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1 CHAPTER — Relations and Functions

1 Mark Questions

Q.1 If $f : R \to R$ be given by $f(x) = (3 - x^3)^{1/3}$, then $fof(x)$ is [*HP Board 2016*] **[1]**

(A) $x^{1/3}$ (B) x^3

(C) x (D) $(3 - x^3)$

3½ Mark Questions

Q.2 Find gof and fog if $f(x) = 8x^3$ and $g(x) = x^{\frac{1}{3}}$

[*HP Board 2016, 2018*] **[3½]**

Q.3 Find gof and fog, if

i) $f(x) = |x|$ and $g(x) = |5x - 2|$ [*HP Board 2014*]

ii) $f(x) = 8x^3$ and $g(x) = x^{1/3}$.

[*HP Board 2011, 2014, 2018*] **[3½]**

Q.4 Let L be the set of all lines in XY plane and R be the relation in L defined as $R = \{(L_1, L_2) : L_1 \text{ is parallel to } L_2\}$. Show that R is an equivalence relation.

[*HP Board 2017*] **[3½]**

Q.5 Let T be the set of all triangles in a plane with R a relation in T given by $R = \{(T_1, T_2) : T_1 \text{ is congruent to } T_2\}$. Show that R is an equivalence relation.

[*HP Board 2017*] **[3½]**

Q.6 If $f : R \to R$ be defined by $f(x) = x^2 - 3x + 2$, find $f(f(x))$. [*HP Board 2016, 2018*] **[3½]**

Q.7 If $f : R \to R$ be given by $f(x) = (3 - x^3)^{1/3}$ find $fof(x)$ [*HP Board 2016*] **[3½]**

Q.8 Consider $f : R^+ \to [4, \infty)$ given by $f(x) = x^2 + 4$. Show that f is invertible with the inverse f^{-1} of f given by $f^{-1}(y) = \sqrt{y - 4}$, where R^+ is the set of all non-negative real numbers. [*HP Board 2013, 2015*] **[3½]**

Q.9 Consider $f : R \to R$ given by $f(x) = 4x + 3$. Show that f is invertible. Find the inverse of f.

[*HP Board 2015*] **[3½]**

Q.10 Find fog and gof of $f : R \to R$ and $g : R \to R$ are given by $f(x) = \cos x$ and $g(x) = 3x^2$. Show that $fog \neq gof$.

[*HP Board 2014*] **[3½]**

Q.11 Show that $f : R_+ \to [5, \infty)$ given by

$f(x) = 9x^2 + 6x - 5$ is invertible with $f^{-1}(y) = \frac{\sqrt{y+6} - 1}{3}$.

[*HP Board 2012, 2013*] **[3½]**

Q.12 Let $f : \{1, 3, 4\} \to \{1, 2, 5\}$ and ;

$g : \{1, 2, 5\} \to \{1, 3\}$ be given by ;

$f : \{(1, 2), (3, 5), (4, 1)\}$ and ;

$g : \{(1, 3), (2, 3), (5, 1)\}$ Find gof.

[*HP Board 2011*] **[3½]**

4 Mark Questions

Q.13 Find $fof(x)$, if $f(x) = (3 - x^3)^{1/3}$ [*HP Board 2020*] **[4]**

Q.14 Find gof and fog, if $f(x) = 8x^3$ and $g(x) = x^{1/3}$

[*HP Board 2020*] **[4]**

Q.15 Find gof and fog, if $f(x) = x$ and $g(x) = |5x - 2|$

[*HP Board 2020*] **[4]**

Q.16 Find gof and fog, if $f : R \to R$ and $g : R \to R$ are given by $f(x) = \cos x$ and $g(x) = 3x^2$ [*HP Board 2019*] **[4]**

Q.17 Find gof and fog, if $f(x) = |x|$ and $g(x) = |5x - 2|$

[*HP Board 2019*] **[4]**

Q.18 Find gof and fog if $f(x) = 8x^3$ and $g(x) = x^{1/3}$.

[*HP Board 2019*] **[4]**

2 CHAPTER

Inverse Trigonometric Functions

1 Mark Questions

Q.1 $\frac{d}{dx}\cos^{-1}x$ = ? [*HP Board 2020*] **[1]**

(A) $\frac{1}{\sqrt{x^2-1}}$, $1 < x < -1$ (B) $-\frac{1}{\sqrt{1-x^2}}$, $-1 < x < 1$

(C) $-\frac{1}{\sqrt{x^2-1}}$, $-1 < x < 1$ (D) None of these

Q.2 $\sin\left\{\frac{\pi}{3}-\sin^{-1}\left(-\frac{1}{2}\right)\right\}$ is equal to :

(A) $\frac{1}{2}$ (B) 1 (C) $\frac{1}{3}$ (D) $\frac{1}{4}$

[*HP Board 2020*] **[1]**

Q.3 $\frac{d}{dx}(\sec^{-1}x)$ = ? [*HP Board 2020*] **[1]**

(A) $\cos^{-1}x$ (B) $\frac{x}{\sqrt{x^2-1}}$, $x < 0$

(C) $\frac{1}{|x|\sqrt{x^2-1}}$, $|x| > 0$ (D) None of these

Q.4 $\tan^{-1}(\sqrt{3}) - \sec^{-1}(-2)$ = ? [*HP Board 2020*] **[1]**

(A) π (B) $-\frac{\pi}{3}$ (C) $\frac{2\pi}{3}$ (D) $\frac{\pi}{3}$

Q.5 $\frac{d}{dx}(\tan^{-1}x)$ = ? [*HP Board 2020*] **[1]**

(A) $\frac{1}{1+x^2}$ (B) $\frac{1}{1-x^2}$

(C) $\frac{-1}{1+x^2}$ (D) None of these

Q.6 $\tan^{-1}(\sqrt{3}) - \cot^{-1}(-\sqrt{3})$ = ? [*HP Board 2020*] **[1]**

(A) $2\sqrt{2}$ (B) π (C) $\frac{-\pi}{2}$ (D) 0

Q.7 $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$ is equal to

(A) π (B) $\frac{-\pi}{2}$ (C) 0 (D) $2\sqrt{3}$

[*HP Board 2019*] **[1]**

Q.8 $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is equal to [*HP Board 2019*] **[1]**

(A) $\frac{7\pi}{6}$ (B) $\frac{5\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$

Q.9 $\sin\left(\frac{\pi}{3}-\sin^{-1}\left(\frac{-1}{2}\right)\right)$ is equal to [*HP Board 2019*] **[1]**

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) 1

Q.10 The principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is :

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

[*HP Board 2018*] **[1]**

Q.11 The principal value of $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is :

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

[*HP Board 2018*] **[1]**

Q.12 The principal value of $\tan^{-1}(-\sqrt{3})$ is :

(A) $\frac{\pi}{2}$ (B) $-\frac{\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $-\frac{\pi}{2}$

[*HP Board 2018*] **[1]**

Q.13 The principal value of $\cos^{-1}\left(-\frac{1}{2}\right)$ is

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $-\frac{\pi}{3}$ (D) $\frac{\pi}{6}$

[HP Board 2017] **[1]**

Q.14 The principal value of $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ is

[HP Board 2017] **[1]**

(A) $\frac{3\pi}{4}$ (B) $\frac{\pi}{4}$ (C) $-\frac{\pi}{4}$ (D) $\frac{5\pi}{4}$

Q.15 If $\sin^{-1} x = y$ then *[HP Board 2016]* **[1]**

(A) $0 \le y \le \pi$ (B) $-\pi/2 \le y \le \pi/2$

(C) $0 < y < \pi$ (D) $-\pi/2 < y < \pi/2$

Q.16 $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ equals to *[HP Board 2016]* **[1]**

(A) $\frac{3\pi}{4}$ (B) $\frac{-\pi}{4}$

(C) $\frac{\pi}{4}$ (D) None of these

Q.17 $\sin(\tan^{-1}x)$, $|x| < 1$ is equal to

(A) $\frac{x}{\sqrt{1-x^2}}$ (B) $\frac{1}{\sqrt{1+x^2}}$ (C) $\frac{x}{\sqrt{1+x^2}}$ (D) $\frac{1}{\sqrt{1-x^2}}$

[HP Board 2015] **[1]**

Q.18 The value of $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ is equal to

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) 1

[HP Board 2010, 2013, 2015] **[1]**

Q.19 The value of $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$ is equal to

(A) π (B) $\frac{-\pi}{2}$ (C) 0 (D) $2\sqrt{3}$

[HP Board 2010, 2013, 2015] **[1]**

Q.20 The principal value of $\tan^{-1}(-1)$ is

(A) $\frac{\pi}{4}$ (B) $\frac{3\pi}{4}$

(C) $\frac{-\pi}{4}$ (D) $\frac{\pi}{3}$

[HP Board 2012, 2014] **[1]**

Q.21 The principal value of $\sin^{-1}\left(-\frac{1}{2}\right)$ is

(A) $-\frac{\pi}{6}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $-\frac{\pi}{3}$

[HP Board 2012] **[1]**

Q.22 The principal value of $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$ is

(A) $\frac{3\pi}{5}$ (B) $\frac{-3\pi}{5}$

(C) $\frac{2\pi}{5}$ (D) None of these.

[HP Board 2011] **[1]**

Q.23 Write the principal value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$.

[HP Board 2011, 2013, 2014] **[1]**

Q.24 Find the value of $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$.

[HP Board 2011, 2014] **[1]**

3½ Mark Questions

Q.25 Solve $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$.

[HP Board 2018] **[3½]**

Q.26 Express $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ in the simplest form, $x \neq 0$.

[HP Board 2017, 2018] **[3½]**

Q.27 Solve $2\tan^{-1}(\cos x) = \tan^{-1}(2\operatorname{cosec} x)$.

[HP Board 2018] **[3½]**

Q.28 Express for following in the simplest form :

$\tan^{-1}\left(\frac{x}{\sqrt{a^2-x^2}}\right)$, $|x| < a$

[HP Board 2018] **[3½]**

Q.29 Write in the simplest form : $\tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right)$; $x < \pi$.

[HP Board 2010, 2012, 2013, 2018] **[3½]**

Q.30 Show that $\cos^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13} = \cos^{-1}\frac{33}{65}$

[HP Board 2017] **[3½]**

Q.31 Express $\tan^{-1}\left(\frac{\cos x - \sin x}{\cos x + \sin x}\right)$ in the simplest form ; $x < \pi$.

