

CHAPTER 1

Relations and Functions

Question 1.

The function $f : A \rightarrow B$ defined by $f(x) = 4x + 7, x \in R$ is

- (a) one-one
- (b) Many-one
- (c) Odd
- (d) Even

Question 2.

The function $f: R \rightarrow R$ defined by $f(x) = 3 - 4x$ is

- (a) Onto
- (b) Not onto
- (c) None one-one
- (d) None of these

Question 3.

The number of objective functions from set A to itself when A contains 106 elements is

- (a) 106
- (b) $(106)^2$
- (c) $106!$
- (d) 2^{106}

Question 4.

If $f: R \rightarrow R, g: R \rightarrow R$ and $h: R \rightarrow R$ is such that $f(x) = x^2, g(x) = \tan x$ and $h(x) = \log x$, then the value of $[h \circ (g \circ f)](x)$, if $x = \pi\sqrt{2}$ will be

- (a) 0
- (b) 1
- (c) -1
- (d) 10

Question 5.

If $f: R \rightarrow R, g: R \rightarrow R$ and $h: R \rightarrow R$ are such that $f(x) = x^2, g(x) = \tan x$ and $h(x) = \log x$, then the value of $(g \circ (f \circ h))(x)$, if $x = 1$ will be

- (a) 0
- (b) 1

(c) -1

(d) π

Question 6.

Let T be the set of all triangles in the Euclidean plane, and let a relation R on T be defined as aRb if a is congruent to $b \forall a, b \in T$.

Then R is

(a) reflexive but not transitive

(b) transitive but not symmetric

(c) equivalence

(d) None of these

Question 7.

Let us define a relation R in R as aRb if $a \geq b$. Then R is

(a) an equivalence relation

(b) reflexive, transitive but not symmetric

(c) symmetric, transitive but not reflexive

(d) neither transitive nor reflexive but symmetric

Question 8.

Let $A = \{1, 2, 3\}$ and consider the relation $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$. Then R is

(a) reflexive but not symmetric

(b) reflexive but not transitive

(c) symmetric and transitive

(d) neither symmetric, nor transitive

Question 9

Let $f : R \rightarrow R$ be defined by $f(x) = 1x \forall x \in R$. Then f is

(a) one-one

(b) onto

(c) bijective

(d) f is not defined

Question 10.

Let R be the relation "is congruent to" on the set of all triangles in a plane is

(a) reflexive

(b) symmetric

(c) symmetric and reflexive

(d) equivalence

CHAPTER 2

Inverse Trigonometric Functions

Question 1.

The value of $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{7}{8}\right)$ is

(a) $\tan^{-1}\left(\frac{7}{8}\right)$

(b) $\cot^{-1}(15)$

(c) $\tan^{-1}(15)$

(d) $\tan^{-1}\left(\frac{25}{24}\right)$

Question 2.

The value of $\tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{1}{7}\right)$ is

(a) π

(b) $\frac{\pi}{2}$

(c) $\frac{3\pi}{4}$

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

Question 3.

If $\tan^{-1}(\cot \theta) = 2\theta$, then θ is equal to

(a) $\pi/3$

(b) $\pi/4$

(c) $\pi/6$

(d) None of these

Question 4.

$\cot(\pi/4 - 2\cot^{-1} 3) =$

(a) 7

(b) 6

(c) 5

(d) None of these

Question 5.

$\sin^{-1}\left(\frac{-1}{2}\right)$

(a) $\frac{\pi}{3}$

(b) $-\frac{\pi}{3}$

(c) $\frac{\pi}{6}$

(d) $-\frac{\pi}{6}$

Question 6.

$$\tan^{-1} 1 + \cos^{-1}\left(\frac{-1}{2}\right) + \sin^{-1}\left(\frac{-1}{2}\right)$$

(a) $\frac{2\pi}{3}$

(b) $\frac{3\pi}{4}$

(c) $\frac{\pi}{2}$

(d) 6π

Question 7.

If $\cot^{-1}(\sqrt{\cos \alpha}) - \tan^{-1}(\sqrt{\cos \alpha}) = x$, then $\sin x$ is equal to

(a) $\tan^2\left(\frac{\alpha}{2}\right)$

(b) $\cot^2\left(\frac{\alpha}{2}\right)$

(c) $\tan \alpha$

(d) $\cot\left(\frac{\alpha}{2}\right)$

Question 8.

$\sin\left\{2\cos^{-1}\left(\frac{-3}{5}\right)\right\}$ is equal to

(a) $\frac{6}{25}$

(b) $\frac{24}{25}$

(c) $\frac{4}{5}$

(d) $-\frac{24}{25}$

Question 9.

The value of $\cos^{-1}\left(\cos\left(\frac{33\pi}{5}\right)\right)$ is

(a) $\frac{3\pi}{5}$

(b) $\frac{-3\pi}{5}$

(c) $\frac{\pi}{10}$

(d) $\frac{-\pi}{10}$

Question 10.

The value of $\sin\left[\cos^{-1}\left(\frac{7}{25}\right)\right]$ is

(a) $\frac{25}{24}$

(b) $\frac{25}{7}$

(c) $\frac{24}{25}$

(d) $\frac{7}{24}$

Chapter 3

Matrices

Question 1.

If A and B are symmetric matrices of the same order, then

- (a) AB is a symmetric matrix
- (b) A – B is a skew-symmetric matrix
- (c) AB + BA is a symmetric matrix
- (d) AB – BA is a symmetric matrix

Question 2.

If $A = \begin{bmatrix} 3 & 2x+3 \\ 2x+3 & 1 \end{bmatrix}$ is a symmetric matrix, then x =

- (a) 4
- (b) 3
- (c) -4
- (d) -3

Question 3.

