

II PUC MID-TERM EXAMINATION, OCT./NOV. - 2024

SUBJECT : BASIC MATHEMATICS (75)

Time : 3 Hours

Max Marks : 80

Instructions :

- The question paper has 5 parts A, B, C, D and E. Answer all the parts.
- 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.
- Write the question number properly as indicated in the question paper.

PART-A

I Answer ALL the multiple-choice questions:

10x1=10

- If $\begin{vmatrix} 3 & x \\ 4 & 5 \end{vmatrix} = -2$ then the value of x is
a) $\frac{17}{4}$ b) $-\frac{17}{4}$ c) $\frac{15}{4}$ d) $\frac{13}{4}$
- The negation of $(p \rightarrow q)$ is
a) $p \wedge q$ b) $\sim p \vee q$ c) $p \wedge \sim q$ d) $p \rightarrow \sim q$
- If the compound proposition $p \rightarrow (q \vee r)$ is false, then the truth values of p, q and r respectively is
a) T, F, F b) T, F, T c) F, T, T d) F, T, F
- The compound ratio of 3 : 5 and 4 : 7 is
a) 35 : 12 b) 12 : 35 c) 1 : 2 d) 7 : 12
- A bill is drawn on 1-5-23 for 4 months then the legally due date is
a) 1-8-23 b) 14-9-23 c) 4-9-23 d) 10-7-23
- The bankers discount on a bill of ₹ 415 due 9 months hence at 15% p.a. is
a) ₹ 36.68 b) ₹ 56.68 c) ₹ 66.68 d) ₹ 46.68
- The money will a man get by selling ₹ 6000 stock at 5% at ₹ 20 premium is
a) ₹ 7000 b) ₹ 7200 c) ₹ 4800 d) ₹ 5000
- The value of $3 \sin 10^\circ - 4 \sin^3 10^\circ$ is
a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{\sqrt{2}}$ d) $-\frac{1}{2}$
- The product form of the sum of the two trigonometric functions $\sin 12x + \sin 4x$ is
a) $2 \sin 4x \cos 8x$ b) $2 \sin 2x \cos 4x$ c) $2 \sin 8x \cos 4x$ d) None of these
- The value of $\lim_{x \rightarrow 3} \frac{x^2 - 4x}{x - 2}$ is
a) -2 b) 2 c) 3 d) -3

II Match the following :

5x1=5

- i) $\begin{vmatrix} 401 & 402 \\ 403 & 404 \end{vmatrix} =$ a) 24
ii) If $5 : 20 = 3 : x$, then $x =$ b) $\frac{\sqrt{3}}{2}$
iii) Percentage of yield obtained when
₹ 5000, 3% stock is purchased at ₹ 125 c) 12
iv) If $\sin A = \frac{1}{2}$, then $\sin 2A =$ d) 2
v) $\lim_{x \rightarrow 0} \frac{2}{x} \log(1 + x) =$ e) -2
f) $\frac{1}{2}$

(P.T.O.)

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

5x1=5

- $\left[\frac{24}{25}, 200, \frac{b}{a}, 9, 4, \frac{a}{b} \right]$
- 12) If $\begin{bmatrix} 3 & x \\ 4 & 7 \end{bmatrix}$ is a symmetric matrix, then the value of x is _____.
- 13) The third proportional of 4 and 6 is _____.
- 14) Income obtained by investing ₹ 3600 in 5% stock at 90 is _____.
- 15) If $\sin A = \frac{3}{5}$ and $\cos B = \frac{4}{5}$, A and B are acute angles, then $\sin(A+B)$ is _____.
- 16) $\lim_{x \rightarrow 0} \frac{\sin ax}{bx}$ is _____. (a, b ≠ 0)

PART-B

IV Answer any SIX of the following questions :