[HP Board 2017] **[3½]**

Q.32 Show that $\cos^{-1}\frac{12}{13} + \sin^{-1}\frac{3}{5} = \sin^{-1}\frac{56}{65}$

[HP Board 2017] **[3½]**

Q.33 Prove that : $\tan^{-1}\frac{2}{11} + \tan^{-1}\frac{7}{24} = \tan^{-1}\frac{1}{2}$

[HP Board 2016] **[3½]**

Q.34 Write the function in simplest form

$\tan^{-1}\left(\frac{3a^2x - x^3}{a^3 - 3ax^2}\right), a > 0; \frac{-a}{\sqrt{3}} \le x \le \frac{a}{\sqrt{3}}$

[HP Board 2016] **[3½]**

Q.35 Prove that $\sin^{-1}\frac{3}{5}-\sin^{-1}\frac{8}{17}=\cos^{-1}\frac{84}{85}$

[HP Board 2016] **[3½]**

Q.36 Express in simplest form $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right); \frac{-\pi}{2}<x<\frac{\pi}{2}$

[HP Board 2016] **[3½]**

Q.37 Prove that : $\cos^{-1}\frac{4}{5}+\cos^{-1}\frac{12}{13}=\cos^{-1}\frac{33}{65}$

[HP Board 2015] **[3½]**

Q.38 Prove that : $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)=\frac{x}{2}$, $x\in\left(0,\frac{\pi}{4}\right)$.

[HP Board 2015] **[3½]**

Q.39 Prove that : $\frac{9\pi}{8}-\frac{9}{4}\sin^{-1}\frac{1}{3}=\frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$.

[HP Board 2015] **[3½]**

Q.40 Prove that $\cos^{-1}\frac{12}{13}+\sin^{-1}\frac{3}{5}=\sin^{-1}\frac{56}{65}$.

[HP Board 2015] **[3½]**

Q.41 Prove that : $\tan^{-1}\frac{2}{11}+\tan^{-1}\frac{7}{24}=\tan^{-1}\frac{1}{2}$.

[HP Board 2014] **[3½]**

Q.42 Express : $\tan^{-1}\left[\frac{\cos x}{1-\sin x}\right], -\frac{\pi}{2}<x<\frac{\pi}{2}$ in simples form.

[HP Board 2014] **[3½]**

Q.43 Prove that : $2\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{7}=\tan^{-1}\frac{31}{17}$.

[HP Board 2013, 2014] **[3½]**

Q.44 Show that : $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{2}{11}\right)=\tan^{-1}\left(\frac{3}{4}\right)$.

[HP Board 2011, 2014] **[3½]**

Q.45 If $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$, then find the value of x.

[HP Board 2013] **[3½]**

Q.46 If $\tan^{-1}\frac{x-1}{x-2}+\tan^{-1}\frac{x+1}{x+2}=\frac{\pi}{4}$, then find the value of x.

[HP Board 2013] **[3½]**

Q.47 Show that $\sin^{-1}\left(\frac{5}{13}\right)+\cos^{-1}\left(\frac{3}{5}\right)=\tan^{-1}\left(\frac{63}{16}\right)$.

[HP Board 2011] **[3½]**

4 Mark Questions

Q.48 Express $\tan^{-1}\left(\frac{\sqrt{1+x^2}}{x}\right)$, in simplest form, $x\neq 0$.

[HP Board 2020] **[4]**

Q.49 Express $\tan^{-1}\left(\frac{\cos x-\sin x}{\cos x+\sin x}\right)$ in simplest form, $x <= \pi$.

[HP Board 2020] **[4]**

Q.50 Express $\tan^{-1}\left(\frac{x}{\sqrt{a^2+x^2}}\right)$, $|x| < a$ in the simplest a form.

[HP Board 2020] **[4]**

Q.51 Express $\tan^{-1}\left[\frac{\cos x}{1-\sin x}\right]$, $\frac{-3\pi}{2}<x<\frac{3\pi}{2}$ in simplest form.

[HP Board 2019] **[4]**

Q.52 Express $\tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right)$, $0<x<\pi$ in simplest form.

[HP Board 2019] **[4]**

Q.53 Express $\tan^{-1}\left(\frac{\cos x-\sin x}{\cos x+\sin x}\right)$, $0<x<\pi$ in simplest form.

[HP Board 2019] **[4]**

3 CHAPTER — Matrices

1 Mark Questions

Q.1 If A and B are symmetric matrices of same order, then AB – BA is a :

(A) Skew-symmetric matrix

(B) Symmetric matrix

(C) Zero matrix

(D) Identity matrix [*HP Board 2020*] **[1]**

Q.2 If a matrix A is both symmetric and skew-symmetric, then : [*HP Board 2020*] **[1]**

(A) A is a zero matrix (B) A is a square matrix

(C) A is a diagonal matrix (D) None of these

Q.3 The number of all possible matrices of order 3×3 with each entry 0 or 1 is [*HP Board 2019*] **[1]**

(A) 27 (B) 18 (C) 81 (D) 512

Q.4 $A = [a_{ij}]_{m\times n}$ is a square matrix if [*HP Board 2019*] **[1]**

(A) $m < n$ (B) $m > n$

(C) $m = n$ (D) None of these

Q.5 If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$, then A + A' = I, if the value of α is [*HP Board 2019*] **[1]**

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) π (D) $\frac{3\pi}{2}$

Q.6 If A and B are symmetric matrices of same order then AB – BA is : [*HP Board 2018*] **[1]**

(A) skew symmetric matrix

(B) symmetric matrix

(C) zero matrix

(D) identity matrix

Q.7 If the matrix A is both symmetric and skew-symmetric, then [*HP Board 2017*] **[1]**

(A) A is a diagonal matrix (B) A is zero matrix

(C) A is a square matrix (D) None of the above.

Q.8 If A and B are invertible matrices of the same order, then $(AB)^{-1}$ is equal to [*HP Board 2017*] **[1]**

(A) BA (B) $B^{-1}A$

(C) BA^{-1} (D) $B^{-1}A^{-1}$

Q.9 If A is a non singular matrix of order n then |adj A| is equal to [*HP Board 2016*] **[1]**

(A) |A| (B) $|A|^n$

(C) $|A|^{n-1}$ (D) 3|A|

Q.10 Let X and Z are matrices of order $2 \times n$ and $2 \times p$ respectively. If $n = p$, then the order of matrix 7X – 5Z is [*HP Board 2015*] **[1]**

(A) $p \times 2$ (B) $n \times 3$ (C) $2 \times n$ (D) $p \times n$

Q.11 If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to [*HP Board 2015*] **[1]**

(A) 3A (B) I (C) I – A (D) A

Q.12 The number of all possible matrices of order 3×3 with each entry 0 or 1 is [*HP Board 2013, 2015*] **[1]**

(A) 27 (B)18 (C) 81 (D) 512

Q.13 $A = [a_{ij}]_{m\times n}$ is a square matrix, if

(A) $m < n$ (B) $m > n$

(C) $m = n$ (D) none of these

[*HP Board 2010, 2011, 2014*] **[1]**

Q.14 If $A = [a_{ij}]_{m\times n}$ is a rectangular matrix of

(A) $m < n$ (B) $m > n$

(C) $m \neq n$ (D) None of these.

[*HP Board 2014*] **[1]**

Q.15 Matrices A and B will be inverse of each other only if

(A) AB = BA (B) AB = BA = 0

(C) AB = 0, BA = 1 (D) AB = BA = 1

[*HP Board 2014*] **[1]**

Q.16 Construct a 3×4 matrix whose elements are given by $a_{ij} = \frac{1}{2}|-3i + j|$. [*HP Board 2016*] **[1]**

2 Mark Questions

Q.17 Using elementary transformations find the inverse of the matrix $A=\begin{bmatrix}4 & 5\\ 3 & 4\end{bmatrix}$ [*HP Board 2016, 2018*] **[2]**

Q.18 Using elementary transformations, find the inverse of the matrix $\begin{bmatrix}1 & -1\\ 2 & 3\end{bmatrix}$.

[*HP Board March 2012, 2015, 2018*] **[2]**

Q.19 For the matrix $A=\begin{bmatrix}1 & 5\\ 6 & 7\end{bmatrix}$, verify that $(A + A')$ is a symmetric matrix. [*HP Board 2013, 2015, 2018*] **[2]**

Q.20 For the matrix $A=\begin{bmatrix}1 & 5\\ 6 & 7\end{bmatrix}$, verify that $(A - A')$ is a skew symmetric matrix. Also A+A' symmetric matrix.

[*HP Board 2013, 2018*] **[2]**

Q.21 If $A=\begin{bmatrix}-2\\ 4\\ 5\end{bmatrix}$, $B=[1 \quad 3 \quad -6]$ verify that $(AB)' = B'A'$.

[*HP Board March 2012, 2018*] **[2]**

Q.22 Find the values of x and y, from the equation

$$2\begin{bmatrix}x & 5\\ 7 & y-3\end{bmatrix}+\begin{bmatrix}3 & -4\\ 1 & 2\end{bmatrix}=\begin{bmatrix}7 & 6\\ 15 & 14\end{bmatrix}$$

[*HP Board 2017*] **[2]**

Q.23 Construct a 3×2 matrix whose elements are given by

$a_{ij}=\frac{1}{2}|i-3j|$ [*HP Board 2016*] **[2]**

Q.24 Using elementary transformation find the inverse of the matrix $A=\begin{bmatrix}2 & 5\\ 1 & 3\end{bmatrix}$ [*HP Board 2016*] **[2]**

Q.25 Construct a 2×2 matrix whose elements are

$a_{ij}=\frac{(i+2\hat{j})^2}{2}$ [*HP Board 2016*] **[2]**

Q.26 Using elementary transformations find the inverse of the matrix $A=\begin{bmatrix}2 & 1\\ 7 & 4\end{bmatrix}$. [*HP Board 2016*] **[2]**

Q.27 If $A=\begin{bmatrix}\cos\alpha & \sin\alpha\\ -\sin\alpha & \cos\alpha\end{bmatrix}$, then verify that $A'A = I$.

[*HP Board 2015*] **[2]**

Q.28 Using elementary operations, find the inverse of the matrix $\begin{bmatrix}1 & 3\\ 2 & 7\end{bmatrix}$.

[*HP Board March 2012, 2015, 2018*] **[2]**

Q.29 Using elementary operatoins, find the inverse of the matrix $A=\begin{bmatrix}1 & 2\\ 2 & -1\end{bmatrix}$ if exists.