If A is a square matrix, then $A - A'$ is a

- (a) diagonal matrix
- (b) skew-symmetric matrix
- (c) symmetric matrix
- (d) none of these

Question 4.

If A is any square matrix, then which of the following is skew-symmetric?

- (a) $A + A^T$
- (b) $A - A^T$
- (c) AA^T
- (d) $A^T A$

Question 5.

If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then

- (a) $\alpha = a^2 + b^2, \beta = ab$
- (b) $\alpha = a^2 + b^2, \beta = 2ab$
- (c) $\alpha = a^2 + b^2, \beta = a^2 - b^2$
- (d) $\alpha = 2ab, \beta = a^2 + b^2$

Question 6.

If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ x & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -2 & 1 \\ 0 & y & 0 \end{bmatrix}$ and $AB = I_3$, then $x + y$ equals

- (a) 0
- (b) -1
- (c) 2
- (d) None of these

Question 7.

If $A = [1334]$ and $A^2 - KA - 5I = 0$, then $K =$

- (a) 5
- (b) 3
- (c) 7
- (d) None of these

Question 8.

If $A = \begin{bmatrix} 1 & -2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ 1 & 1 \end{bmatrix}$, then $(AB)^T$ is equal

to

- (a) $\begin{bmatrix} -3 & -2 \\ 10 & 7 \end{bmatrix}$
- (b) $\begin{bmatrix} -3 & 10 \\ -2 & 7 \end{bmatrix}$
- (c) $\begin{bmatrix} -3 & 7 \\ 10 & 2 \end{bmatrix}$
- (d) None of these

Question 9. If matrix $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$ where a, b, c are real

positive numbers, $abc = 1$ and $A^T A = I$, then the value of $a^3 + b^3 + c^3$ is

- (a) 1
- (b) 2
- (c) 3
- (d) 4

Question 10.

Let $A = \begin{bmatrix} 1 & 2 \\ -5 & 1 \end{bmatrix}$ and $A^{-1} = xA + yI$, then the values of x and y respectively are

- (a) $\frac{-1}{11}, \frac{2}{11}$
- (b) $\frac{-1}{11}, \frac{-2}{11}$
- (c) $\frac{1}{11}, \frac{2}{11}$
- (d) $\frac{1}{11}, \frac{-2}{11}$

Chapter 4
Determinants

Question 1.

Find the adjoint of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

(a) $\begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$

Question 2.

Find x , if $\begin{bmatrix} 1 & 2 & x \\ 1 & 1 & 1 \\ 2 & 1 & -1 \end{bmatrix}$ is singular

(a) 1

(b) 2

(c) 3

(d) 4

Question 3.

The area of a triangle with vertices $(-3, 0)$, $(3, 0)$ and $(0, k)$ is 9 sq. units. The value of k will be

(a) 9

(b) 3

(c) -9

(d) 6

Question 4.

For what value of x , matrix $\begin{bmatrix} 6-x & 4 \\ 3-x & 1 \end{bmatrix}$ is a singular matrix?

(a) 1

(b) 2

(c) -1

(d) -2

Question 5.

Compute $(AB)^{-1}$, If

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \text{ and } B^{-1} = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 3 & -1 \\ 1 & 0 & 2 \end{bmatrix}$$

(a) $\frac{1}{19} \begin{bmatrix} 16 & 12 & 1 \\ 21 & 11 & -7 \\ 10 & -2 & 3 \end{bmatrix}$ (b) $\frac{1}{19} \begin{bmatrix} 16 & 12 & 10 \\ 21 & 11 & -2 \\ 1 & -7 & 3 \end{bmatrix}$

(c) $\frac{1}{19} \begin{bmatrix} 16 & 12 & 1 \\ -21 & -11 & 7 \\ 10 & -2 & 3 \end{bmatrix}$ (d) $\frac{1}{19} \begin{bmatrix} 16 & -21 & 1 \\ 21 & 11 & 7 \\ 10 & -2 & 3 \end{bmatrix}$

Question 6.

If $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ then $\frac{A^2 - 3I}{2} =$

- (a) A^{-1} (b) $2A$
(c) $2A^{-1}$ (d) $\frac{3}{2}A^{-1}$

Question 7.

If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$, then find $(AB)^{-1}$.

- (a) $\frac{1}{11} \begin{bmatrix} 14 & 5 \\ 5 & 1 \end{bmatrix}$ (b) $\frac{1}{11} \begin{bmatrix} 14 & -5 \\ -5 & 1 \end{bmatrix}$
(c) $\frac{1}{11} \begin{bmatrix} 1 & 5 \\ 5 & 14 \end{bmatrix}$ (d) $\frac{1}{11} \begin{bmatrix} 1 & -5 \\ -5 & 14 \end{bmatrix}$

Question 8.

Find a 2×2 matrix B such that $B = \begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$

- (a) $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 4 & 2 \\ 1 & 1 \end{bmatrix}$
(c) $\begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & -2 \\ -1 & 4 \end{bmatrix}$

Question 9.

A non-trivial solution of the system of equations $x + \lambda y + 2z = 0$, $2x + \lambda z = 0$, $2\lambda x - 2y + 3z = 0$ is given by $x : y : z =$

- (a) $1 : 2 : -2$
(b) $1 : -2 : 2$
(c) $2 : 1 : 2$
(d) $2 : 1 : -2$

Question 10.

If $\begin{bmatrix} 2x & 5 \\ 8 & x \end{bmatrix} = \begin{bmatrix} 6 & -2 \\ 7 & 3 \end{bmatrix}$, then the value of x is

- (a) 3
- (b) ± 3
- (c) ± 6
- (d) 6

Question 11.

