

607 R/E
[Regular/Ex-Regular]

MAT
(Science/Arts)

(For Students registered up to 2020)
(As per Reduced Syllabus)

2 0 2 2 (A)

MATHEMATICS

SCIENCE / ARTS

Full Marks : 100

Time : 3 hours

The figures in the right-hand margin indicate marks

ଦକ୍ଷିଣ ପାର୍ଶ୍ୱରେ ଥିବା ସଂଖ୍ୟା ପ୍ରଶ୍ନର ମୂଲ୍ୟାଙ୍କ ସୂଚାଉଛି

*Answer questions from all the Groups as per
instruction given*

ସମସ୍ତ ବିଭାଗରେ ଦିଆଯାଇଥିବା ନିର୍ଦ୍ଦେଶ ଅନୁଯାୟୀ ପ୍ରଶ୍ନର ଉତ୍ତର ଦିଅ

(2)

GROUP—A

କ—ବିଭାଗ

(Marks : 50)

(ନମ୍ବର : 50)

1. Answer the following questions by choosing the correct answer from the suggestive answers given in each : 1×25=25

ପ୍ରତ୍ୟେକ ପ୍ରଶ୍ନରେ ଦିଆଯାଇଥିବା ସମ୍ଭାବ୍ୟ ଉତ୍ତରଗୁଡ଼ିକ ମଧ୍ୟରୁ ସଠିକ୍ ଉତ୍ତରଟି ବାଛି ନିମ୍ନଲିଖିତ ପ୍ରଶ୍ନଗୁଡ଼ିକର ଉତ୍ତର ଦିଅ :

(a) $\frac{d^2 \sin(3x+5)}{dx^2} = ?$

(i) $\sin(3x+5)$

(ii) $9 \cos(3x+5)$

(iii) $-9 \sin(3x+5)$

(iv) $9 \sin(3x+5)$

(b) If (ଉଦି) $xy = 2a^2$, then (ଫଳ) $\frac{dy}{dx} = ?$

(i) $-\frac{2a^2}{x^2}$

(ii) $\frac{2a^2}{x^2}$

(iii) 0

(iv) $2a^2x^2$

(c) For what value(s) of x , the function $f(x) = 6x - x^2$ is increasing?

x ର କେଉଁ ମାନ ପାଇଁ $f(x) = 6x - x^2$ ଫଳନଟି ବର୍ଦ୍ଧମାନ ଅଟେ?

(i) $x > 3$

(ii) $x = 3$

(iii) $x < 6$

~~(iv)~~ $x < 3$

(d) What is the slope of the tangent to the curve $y = \ln x$ ($x > 0$) at $x = 1$?

$x = 1$ ଠାରେ $y = \ln x$ ($x > 0$) ବକ୍ରର ସ୍ପର୍ଶକର ଆନତି କେତେ?

(i) -1

~~(ii) 1~~

(iii) 0

(iv) 2

(e) $\int_0^1 \frac{d}{dx}(\tan^{-1} x) dx = ?$

~~(i) $-\frac{1}{2}$~~

(ii) $\frac{1}{2}$

(iii) $\frac{\pi}{4}$

(iv) π

$$(f) \int \frac{x^2}{1+x^3} dx = ?$$

$$\checkmark (i) \frac{1}{3} \ln(1+x^3) + C$$

$$(ii) \frac{1}{3} \ln(1+x^3)$$

$$(iii) \frac{1}{1+x^3} + C$$

$$(iv) \frac{1}{1+x^3}$$

(g) Write the area of the region bounded by $y = x$, X-axis, $x = 1$ and $x = 3$.

$y = x$, X-ଅକ୍ଷ, $x = 1$ ଓ $x = 3$ ଦ୍ୱାରା ଆବଦ୍ଧ କ୍ଷେତ୍ରର କ୍ଷେତ୍ରଫଳ ଲେଖ।

(i) 8 sq. units

8 ବର୍ଗ ଏକକ

(ii) 4 sq. units

4 ବର୍ଗ ଏକକ

(iii) 2 sq. units

2 ବର୍ଗ ଏକକ

(iv) 1 sq. unit

1 ବର୍ଗ ଏକକ

- (h) Write the order and degree of the following differential equation :