[*HP Board 2011, 2015*] **[2]**

Q.30 If $A=\begin{bmatrix}-1 & 2 & 3\\ 5 & 7 & 9\\ 2 & 1 & 1\end{bmatrix}$ and $B=\begin{bmatrix}-4 & 1 & -5\\ 1 & 2 & 0\\ 1 & 3 & 1\end{bmatrix}$, then verify that $(A+B)^1 = A^1 + B^1$. [*HP Board 2014*] **[2]**

Q.31 If $A'=\begin{bmatrix}-2 & 3\\ 1 & 1\end{bmatrix}$ and $B=\begin{bmatrix}-1 & 0\\ 1 & 2\end{bmatrix}$, then find $(A + 2B)'$.

[*HP Board 2014*] **[2]**

Q.32 Show that the matrix : $A=\begin{bmatrix}1 & -1 & 5\\ -1 & 2 & 1\\ 5 & 1 & 3\end{bmatrix}$ is a symmetric matrix. [*HP Board 2013*] **[2]**

Q.33 Using elementary transformations, find the inverse of $\begin{bmatrix}3 & 1\\ 5 & 2\end{bmatrix}$. [*HP Board 2013*] **[2]**

Q.34 Using elementary operations find the inverse of the matrix $A=\begin{bmatrix}2 & 5\\ 1 & 3\end{bmatrix}$ if exits. [*HP Board 2011, 2013*] **[2]**

Q.35 If $A = \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$, $B = [1 \quad 5 \quad 7]$ verify that $(AB') = B'A'$.

[*HP Board March 2012*] **[2]**

Q.36 Find the value of x, y and z from equations $\begin{bmatrix} 4 & 3 \\ x & 5 \end{bmatrix} = \begin{bmatrix} y & z \\ 1 & 5 \end{bmatrix}$. [*HP Board 2011*] **[2]**

Q.37 Find the value of x, y and z from the equations

$$\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}.$$

[*HP Board 2011*] **[2]**

Q.38 Find the values of x, y and z from the equations

$$\begin{bmatrix} x+y & 2 \\ -5+z & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ -5 & 8 \end{bmatrix}.$$

[*HP Board 2011*] **[2]**

Q.39 Using elementary operations, find the inverse of the matrix $A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$ if exists. [*HP Board 2011*] **[2]**

3½ Mark Questions

Q.40 For the matrices A and B, verify that $(AB)' = (B'A')$, where $A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}$, $B = [-1 \quad 2 \quad 1]$.

[*HP Board 2012*] **[3½]**

4 Mark Questions

Q.41 If $A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}$ and $B = [-1 \quad 2 \quad 1]$, then verify that $(AB)' = B'A'$ [*HP Board 2020*] **[4]**

Q.42 If $A = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}$ and $B = [1 \ 3 \ -6]$, then verify that $(AB)' = B'A'$ [*HP Board 2020*] **[4]**

Q.43 If $A = \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$ and $B = [1 \ 5 \ 7]$, then verify that $(AB)' = B'A'$. [*HP Board 2020*] **[4]**

Q.44 Find $\frac{1}{2}(A + A')$ and $\frac{1}{2}(A - A')$ when

$$A = \begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$$

[*HP Board 2019*] **[4]**

Q.45 Find inverse by using Elementary transformation of $\begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$. [*HP Board 2019*] **[4]**

Q.46 Find inverse by using Elementary transformation of $\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$. [*HP Board 2019*] **[4]**

4 CHAPTER

Determinants

1 Mark Questions

Q.1 If A and B are invertible matrices of same order, then $(AB)^{-1}$ is equal to : [*HP Board 2020*] **[1]**

(A) BA (B) $B^{-1}A$

(C) $B^{-1}A^{-1}$ (D) None of these

Q.2 If A is an invertible matrix of order 2 then det. (A^{-1}) is equal to : [*HP Board 2018*] **[1]**

(A) det. (A) (B) $\frac{1}{\det(A)}$

(C) 1 (D) 0

Q.3 Let A be a non-singular square matrix or order 3×3, then |adj. (A)|. [*HP Board 2018*] **[1]**

(A) |A| (B) $|A|^3$

(C) $|A|^2$ (D) |3A|

Q.4 Let A be a square matrix of order 3 × 3, then |*k*A| is equal to

(A) $k|A|$ (B) $k^2|A|$

(C) $k^3|A|$ (D) $3k|A|$

[*HP Board 2009*] **[1]**

Q.5 If A is an invertible matrix of order *n*, then |adj A| =

(A) $|A|^n$ (B) $|A|^{n+1}$

(C) $|A|^{n-1}$ (D) $|A|^{n+2}$

[*HP Board 2009*] **[1]**

3½ Mark Questions

Q.6 Using properties of determinants, prove that

$$\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix} = 4abc$$

[*HP Board 2009, 2011, 2014*] **[3½]**

Q.7 By using properties of determinants show that,

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

[*HP Board 2016, 2018*] **[3½]**

Q.8 Using the properties of determinant, prove that

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x)^2 .$$

[*HP Board 2017*] **[3½]**

Q.9 Using the properties of determinant, show that

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2(3y+k)$$

[*HP Board 2017*] **[3½]**

Q.10 Using the properties of determinants, show that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc+bc+ca+ab$$

[*HP Board 2017*] **[3½]**

Q.11 Using properties of determinants show that

$$\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix} = 2(x+y+z)^3$$

[*HP Board 2016*] **[3½]**

Q.12 Using properties of determinants show that

$$\begin{vmatrix} x & y & x+y \\ y & x+y & x \\ x+y & x & y \end{vmatrix} = -2(x^3+y^3)$$

[*HP Board 2016*] **[3½]**

Q.13 Using properties of determinant, prove that

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x)^2.$$

[*HP Board March 2012, 2015*] **[3½]**

Q.14 Prove that

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3.$$

[*HP Board 2009, 2015*] **[3½]**

Q.15 Using properties of determinants prove that :

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c).$$

[*HP Board 2010, 2011, 2014*] **[3½]**

Q.16 Using the properties of determinant, prove that

$$\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = 4a^2b^2c^2.$$ [*HP Board 2010*] **[3½]**

Q.17 Using properties of determinants, prove that if x, y, z are different and $\Delta = \begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$,

then $1 + xyz = 0$. [*HP Board 2013*] **[3½]**

Q.18 Using properties of determinant, prove that

$$\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1-x^3)^2.$$

[*HP Board March 2012*] **[3½]**

4 Mark Questions

Q.19 Using properties of determinants, show that

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x)^2$$

[*HP Board 2020*] **[4]**

Q.20 Using properties of determinants, show that

$$\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1-x^3)^2$$

[*HP Board 2020*] **[4]**

Q.21 Using properties of determinants, show that

$$\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$$

[*HP Board 2020*] **[4]**

Q.22 By using properties of determinants show that

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x)^2$$

[*HP Board 2019*] **[4]**

Q.23 By using properties of determinants show that

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2(3y+k)$$

[*HP Board 2019*] **[4]**

Q.24 By using properties of determinants show that

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

[*HP Board 2019*] **[4]**

Q.25 Solve the system of linear equations, using matrix method.

$$x - y + 2z = 7$$
$$3x + 4y - 5z = -5$$
$$2x - y + 3z = 12$$

[*HP Board 2019*] **[6]**

5 Mark Questions

Q.26 Solve the following system of equations by using Matrix method:

$x - y + 2z = 7$; $3x + 4y - 5z = -5$;

$2x - y + 3z = 12$.

[*HP Board 2010, 2012, 2013, 2014*] **[5]**

Q.27 Solve the following system of equations using matrix method : $x - y + z = 4$, $2x + y - 3z = 0$ and $x + y + z = 2$. [*HP Board 2010, 2011, 2014*] **[5]**

Q.28 Solve the following system of equations $\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=4$, $\frac{4}{x}-\frac{6}{y}+\frac{5}{z}=1$, $\frac{6}{x}+\frac{9}{y}-\frac{20}{z}=2$. [*HP Board 2013*] **[5]**

Q.29 Solve the following system of equation by matrix method :

$3x - 2y + 3z = 8$; $2x + y - z = 1$; $4x - 3y + 2z = 4$

[*HP Board March 2012*] **[5]**

Q.30 Solve system of linear equations using matrix method

$2x + 3y + 3z = 5$

$x - 2y + z = -4$

$3x - y - 2z = 3$ [*HP Board 2016*] **[5]**

Q.31 Solve system of linear equation using matrix method.

$2x - 3y + 5z = 11$, $3x + 2y - 4z = -5$, $x + y - 2z = -3$.

[*HP Board 2016*] **[5]**

Q.32 Solve the system of equations by using matrix method:

$2x + y + z = 1$; $x - 2y - z = \frac{3}{2}$; $3y - 5z = 9$

[*HP Board March 2013, 2015*] **[5]**

6 Mark Questions

Q.33 Using matrix method, solve the following system of equations :

$x - y + z = 4$

$2x + y - 3z = 0$

$x + y + z = 2$ [*HP Board 2020*] **[6]**

Q.34 Using matrix method, solve following system of equations :

$x - y + 2z = 7$

$3x + 4y - 5z = -5$

$2x - y + 3z = 12$ [*HP Board 2020*] **[6]**

Q.35 Using matrix method, solve following system of equations :

$2x + 3y + 3z = 5$

$x - 2y + z = -4$

$3x - y - 2z = 3$ [*HP Board 2020*] **[6]**

Q.36 Solve system of linear equations using matrix method:

$x - y + z = 4$

$2x + y - 3z = 0$

$x + y + z = 2$ [*HP Board 2019*] **[6]**

Q.37 Solve system of linear equation , using matrix method.