Find the area of the triangle with vertices P(4, 5), Q(4, -2) and R(-6, 2).

- (a) 21 sq. units
- (b) 35 sq. units
- (c) 30 sq. units
- (d) 40 sq. units

Chapter 5

Continuity and Differentiability

Question 1.

The derivative of

$$\sin^{-1}\left(\frac{2x}{1+x^2}\right) \text{ with respect to } \tan^{-1}\left(\frac{2x}{1-x^2}\right) \text{ is}$$

- (a) 0 (b) 1
(c) $\frac{1}{1-x^2}$ (d) $\frac{1}{1+x^2}$

Question 2.

If $x = a \sin \theta$ and $y = b \cos \theta$, then $\frac{d^2y}{dx^2}$ is equal to

- (a) $\frac{a}{b^2} \sec^2 \theta$ (b) $\frac{b}{a} \sec^2 \theta$
(c) $\frac{b}{a^2} \sec^3 \theta$ (d) $-\frac{b}{a^2} \sec^3 \theta$

Question 3.

If $y = a^x$, b^{2x-1} , then $\frac{d^2y}{dx^2}$ is

- (a) $y^2 \cdot \log ab^2$ (b) $y \cdot \log ab^2$
(c) $y \cdot (\log ab^2)^2$ (d) $y \cdot (\log a^2b)^2$

Question 4.

If $\sqrt{x+y} + \sqrt{y-x} = a$, then $\frac{dy}{dx} =$

- (a) $\frac{\sqrt{x+y} - \sqrt{y-x}}{\sqrt{y-x} + \sqrt{x+y}}$ (b) $\frac{2\sqrt{x-y}}{\sqrt{x+y} - \sqrt{x-y}}$
(c) $\frac{x+y+\sqrt{xy}}{\sqrt{x+y}}$ (d) $\frac{x^2+y^2+2xy}{x^2+y^2}$

Question 5.

If $xy^2 = ax^2 + bxy + y^2$, then find $\frac{dy}{dx}$

- (a) $\frac{2ax+by+y^2}{2xy+bx+2y}$ (b) $\frac{2ax+by-y^2}{2xy-bx-2y}$
(c) $\frac{ax+by-xy}{xy+x^2+y^2}$ (d) $\frac{2x^2+axy+y^2}{x^2+y^2+2xy}$

Question 6.

If $y = e^{\frac{1}{2} \log(1+\tan^2 x)}$, then $\frac{dy}{dx}$ is equal to

- (a) $\frac{1}{2} \sec^2 x$ (b) $\sec^2 x$
(c) $\sec x \tan x$ (d) $e^{\frac{1}{2} \log(1+\tan^2 x)}$

Question 7.

Let $f(x) = \frac{1-\tan x}{4x-\pi}$, $x \neq \frac{\pi}{4}$, $x \in \left(0, \frac{\pi}{2}\right)$.

If $f(x)$ is continuous in $\left(0, \frac{\pi}{2}\right)$, then $f\left(\frac{\pi}{4}\right) =$

- (a) 1 (b) $\frac{1}{2}$
(c) $-\frac{1}{2}$ (d) -1

Question 8.

If $f(x) = -\sqrt{25-x^2}$, then $\lim_{x \rightarrow 1} \frac{f(x) - f(1)}{x-1}$ is equal to

- (a) $\frac{1}{24}$ (b) $\frac{1}{5}$
(c) $-\sqrt{24}$ (d) $\frac{1}{\sqrt{24}}$

Question 9.

If $x^m y^n = (x+y)^{m+n}$, then $\frac{dy}{dx}$ is equal to

- (a) $\frac{x+y}{xy}$ (b) xy
(c) $\frac{x}{y}$ (d) $\frac{y}{x}$

Question 10.

If $x^y \cdot y^x = 16$, then the value of $\frac{dy}{dx}$ at (2, 2) is

- (a) -1
(b) 0
(c) 1
(d) none of these

Chapter 6

Application of Derivatives

Question 1.

Find the local minimum value of the function $f(x) = \sin^4 x + \cos^4 x$, $0 < x < \pi/2$

- (a) $\frac{1}{\sqrt{2}}$
- (b) $\frac{1}{2}$
- (c) $\frac{\sqrt{3}}{2}$
- (d) 0

Question 2.

Find the points of local maxima and local minima respectively for the function $f(x) = \sin 2x - x$, where $-\pi/2 \leq x \leq \pi/2$

- (a) $-\pi/6, \pi/6$
- (b) $\pi/3, -\pi/3$
- (c) $-\pi/3, \pi/3$
- (d) $\pi/6, -\pi/6$

Question 3.

If $y = ax - b(x-1)(x-4)$ has a turning point $P(2, -1)$, then find the value of a and b respectively.

- (a) 1, 2
- (b) 2, 1
- (c) 0, 1
- (d) 1, 0

Question 4.

If $y = x^3 + x^2 + x + 1$, then y

- (a) has a local minimum
- (b) has a local maximum
- (c) neither has a local minimum nor local maximum
- (d) None of these

Question 5.

It is given that at $x = 1$, the function $x^4 - 62x^2 + ax + 9$ attains its maximum value on the interval $[0, 2]$. Find the value of a .

- (a) 100
- (b) 120
- (c) 140
- (d) 160

Question 6.

Find the height of the cylinder of maximum volume that can be inscribed in a sphere of radius a .

- (a) $\frac{2a}{3}$
- (b) $\frac{2a}{\sqrt{3}}$
- (c) $\frac{a}{3}$
- (d) $\frac{a}{\sqrt{3}}$

Question 7.

Find the volume of the largest cylinder that can be inscribed in a sphere of radius r cm.