6x2=12

- 17) If $A = \begin{bmatrix} 1 & 3 & -1 \\ -1 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -1 & 2 \\ 1 & 3 & -2 \end{bmatrix}$ then find $2A - 3B$.
- 18) If $A = \begin{bmatrix} 3 & -1 \\ 2 & -4 \end{bmatrix}$. Find A^2 .
- 19) If the truth values of the propositions p, q, r are F, T, F respectively, then find the truth value of the compound proposition $(\sim p \rightarrow q) \vee r$.
- 20) Two numbers are in the ratio 3 : 5. If 5 is added to each, they are in the ratio 2 : 3. Find the numbers.
- 21) 500 workers can finish a work in 8 days. How many workers will finish the same work in 5 days?
- 22) Find the present value of ₹ 750 due 4 months hence at 15% p.a. Also find TD.
- 23) If $\tan A = \frac{3}{4}$ and $\tan B = \frac{1}{7}$. Show that $\tan(A+B)=1$.
- 24) Evaluate $\lim_{x \rightarrow -2} \left[\frac{x^5 + 32}{x + 2} \right]$.
- 25) Evaluate $\lim_{x \rightarrow 2} \left[\frac{2x^2 - 5x + 2}{x^2 - 3x + 2} \right]$.

PART-C

V Answer any SIX of the following questions :

6x3=18

- 26) Find A and B if $2A + B = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}$ and $A - 3B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$.
- 27) Solve by Cramer's rule : $3x + 4y = 7$, $7x - y = 6$.
- 28) Write the converse, inverse and contrapositive of "If x is less than 1 then it is a prime number".
- 29) Two numbers are in the ratio 3 : 4. If the sum of their squares is 900. Find the numbers.
- 30) Two taps fill a tank separately 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 ?

(P.T.O.)

- 31) A banker pays ₹ 4520 on a bill of ₹ 5000, 146 days before the legally due date. Find the rate of discount charged by the banker.
- 32) A person invests ₹ 15000 partly in 3% stock at 75 and partly in 6% stock at 125. If the income come from both is ₹ 675 find his investment in the 2 types of stock.
- 33) Prove that $\frac{\sin 3A}{\sin A} - \frac{\cos 3A}{\cos A} = 2$.
- 34) Find the value of k if the function $f(x) = \begin{cases} \frac{e^{2x}-1}{x} & x \neq 0 \\ k & x = 0 \end{cases}$ is continuous at $x = 0$.

PART-D

VI Answer any FOUR of the following questions :

4x5=20

- 35) If $A = \begin{bmatrix} 1 & 2 & -3 \\ 1 & -4 & 1 \\ 0 & 5 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 4 & -2 & -3 \\ 2 & -4 & -1 \\ 0 & 1 & 3 \end{bmatrix}$, $C = \begin{bmatrix} 4 & 1 & 2 \\ 0 & 3 & 1 \\ -1 & -3 & 4 \end{bmatrix}$. Verify $(A+B)C = AC + BC$.
- 36) Solve by Matrix method $x + y - z = 1$; $3x + y - 2z = 3$; $x - y - z = -1$.
- 37) Find the term independent of x in the expansion of $\left[\sqrt{x} + \frac{1}{3x^2} \right]^{10}$.
- 38) Resolve $\frac{3x+2}{(x-2)(x+3)^2}$ into partial fractions.
- 39) Verify whether the proposition $\sim(p \vee q) \rightarrow (\sim p \wedge \sim q)$ is a tautology or contradiction or neither.
- 40) An engineering company has 80% learning effect and spends 1000 hours to produce 1 lot of the product. Estimate the labour cost of producing 8 lots of the product if the labour cost is ₹ 40 per hour.
- 41) Prove that $\frac{\sin 6A + \sin 2A + 2\sin 4A}{\sin 7A + \sin 3A + 2\sin 5A} = \frac{\sin 4A}{\sin 5A}$.

PART-E

VII Answer the following questions :

- 42) Prove that $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$ for all rational values of n.

(OR)

Evaluate $\lim_{x \rightarrow 2} \frac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x-2}}$

(6 Marks)

- 43) Find the value of $(0.99)^5$ using Binomial theorem, up to 4 decimal places.

(OR)

Find the middle term/s in the binomial expansion of $\left(\frac{x}{2} + \frac{3}{x^2} \right)^{19}$.

(4 Marks)