$3x - 2y + 3z = 8$

$2x + y - z = 1$

$4x - 3y + 2z = 4$ [*HP Board 2019*] **[6]**

5 CHAPTER

Continuity and Differentiability

1 Mark Questions

Q.1 Find all points of discontinuity of 'f', where

$$f(x) = \begin{cases} \frac{\sin x}{x}, & \text{if } x < 1 \\ x+1, & \text{if } x \geq 0 \end{cases}$$ [*HP Board 2020*] **[3]**

Q.2 Derivative of $\cos \sqrt{x}$ is [*HP Board 2019*] **[1]**

(A) $-\frac{\sin \sqrt{x}}{2\sqrt{x}}$ (B) $\frac{\sin \sqrt{x}}{2\sqrt{x}}$

(C) $-\frac{\sin \sqrt{x}}{\sqrt{x}}$ (D) $-\frac{\sin \sqrt{x}}{2}$

Q.3 If $x - y = \pi$ then $\frac{dy}{dx}$ is [*HP Board 2019*] **[1]**

(A) 1 (B) 3

(C) π (D) – 1

Q.4 $\frac{d}{dx} \tan^{-1}x$ is [*HP Board 2019*] **[1]**

(A) $\frac{1}{1+x^2}$ (B) $\frac{1}{1-x^2}$ (C) $\frac{-1}{1+x^2}$ (D) $\frac{-1}{1-x^2}$

Q.5 The derivative of a^x is : [*HP Board 2018*] **[1]**

(A) a^x (B) $\frac{a^x}{\log a}$

(C) $a^x \log a$ (D) None of these

Q.6 The derivative of 2^x is : [*HP Board 2018*] **[1]**

(A) 2^x (B) $\frac{2^x}{\log 2}$

(C) $2^x \log 2$ (D) None of these

Q.7 The derivative of 5^x is : [*HP Board 2018*] **[1]**

(A) 5^x (B) $\frac{5^x}{\log 5}$

(C) $5^x \log 5$ (D) None of these

Q.8 The derivative of sin 30° is

(A) $\frac{1}{2}$ (B) cos 30°

(C) – cos 30° (D) 0 [*HP Board 2017*] **[1]**

Q.9 The derivative of cos 30° is

(A) – sin 30° (B) sin 30°

(C) $\frac{\sqrt{3}}{2}$ (D) 0 [*HP Board 2017*] **[1]**

Q.10 The derivative of tan 45° is [*HP Board 2017*] **[1]**

(A) 1 (B) cot 45°

(C) – cot 45° (D) 0

Q.11 The derivative of $f(x) = |x|$ at $x = 0$ is

(A) 1 (B) 0

(C) –1 (D) Does not exist

[*HP Board 2016*] **[1]**

Q.12 The derivative of log $(ax + b)$ is [*HP Board 2016*] **[1]**

(A) $\frac{1}{ax+b}$ (B) $\frac{b}{ax+b}$

(C) $\frac{a}{ax+b}$ (D) $\frac{a+b}{ax+b}$

Q.13 The derivative of $e^{\sin^{-1}x}$ is : [*HP Board 2015*] **[1]**

(A) $\frac{1}{\sqrt{1-x^2}}$ (B) $\frac{1}{\sqrt{1+x^2}}$

(C) $\frac{e^{\sin^{-1}x}}{\sqrt{1-x^2}}$ (D) $\frac{e^{\sin^{-1}x}}{\sqrt{1+x^2}}$

Q.14 The derivative of $\cos^{-1}(e^x)$ is [*HP Board 2015*] **[1]**

(A) $\sin^{-1}(e^x)\cdot e^x$ (B) $\frac{-e^x}{\sqrt{1-e^{2x}}}$

(C) $\frac{e^x}{\sqrt{1-e^{2x}}}$ (D) None of these.

Q.15 The derivative of $\sin(\log x)$, $x > 0$ is

(A) $\frac{\cos(\log x)}{x}$ (B) $x \cos(\log x)$

(C) $\log x \cos(\log x)$ (D) None of these.

[*HP Board 2015*] **[1]**

Q.16 The second order derivative of $\log x$ is

(A) $\frac{1}{x}$ (B) $\frac{1}{x^2}$

(C) $\frac{-1}{x^2}$ (D) None of these

[*HP Board 2014*] **[1]**

Q.17 If $y = a^{\log x}$, $a > 0$ then $\frac{dy}{dx}$ equals

(A) $\frac{a^{\log x}}{x}$ (B) $\frac{a^{\log x}}{\log a}$

(C) $\frac{a^{\log x}}{\log x}$ (D) None of these.

[*HP Board 2011, 2014*] **[1]**

Q.18 The derivative of $\cos^{-1}x$ is [*HP Board 2013*] **[1]**

(A) $\frac{1}{\sqrt{1-x^2}}$ (B) $-\frac{1}{\sqrt{1-x^2}}$

(C) $\frac{1}{1+x^2}$ (D) $\frac{1}{\sqrt{x^2-1}}$.

Q.19 The derivative of $\log(\log x)$ w.r.t. x is

(A) $(x \log x)^{-1}$ (B) $x \log x$

(C) $\frac{\log x}{x}$ (D) None of these.

[*HP Board 2011*] **[1]**

Q.20 Find all points of discontinuity of f, where f is defined by $f(x) = \begin{cases} \frac{x}{|x|}, & \text{if } x < 0 \\ -1, & \text{if } x \geq 0 \end{cases}$. [*HP Board 2012*] **[1]**

2 Mark Questions

Q.21 Examine the function given by $f(x) = \begin{cases} \frac{\sin x}{x}, & x < 0 \\ x+1, & x \geq 0 \end{cases}$ for continuity. [*HP Board 2018*] **[2]**

Q.22 Find the relationship between a and b so that the function f, defined by

$$f(x) = \begin{cases} ax+1 & \text{if } x \leq 3 \\ bx+3 & \text{if } x > 3 \end{cases}$$ is continuous at $x = 3$.

[*HP Board 2017*] **[2]**

Q.23 Find the values of k so that the function f, defined by

$$f(x) = \begin{cases} kx+1 & \text{if } x \leq 5 \\ 3x-5 & \text{if } x > 5 \end{cases}$$ is continuous at $x = 5$.

[*HP Board 2017*] **[2]**

Q.24 Find all points of discontinuity of f where f defined by

$$f(x) = \begin{cases} 2x+3 & \text{if } x \leq 2 \\ 2x-3 & \text{if } x > 2 \end{cases}$$ [*HP Board 2016*] **[2]**

Q.25 Find all points of discontinuity of f where f defined by

$$f(x) = \begin{cases} x+1 & \text{if } x \geq 1 \\ x^2+1 & \text{if } x < 1 \end{cases}$$ [*HP Board 2016*] **[2]**

Q.26 Find all points of discontinuity of f where f is defined by

$$f(x) = \begin{cases} x^3-3 & \text{if } x \leq 2 \\ x^2+1 & \text{if } x > 2 \end{cases}$$ [*HP Board 2016*] **[2]**

Q.27 Find the value of k so that the function

$$f(x) = \begin{cases} \frac{k\cos x}{\pi - 2x}, & \text{if } x \neq \frac{\pi}{2} \\ 3, & \text{if } x = \frac{\pi}{2} \end{cases}$$ is continuous at $x = \frac{\pi}{2}$.

[*HP Board 2015*] **[2]**

Q.28 Find the value of k so that the function f defined by

$$f(x) = \begin{cases} kx + 1, & \text{if } x \leq \pi \\ \cos x, & \text{if } x > \pi \end{cases}$$ is continuous at point $x = \pi$.

[*HP Board 2011, 2015*] **[2]**

Q.29 Discuss the continuity of the function f, where f is defined by $f(x) = \begin{cases} 2x, & \text{if } x < 0 \\ 0, & \text{if } 0 \leq x \leq 1 \\ 4x, & \text{if } x > 1 \end{cases}$.

[*HP Board 2014*] **[2]**

Q.30 Disuss the continuity of the function f where f is defined by $f(x) = \begin{cases} 3 & \text{if } 0 \leq x \leq 1 \\ 4 & \text{if } 1 < x < 3 \\ 5 & \text{if } 3 \leq x \leq 10 \end{cases}$.

[*HP Board 2014*] **[2]**

Q.31 For what value of λ is the function

$$f(x) = \begin{cases} \lambda(x^2 - 2x), & x \leq 0 \\ 4x + 1, & x > 0 \end{cases}$$ continuous at $x = 0$? What about continuity at $x = 1$? [*HP Board 2013*] **[2]**

Q.32 Find all points of discontinuity of $f(x)$ where

$$f(x) = \begin{cases} \frac{|x|}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$$.

[*HP Board March 2012*] **[2]**

Q.33 Discuss the continuity of $f(x) = \sin x + \cos x$.

[*HP Board 2010*] **[2]**

Q.34 Discuss the continuity of $f(x) = \sin x - \cos x$.

[*HP Board 2010*] **[2]**

3 Mark Questions

Q.35 Find all points of discontinuity of 'f' given by

$$f(x) = \begin{cases} x^3 - 3, & x \leq 2 \\ x^3 + 1, & x > 2 \end{cases}$$ [*HP Board 2020*] **[3]**

Q.36 Find all points of discontinuity of 'f' given by

$$f(x) = \begin{cases} x + 1, & \text{if } x \geq 1 \\ x^2 + 1, & \text{if } x < 1 \end{cases}$$

[*HP Board 2020*] **[3]**

Q.37 Find all points of discontinuity of f when f is defined by [*HP Board 2019*] **[3]**

$$f(x) = \begin{cases} 2x + 3, & \text{if } x \leq 2 \\ 2x - 3, & \text{if } x > 2 \end{cases}$$

Q.38 Find the pionts of discontinuity of f where f is defined by [*HP Board 2019*] **[3]**

$$f(x) = \begin{cases} x + 1, & \text{if } x \geq 1 \\ x^2 + 1, & \text{if } x < 1 \end{cases}$$

3½ Mark Questions

Q.39 Find $\frac{dy}{dx}$ of the functions given below :

i) $(\cos x)^y = (\cos y)^x$

[*HP Board 2005, 2014, 2016*] **[3½]**

ii) $xy = e^{x-y}$ [*HP Board 2008, 2012, 2015, 2018*] **[3½]**

Q.40 Differentiate $\sin\{(\tan^{-1}(e^{-x}))\}$ w.r.t. x

[*HP Board 2018*] **[3½]**

Q.41 Differentiate the function given below w.r.t. x,

(*i*) $(\log x)^{\cos x}$ [*HP Board 2018*] **[3½]**

(*ii*) $\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$.

Q.42 If $y^x = x^y$, find $\frac{dy}{dx}$. [*HP Board 2013, 2018*] **[3½]**

Q.43 Find $\frac{dy}{dx}$, if $\sin^2 x + \cos^2 y = 1$. [*HP Board 2017*] **[3½]**

Q.44 If $y = Ae^{mx} + Be^{nx}$, show that $\frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + mny = 0$

[*HP Board 2017*] **[3½]**

Q.45 If $y = 3e^{2x} + 2e^{3x}$, then prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$

[*HP Board 2017*] **[3½]**

Q.46 Differentiate the function w.r.t. 'x'

$(\log x)^x + x^{\log x}$ [*HP Board 2016*] **[3½]**

Q.47 If $y = 500e^{7x} + 600e^{-7x}$ show that $\frac{d^2y}{dx^2} = 49y$

[*HP Board 2016*] **[3½]**

Q.48 Find $\frac{dy}{dx}$ of the function $(\cos x)^y = (\cos y)^x$

[*HP Board 2016*] **[3½]**

Q.49 Differentiate the function $(x + 3)^2(x - 4)^3 . (x + 5)^4$ w.r.t. x [*HP Board 2016*] **[3½]**

Q.50 If $y = 3 \cos (\log x) - 4 \sin (\log x)$ show that

$x^2y_2 + xy_1 + y = 0$. [*HP Board 2016*] **[3½]**

Q.51 Find $\frac{dy}{dx}$ of the function $xy = e^{(x-y)}$.