- (a) $\frac{\pi r^3}{3\sqrt{3}}$
- (b) $\frac{4\pi r^2 h}{3\sqrt{3}}$
- (c) $4\pi r^3$
- (d) $\frac{4\pi r^3}{3\sqrt{3}}$

Question 8.

The area of a right-angled triangle of the given hypotenuse is maximum when the triangle is

- (a) scalene
- (b) equilateral
- (c) isosceles
- (d) None of these

Question 9.

$2x^3 - 6x + 5$ is an increasing function, if

- (a) $0 < x < 1$
- (b) $-1 < x < 1$
- (c) $x < -1$ or $x > 1$
- (d) $-1 < x < -\frac{1}{2}$

Question 10.

The function $f(x) = x^3 + 6x^2 + (9 + 2k)x + 1$ is strictly increasing for all x , if

- (a) $k > \frac{3}{2}$
- (b) $k < \frac{3}{2}$
- (c) $k \geq \frac{3}{2}$
- (d) $k \leq \frac{3}{2}$

Question 11.

The tangent to the parabola $x^2 = 2y$ at the point $(1, \frac{1}{2})$ makes with the x-axis an angle of

- (a) 0°
- (b) 45°
- (c) 30°
- (d) 60°

Chapter 7
INTEGRALS

Question 1.

Evaluate: $\int_0^{\pi/4} \sqrt{1 - \sin 2x} dx$

- (a) $\sqrt{2} - 1$
- (b) $\sqrt{2} + 1$
- (c) $\sqrt{2}$

Question 2.

Evaluate: $\int_0^{2\pi} \sin\left(\frac{\pi}{4} + \frac{\pi}{2}\right) dx$

- (a) $-2\sqrt{2}$
- (b) -2
- (c) $\sqrt{2}$
- (d) $2\sqrt{2}$

Question 3.

Evaluate : $\int_0^{\pi/2} \frac{\cos \theta}{(1 + \sin \theta)(2 + \sin \theta)} d\theta$

- (a) $\log\left(\frac{4}{3}\right)$
- (b) $\log\left(\frac{3}{4}\right)$
- (c) $\log 4 + \log 3$
- (d) None of these

Question 4.

Evaluate : $\int_0^1 \frac{x \tan^{-1} x}{(1 + x^2)^{3/2}} dx$

- (a) $\frac{4 - \pi}{2\sqrt{2}}$
- (b) $\frac{4 + \pi}{2\sqrt{2}}$
- (c) $\frac{4 - \pi}{4\sqrt{2}}$
- (d) None of these

Question 5.

Evaluate : $\int_0^{\pi/2} \frac{1}{2\cos x + 4\sin x} dx$

- (a) $\sqrt{5} \log\left(\frac{3 + \sqrt{5}}{2}\right)$
- (b) $\frac{1}{\sqrt{55}} \log\left(\frac{3 - \sqrt{5}}{2}\right)$
- (c) $\frac{1}{\sqrt{5}} \log\left(\frac{3 + \sqrt{5}}{2}\right)$
- (d) None of these

Question 6.

Evaluate : $\int (e^{x \log a} + e^{a \log x} + e^{\log a}) dx$

(a) $\frac{a^x}{\log a} + \frac{x^{a+1}}{a+1} + a^a x + C$

(b) $\frac{a^x}{\log a} + \frac{x^{a+1}}{a-1} + ax^a + C$

(c) $\frac{a^x}{\log a} + \frac{x^a}{a+1} + ax^a + C$

(d) $\frac{a^x}{\log x} + \frac{x^{a+1}}{a+1} + a^a x + C$

Question 7.

Evaluate : $\int \cos^3 x e^{\log \sin x} dx = \int \cos^3 x \sin x dx$

(a) $\frac{\cos^4 x}{4} + C$

(b) $-\frac{\cos^4 x}{4} + C$

(c) $\frac{\cos^4 x}{4x} + C$

(d) None of these

Question 8.

Evaluate : $\int \frac{1}{\sqrt{\sin^3 x \cos^5 x}} dx$

(a) $\frac{2}{\sqrt{\tan x}} - \frac{2}{3}(\tan x)^{3/2} + C$

(b) $-\frac{2}{\sqrt{\tan x}} + \frac{2}{3}(\tan x)^{3/2} + C$

(c) $-\frac{2}{\sqrt{\tan x}} - \frac{2}{3}(\tan x)^{2/3} + C$

(d) None of these

Question 9.

Evaluate : $\int \frac{x^3 + x}{x^4 - 9} dx$

(a) $\frac{1}{4} \log|x^4 - 9| + \frac{1}{12} \log \left| \frac{x^2 + 3}{x^2 - 3} \right| + C$

(b) $\frac{1}{4} \log|x^4 - 9| - \frac{1}{12} \log \left| \frac{x^2 - 3}{x^2 + 3} \right| + C$

(c) $\frac{1}{4} \log|x^4 - 9| + \frac{1}{12} \log \left| \frac{x^2 - 3}{x^2 + 3} \right| + C$

(d) None of these

Question 10.

Evaluate : $\int_0^{\pi/2} \sqrt{\cos \theta} \sin^3 \theta d\theta$

- (a) $\frac{8}{21}$ (b) $\frac{7}{21}$ (c) $\frac{8}{23}$ (d) $\frac{7}{23}$

Question 23.

Evaluate : $\int_0^{\pi/2} \frac{\cos x}{\left(\cos \frac{x}{2} + \sin \frac{x}{2}\right)^3} dx$

- (a) $2 - \sqrt{2}$ (b) $2 + \sqrt{2}$ (c) $3 + \sqrt{3}$ (d) $3 - \sqrt{3}$

Chapter 8
Application of Integrals

Question 1.