ନିମ୍ନ ଅବକଳ ସମୀକରଣର କ୍ରମ ଓ ଘାତ ଲେଖ :

$$\frac{x \frac{dx}{dt}}{1 + \frac{dx}{dt}} = \sqrt{t + \frac{dx}{dt}}$$

(i) 1, 1,

(ii) 1, $\frac{3}{2}$

(iii) 1, 2

(iv) 1, 3

- (i) Write the solution of the following differential equation :

ନିମ୍ନ ଅବକଳ ସମୀକରଣର ସମାଧାନ ଲେଖ :

$$\frac{dy}{dx} = 2x$$

(i) $y = 2x^2 + C$

~~(ii) $y = x^2 + C$~~

(iii) $y = 2 \ln x + C$

(iv) $y = \ln x + C$

- (j) The position vectors of the points A and B are $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 3\hat{j} - \hat{k}$ respectively. Write the position vector of the point which divides \overline{AB} in the ratio 1 : 3 internally.

A ଓ B ବିନ୍ଦୁର ଦିଗ ଭେକ୍ଟର ଯଥାକ୍ରମେ $3\hat{i} + \hat{j} - 2\hat{k}$ ଏବଂ $\hat{i} - 3\hat{j} - \hat{k}$. ଯେଉଁ ବିନ୍ଦୁ \overline{AB} କୁ 1 : 3 ଅନୁପାତରେ ଅନ୍ତର୍ଭିତ୍ତ କରେ ତାହାର ଦିଗ ଭେକ୍ଟର ଲେଖ।

(i) $\frac{5}{2}\hat{i} - \frac{7}{4}\hat{k}$

(ii) $\frac{3}{2}\hat{i} - 2\hat{j} - \frac{5}{4}\hat{k}$

(iii) $4\hat{i} + 3\hat{j} - \frac{5}{2}\hat{k}$

(iv) $5\hat{j} - \frac{1}{2}\hat{k}$

- (k) If (ଯଦି) $\vec{a} = 2\hat{i} + 3\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and (ଏବଂ) $\vec{c} = 3\hat{j} - 4\hat{k}$, then (ତେଣୁ) determine (ନିର୍ଣ୍ଣୟ କର) $\vec{a} - \vec{b} + 2\vec{c}$.

(i) $2\hat{i} - 4\hat{j} + 8\hat{k}$

(ii) $\hat{i} - 4\hat{j} - 8\hat{k}$

(iii) $\hat{i} + 4\hat{j} - 8\hat{k}$

(iv) $\hat{i} + 4\hat{j} + 8\hat{k}$

(l) $3\vec{a} \times 4\vec{a} = ?$

(i) 0

(ii) 12

(iii) $12\vec{a}$

(iv) $\vec{0}$

(m) Write the equation of the line passing through the points (2, 1, 3) and (4, -2, 5).

(2, 1, 3) ଏବଂ (4, -2, 5) ବିନ୍ଦୁଦ୍ୱୟ ଦେଇ ଯାଉଥିବା ସରଳ ରେଖାର ସମୀକରଣ ଲେଖ।

✓ (i) $\frac{x-2}{2} = \frac{y-1}{-3} = \frac{z-3}{2}$

(ii) $\frac{x+2}{2} = \frac{y+1}{-3} = \frac{z+3}{2}$

(iii) $\frac{x-2}{2} = \frac{y-1}{3} = \frac{z-3}{-2}$

(iv) $\frac{x-2}{-2} = \frac{y-1}{3} = \frac{z-3}{2}$

(n) Which of the following planes is perpendicular to the line $x = y = z$?

ନିମ୍ନଲିଖିତ ସମତଳ ମଧ୍ୟରୁ କେଉଁଟି $x = y = z$ ସରଳ ରେଖା ପ୍ରତି ଲମ୍ବ?

(i) $x - y + z = 0$

(ii) $x + y + z = 0$

(iii) $x + y - z = 0$

(iv) $-x + y + z = 0$

(o) If $A = \{x, y, z\}$ and $B = \{1, 2, 3, 4, 5\}$, then write the domain of the relation $R = \{(x, 2), (x, 3), (y, 1), (y, 5), (y, 4)\}$ from A to B.

