[ডান পাশের সংখ্যা প্রশ্নের পূর্ণমান জ্ঞাপক।]

ক বিভাগ : বীজগণিত

১। যে কোনো **দুইটি** প্রশ্নের উত্তর দাও :   ৫×২=১০

(ক) কর্ণ ম্যাট্রিক্স কাকে বলে? $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 4 \\ 6 \\ -1 \end{bmatrix}$

$C = \begin{bmatrix} 1 & 2 & -5 & 6 \end{bmatrix}$ হলে, $(AB)C$ নির্ণয় কর।

(খ) প্রমাণ কর যে,

$$\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = (ax^2 + 2bxy + cy^2)(b^2 - ac).$$

(গ) যদি $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ হয়, তবে A^{-1} নির্ণয় কর।

২। যে কোনো **একটি** প্রশ্নের উত্তর দাও :   ৫×১=৫

(ক) একটি পরীক্ষায় 12টি প্রশ্ন থেকে 6টি প্রশ্নের উত্তর দিতে হবে। তাকে প্রথম 5টি থেকে অবশ্যই 4টি প্রশ্নের উত্তর করতে হবে। সে কত প্রকারে প্রশ্নগুলো বাছাই করতে পারবে?

(খ) 'PERMUTATIONS' শব্দটির বর্ণগুলি থেকে 1টি স্বরবর্ণ এবং 2টি ব্যঞ্জনবর্ণ নিয়ে কতগুলি শব্দ গঠন করা সম্ভব যেন বর্ণগুলি সর্বদা মাঝখানে থাকে?

খ বিভাগ : জ্যামিতি ও ভেক্টর

৩। যে কোনো **একটি** প্রশ্নের উত্তর দাও :   ৫×১=৫

(ক) $\vec{\alpha} = \hat{i} + 2\hat{j} - 3\hat{k}$ এবং $\vec{\beta} = 3\hat{i} - \hat{j} + 2\hat{k}$ হলে, দেখাও যে, $\vec{\alpha} + \vec{\beta}$ এবং $\vec{\alpha} - \vec{\beta}$ ভেক্টর দুইটি পরস্পর লম্ব।

(খ) $\vec{\alpha} = 3\hat{i} + \hat{j} - 2\hat{k}$, $\vec{\beta} = 2\hat{i} - \hat{j} + \hat{k}$ এবং $\vec{\gamma} = \hat{i} + 3\hat{j} - 2\hat{k}$ হলে, $\vec{\alpha} \times (\vec{\beta} \times \vec{\gamma})$ নির্ণয় কর।

৪। যে কোনো **তিনটি** প্রশ্নের উত্তর দাও :   ৫×৩=১৫

(ক) OABC একটি সামান্তরিক; x- অক্ষ বরাবর OA অবস্থিত। OC রেখার সমীকরণ $y = 2x$ এবং B বিন্দুর স্থানাঙ্ক (4, 2)। A ও C বিন্দুর স্থানাঙ্ক এবং AC কর্ণের সমীকরণ নির্ণয় কর।

(খ) $\frac{x}{a} - \frac{y}{b} = 1$ রেখার উপর লম্ব এবং প্রদত্ত রেখা ও x-অক্ষের ছেদবিন্দুগামী সরলরেখার সমীকরণ নির্ণয় কর।

(গ) b বাহুবিশিষ্ট OABC একটি বর্গ। OA ও OC বাহুদ্বয় দিয়ে দেখাও যে, বৃত্তের পরিব্যাপ্ত সমীকরণ হবে $x^2 + y^2 = b(x+y)$।

(ঘ) $\sqrt{2}$ ব্যাসার্ধবিশিষ্ট দুইটি বৃত্তের সমীকরণ নির্ণয় কর যারা $x + y + 1 = 0$ রেখাকে স্পর্শ করে এবং যাদের কেন্দ্র x অক্ষের উপর অবস্থিত।

গ বিভাগ : ত্রিকোণমিতি

৫। যে কোনো **দুইটি** প্রশ্নের উত্তর দাও :   ৫×২=১০

(ক) $cosecA + cosecB + cosecC = 0$ হলে দেখাও যে, $(\sum sinA)^2 = \sum sin^2A$।

(খ) যদি $\tan\frac{\theta}{2} = \sqrt{\frac{1-e}{1+e}} \tan\frac{\phi}{2}$ হয়, প্রমাণ কর যে, $cos\phi = \frac{cos\theta - e}{1 - ecos\theta}$।