The area enclosed by the parabola $y^2 = 2x$ and tangents through the point $(-2, 0)$ is

- (a) 3 sq. units
- (b) 4 sq. units
- (c) $\frac{4}{3}$ sq. units
- (d) $\frac{8}{3}$ sq. units

Question 2.

The area bounded by the lines $y = 4x + 5$, $y = 5 - x$ and $4y = x + 5$ is

- (a) $\frac{15}{2}$ sq. units
- (b) $\frac{9}{2}$ sq. units
- (c) $\frac{13}{2}$ sq. units
- (d) None of these

Question 3.

The area of the circle $4x^2 + 4y^2 = 9$ which is interior to the parabola $x^2 = 4y$ is

- (a) $\frac{\sqrt{2}}{6} + \frac{9}{4} \sin^{-1} \left(\frac{2\sqrt{2}}{3} \right)$ sq. units
- (b) $\frac{\sqrt{2}}{6} - \frac{1}{4} \sin^{-1} \left(\frac{2\sqrt{2}}{3} \right)$ sq. units
- (c) $\frac{3}{2}$ sq. units
- (d) $\frac{7}{2}$ sq. units

Question 4.

Find the area enclosed by the parabola $4y = 3x^2$ and the line $2y = 3x + 12$.

- (a) 27 sq. units
- (b) 28 sq. units
- (c) 54 sq. units
- (d) 30 sq. units

Question 5.

The area included between the curves $x^2 = 4by$ and $y^2 = 4ax$

- (a) $16ab$ sq. units
- (b) $\frac{16ab}{3}$ sq. units

- (c) $4ab$ sq. units
- (d) $16\pi ab$ sq. units

Question 6.

The area of the ellipse $\frac{x^2}{4^2} + \frac{y^2}{9^2} = 1$ is

- (a) 6π sq. units
- (b) $\frac{\pi(a^2+b^2)}{4}$ sq. units
- (c) $\pi(a+b)$ sq. units
- (d) none of these

Question 7.

The area bounded by the curve $2x^2 + y^2 = 2$ is

- (a) π sq. units
- (b) $\sqrt{2}\pi$ sq. units
- (c) $\frac{\pi}{2}$ sq. units
- (d) 2π sq. units

Question 8.

Area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

- (a) $4\pi ab$ sq. units
- (b) $2\pi ab$ sq. units
- (c) πab sq. units
- (d) $\frac{\pi ab}{2}$ sq. units

Question 9.

The area enclosed by curve $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is

- (a) 10π sq. units
- (b) 20π sq. units
- (c) 5π sq. units
- (d) 4π sq. units

Question 10.

The area bounded by the curves $y = \sin x$, $y = \cos x$ and $x = 0$ is

- (a) $(\sqrt{2} - 1)$ sq. units
- (b) 1 sq. units
- (c) $\sqrt{2}$ sq. units
- (d) $(1 + \sqrt{2})$ sq. units

Question 11.

The area bounded by the lines $y = |x - 2|$, $x = 1$, $x = 3$ and the x-axis is

- (a) 1 sq. units

- (b) 2 sq. units
- (c) 3 sq. units
- (d) 4 sq. units

Question 12.

Area of the region bounded by the curve $y = x^2$ and the line $y = 4$ is

- (a) $\frac{11}{2}$ sq. units
- (b) $\frac{32}{3}$ sq. units
- (c) $\frac{43}{3}$ sq. units
- (d) $\frac{47}{3}$ sq. units

Chapter 9

Differential Equations

Question 1.

If $(x + 2y^3)\frac{dy}{dx} = y$, then

(a) $\frac{x}{y} + y^2 = c$

(b) $\frac{y}{x} + x^2 = c$

(c) $\frac{x}{y} - y^2 = c$

(d) $\frac{y}{x} - x^2 = c$

Question 2.

The solution of $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{\sqrt{1+x^2}}$ is

(a) $y = \frac{1+x^2}{x} + \frac{c}{x}$

(b) $y = \frac{\sqrt{1+x^2}}{x} + \frac{c}{x}$

(c) $y = \frac{x}{\sqrt{1+x^2}} + cx$

(d) none of these

Question 3.

The solution of the differential equation,

$x^2 \frac{dy}{dx} \cdot \cos \frac{1}{x} - y \sin \frac{1}{x} = -1$, where $y \rightarrow -1$ as $x \rightarrow \infty$, is

(a) $y = \sin \frac{1}{x} - \cos \frac{1}{x}$

(b) $y = \frac{x+1}{x \sin \frac{1}{x}}$

(c) $y = \cos \frac{1}{x} + \sin \frac{1}{x}$

(d) $y = \frac{x+1}{x \cos \frac{1}{x}}$

Question 4.

The degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x \sin\left(\frac{dy}{dx}\right) \text{ is}$$

(a) 1

(b) 2

(c) 3

(d) not defined

Question 5.

The order and degree of the differential

equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^{\frac{1}{4}} + x^{\frac{1}{5}} = 0$ respectively are

- (a) 2 and not defined
- (b) 2 and 2
- (c) 2 and 3
- (d) 3 and 3

Question 6.

Integrating factor of the differential equation

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

- (a) $-x$
- (b) $\frac{x}{1+x^2}$
- (c) $\sqrt{1-x^2}$
- (d) $\frac{1}{2}\log(1-x^2)$

Question 7.

If $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$, $y(0) = 0$, then

$$\tan \frac{x+y}{2} =$$

- (a) $e^x - 1$
- (b) $\frac{e^x - 1}{2}$
- (c) $2(e^x - 1)$
- (d) $1 - e^x$

Question 8.