ଯଦି $A = \{x, y, z\}$ ଏବଂ $B = \{1, 2, 3, 4, 5\}$

ହୁଏ, ତେବେ A ରୁ B ମଧ୍ୟରେ ଥିବା ସମ୍ପର୍କ

$R = \{(x, 2), (x, 3), (y, 1), (y, 5), (y, 4)\}$ ର

ଡୋମେନ୍ ଲେଖ।

(i) $\{x, y, z\}$

(ii) $\{x, y\}$

(iii) $\{x, z\}$

(iv) $\{z\}$

- (p) $A = \{a, b, c\}$, $B = \{1, 2, 3, 4\}$ and $f = \{(a, 2), (b, 3), (c, 4)\}$ is a function from A to B . Which one of the following is true for the function f ?

$A = \{a, b, c\}$, $B = \{1, 2, 3, 4\}$ ଏବଂ $f = \{(a, 2), (b, 3), (c, 4)\}$, A ରୁ B ରୁ ଏକ ଫଳନ। ନିମ୍ନଲିଖିତ ଉକ୍ତି ମଧ୍ୟରୁ କେଉଁଟି ଫଳନ f ପାଇଁ ସତ୍ୟ?

- (i) One-to-one
ଏକେକ
- (ii) Onto
ଅନ୍ତୁ
- (iii) One-to-one and onto
ଏକେକ ଏବଂ ଅନ୍ତୁ
-

- (iv) Many-one
ଅଧିକ

- (q) Write the value of $\sin^{-1} \frac{1}{3} + \cos^{-1} \frac{1}{3}$.

$\sin^{-1} \frac{1}{3} + \cos^{-1} \frac{1}{3}$ ର ମୂଲ୍ୟ ଲେଖ।

- (i) 0
- (ii) 1
- (iii) $\frac{\pi}{2}$
- (iv) π

(r) If $\sin^{-1} x = \frac{\pi}{5}$, then what is the value of $\cos^{-1} x$?

ଯଦି $\sin^{-1} x = \frac{\pi}{5}$, ତେବେ $\cos^{-1} x$ ର ମୂଲ୍ୟ କେତେ?

(i) $\frac{9\pi}{10}$

(ii) $\frac{7\pi}{10}$

(iii) $\frac{5\pi}{10}$

(iv) $\frac{3\pi}{10}$

(s) What is the maximum value of $3x+y+5$, subject to $y+3x \leq 5$, $x \geq 0$, $y \geq 0$?

$y+3x \leq 5$, $x \geq 0$ ଏବଂ $y \geq 0$ ହେଲେ, $3x+y+5$ ର ଗରିଷ୍ଠମାନ କେତେ?

(i) 0

(ii) 7

(iii) 10

(iv) 12

30.C

(Turn Over)

- (t) If the orders of the matrices A and B are 3×5 and 5×2 respectively, then what is the order of $(AB)^T$?

ଯଦି A ଓ B ମାଟ୍ରିକ୍ସଦ୍ୱୟର କ୍ରମ ଯଥାକ୍ରମେ 3×5 ଓ 5×2 ହୁଏ, ତେବେ $(AB)^T$ ମାଟ୍ରିକ୍ସର କ୍ରମ କେତେ?

- (i) 3×2
(ii) 2×3
(iii) 5×5
(iv) 3×3

- (u) Write the following equations in matrix form :

ନିମ୍ନଲିଖିତ ସମୀକରଣଦ୍ୱୟକୁ ମାଟ୍ରିକ୍ସ ରୂପରେ ପ୍ରକାଶ କର :

$$2x - 5y + 3 = 0, \quad y + 7 = 0$$

(i) $\begin{bmatrix} 0 & 1 \\ 2 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -3 \\ -7 \end{bmatrix}$

(ii) $\begin{bmatrix} 2 & -5 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -3 \\ -7 \end{bmatrix}$

(iii) $\begin{bmatrix} 0 & 1 \\ 2 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 7 \end{bmatrix}$

(iv) $\begin{bmatrix} 2 & -5 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -3 \\ -7 \end{bmatrix}$

(v) If $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$, then find $2A + 3B$.

ଉଦା. $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ ଏବଂ $B = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$ ଦିଆ, ତେଣୁ

$2A + 3B$ ନିର୍ଣ୍ଣୟ କର।

(i) $\begin{bmatrix} 6 & 5 \\ 0 & 2 \end{bmatrix}$

(ii) $\begin{bmatrix} 8 & 7 \\ -3 & 2 \end{bmatrix}$

(iii) $\begin{bmatrix} 7 & 7 \\ -3 & 2 \end{bmatrix}$

(iv) $\begin{bmatrix} 8 & 7 \\ -2 & 3 \end{bmatrix}$

(w) What is the value of the following determinant?