(গ) লেখচিত্রের অঙ্কন কর; $y = cos^2x$ যখন $-\pi \le x \le \pi$।

৬। যে কোনো **দুইটি** প্রশ্নের উত্তর দাও :   ৫×২=১০

(ক) প্রমাণ কর যে, $tan70° - 2tan50° = tan20°$।

(খ) প্রমাণ কর যে, $cos^4\frac{\pi}{8} + cos^4\frac{3\pi}{8} + cos^4\frac{5\pi}{8} + cos^4\frac{7\pi}{8} = \frac{3}{2}$।

(গ) $\triangle ABC$-এ $a = \sqrt{3} + 1$, $b = \sqrt{3} - 1$ এবং $\angle C = 60°$ হলে ত্রিভুজটি সমাধান কর।

ঘ বিভাগ : ক্যালকুলাস

৭। যে কোনো **একটি** প্রশ্নের উত্তর দাও :   ৫×১=৫

(ক) A, B বাস্তব সংখ্যার সেট R এর দুইটি উপসেট এবং $f : A \to B$; যেখানে $f(x) = \frac{x-3}{2x+1}$।

(i) ফাংশনটির ডোমেন এবং রেঞ্জ নির্ণয় কর। (ii) $f^{-1}(1)$ নির্ণয় কর।

(খ) যদি $f(x) = 2x - 5$ এবং $g(x) = x^2 + 6$ হয়, তবে $g\{f(2)\}$ এবং $f\{g(5)\}$ এর মান নির্ণয় কর।

৮। যে কোনো **তিনটি** প্রশ্নের উত্তর দাও :   ৫×৩=১৫

(ক) মান নির্ণয় কর : $\displaystyle\lim_{x \to 0} \frac{tanx - sinx}{x^3}$ ৫

(খ) x এর সাপেক্ষে অন্তরীত সহগ নির্ণয় কর (যে কোনো দুইটি) : $\frac{5}{2}$×২=৫

(i) $\sqrt{sin^{-1}x}$ (ii) $tan^{-1}\frac{2\sqrt{x}}{1-x}$ (iii) $\frac{\sqrt{x}+1}{\sqrt{x}-1}$

(গ) $y = tan^{-1}x$ হলে, প্রমাণ কর যে, $(1 + x^2)y_2 + (2x - 1)y_1 = 0$ ৫

(ঘ) যে কোনো **দুইটি** প্রশ্নের উত্তর দাও : $\frac{5}{2}$×২=৫

(i) $\displaystyle\int \frac{sinx}{3 + 4cosx} dx$ (ii) $\displaystyle\int \frac{x^2 - 1}{x^2 - 4} dx$ নির্ণয় কর;

(iii) $\displaystyle\int \frac{x\,dx}{\sqrt{9 - 2x^2}}$ নির্ণয় কর।

১। (ক) $\begin{bmatrix} 13 & 26 & -65 & 78 \\ 40 & 80 & -200 & 240 \end{bmatrix}$

(গ) $\begin{bmatrix} \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ -4 & 3 & -1 \\ \frac{5}{2} & -\frac{3}{2} & \frac{1}{2} \end{bmatrix}$

২। (ক) 105

(খ) 155

৩। (খ) $17\hat{i} - 19\hat{j} + 16\hat{k}$

৪। (ক) (3, 0), (1, 2) : $x + y - 3 = 0$

(খ) $ax + by = a^2$

৫। (ঘ) $x^2 + y^2 - 2x - 1 = 0$, $x^2 + y^2 + 6x + 7 = 0$

৬। (গ) $A = 105°$, $B = 15°$, $C = \sqrt{6}$

৭। (ক) (i) ডোমেন $f = R - \left\{-\frac{1}{2}\right\}$, রেঞ্জ $f = R - \left\{\frac{1}{2}\right\}$

(ii) $f^{-1}(1) = -4$

(খ) $g\{f(2)\} = 7$ এবং $f\{g(5)\} = 57$

৮। (ক) $\frac{1}{2}$

(খ) (i) $\frac{5x^4}{\sqrt{(1-x^{10})} \cdot 2\sqrt{sin^{-1}x}}$ (ii) $\frac{1}{\sqrt{x}(1+x)}$ (iii) —

(ঘ) (i) $-\frac{1}{4}\ln(3 + 4cosx) + c$ (ii) $x + \frac{3}{4}\ln\left|\frac{x-2}{x+2}\right| + c$ (iii) —

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