The solution of differential equation $(e^y + 1) \cos x \, dx + e^y \sin x \, dy = 0$ is

- (a) $(e^y + 1) \sin x = c$
- (b) $e^x \sin x = c$
- (c) $(e^x + 1) \cos x = c$
- (d) none of these

Question 9.

The solution of the differential equation $dy/dx = x^2 + x$ is

- (a) $y = \frac{1}{2} \log|2+x^2| + c$
- (b) $y = \frac{1}{2} \log(1+x) + c$
- (c) $y = \log\left(\sqrt{1+x^2}\right) + c$
- (d) none of these

Question 10.

The Solution of $\cos(x+y) \, dy = dx$ is

- (a) $y = \tan\left(\frac{x+y}{2}\right) + C$
- (b) $y = \cos^{-1}\left(\frac{y}{x}\right) + C$
- (c) $y = x \sec\left(\frac{y}{x}\right) + C$
- (d) none of these

Question 11.

If $\frac{dy}{dx} = \frac{x+y}{x}$, $y(1) = 1$, then $y =$

(a) $x + \ln x$

(b) $x^2 + x \ln x$

(c) xe^{x-1}

(d) $x + x \ln x$

Chapter 10
Vector Algebra

Question 1.

A unit vector perpendicular to the plane of

$\vec{a} = 2\hat{i} - 6\hat{j} - 3\hat{k}$ and $\vec{b} = 4\hat{i} + 3\hat{j} - \hat{k}$ is

- (a) $\frac{4\hat{i} + 3\hat{j} - \hat{k}}{\sqrt{26}}$ (b) $\frac{2\hat{i} - 6\hat{j} - \hat{k}}{7}$
(c) $\frac{3\hat{i} - 2\hat{j} + 6\hat{k}}{7}$ (d) $\frac{2\hat{i} - 3\hat{j} - 6\hat{k}}{7}$

Question 2.

The area of parallelogram whose adjacent sides are $\hat{i} + 2\hat{j} + 3\hat{k}$ and $+ 2\hat{i} + \hat{j} - 4\hat{k}$ is

- (a) $10\sqrt{6}$
(b) $5\sqrt{6}$
(c) $10\sqrt{3}$
(d) $5\sqrt{3}$

Question 3.

If $\vec{AB} \times \vec{AC} = 2\hat{i} - 4\hat{j} + 4\hat{k}$, then the area of ΔABC is

- (a) 3 sq. units
(b) 4 sq. units
(c) 16 sq. units
(d) 9 sq. units

Question 4.

A vector of magnitude 5 and perpendicular to

$(\hat{i} - 2\hat{j} + \hat{k})$ and $(2\hat{i} + \hat{j} - 3\hat{k})$ is

- (a) $\frac{5\sqrt{3}}{3}(\hat{i} + \hat{j} + \hat{k})$ (b) $\frac{5\sqrt{3}}{3}(\hat{i} + \hat{j} - \hat{k})$
(c) $\frac{5\sqrt{3}}{3}(\hat{i} - \hat{j} + \hat{k})$ (d) $\frac{5\sqrt{3}}{3}(-\hat{i} + \hat{j} + \hat{k})$

Question 5.

$|\vec{a} \times \vec{b}|^2 + |\vec{a} \cdot \vec{b}|^2 = 144$ and $|\vec{a}| = 4$, then $|\vec{b}|$ is equal to

- (a) 12
(b) 3
(c) 8
(d) 4

Question 6.

If $\vec{a} = (\hat{i} + \hat{j} + \hat{k})$, $\vec{a} \cdot \vec{b} = 1$ and $\vec{a} \times \vec{b} = \hat{j} - \hat{k}$, then \vec{b} is

- (a) $\hat{i} - \hat{j} + \hat{k}$ (b) $2\hat{j} - \hat{k}$ (c) \hat{i} (d) $2\hat{i}$

Question 7.

If $|a| = 5$, $|b| = 13$ and $|a \times b| = 25$, find $a \cdot b$

- (a) ± 10
(b) ± 40
(c) ± 60
(d) ± 25

Question 8.

If O is origin and C is the mid point of A(2, -1) and B(-4, 3), then the value of OC is

- (a) $\hat{i} + \hat{j}$
(b) $\hat{i} - \hat{j}$
(c) $-\hat{i} + \hat{j}$
(d) $-\hat{i} - \hat{j}$

Question 9.

The summation of two unit vectors is a third unit vector, then the modulus of the difference of the unit vector is

- (a) $\sqrt{3}$
(b) $1 - \sqrt{3}$
(c) $1 + \sqrt{3}$
(d) $-\sqrt{3}$

Question 10.

Let $\vec{a} = \hat{i} + \hat{j} - \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and \hat{c} be a unit vector perpendicular to \vec{a} and coplanar with \vec{a} and \vec{b} , then \hat{c} is

- (a) $\frac{1}{\sqrt{2}}(\hat{j} + \hat{k})$ (b) $\frac{1}{\sqrt{2}}(\hat{j} - \hat{k})$
(c) $\frac{1}{\sqrt{6}}(\hat{i} - 2\hat{j} + \hat{k})$ (d) $\frac{1}{\sqrt{6}}(2\hat{i} - \hat{j} + \hat{k})$

Question 11.

If \hat{a} and \hat{b} are unit vectors enclosing an angle θ and

$|\hat{a} + \hat{b}| < 1$, then

(a) $\theta = \frac{\pi}{2}$

(b) $\theta < \frac{\pi}{3}$ (c)

$\pi \geq \theta > \frac{2\pi}{3}$

(d) $\frac{\pi}{3} < \theta < \frac{2\pi}{3}$

Question 12.