ନିମ୍ନ ଡିଟରମିନାଣ୍ଟର ମୂଲ୍ୟ କେତେ?

$$\begin{vmatrix} \omega^{21} & \omega^{27} \\ \omega^{105} & \omega^{501} \end{vmatrix}$$

(i) -1

(ii) 0

(iii) 1

(iv) 4

(x) For what value of x , $\begin{vmatrix} a & b & c \\ b & c & b \\ x & b & c \end{vmatrix} = 0$?

x ର କେଉଁ ମୂଲ୍ୟ ପାଇଁ $\begin{vmatrix} a & b & c \\ b & c & b \\ x & b & c \end{vmatrix} = 0$?

(i) a

(ii) b

(iii) c

(iv) 0

(y) If $f(x) = \frac{\sin x}{x}$ is continuous at $x=0$, then what is the value of $f(0)$?

ଯଦି $f(x) = \frac{\sin x}{x}$, $x=0$ ଠାରେ ନିରବଚ୍ଛିନ୍ନ ହୁଏ, ତେବେ $f(0)$ ର ମୂଲ୍ୟ କେତେ?

(i) -1

(ii) 0

(iii) 1

(iv) 2

2. Fill in the blank by choosing the correct answer given in the bracket in each case :

1×25=25

ପ୍ରତ୍ୟେକ ପ୍ରଶ୍ନର ବନ୍ଧନା ମଧ୍ୟରେ ଦିଆଯାଇଥିବା ସମ୍ଭାବ୍ୟ
ଉତ୍ତରମାନଙ୍କ ମଧ୍ୟରୁ ସଠିକ୍ ଉତ୍ତରଟି ବାଛି ଶୂନ୍ୟସ୍ଥାନ ପୂରଣ
କର :

(a) If (ଯଦି)

$$f(x) = \begin{cases} \frac{e^x - 1}{2x}, & x \neq 0 \\ k, & x = 0 \end{cases}$$

is continuous at $x=0$, then $k = \underline{\hspace{2cm}}$.

$x=0$ ଠାରେ ନିରବଚ୍ଛିନ୍ନ ହୁଏ, ତେବେ $k = \underline{\hspace{2cm}}$ ।

$$\left[2, 1, \frac{1}{2}, 0 \right]$$

(b) The derivative of x^5 with respect to x^3
is $\underline{\hspace{2cm}}$.

x^5 ର x^3 ଭିତ୍ତିକ ଅବକଳକ $\underline{\hspace{2cm}}$ ଅଟେ।

$$\left[\frac{5}{3}x^2, \frac{3}{5}x^2, \frac{5}{2}x^3, \frac{2}{5}x^3 \right]$$

(c) $\frac{d}{dx}(\tan^{-1} x^5) = \underline{\hspace{2cm}}$.

$$\left[5x^4 \tan^{-1} x^5, 5x^4 \cot^{-1} x^5, \frac{5x^4}{\sqrt{1+x^{10}}}, \frac{5x^4}{1+x^{10}} \right]$$

(Turn Over)

(d) For $x = \underline{\hspace{2cm}}$, the tangent to the curve $y = \cos x$, $0 \leq x \leq \pi$, is parallel with Y-axis.

$y = \cos x$, $0 \leq x \leq \pi$ ବକ୍ରର ସ୍ପର୍ଶକ $x = \underline{\hspace{2cm}}$ ପାଇଁ Y-ଅକ୍ଷ ସହିତ ସମାନ୍ତର ହେବ।

$$\left[\frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi \right]$$

(e) The value of the function $f(x) = x^2 - 4x + 5$ will be maximum or minimum for $x = \underline{\hspace{2cm}}$.

$x = \underline{\hspace{2cm}}$ ପାଇଁ $f(x) = x^2 - 4x + 5$ ଫଳନଟିର ମୂଲ୍ୟ ସର୍ବାଧିକ କିମ୍ବା ସର୍ବନିମ୍ନ ହେବ।

$$[3, 2, 1, 0]$$

(f) $\int \frac{\log x}{x} dx = \underline{\hspace{2cm}}$.

$$\left[\frac{1}{x^2} + C, \frac{1}{2}(\log x)^2 + C, \frac{1}{2}(\log x)^2, (\log x)^2 + C \right]$$

(g) $\int e^x(\cos x - \sin x) dx = \underline{\hspace{2cm}}$.

$$\left[e^x \cos x + C, e^x \sin x + C, e^x \cos\left(\frac{\pi}{4} - x\right) + C, e^x \sin\left(\frac{\pi}{4} - x\right) + C \right]$$

(h) $\int_0^2 [x] dx = \underline{\hspace{2cm}}$.

