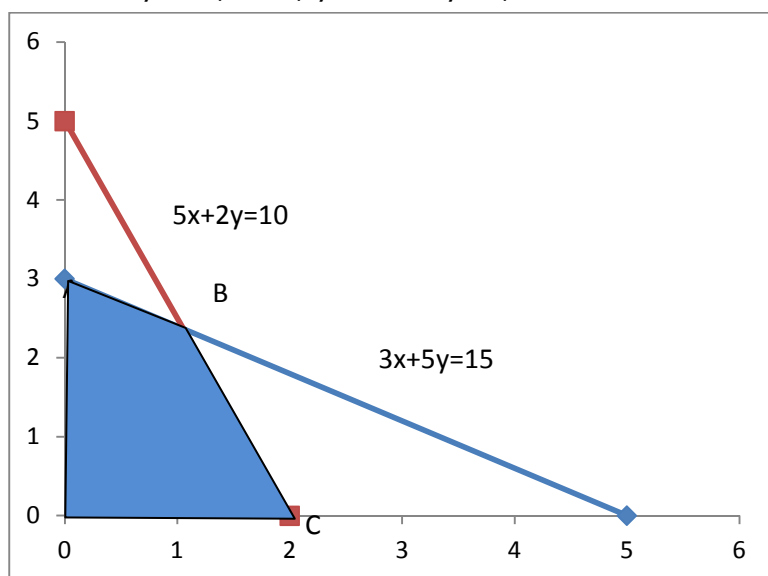
39.

Units produced	Total output in units	Cumulative average time per unit	total hours
1	1	1000	1000
1	2	900	1800
2	4	810	3240

Total Labour cost $3240 \times 20 = \text{Rs. } 64800$

40. $3x+5y=15$; $x=0$, $y=3$ and $y=0$, $x=5$

$5x+2y=10$; $x=0$, $y=5$ and $y=0$, $x=2$



Corner Points	$Z=5x+3y$
O(0, 0)	0
A(0, 3)	9
B(20/19, 45/19)	235/19 - MAXIMUM
C(2, 0)	10

Z is maximum at B(20/19, 45/19). $x=20/19$, $y=45/19$ and $Z=235/19$

41. LHS
$$\frac{(\sin 6A + \sin 2A) + 2 \sin 4A}{(\sin 7A + \sin 3A) + 2 \sin 5A}$$

$$= \frac{2 \sin 4A \cdot \cos 2A + 2 \sin 4A}{2 \sin 5A \cdot \cos 2A + 2 \sin 5A}$$

$$= \frac{2 \sin 4A (\cos 2A + 1)}{2 \sin 5A (\cos 2A + 1)} = \frac{\sin 4A}{\sin 5A} = \text{RHS}$$

42. Equation of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$

Passes through (1, -4) $\Rightarrow 2g - 8f + c = -17$

Passes through (5, 2) $\Rightarrow 10g + 4f + c = -29$

Center (-g, -f) is on $x - 2y + 9 = 0$

$-g + 2f = -9$

On solving $g = 3, f = -3, c = -47$

Equation of the circle $x^2 + y^2 + 6x - 6y - 47 = 0$

43. $\lim_{x \rightarrow 2} \left[\frac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x-2}} \right]$

Rationalizing the denominator

$$\lim_{x \rightarrow 2} \left[\frac{(x^2 - 4)(\sqrt{x+2} + \sqrt{3x-2})}{(x+2) - (3x-2)} \right]$$

$$= \lim_{x \rightarrow 2} \left[\frac{(x+2)(x-2)(\sqrt{x+2} + \sqrt{3x-2})}{-2(x-2)} \right]$$

$$= \lim_{x \rightarrow 2} \left[\frac{(x+2)(\sqrt{x+2} + \sqrt{3x-2})}{-2} \right]$$

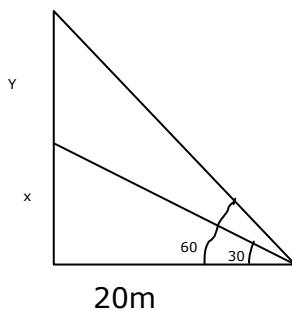
$$= \frac{(2+2)(\sqrt{2+2} + \sqrt{6-2})}{-2} = -8$$

PART - E

VIII. Answer any TWO of the following questions.

2x4=8

44.



$\tan 30 = x/20$

$$\frac{1}{\sqrt{3}} = \frac{x}{20} \text{ or } x = \frac{20}{\sqrt{3}}$$

$\tan 60 = (x+y)/20$

$$\sqrt{3} = \frac{\frac{20}{\sqrt{3}} + y}{20}$$

$$20\sqrt{3} = \frac{20}{\sqrt{3}} + y$$

$$y = \frac{40}{\sqrt{3}}$$

45. $y = a \cos(\log x) + b \sin(\log x)$

$$y_1 = -a \sin(\log x) \frac{1}{x} + b \cos(\log x) \frac{1}{x}$$

$$xy_1 = -a \sin(\log x) + b \cos(\log x)$$

$$xy_2 + y_1 = -a \cos(\log x) \frac{1}{x} - b \sin(\log x) \frac{1}{x}$$

$$x^2 y_2 + y_1 = -y$$

$$x^2 y_2 + y_1 + y = 0$$

46. $R = 400x - 2x^2$, $C = 2x^2 + 40x + 4000$

(a) $MR = \frac{dR}{dx} = 400 - 4x$, $MC = \frac{dC}{dx} = 4x + 40$

(b) Given that $MR = MC$

$$400 - 4x = 4x + 40$$

$$x = 45 \text{ Units}$$