The vectors from origin to the points A and B are $a = 2\hat{i} - 3\hat{j} + 2\hat{k}$ and $b = 2\hat{i} + 3\hat{j} + \hat{k}$, respectively then the area of triangle OAB is

(a) 340

(b) $\sqrt{25}$

(c) $\sqrt{229}$

(d) $\frac{1}{2}\sqrt{229}$

Chapter 11
Three Dimensional Geometry

Question 1.

The angle between the line $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and

$\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ is

- (a) 0 (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{4}$

Question 2.

The angle between the lines passing through the points (4, 7, 8), (2, 3, 4) and (-1, -2, 1), (1, 2, 5) is

- (a) 0
(b) $\frac{\pi}{2}$
(c) $\frac{\pi}{4}$
(d) $\frac{\pi}{6}$

Question 3.

Equation of the plane passing through three points A, B, C with position vectors

$$-6\hat{i} + 3\hat{j} + 2\hat{k}, 3\hat{i} - 2\hat{j} + 4\hat{k}, 5\hat{i} + 7\hat{j} + 3\hat{k}$$

- (a) $\vec{r} \cdot (\hat{i} - \hat{j} - 2\hat{k}) + 23 = 0$
(b) $\vec{r} \cdot (\hat{i} + \hat{j} + 7\hat{k}) = 23$
(c) $\vec{r} \cdot (\hat{i} + \hat{j} - 7\hat{k}) + 23 = 0$
(d) $\vec{r} \cdot (\hat{i} - \hat{j} - 7\hat{k}) = 23$

Question 4.

Find the equation of plane passing through the points P(1, 1, 1), Q(3, -1, 2), R(-3, 5, -4).

- (a) $x + 2y = 0$
(b) $x - y = 2$
(c) $-x + 2y = 2$
(d) $x + y = 2$

Question 5.

The vector equation of a plane passing through the intersection of

the planes $r \cdot (\hat{i} + \hat{j} + \hat{k}) = 6$ and $r \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = -5$ and the point $(1, 1, 1)$ is

- (a) $\vec{r} \cdot (3\hat{i} + 4\hat{j} + 5\hat{k}) = 1$ (b) $\vec{r} \cdot (8\hat{i} + 5\hat{j} + 2\hat{k}) = 99$
 (c) $\vec{r} \cdot (20\hat{i} + 23\hat{j} + 26\hat{k}) = 69$
 (d) $\vec{r} \cdot (20\hat{i} - 23\hat{j} - 26\hat{k}) = 69$

Question 6.

The lines $\frac{x+3}{-3} = \frac{y-1}{1} = \frac{z-5}{5}$ and $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$

are

- (a) coplanar
 (b) non-coplanar
 (c) perpendicular
 (d) None of the above

Question 7.

The equation of the plane through the point $(0, -4, -6)$ and $(-2, 9, 3)$ and perpendicular to the plane $x - 4y - 2z = 8$ is

- (a) $3x + 3y - 2z = 0$
 (b) $x - 2y + z = 2$
 (c) $2x + y - z = 2$
 (d) $5x - 3y + 2z = 0$

Question 8.

The shortest distance between the lines

$\vec{r} = -(\hat{i} + \hat{j} + \hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 4\hat{k})$ and

$\vec{r} = -\hat{i} + \mu(3\hat{i} + 4\hat{j} + 5\hat{k})$ is

- (a) 1 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{6}}$

Question 9.

Find the angle between the line

$\vec{r} = \hat{i} + 2\hat{j} - \hat{k} + \lambda(\hat{i} - \hat{j} + \hat{k})$ and the plane

$\vec{r} \cdot (2\hat{i} - \hat{j} + \hat{k}) = 4$.

- (a) $\sin^{-1}\left(\frac{2\sqrt{2}}{3}\right)$ (b) $\sin^{-1}\left(\frac{2}{3}\right)$
 (c) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (d) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

Question 10.

The distance of the plane $\mathbf{r} \cdot (\frac{2}{7}\hat{i} + \frac{3}{7}\hat{j} - \frac{6}{7}\hat{k}) = 1$ from the origin is

(a) 1

(b) 7

(c) $\frac{1}{7}$

(d) None of these

Question 11.

The equation of the straight line passing through the point (a, b, c) and parallel to Z-axis is

(a) $\frac{x-a}{1} = \frac{y-b}{1} = \frac{z-c}{0}$

(b) $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{1}$

(c) $\frac{x-a}{1} = \frac{y-b}{0} = \frac{z-c}{0}$

(d) $\frac{x-a}{0} = \frac{y-b}{0} = \frac{z-c}{1}$

Question 12.

The point A(1, 2, 3), B(-1, -2, -1) and C(2, 3, 2) are three vertices of a parallelogram ABCD. Find the equation of CD.

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

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

Chapter 12

Linear Programming

Question 1.

$Z = 20x_1 + 20x_2$, subject to $x_1 \geq 0$, $x_2 \geq 0$, $x_1 + 2x_2 \geq 8$, $3x_1 + 2x_2 \geq 15$, $5x_1 + 2x_2 \geq 20$. The minimum value of Z occurs at

- (a) (8, 0)
- (b) $\left(\frac{5}{2}, \frac{15}{4}\right)$
- (c) $\left(\frac{7}{2}, \frac{9}{4}\right)$
- (d) (0, 10)

Question 2.

$Z = 7x + y$, subject to $5x + y \geq 5$, $x + y \geq 3$, $x \geq 0$, $y \geq 0$. The minimum value of Z occurs at

- (a) (3, 0)
- (b) $\left(\frac{1}{2}, \frac{5}{2}\right)$
- (c) (7, 0)
- (d) (0, 5)

Question 3.