[-1, 0, 1, 2]

- (i) The area of the region bounded by the curve $y = x^2$, X-axis, $x = -1$ and $x = 1$ is $\underline{\hspace{2cm}}$ square unit(s).

ବକ୍ର $y = x^2$, X-ଅକ୍ଷ, $x = -1$ ଏବଂ $x = 1$ ଦ୍ୱାରା ଆବଦ୍ଧ କ୍ଷେତ୍ରର କ୍ଷେତ୍ରଫଳ $\underline{\hspace{2cm}}$ ବର୍ଗ ଏକକ।

$\left[\frac{4}{3}, \frac{2}{3}, \frac{1}{2}, 1 \right]$

- (j) The differential equation of the family of curves given by $y = Ae^{2x}$ is $\underline{\hspace{2cm}}$.

ବକ୍ର $y = Ae^{2x}$, X-ଅକ୍ଷ, $x = -1$ ଏବଂ $x = 1$ ଦ୍ୱାରା ଆବଦ୍ଧ କ୍ଷେତ୍ରର କ୍ଷେତ୍ରଫଳ $\underline{\hspace{2cm}}$ ବର୍ଗ ଏକକ।

$\left[\frac{4}{3}, \frac{2}{3}, \frac{1}{2}, 1 \right]$

- (j) The differential equation of the family of curves given by $y = Ae^{2x}$ is $\underline{\hspace{2cm}}$.

$y = Ae^{2x}$ ଦ୍ୱାରା ଦତ୍ତ ବକ୍ରମାନଙ୍କର ଅବକଳନ ସମୀକରଣଟି $\underline{\hspace{2cm}}$ ଅଟେ।

$$\left[\frac{dy}{dx} = 2x, \frac{dy}{dx} = x, \frac{dy}{dx} = 2y, \frac{dy}{dx} = y \right]$$

- (k) The distance of the point $P(x, y, z)$ from XY-plane is $\underline{\hspace{2cm}}$.

XY-ସମତଳ ଠାରୁ $P(x, y, z)$ ବିନ୍ଦୁର ଦୂରତା $\underline{\hspace{2cm}}$ ।

$\left[x, y, z, \sqrt{x^2 + y^2} \right]$

(l) The length of the vector $2\hat{i} + 3\hat{j} + \hat{k}$ is _____ units.

$2\hat{i} + 3\hat{j} + \hat{k}$ ଭେକ୍ଟରର ଦୈର୍ଘ୍ୟ _____ ଏକକ।

[6, 4, $\sqrt{6}$, $\sqrt{14}$]

(m) The measure of the angle between the vectors $\hat{i} + \hat{j} - \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is _____.

$\hat{i} + \hat{j} - \hat{k}$ ଏବଂ $\hat{i} - \hat{j} + \hat{k}$ ଭେକ୍ଟରଦ୍ୱୟର ଅନ୍ତର୍ଗତ

କୋଣର ପରିମାଣ _____ ଅଟେ।

$$\left[\frac{1}{\sqrt{3}} \cos^{-1} 1, \cos^{-1} \left(\frac{-1}{3} \right), \frac{2}{3} \cos^{-1} 1, \frac{1}{6} \cos^{-1} 1 \right]$$

(n) $[2\hat{i}, 3\hat{i}, \hat{j}] = \underline{\hspace{2cm}}$.

[-6, 0, 5, 6]

(o) The plane _____ passes through the line of intersection of the planes $x + y = 0$ and $x - y = 0$.

_____ ସମତଳଟି $x + y = 0$ ଏବଂ $x - y = 0$

ସମତଳଦ୍ୱୟର ଛେଦ ରେଖା ମଧ୍ୟ ଦେଇ

ଯାଉଅଛି।

$\sqrt{x=0, x+2y=0, x-2y=0, y+2x=0}$

(p) $A = \{a, b, c\}$ and $R = \{(a, a), (b, b), (c, c), (a, b), (b, c)\}$ is a relation defined on A . The relation R is _____.