[*HP Board 2015*] **[3½]**

Q.52 If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, for $-1 < x < 1$, prove that

$\frac{d^2y}{dx^2} = \frac{-1}{(1+x)^2}$. [*HP Board 2015*] **[3½]**

Q.53 If $\cos y = x \cos (a + y)$, with $\cos a \neq \pm 1$, prove that

$\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$. [*HP Board 2015*] **[3½]**

Q.54 If $x^y + y^x = 1$, find $\frac{dy}{dx}$. [*HP Board 2013, 2015*] **[3½]**

Q.55 Find the derivative of the given functions

i) $x^x - 2^{\sin x}$ ***ii)*** $(\sin x)^x + \sin^{-1}\sqrt{x}$.

[*HP Board 2015*] **[3½]**

Q.56 Differentiate: $(\log x)^n + x^{\log x}$.

[*HP Board 2014*] **[3½]**

Q.57 $y = 5 \cos x - 3 \sin x$, prove that $\frac{d^2y}{dx^2} + y = 0$.

[*HP Board 2014*] **[3½]**

Q.58 If $y = 3e^{2x} + 2e^{3x}$, prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.

[*HP Board 2011, 2012, 2013, 2014*] **[3½]**

Q.59 For a positive constant a find $\frac{dy}{dx}$, where $y = a^{t+1}$ and $x = \left(t + \frac{1}{t}\right)^a$. [*HP Board 2013*] **[3½]**

Q.60 Find the value of the constant k so that the function $f(x) = \begin{cases} kx^2, & \text{if } x \leq 2 \\ 3, & \text{if } x > 2 \end{cases}$ is continuous at $x = 2$.

[*HP Board 2011*] **[3½]**

Q.61 Differentiate $x^{x^2-3} + (x-3)^{x^2}$, for $x > 3$ w.r.t. x.

[*HP Board 2011*] **[3½]**

Q.62 Differentiate $(\sin x)^x + x^{\sin x}$, w.r.t. 'x'.

[*HP Board 2011*] **[3½]**

Q.63 Differentiate the following w.r.t. x :

i) $e^x + e^{x^2} + \ldots\ldots + e^{x^5}$ ***ii)*** $\cos (\log x + e^x)$, $x > 0$

[*HP Board 2010, 2018*] **[3½]**

Q.64 Differentiate w.r.t. x : $\log (\cos e^x)$.

[*HP Board 2010*] **[3½]**

Q.65 If $y = (\tan^{-1}x)^2$, then show that

$(x^2 + 1)^2y_2 + 2x(x^2 + 1)y_1 = 2$.

[*HP Board 2009*] **[3½]**

4 Mark Questions

Q.66 If $y = 3e^{2x} + 2e^{3x}$, then show that

$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ [*HP Board 2020*] **[4]**

Q.67 If $y = Ae^{mx} + Be^{nx}$, then show that

$\frac{d^2y}{dx^2} - (m + n)\frac{dy}{dx} + mn\,y = 0$

[*HP Board 2020*] **[4]**

Q.68 If $y = 500\ e^{7x} + 600\ e^{-7x}$, then show that $\frac{d^2y}{dx^2} = 49y$

[*HP Board 2020*] **[4]**

Q.69 Differentiate : $\cos x \cdot \cos 2x \cdot \cos 3x$ w.r.t. x.

[*HP Board 2019*] **[4]**

Q.70 Differentiate $(\log x)^{\cos x}$ [*HP Board 2019*] **[4]**

Q.71 Differentiate $x^x - 2^{\sin x}$ [*HP Board 2019*] **[4]**

6 Mark Questions

Q.72 Find area of region bounded by ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$

[*HP Board 2020*] **[6]**

6 CHAPTER

Application of Derivatives

1 Mark Questions

Q.1 The intervals, in which $y = x^2 e^{-x}$ is increasing is :

(A) (0, 2) (B) (– 2, 0)

(C) (– ∞, ∞) (D) (2, ∞)

[*HP Board 2020*] **[1]**

Q.2 The function $f(x) = x^{100} + \sin x - 1$ is strictly decreasing in the interval : [*HP Board 2020*] **[1]**

(A) (0, 1) (B) $\left(\frac{\pi}{2}, \pi\right)$

(C) $\left(0, \frac{\pi}{2}\right)$ (D) None of these

Q.3 The function $y = \log(\sin x)$ is strictly increasing in the interval : [*HP Board 2020*] **[1]**

(A) $\left(\frac{\pi}{2}, \pi\right)$ (B) $\left[0, \frac{\pi}{2}\right]$

(C) $\left(0, \frac{\pi}{2}\right)$ (D) None of these

Q.4 The slope of the normal to the curve $y = 2x^2 + 3 \sin x = 0$ is : [*HP Board 2019*] **[1]**

(A) 3 (B) $\frac{1}{3}$ (C) –3 (D) $\frac{-1}{3}$

Q.5 The line $y = x + 1$ is a tangent to the curve $y^2 = 4x$ at the point [*HP Board 2019*] **[1]**

(A) (1, 2) (B) (2, 1) (C) (1, –2) (D) (–1, 2)

Q.6 The rate of change of the area of a circle with respect to its radius r at r = 6 cm is [*HP Board 2019*] **[1]**

(A) 10 π cm^2 / cm (B) 12 π cm^2 / cm

(C) 8 π cm^2 / cm (D) 11 π cm^2 / cm

Q.7 The approximate change in the volume V of a cube of side x metres caused by increasing the side by 2% is

(A) $0.06x^3m^3$ (B) $0.002x^3m^3$

(C) $0.6x^3m^3$ (D) $0.006x^3m^3$

[*HP Board 2017*] **[1]**

Q.8 The approximate change in the volume of a cube of side x metres caused by increasing the side by 3% is

(A) $0.06x^3m^3$ (B) $0.6x^3m^3$

(C) $0.09x^3m^3$ (D) $0.9x^3m^3$

[*HP Board 2017*] **[1]**

Q.9 The approximate change in the volume V of a cube of side x metres caused by increasing the side by 1% is

(A) $0.03x^3m^3$ (B) $0.3x^3m^3$

(C) $0.003x^3m^3$ (D) $0.001x^3m^3$

[*HP Board 2017*] **[1]**

Q.10 The radius of a circle is increasing at the rate of 0.7 cm/sec then the rate of increasing circumference is

(A) 1.4 π cm/sec. (B) 2.4 cm/sec.

(C) 0.4 π cm/sec. (D) –0.4 cm/sec.

[*HP Board 2016*] **[1]**

Q.11 The volume of a cube is increasing at a rate of $9cm^3sec^{-1}$. How fast is surface area increasing when the length of an edge is 10cm. [*HP Board 2016*] **[1]**

(A) $1.8cm^2/s$ (B) $2.7\ cm^2/s$
(C) $3.6\ cm^2/s$ (D) none of these

Q.12 The length x of a rectangle is decreasing at the rate of 3cm/min and breadth is increasing at the rate 2cm/min. At what rate the perimeter of rectang decreases? [*HP Board 2016*] **[1]**

(A) 3 cm/min (B) 2 cm/min
(C) 1 cm/min (D) 4 cm/min

Q.13 Which of the following functions are strictly decreasing on $\left(0, \frac{\pi}{2}\right)$? [*HP Board 2015*] **[1]**

(A) $\sin x$ (B) $\cos 3x$
(C) $\cos 2x$ (D) $\tan x$

Q.14 The function $f(x) = x^{100} + \sin x - 1$ is strictly decreasing in the interval [*HP Board 2015*] **[1]**

(A) (0, 1) (B) $\left(\frac{\pi}{2}, \pi\right)$
(C) $\left(0, \frac{\pi}{2}\right)$ (D) None of these.

Q.15 The interval, in which $y = x^2e^{-x}$ is increasing, is

(A) (0, 2) (B) (–2, 0) (C) $(-\infty, \infty)$ (D) (2, ∞)

[*HP Board 2015*] **[1]**

Q.16 Find the rate of change of the area of the circle with respect to its radius r when $r = 6$ cm is

(A) 10π (B) 12π
(C) 8π (D) None of these.

[*HP Board 2011, 2014*] **[1]**

Q.17 The slope of the normal to the curve $y = 2x^2 + 3\sin x$ at $x = 0$ is

(A) 3 (B) $\frac{1}{3}$ (C) –3 (D) $-\frac{1}{3}$

[*HP Board 2012*] **[1]**

Q.18 The normal at the point (1, 1) on the curve $2y + x^2 = 3$ is

(A) $x + y = 0$ (B) $x - y = 0$
(C) $x + y + 1 = 0$ (D) $x - y + 1 = 0$

[*HP Board 2012*] **[1]**

Q.19 Find the rate of change of the area of a circle with respect to its radius r when $r = 4$ cm, is

(A) $6\pi\ cm^2/s$ (B) $4\pi\ cm^2/s$
(C) $8\pi\ cm^2/s$ (D) None of these.

[*HP Board 2011*] **[1]**

Q.20 Find the rate of change of the area of a circle with respect to its radius r when $r = 5$ cm, is

(A) $8\pi\ cm^2/cm$ (B) $10\pi\ cm^2/cm$
(C) $11\pi\ cm^2/cm$ (D) None of these.

[*HP Board 2011*] **[1]**

Q.21 The total revenue in rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. The marginal revenue, when $x = 15$ is

(A) 116 (B) 96
(C) 90 (D) 126

[*HP Board 2010*] **[1]**

Q.22 An edge of a variable cube is increasing at the rate of 3 cm/sec, then the rate of increasing of the volume of cube, when edge is 10 cm long, is [*HP Board 2010*] **[1]**

(A) $900\ cm^3/sec$ (B) $100\ cm^3/sec$
(C) $300\ cm^3/sec$ (D) none of these.

2 Mark Questions

Q.23 A balloon which always remains spherical on inflation, is being inflated by pumping in 900 cubic centimeter of gas per second. Find the rate at which the radius of the balloon increases when the radius of the balloon increases when the radius is 15 cm.