Minimize $Z = 20x_1 + 9x_2$, subject to $x_1 \geq 0$, $x_2 \geq 0$, $2x_1 + 2x_2 \geq 36$, $6x_1 + x_2 \geq 60$.

- (a) 360 at (18, 0)
- (b) 336 at (6, 4)
- (c) 540 at (0, 60)
- (d) 0 at (0, 0)

Question 4.

$Z = 8x + 10y$, subject to $2x + y \geq 1$, $2x + 3y \geq 15$, $y \geq 2$, $x \geq 0$, $y \geq 0$. The minimum value of Z occurs at

- (a) (4.5, 2)
- (b) (1.5, 4)
- (c) (0, 7)
- (d) (7, 0)

Question 5.

$Z = 4x_1 + 5x_2$, subject to $2x_1 + x_2 \geq 7$, $2x_1 + 3x_2 \leq 15$, $x_2 \leq 3$, $x_1, x_2 \geq 0$. The minimum value of Z occurs at

- (a) (3.5, 0)
- (b) (3, 3)
- (c) (7.5, 0)
- (d) (2, 3)

Question 6.

The maximum value of $f = 4x + 3y$ subject to constraints $x \geq 0, y \geq 0, 2x + 3y \leq 18; x + y \geq 10$ is

- (a) 35
- (b) 36
- (c) 34
- (d) none of these

Question 7.

Objective function of a L.P.P. is

- (a) a constant
- (b) a function to be optimised
- (c) a relation between the variables
- (d) none of these

Question 8.

The optimal value of the objective function is attained at the points

- (a) on X-axis
- (b) on Y-axis
- (c) which are corner points of the feasible region
- (d) none of these

Question 9.

In solving the LPP:

“minimize $f = 6x + 10y$ subject to constraints $x \geq 6, y \geq 2, 2x + y \geq 10, x \geq 0, y \geq 0$ ” redundant constraints are

- (a) $x \geq 6, y \geq 2$
- (b) $2x + y \geq 10, x \geq 0, y \geq 0$
- (c) $x \geq 6$
- (d) none of these

Question 10.

Region represented by $x \geq 0, y \geq 0$ is

- (a) first quadrant
- (b) second quadrant

(c) third quadrant

(d) fourth quadrant

Chapter 13

Probability

Question 1.

Find the probability of throwing atmost 2 sixes in 6 throws of a single die.

(a) $\frac{35}{18} \left(\frac{5}{6}\right)^3$

(b) $\frac{35}{18} \left(\frac{5}{6}\right)^4$

(c) $\frac{18}{29} \left(\frac{2}{3}\right)^4$

(d) $\frac{18}{29} \left(\frac{2}{3}\right)^3$

Question 2.

A die is thrown again and again until three sixes are obtained. Find the probability of obtaining third six in the sixth throw of the die.

(a) $\frac{625}{23329}$

(b) $\frac{621}{25329}$

(c) $\frac{625}{23328}$

(d) $\frac{620}{23328}$

Question 3.

A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replecement the probability of getting exactly one red ball is

(a) $\frac{45}{196}$

(b) $\frac{135}{392}$

(c) $\frac{15}{56}$

(d) $\frac{15}{29}$

Question 4.

A die is thrown and card is selected a random from a deck of 52 playing cards. The probability of gettingan even number on the die and a spade card is

- (a) $\frac{1}{2}$
- (b) $\frac{1}{4}$
- (c) $\frac{1}{8}$
- (d) $\frac{3}{4}$

Question 5.

Two cards are drawn from a well shuffled deck of 52 playing cards with replacement. The probability, that both cards are queens, is

- (a) $\frac{1}{13} \times \frac{1}{13}$
- (b) $\frac{1}{13} + \frac{1}{13}$
- (c) $\frac{1}{13} \times \frac{1}{17}$
- (d) $\frac{1}{13} \times \frac{4}{51}$

Question 6.

P has 2 children. He has a son, Jatin. What is the probability that Jain's sibling is a brother?

- (a) $\frac{1}{3}$
- (b) $\frac{1}{4}$
- (c) $\frac{2}{3}$
- (d) $\frac{1}{2}$

Question 7.

If A and B are 2 events such that $P(A) > 0$ and $P(B) \neq 1$, then $P(A^c/B^c) =$

- (a) $1 - P(A|B)$
- (b) $1 - P(A/B^c)$
- (c) $\frac{1 - P(A \cup B)}{P(B)}$
- (d) $\frac{1 - P(\bar{A})}{P(B)}$

Question 8.

If two events A and B are such that $P(\bar{A}) = 0.3$, $P(B) = 0.4$ and $P(B|A \cup \bar{B}) =$

- (a) $\frac{1}{2}$
- (b) $\frac{1}{3}$
- (c) $\frac{2}{5}$
- (d) $\frac{1}{4}$

Question 9.

If E and F are events such that $0 < P(F) < 1$, then

- (a) $P(E|F) + P(E^-|F) = 1$
- (b) $P(E|F) + P(E|F^-) = 1$
- (c) $P(E^-|F) + P(E|F^-) = 1$
- (d) $P(E|F^-) + P(E^-|F^-) = 0$

Question 10.

$P(E \cap F)$ is equal to

- (a) $P(E) \cdot P(F|E)$
- (b) $P(F) \cdot P(E|F)$
- (c) Both (a) and (b)
- (d) None of these

Question 11.

If three events of a sample space are E, F and G, then $P(E \cap F \cap G)$ is equal to

- (a) $P(E) P(F|E) P(G|(E \cap F))$
- (b) $P(E) P(F|E) P(G|EF)$
- (c) Both (a) and (b)
- (d) None of these