$A = \{a, b, c\}$ ଏବଂ $R = \{(a, a), (b, b), (c, c), (a, b), (b, c)\}$ A ସେଟ୍‌ରେ ଏକ ସମ୍ବନ୍ଧ ଅଟେ। R ଏକ _____ ସମ୍ବନ୍ଧ।

[reflexive (ସ୍ୱତୁଲ୍ୟ), symmetric (ପ୍ରତିସମ), transitive (ସଂକ୍ରମକ), equivalence relation (ସମତୁଲ୍ୟ ରିଲେଶନ)]

(q) If $O(A) = 3$ and $O(B) = 5$, then the total number of onto relations that can be defined from set A to set B is _____.

ଯଦି $O(A) = 3$ ଏବଂ $O(B) = 5$, ତେବେ A ସେଟ୍ ଠାରୁ B ସେଟ୍‌କୁ _____ ଟି ଆଛାଦକ ଫଳନ ସୃଷ୍ଟି କରା ଯାଇ ପାରେ।

[30, ~~60~~, 10, 45]

(r) If the function $f: R \rightarrow R$ is defined as $f(x) = x^2 + 1$, then $f^{-1}(17) =$ _____.

ଯଦି $f: R \rightarrow R$ ଫଳନର ସଂଜ୍ଞା $f(x) = x^2 + 1$ ହୁଏ, ତେବେ $f^{-1}(17) =$ _____.

[ϕ , ~~± 4~~ , ± 3 , ± 2]

(s) $\tan\left(\sin^{-1}\frac{4}{\sqrt{17}}\right) = \underline{\hspace{2cm}}$.
[1, $\sqrt{17}$, 4, $\sqrt{13}$]

(t) If (ଉତ୍ତର) $\sin^{-1}\frac{x}{5} + \sec^{-1}\frac{5}{4} = \frac{\pi}{2}$, then
(ଶେଷ) $x = \underline{\hspace{2cm}}$.
[1, 3, 4, 5]

(u) $\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} = \underline{\hspace{2cm}}$.
[0, 1, 3, -1]

(v) If (ଉତ୍ତର) $\begin{vmatrix} 4 & x+1 \\ 3 & x \end{vmatrix} = 5$, then (ଶେଷ)
 $x = \underline{\hspace{2cm}}$.
[3, 4, 5, 8]

(w) If (ଉତ୍ତର)
 $\begin{vmatrix} aa_1 & aa_2 & aa_3 \\ ab_1 & ab_2 & ab_3 \\ ac_1 & ac_2 & ac_3 \end{vmatrix} = k \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$
then (ଶେଷ) $k = \underline{\hspace{2cm}}$.
[1, α^2 , α^3]

(x) The number of multiplicative inverses of a non-singular square matrix is ____.

ଗୋଟିଏ ଅଣସିଙ୍ଗୁଲାର ବର୍ଗାକାର ମାଟ୍ରିକ୍ସର ____ଟି
ଗୁଣନାତ୍ମକ ବିଲୋମୀ ଅଛି।

[0, $\sqrt{2}$, infinite (ଅସଂଖ୍ୟ)]

(y) If (ଯଦି) $\begin{bmatrix} 3 & 2 \\ 7 & x \end{bmatrix} \begin{bmatrix} 5 & -2 \\ -7 & y \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then

(ତେବେ) $x = \underline{\hspace{2cm}}$ and (ଏବଂ) $y = \underline{\hspace{2cm}}$.

[5 and (ଏବଂ) 3, 3 and (ଏବଂ) 5,
-3 and (ଏବଂ) 5, 3 and (ଏବଂ) -5]

GROUP—B

ଖ—ବିଭାଗ

(Marks : 30)

(ନମ୍ବର : 30)

3. Answer any ten questions : 3×10=30

ଯେକୌଣସି ଦଶଟି ପ୍ରଶ୍ନର ଉତ୍ତର ଦିଅ :

(a) If (ଯଦି) $e^{xy} = x^2 + y^2$, then find (ତେବେ)

ନିର୍ଣ୍ଣୟ କର) $\frac{dy}{dx}$.

(b) If (ଯଦି) $x = a \cos^3 t$, $y = a \sin^3 t$, then
find (ତେବେ ନିର୍ଣ୍ଣୟ କର) $\frac{dy}{dx}$.

