BCS-012 : BASIC MATHEMATICS

IMPORTANT QUESTIONS FOR TERM END EXAM

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Question 1.

Show that

$$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a).$$

Question 2.

If $A = \begin{pmatrix} 1 & -2 \\ 2 & -1 \end{pmatrix}$, $B = \begin{pmatrix} a & 1 \\ b & -1 \end{pmatrix}$ and

$(A+B)^2 = A^2 + B^2$, find a and b.

Question 3.

Use the principle of mathematical induction to show that $2 + 2^2 + \ldots + 2^n = 2^{n+1} - 2$ for each natural number n.

Question 4.

If Z is a complex number such that

$| Z - 2i | = | Z + 2i |$, show that Im(Z) = 0.

Question 5.

Find the 10^{th} term of the harmonic progression $\frac{1}{7}, \frac{1}{15}, \frac{1}{23}, \frac{1}{31}, \cdots$

Question 6.

Find the quadratic equation whose roots are $2 - \sqrt{3}$, $2 + \sqrt{3}$.

Question 7.

If $y = ln\left[e^x\left(\frac{x-2}{x+2}\right)^{3/4}\right]$, find $\frac{dy}{dx}$.

Question 8.

Evaluate :

$$\int \frac{dx}{\sqrt{x} + x}$$

Question 9.

If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, show that

$A^2 - 4A - 5I_3 = 0$. Hence obtain A^{-1} and A^3.

Question 10.

If $A = \begin{bmatrix} 3 & 4 & -5 \\ 1 & 1 & 0 \\ 1 & 1 & 5 \end{bmatrix}$, show that A is

row equivalent to I_3.

Question 11.

Use Cramer's rule to solve the following system of equations :

$x + 2y + 2z = 3$

$3x - 2y + z = 4$

$x + y + z = 2$

Question 12.

Find the sum of an infinite G.P. whose first term is 28 and fourth term is $\frac{4}{49}$.

Question 13.

If $x = a + b$, $y = a\omega + b\omega^2$, $z = a\omega^2 + b\omega$ (where ω is a cube root of unity and $\omega \neq 1$), show that $xyz = a^3 + b^3$.

Question 14.

If the roots of $ax^3 + bx^2 + cx + d = 0$ are in A.P., show that

$$2b^3 - 9abc + 27a^2d = 0.$$

Question 15.

Solve the inequality

$$\frac{5}{|x - 3|} < 7.$$

Question 16.

Determine the values of x for which $f(x) = 5x^{3/2} - 3x^{5/2}$, $x > 0$ is

(i) increasing

(ii) decreasing.

Question 17.

Find the points of local extrema of

$$f(x) = \frac{3}{4}x^4 - 8x^3 + \frac{45}{2}x^2 + 2015.$$

Question 18.

Evaluate :

$$\int \frac{x^2}{(x+2)^3}\,dx$$

Question 19.

Find the area bounded by the curves $y = x^2$ and $y^2 = x$.

Question 20.

A man wishes to invest at most ₹ 12,000 in Bond A and Bond B. He must invest at least ₹ 2,000 in Bond A and at least ₹ 4,000 in Bond B. If Bond A gives return of 8% and Bond B that of 10%, find how much money be invested in the two bonds to maximize the return.