[*HP Board 2018*] **[2]**

Q.24 Find the intervals in which the function f given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is strictly increasing and strictly decreasing. [*HP Board 2017*] **[2]**

Q.25 Find the intervals in which the function if given $f(x) = -2x^3 - 9x^2 - 12x + 1$ is strictly decreasing.
[*HP Board 2016*] **[2]**

Q.26 Find the interval for which the given function $f(x) = 10 - 6x - 2x^2$ strictly increasing. [*HP Board 2016*] **[2]**

Q.27 Prove that the function f defined by $f(x) = \log(\cos x)$ is strictly decreasing on $\left(0, \frac{\pi}{2}\right)$.
[*HP Board 2010, 2014*] **[2]**

Q.28 Find the intervals in which $f(x) = x^2 + 2x - 5$ is strictly increasing or decreasing. [*HP Board 2010, 2013*] **[2]**

Q.29 Find the intervals in which $f(x) = 6 - 9x - x^2$ is strictly increasing or decreasing. [*HP Board 2010, 2012*] **[2]**

Q.30 Show that $y = \log(1+x) - \frac{2x}{2+x}$ is an increasing function of x, for all values of $x > -1$. [*HP Board 2009*] **[2]**

3 Mark Questions

Q.31 Find intervals in which the function $f(x) = -2x^3 - 9x^2 - 12x + 1$ is increasing or decreasing.
[*HP Board 2020*] **[3]**

Q.32 Find the intervals for which function $f(x) = 10 - 6x - 2x^2$ is strictly increasing.
[*HP Board 2020*] **[3]**

Q.33 Find intervals in which the function 'f' given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is strictly increasing.
[*HP Board 2020*] **[3]**

Q.34 Use differential to approximate $\sqrt{36.6}$
[*HP Board 2019*] **[3]**

Q.35 Use differential to approximate $(25)^{1/3}$
[*HP Board 2019*] **[3]**

Q.36 Use differential to approximate $\sqrt{25.3}$
[*HP Board 2019*] **[3]**

3½ Mark Questions

Q.37 Prove that the curves $x = y^2$ and $xy = k$ cut at right angles if $8k^2 = 1$. [*HP Board 2011, 2012*] **[3½]**

5 Mark Questions

Q.38 Find two positive numbers whose sum is 16 and sum of whose cubes is minimum. [*HP Board 2017*] **[5]**

Q.39 Find the equations of the tangent and normal to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at the point (x_0, y_0).
[*HP Board 2017*] **[5]**

Q.40 Find two positive numbers x and y such that $x+y = 60$ and xy^3 is maximum. [*HP Board 2017*] **[5]**

Q.41 Find the equation of the normals to the curve $y = x^3 + 2x + 6$ which are parallel to the line $x + 14y + 4 = 0$. [*HP Board 2016*] **[5]**

Q.42 Show that the right circular cone of least curved surface area and given volume has an altitude equal to $\sqrt{2}$ times the radius of the base. [*HP Board 2016*] **[5]**

Q.43 Find the equation of tangent and normal to the parabola $y^2 = 4ax$ at point $(at^2, 2at)$. [*HP Board 2016*] **[5]**

Q.44 Show that the altitide of the right circular cone of maximum volume that cand be inscribed in a sphere of radius r is $\frac{4r}{3}$. [*HP Board 2016*] **[5]**

Q.45 Find the equation of the tangent to the curve $y = \sqrt{3x-2}$, which is parallel to line $4x - 2y + 5 = 0$.
[*HP Board 2016*] **[5]**

Q.46 Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also find the maximum volume.
[*HP Board 2015*] **[5]**

Q.47 Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere. [*HP Board 2015*] **[5]**

Q.48 A rectangular sheet of tin 45 cm by 24 cm is to be made into a box without a top, by cutting off square piece from each corner and folding up the flaps. What should be the side of the square to be cut off so that the volume of the box is maximum ?

[*HP Board 2015*] **[5]**

Q.49 Using differentials, find the approximate value of $(0.009)^{1/3}$. [*HP Board 2011, 2014*] **[5]**

Q.50 Show that of all the rectangles inscribed in a given fixed circle, the square has the maximum area.

[*HP Board 2005, 2008, 2009, 2012, 2014*] **[5]**

Q.51 Find the equation of tangent line to the curve $y = x^2 - 2x + 7$ which is parallel to the line $2x - y + 9 = 0$.

[*HP Board 2014*] **[5]**

Q.52 Find the points at which the tangent to the curve $y = x^3 - 3x^2 - 9x + 7$ is parallel to the x-axis.

[*HP Board 2013, 2018*] **[5]**

Q.53 Show that the semi-vertical angle of right circular cone of given surface area and maximum volume is $\sin^{-1}\left(\frac{1}{3}\right)$.

[*HP Board 2018*] **[5]**

Q.54 Show that the right circular cylinder of given surface and maximum volume is such that its height is equal to the diameter of the base. [*HP Board 2009, 2012*] **[5]**

Q.55 Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$.

[*HP Board 2011, 2018*] **[5]**

Q.56 Prove that the radius of the right circular cylinder of greatest curved surface area which can be inscroibed in a given cone is half of that of the cone.

[*HP Board 2011*] **[5]**

Q.57 The volume of a cube is increasing at the rate of 8 cm^3/s. How fast is the surface area increasing when the length of an edge is 2 cm ? [*HP Board 2010*] **[5]**

6 Mark Questions

Q.58 Show that the right-circular cone of least curved surface and given volume has an altitude equal to $\sqrt{2}$ times the radius of the base. [*HP Board 2016*] **[6]**

Q.59 Find equations of tangent and normal to the curve $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at P (x_0, y_0). [*HP Board 2020*] **[6]**

Or

Show that right circular cone of least curved surface area and given volume has an altitude equal to $\sqrt{2}$ times the radius of the base. [*HP Board 2020*] **[6]**

Q.60 Find equations of tangent and normal to the curve $x^{2/3} + y^{2/3} = 2$ at P (1, 1). [*HP Board 2020*] **[6]**

Or

Show that semi-vertical angle of right circular cone of given surface area and maximum volume is $\sin^{-1}\left(\frac{1}{3}\right)$

[*HP Board 2020*] **[6]**

Q.61 Find equations of tangent and normal to the curve : $ay^2 = x^3$ at P(am^2, am^3) [*HP Board 2020*] **[6]**

Or

Show that semi-vertical angle of the cone of maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$.

[*HP Board 2020*] **[6]**

Q.62 Find two positive numbers whose sum is 16 and sum of whose cubes is minimum. [*HP Board 2019*] **[6]**

Or

Find the equations of the tangent and normal to the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 2$ at (1, 1). [*HP Board 2019*] **[6]**

Q.63 Find two positive numbers x and y such that $x+y = 60$ and xy^3 is maximum. [*HP Board 2019*] **[6]**

Or

Find the equation of tangent and normal to the parabola $y^2 = 4ax$ at the point $(at^2, 2at)$. [*HP Board 2019*] **[6]**

Q.64 Find two numbers whose sum is 24 and whose product is as large as possible. [*HP Board 2019*] **[6]**

Or

Find the equation of tangent and normal to the curve $y = x^4 - 6x^3 + 13x^2 - 10x + 5$ at (0, 5).

[*HP Board 2019*] **[6]**

7 CHAPTER — Integrals

1 Mark Questions

Q.1 $\int \sec x\,dx = ?$

(A) $\sec x \tan x + c$
(B) $\log|\sec x + \tan x| + c$
(C) $-\log|\sec x + \tan x| + c$
(D) $\log|\sec x - \tan x| + c$ [*HP Board 2020*] **[1]**

Q.2 $\int \text{cosec } x\,dx = ?$ [*HP Board 2020*] **[1]**

(A) $-\text{cosec } x \cot x + c$
(B) $\log|\text{cosec } x - \cot x| + c$
(C) $-\log|\text{cosec } x - \cot x| + c$
(D) None of these

Q.3 $\int \cot x\,dx = ?$ [*HP Board 2020*] **[1]**

(A) $\tan x + C$ (B) $\log|\sin x| + C$
(C) $-\log|\sin x| + C$ (D) $-\text{cosec}^2 x + C$

Q.4 $\int \sin mx\,dx$ is [*HP Board 2019*] **[1]**

(A) $m \cos mx + c$ (B) $-m \cos mx + c$
(C) $-\frac{1}{m}\cos mx + c$ (D) $\frac{\cos mx}{m} + c$

Q.5 $\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x}\,dx$ [*HP Board 2019*] **[1]**

(A) $\tan x + \cot x + c$ (B) $\tan x + \text{cosec } x + c$
(C) $-\tan x + \cot x + c$ (D) $\tan x + \sec x + c$

Q.6 $\int \frac{e^x(1+x)}{\cos^2(e^x \cdot x)}\,dx$ equal to [*HP Board 2019*] **[1]**

(A) $-\cot(e\,x^x) + c$ (B) $\tan(x \cdot e^x) + c$
(C) $\tan(e^x) + c$ (D) $\cot(e^x) + c$

Q.7 $\int e^x \sec x(1 + \tan x)dx$ is equal to : [*HP Board 2018*] **[1]**

(A) $e^x \cos x + c$ (B) $e^x \sec x + c$
(C) $e^x \sin x + c$ (D) $e^x \tan x + c$

Q.8 $\int e^x(\sin x + \cos x)dx$ is equal to : [*HP Board 2018*] **[1]**

(A) $e^x \cos x + c$ (B) $-e^x \sin x + c$
(C) $e^x \sin x + c$ (D) $-e^x \cos x + c$

Q.9 $\int e^x(f(x) + f'(x))dx$ is equal to: [*HP Board 2018*] **[1]**

(A) $e^x f'(x) + c$ (B) $e^x f(x) + c$
(C) $-e^x f'(x) + c$ (D) $-e^x f(x) + c$

Q.10 An antiderivative of $\sin 2x$ is [*HP Board 2017*] **[1]**

(A) $\cos 2x$ (B) $-\cos 2x$
(C) $-\frac{\cos 2x}{2}$ (D) $2\cos 2x$

Q.11 An antiderivative of $\cos 5x$ is [*HP Board 2017*] **[1]**

(A) $\frac{\sin 5x}{5}$ (B) $-5 \sin 5x$
(C) $\sin 5x$ (D) $5 \cos 5x$

Q.12 An antiderivative of $\sin mx$ is [*HP Board 2017*] **[1]**

(A) $-\frac{\cos mx}{m}$ (B) $-\cos mx$

(C) $-m\cos mx$ (D) $\cos mx$

Q.13 $\int \frac{dx}{\sin^2 . \cos^2 x}$ equals [*HP Board 2016*] **[1]**

(A) $\tan x + \cot x + c$ (B) $\tan x - \cot x + c$

(C) $\tan x . \cot x + c$ (D) $\tan x - \cot 2x + c$

Q.14 $\int \frac{e^x(1+x)}{\cos^2(xe^x)}dx$ is equal to [*HP Board 2016*] **[1]**

(A) $-\cot(ex . x) + c$ (B) $\tan(x e^x) + c$

(C) $\tan (e^x) + c$ (D) $x \tan (e^x) + c$

Q.15 $\int \frac{dx}{x^2+2x+2}$ equals to [*HP Board 2016*] **[1]**

(A) $x \tan^{-1} (x + 1) + c$ (B) $\tan^{-1} (x + 1) + c$

(C) $\tan^{-1} x + c$ (D) $(x + 1) \tan^{-1} x + c$

Q.16 Choose the correct answer of $\int e^x \sec x(1+\tan x)dx$.