(c) Find the equation of the normal to the curve $y(x-2) - x + 3 = 0$ at the point where it meets X-axis.

ବକ୍ର $y(x-2) - x + 3 = 0$ ଯେଉଁ ବିନ୍ଦୁରେ X-ଅକ୍ଷକୁ ଛେଦ କରେ, ସେଠାରେ ବକ୍ରପ୍ରତି ଅଭିଲମ୍ବର ସମୀକରଣଟି ନିର୍ଣ୍ଣୟ କର।

(d) Integrate (ସମାକଳନ କର) :

$$\int \cos x \cos 3x dx$$

(e) Find the area of the region bounded by the parabola $y^2 = x$ and the ordinate $x = 4$.

ପାରାବୋଲା $y^2 = x$ ଏବଂ କୋଟି $x = 4$ ଦ୍ୱାରା ଆବଦ୍ଧ କ୍ଷେତ୍ରର କ୍ଷେତ୍ରଫଳ ନିର୍ଣ୍ଣୟ କର।

(f) Solve (ସମାଧାନ କର) :

$$\frac{dy}{dx} = 2x \sec y$$

(g) Prove that (ପ୍ରମାଣ କର ଯେ)

$$\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx = \frac{\pi}{4}$$

- (h) Determine the value of λ , for which the points $(-1, -4, 1)$, $(1, -3, 0)$ and $(5, -1, \lambda)$ lie on a straight line.

λ ର କେଉଁ ମୂଲ୍ୟ ପାଇଁ $(-1, -4, 1)$, $(1, -3, 0)$ ଏବଂ $(5, -1, \lambda)$ ବିନ୍ଦୁତ୍ରୟ ଏକ ସରଳ ରେଖାରେ ରହିବେ, ନିର୍ଣ୍ଣୟ କର।

- (i) If the position vectors of the points P, Q, R and S are $4\hat{i} + 3\hat{j} - \hat{k}$, $5\hat{i} + 2\hat{j} + 2\hat{k}$, $2\hat{i} - 2\hat{j} - 3\hat{k}$ and $4\hat{i} - 4\hat{j} + 3\hat{k}$ respectively, then show that \vec{PQ} and \vec{RS} are parallel.

ଯଦି P, Q, R ଏବଂ S ବିନ୍ଦୁମାନଙ୍କର ଅବସ୍ଥିତି ଭେକ୍ଟର ଯଥାକ୍ରମେ $4\hat{i} + 3\hat{j} - \hat{k}$, $5\hat{i} + 2\hat{j} + 2\hat{k}$, $2\hat{i} - 2\hat{j} - 3\hat{k}$ ଓ $4\hat{i} - 4\hat{j} + 3\hat{k}$ ହୁଏ, ତେବେ ଦର୍ଶାଅ ଯେ \vec{PQ} ଓ \vec{RS} ସମାନ୍ତର।

- (j) Find the distance between the parallel planes $2x - 2y + z + 1 = 0$ and $4x - 4y + 2z + 3 = 0$.

$2x - 2y + z + 1 = 0$ ଏବଂ $4x - 4y + 2z + 3 = 0$ ସମାନ୍ତର ସମତଳଦ୍ୱୟ ମଧ୍ୟରେ ଦୂରତା ନିର୍ଣ୍ଣୟ କର।

- (k) $R = \{(m, n) \in N^2 \mid m + n \geq 50\}$ is a relation on the set of counting number N . Verify the relation for reflexive, symmetric or transitive.

$R = \{(m, n) \in N^2 \mid m + n \geq 50\}$ ଗଣନ ସଂଖ୍ୟା ସେଟ୍ N ରେ ଏକ ସମ୍ପର୍କ। ସମ୍ପର୍କଟି ସ୍ୱତନ୍ତ୍ର, ପ୍ରତିସମ କିମ୍ବା ସଂକ୍ରମକ ହେବା ପାଇଁ ପରୀକ୍ଷା କର।

(Turn Over)

(l) Evaluate (ମୂଲ୍ୟ ନିରୂପଣ କର) :

$$\tan \left[\cos^{-1} \frac{4}{5} + \tan^{-1} \frac{2}{3} \right]$$

(m) Suppose $S = \{1, 2, 3, 4\}$, $T = \{1, 4, 9, 16\}$ and $U = \{11, 14, 19, 26\}$. $f: S \rightarrow T$ and $g: T \rightarrow U$ defined as $f(s) = s^2$ and $g(t) = t + 10$. Determine $g \circ f(2)$ and $g \circ f(4)$.

ମନେକର $S = \{1, 2, 3, 4\}$, $T = \{1, 4, 9, 16\}$ ଏବଂ $U = \{11, 14, 19, 26\}$. ଫଳନ $f: S \rightarrow T$ ଏବଂ ଫଳନ $g: T \rightarrow U$ ମାନକର ସଂଜ୍ଞା ଯଥାକ୍ରମେ $f(s) = s^2$ ଏବଂ $g(t) = t + 10$. $g \circ f(2)$ ଏବଂ $g \circ f(4)$ ନିର୍ଣ୍ଣୟ କର।

(n) If $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$, then determine A^{-1} and show that $AA^{-1} = I$.

ଯଦି $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$ ହେଲେ, ତେବେ A^{-1} ନିର୍ଣ୍ଣୟ କର ଏବଂ ଦେଖାଅ ଯେ $AA^{-1} = I$.

(o) If

$$A = \begin{bmatrix} 1 & -2 & 2 \\ 3 & 1 & -1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 4 \\ 1 & 2 \\ 3 & -1 \end{bmatrix}.$$

show that $(AB)^T = B^T A^T$.

ଯଦି $A = \begin{bmatrix} 1 & -2 & 2 \\ 3 & 1 & -1 \end{bmatrix}$ ଏବଂ $B = \begin{bmatrix} 2 & 4 \\ 1 & 2 \\ 3 & -1 \end{bmatrix}$

ହେଲେ, ଦର୍ଶାଅ ଯେ $(AB)^T = B^T A^T$.

(p) If

$$A = \begin{bmatrix} 4 & 5 \\ 3 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & -2 \\ 2 & 4 \end{bmatrix}$$

show that $AB \neq BA$.

GROUP—C

ଗ—ବିଭାଗ

(Marks : 20)

(ନମ୍ବର : 20)

Answer any four questions :

5×4=20

କୌଣସି ଚାରୋଟି ପ୍ରଶ୍ନର ଉତ୍ତର ଦିଅ :

4. Prove by vector method that the altitudes of a triangle are concurrent.

ଭେକ୍ଟର ପ୍ରଣାଳୀରେ ପ୍ରମାଣ କର ଯେ ତ୍ରିଭୁଜର ଲମ୍ବଦ୍ରୁମ ଏକବିନ୍ଦୁରାମ।

(Turn Over)

5. Prove that the straight lines

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} \text{ and } \frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$$

intersect each other. Find their point of intersection and the equation of the plane on which the lines will lie.

ପ୍ରମାଣ କର ଯେ

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} \text{ ଓ } \frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$$

ସରଳ ରେଖାଦ୍ୱୟ ପରସ୍ପରକୁ ଛେଦ କରିବେ। ସେମାନଙ୍କର ଛେଦବିନ୍ଦୁ ଓ ସେମାନେ ଯେଉଁ ସମତଳରେ ରହିବେ ତାହାର ସମୀକରଣ ନିର୍ଣ୍ଣୟ କର।

6. Solve the following LPP by graphical method :

ଲେଖାଚିତ୍ର ସାହାଯ୍ୟରେ ନିମ୍ନ LPPର ସମାଧାନ କର :

Maximize (ଗରିଷ୍ଠ ମାନ ନିର୍ଣ୍ଣୟ କର)

$$Z = 4x + 3y$$

subject to (ଯେପରିକି)

$$x + y \leq 50$$

$$x + 2y \leq 80$$

$$2x + y \geq 20$$

$$x, y \geq 0$$

7. Prove that (ପ୍ରମାଣ କର ଯେ)

$$\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^3 & y^3 & z^3 \end{vmatrix} = (y-z)(z-x)(x-y)(x+y+z)$$

8. If (ଯଦି) $y = (\sec x)^x + (\log x)^{\sqrt{x}}$, then find (ଠେଣେ ନିର୍ଣ୍ଣୟ କର) $\frac{dy}{dx}$.

9. Integrate (ଅବକଳନ ନିର୍ଣ୍ଣୟ କର) :

$$\int \frac{x \tan^{-1} x}{(1+x^2)^{3/2}} dx$$

10. Solve (ସମାଧାନ କର) :

$$(1+x^2) \frac{dy}{dx} = 2xy - y^2$$