[*HP Board 2010, 2012, 2015*] **[1]**

(A) $e^x \cos x + c$ (B) $e^x \sec x + c$

(C) $e^x \sin x + c$ (D) $e^x \tan x + c$

Q.17 Choose the correct answer of $\int x^2 e^{x^3} dx$.

(A) $\frac{1}{3}e^{x^3} + c$ (B) $\frac{1}{3}e^{x^2} + c$

(C) $\frac{1}{2}e^{x^3} + c$ (D) $\frac{1}{2}e^{x^2} + c$

[*HP Board 2010, 2015*] **[1]**

Q.18 $\int \frac{1}{a^2-x^2}dx$ equals [*HP Board 2011*] **[1]**

(A) $\log \left|\frac{a-x}{a+x}\right| + c$ (B) $\frac{1}{a} \log \left|\frac{a-x}{a+x}\right| + c$

(C) $\frac{1}{2a} \log \left|\frac{a+x}{a-x}\right| + c$ (D) None of these.

Q.19 $\int \frac{1}{\sqrt{a^2-x^2}} dx$ equals [*HP Board 2011*] **[1]**

(A) $\sin^{-1}\left(\frac{a}{x}\right) + c$ (B) $\sin^{-1}\left(\frac{x}{a}\right) + c$

(C) $\log \left|\frac{a}{x}\right| + c$ (D) None of these.

Q.20 $\int \frac{1}{x^2-a^2} dx$ equals [*HP Board 2011*] **[1]**

(A) $\frac{1}{2a}\log\left|\frac{a+x}{a-x}\right| + c$ (B) $\frac{1}{2a}\log\left|\frac{x+a}{x-a}\right| + c$

(C) $\frac{1}{2a}\log\left|\frac{x-a}{x+a}\right| + c$ (D) None of these.

Q.21 The anti derivative of $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)$ equals

(A) $\frac{1}{3}x^{1/3} + 2x^{1/2} + c$ (B) $\frac{2}{3}x^{2/3} + \frac{1}{2}x^2 + c$

(C) $\frac{2}{3}x^{3/2} + 2x^{1/2} + c$ (D) $\frac{3}{2}x^{3/2} + \frac{1}{2}x^{1/2} + c$

[*HP Board 2010*] **[1]**

Q.22 Evaluate $\int \text{cosec } x\, dx$. [*HP Board 2009, 2012*] **[1]**

2 Mark Questions

Q.23 Evaluate $\int \sec x\, dx$. [*HP Board 2012*] **[2]**

3½ Mark Questions

Q.24 Evaluate $\int \frac{6x+7}{\sqrt{(x-5)(x-4)}}dx$

[*HP Board 2016, 2018*] **[3½]**

Q.25 Evaluate $\int \frac{x}{(x-1)^2(x+2)}dx$

[*HP Board 2016, 2018*] **[3½]**

Q.26 Evaluate $\int \frac{5x+3}{\sqrt{x^2+4x+10}}dx$

[HP Board 2016, 2018] **[3½]**

Q.27 Evaluate $\int \frac{5x}{(x+1)(x^2-4)}dx$ *[HP Board 2018]* **[3½]**

Q.28 Evaluate $\int \frac{x}{(x^2+1)(x-1)}dx$. *[HP Board 2018]* **[3½]**

Q.29 Evaluate $\int_0^{\pi} \frac{x}{1+\sin x}dx$ *[HP Board 2018]* **[3½]**

Q.30 Evaluate $\int_0^{\pi} \frac{x\sin x}{1+\cos^2 x}dx$ *[HP Board 2018]* **[3½]**

Q.31 Evaluate $\int x\sqrt{1+x-x^2}dx$. *[HP Board 2017]* **[3½]**

Q.32 Evaluate $\int_0^{\pi/2} \frac{\cos^5 x}{\sin^5 x+\cos^5 x}dx$ *[HP Board 2017]* **[3½]**

Q.33 Evaluate $\int (x+1)\sqrt{2x^2+3}dx$. *[HP Board 2017]* **[3½]**

Q.34 Evaluate $\int \frac{xe^x}{(1+x)^2}dx$. *[HP Board 2017]* **[3½]**

Q.35 Evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx$ *[HP Board 2017]* **[3½]**

Q.36 Evaluate $\int (x+3)\sqrt{3-4x-x^2}dx$. *[HP Board 2017]* **[3½]**

Q.37 Evaluate $\int_0^{\pi/2} \frac{\sin^{3/2} x}{\sin^{3/2} x+\cos^{3/2} x}dx$.

[HP Board 2017] **[3½]**

Q.38 Evaluate $\int_2^8 |x-5|dx$ *[HP Board 2016]* **[3½]**

Q.39 Evaluate $\int \frac{x+3}{\sqrt{5-4x-x^2}}dx$ *[HP Board 2016]* **[3½]**

Q.40 Evaluate $\int \frac{x}{(x-1)(x-2)(x-3)}dx$ *[HP Board 2016]* **[3½]**

Q.41 Evaluate $\int_0^4 |x-1|dx$ *[HP Board 2016]* **[3½]**

Q.42 Evaluate $\int \frac{1}{1+\cot x}dx$. *[HP Board 2015]* **[3½]**

Q.43 I = $\int (x+1)\sqrt{2x^2+3}\,dx$. *[HP Boa rd 2014]* **[3½]**

Q.44 Evaluate $\int_{-5}^{5} |x+2|dx$. *[HP Board 2011, 2014]* **[3½]**

Q.45 Evaluate $\int \frac{5x}{(x+1(x^2+9)}dx$. *[HP Board 2014]* **[3½]**

Q.46 Evaluate $\int \frac{2x}{x^2+3x+2}dx$. *[HP Board 2013]* **[3½]**

Q.47 Find $\int e^x\left(\frac{1}{x}-\frac{1}{x^2}\right)dx$. *[HP Board 2013]* **[3½]**

Q.48 Evaluate $\int e^x\left(\frac{1+\sin x}{1+\cos x}\right)dx$. *[HP Board 2013]* **[3½]**

Q.49 Evaluate $\int_0^{\pi/4} \log(1+\tan x)dx$.

[HP Board 2009, 2013] **[3½]**

Q.50 Evaluate $\int \frac{dx}{\sqrt{5x^2-2x}}$. *[HP Board March 2012]* **[3½]**

Q.51 Evaluate $\int \frac{dx}{\sqrt{8+3x-x^2}}$. *[HP Board March 2012]* **[3½]**

Q.52 Evaluate $\int \frac{x\ \sin^{-1}x}{\sqrt{1-x^2}}dx$. *[HP Board 2012]* **[3½]**

Q.53 Evaluate $\int \frac{3x-1}{(x-1)(x-2)(x-3)}dx$

[HP Board March 2011, 2012] **[3½]**

Q.54 Evaluate $\int (\sin^{-1} x)^2 dx$ [*HP Board 2011*] **[3½]**

Q.55 Evaluate : $\int \frac{1}{9x^2+6x+5} dx$. [*HP Board 2010*] **[3½]**

4 Mark Questions

Q.56 Evaluate $\int e^x \left(\tan^{-1} x + \frac{1}{1+x^2} \right) dx$ [*HP Board 2020*] **[4]**

Or

Evaluate $\int \frac{x\, dx}{(x^2+1)(x-1)}$

Q.57 Evaluate $\int_{-5}^{5} |x-2|\, dx$ [*HP Board 2020*] **[4]**

Q.58 Evaluate $\int e^x \left(\frac{x}{(1+x)^2} \right) dx$ [*HP Board 2020*] **[4]**

Or

Evaluate $\int \frac{x\, dx}{(x-1)^2 (x+2)}$ [*HP Board 2020*] **[4]**

Q.59 Evaluate $\int_{0}^{4} |x-1|\, dx$ [*HP Board 2020*] **[4]**

Q.60 Evaluate $\int e^x \left(\frac{1}{x} - \frac{1}{x^2} \right) dx$ [*HP Board 2020*] **[4]**

Or

Evaluate $\int \frac{2}{(1-x)(1+x^2)} dx$ [*HP Board 2020*] **[4]**

Q.61 Evaluate $\int_{2}^{8} |x-5|\, dx$ [*HP Board 2020*] **[4]**

Q.62 Evaluate $\int \frac{dx}{x^2-6x+13}$ [*HP Board 2019*] **[4]**

Or

Evaluate $\int \frac{\sin x}{1+\cos x}$ [*HP Board 2019*] **[4]**

Q.63 Evaluate $\int_{0}^{2} x\sqrt{(x+2)}\, dx$. [*HP Board 2019*] **[4]**

Q.64 Evaluate $\int \frac{1}{\sqrt{x^2+2x+2}} dx$ [*HP Board 2019*] **[4]**

Or

Evaluate $\int \frac{1}{1+\tan x} dx$ [*HP Board 2019*] **[4]**

Q.65 Evaluate $\int_{0}^{\frac{\pi}{2}} \frac{\sin x}{1+\cos^2 x} dx$. [*HP Board 2019*] **[4]**

Q.66 Evaluate $\int \frac{1}{9x^2+6x+5} dx$ [*HP Board 2019*] **[4]**

Or

Evaluate $\int \frac{1}{1-\tan x} dx$ [*HP Board 2019*] **[4]**

Q.67 Evaluate $\int_{0}^{1} \frac{x}{x^2+1} dx$ [*HP Board 2019*] **[4]**

6 Mark Question

Q.68 Evaluate : $\int_{0}^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$. [*HP Board 2018*] **[6]**

8 CHAPTER Application of Integrals

1 Mark Questions

Q.1 The probability of obtaining an even prime number on each die, when a pair of die is rolled, is :

(A) 0 (B) $\frac{1}{3}$ (C) $\frac{1}{12}$ (D) $\frac{1}{36}$

[*HP Board 2018*] **[1]**

2 Mark Questions

Q.2 Find the area of the region bounded by $x^2 = 4y$, $y = 2$, $y = 4$ and y-axis in the first quadrant.

[*HP Board 2012*] **[3½]**

5 Mark Questions

Q.3 Find the area of region bounded by the curves : $x^2 = y$, the line $y = x + 2$ and the x-axis.

[*HP Board 2018*] **[5]**

Q.4 Find the area of region bounded by the curves : $4y = 3x^2$ and the line $2y = 3x + 12$.

[*HP Board 2018*] **[5]**

Q.5 Find the area of region bounded by the curves : $y^2 = 4ax$ and the line $y = mx$. [*HP Board 2018*] **[5]**

Q.6 Find the area bounded by the curve $x^2 = 4y$ and the line $x = 4y - 2$. [*HP Board 2017*] **[5]**

Q.7 Find the area of the region bounded by the curves $y = x^2 + 2$, $y = x$, $x = 0$ and $x = 3$. [*HP Board 2017*] **[5]**

Q.8 Find the area of the region bounded by the two parabolas $y = x^2$ and $y^2 = x$. [*HP Board 2017*] **[5]**

Q.9 Find the area lying between the curves $y^2 = 4x$ and $y = 2x$. [*HP Board 2017*] **[5]**

Q.10 Find the smaller area enclosed by the circle $x^2 + y^2 = 4$ and line $x + y = 2$. [*HP Board 2016*] **[5]**

Q.11 Using integrations find the area of triangle ABC Co-ordinates of whose vertices are A(2, 0), B(4, 5) and C(6, 3). [*HP Board 2016*] **[5]**

Q.12 Find the area of the region bounded by the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$. [*HP Board 2016*] **[5]**

Q.13 Using integration find the area of region bounded by triangle whose vertices are A(–1, 0), B(1, 3) and C(3, 2). [*HP Board 2016*] **[5]**

Q.14 Find the area of the smaller region bounded by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} + 1$ and the line $\frac{x}{3} + \frac{y}{2} = 1$. [*HP Board 2016*] **[5]**

Q.15 Using integration find the area of region bounded by the triangle whose vertices are (1, 0), (2, 2) and (3, 1).

[*HP Board 2016*] **[5]**

Q.16 Find the area of the circle $x^2 + y^2 = 16$ exterior to the parabola $y^2 = 6x$. [*HP Board 2015*] **[5]**

Q.17 Find the area bounded by curves $(x - 1)^2 + y^2 = 1$ and $x^2 + y^2 = 1$. [*HP Board 2013, 2015*] **[5]**

Q.18 Find the area lying above x-axis and included between the circle $x^2 + y^2 = 8x$ and the parabola $y^2 = 4x$.

[*HP Board 2011, 2012, 2014*] **[5]**

Q.19 Find the area of smaller region bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and the line $\frac{x}{a} + \frac{y}{b} = 1$.

[*HP Board 2011, 2014*] **[5]**

Q.20 Find the area between the curves $y = x$ and $y = x^2$.

[*HP Board 2010, 2013*] **[5]**

Q.21 Find the area of the region bounded by $y^2 = 9x$, $x = 2$, $x = 4$ and the x-axis in the first quadrant.

[*HP Board March 2012*] **[5]**

Q.22 Find the area of the region bounded by the curve $y^2 = x$ and the lines $x = 1$, $x = 4$ and the x-axis in the first quadrant. [*HP Board March 2012*] **[5]**

Q.23 Find the area bounded by curves $\{(x, y) : y \geq x^2$ and $y = |x|\}$. [*HP Board 2011*] **[5]**

Q.24 Find the area enclosed by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2} = 1$. [*HP Board 2010*] **[5]**

6 Mark Question

Q.25 Find the area of the region bounded by the ellipse $\frac{x^2}{16}+\frac{y^2}{9} = 1$. [*HP Board 2010*] **[6]**

Q.26 Using integration, find area of ΔABC, co-ordinates of whose vertices are A (2, 0), B (4, 5) and C (6, 3) [*HP Board 2020*] **[6]**

Q.27 Find area of Region bounded by ellipse $\frac{x^2}{16}+\frac{y^2}{9} = 1$ [*HP Board 2020*] **[6]**

Or

Using integration, find area of region bounded by the triangle where vertices are (1, 0) (2, 2) and (3, 1). [*HP Board 2020*] **[6]**

Q.28 Using integration, find area of region bounded by ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ [*HP Board 2020*] **[6]**

Or

Using integration, find area of region bounded by a ΔABC, co-ordinates of whose vertices are A(– 1, 0), B(1, 3) and C(3, 2). [*HP Board 2020*] **[6]**

Q.29 Find the area bounded by $y^2 = 9x$, $x = 2$, $x = 4$ and x-axis in the first quadrant. [*HP Board 2019*] **[6]**

Or

Find the area of circle $4x^2 + 4y^2 = 9$ which is interior to the parabola $x^2 = 4y$. [*HP Board 2019*] **[6]**

Q.30 Find the area of the region bounded by the curve $y^2 = x$ and the lines $x = 1$, $x = 4$ and the x-axis in the first quadrant. [*HP Board 2019*] **[6]**

Or

Find the area of the region enclosed between the two curves $x^2 + y^2 = 4$ and $(x – 2)^2 + y^2 = 4$ [*HP Board 2019*] **[6]**

Q.31 Find he area of region bounded by $x^2 = 4y$, $y = 2$, $y = 4$ and the y-axis in the first quadrant. [*HP Board 2019*] **[6]**

Or

Find the area bounded by curves $(x – 1)^2 + y^2 = 1$ and $x^2 + y^2 = 1$. [*HP Board 2019*] **[6]**

9 CHAPTER

Differential Equations

1 Mark Questions

Q.1 The degree of differential equation :

$$\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0 \text{ is :}$$ [*HP Board 2020*] **[1]**

(A) 2 (B) Not defined
(C) 1 (D) None of these

Q.2 The degree of differential equation
$(y''')^2 + (y'')^3 + (y')^4 + y^5 = 0$ is :
(A) 2 (B) 4 (C) 5 (D) 3
[*HP Board 2020*] **[1]**

Q.3 If a line has direction ratios (2, – 1, – 2) then its direction cosines are : [*HP Board 2020*] **[1]**

(A) $\left(\frac{2}{3}, \frac{-1}{3}, \frac{-2}{3}\right)$ (B) $\left(\frac{-2}{3}, \frac{-1}{3}, \frac{-2}{3}\right)$

(C) $\left(\frac{-2}{3}, \frac{1}{3}, \frac{-2}{3}\right)$ (D) None of these

Q.4 The degree of differential equation

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0 :$$

(A) 1 (B) 2
(C) 3 (D) Not defined
[*HP Board 2020*] **[1]**

Q.5 Order of differential equation $\frac{dy}{dx} - \cos x = 0$ is
(A) 0 (B) 1 (C) not defined (D) 2
[*HP Board 2019*] **[1]**

Q.6 The order of $y'''+y^2 + e^y = 0$ is [*HP Board 2019*] **[1]**
(A) 2 (B) 1
(C) 3 (D) not defined

Q.7 The degree of $y''' + y^2 + e^{y'} = 0$ is [*HP Board 2019*] **[1]**
(A) 2 (B) 1
(C) 3 (D) not defined

Q.8 The degree of differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + \sin y = 0$ is : [*HP Board 2018*] **[1]**
(A) 1 (B) 2
(C) 3 (D) Not defined

Q.9 The degree of differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 2y = 0$ is [*HP Board 2018*] **[1]**
(A) 1 (B) 2
(C) 3 (D) Not defined

Q.10 The degree of differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ is : [*HP Board 2018*] **[1]**
(A) 4 (B) 1
(C) 2 (D) Not defined

Q.11 The degree of a differential equation

$$2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0 \text{ is}$$ [*HP Board 2017*] **[1]**

(A) 1 (B) 2
(C) 3 (D) Cannot be defined.

Q.12 The degree of the differential equation

$\left(\frac{dy}{dx}\right)^2 + \left(\frac{dy}{dx}\right) - \sin^2 y = 0$ is [*HP Board 2017*] **[1]**

(A) 1 (B) 2

(C) 3 (D) Cannot be defined

Q.13 The degree of the differential equation

$\frac{d^3y}{dx^3} + 2\left(\frac{d^2y}{dx^2}\right)^2 - \frac{dy}{dx} + y = 0$ is [*HP Board 2017*] **[1]**

(A) 1 (B) 2

(C) 3 (D) Cannot be defined

Q.14 The degree of differential equation $\frac{d^4y}{dx^4} + \sin(y''') = 0$

(A) 1 (B) 3

(C) 4 (D) Not defined

[*HP Board 2016*] **[1]**

Q.15 The order of the differential equation

$(y''')^2 + (y'')^3 + (y')^4 + y^5 = 0$ is [*HP Board 2016*] **[1]**

(A) 3 (B) 5

(C) 4 (D) None of these

Q.16 The degree of differential equation

$xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ [*HP Board 2016*] **[1]**

(A) 2 (B) 1

(C) 0 (D) None of these

Q.17 The degree of the differential equation

$(y''')^2 + (y'')^3 + (y')^4 + y^5 = 0$ is [*HP Board 2015*] **[1]**

(A) 2 (B) 4 (C) 5 (D) 3

Q.18 The degree of differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0$

(A) 2 (B) 1

(C) Not defined (D) None of these.

[*HP Board 2013, 2015*] **[1]**

Q.19 The degree of the differential equation

$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is

(A) 3 (B) 2

(C) 1 (D) not defined

[*HP Board 2009, 2012*] **[1]**

Q.20 The degree of differential equation $\frac{d^2y}{dx^2} = y + \left(\frac{dy}{dx}\right)^{-2}$ is [*HP Board 2011*] **[1]**

(A) 4 (B) 2

(C) 1 (D) None of these.

Q.21 The degree of the differential equation

$3\frac{d^2y}{dx^2} + 4\left(\frac{dy}{dx}\right)^3 = \log x$ is [*HP Board 2011*] **[1]**

(A) 1 (B) 4

(C) 2 (D) None of these.

Q.22 The degree of the differential equation

$\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2y}{dx^2}\right)$ is

(A) 1 (B) 2

(C) 3 (D) None of these.

[*HP Board 2011*] **[1]**

Q.23 The integrating factor of the differential equation

$x\frac{dy}{dx} - y = 2x^2$ is [*HP Board 2010*] **[1]**

(A) e^{-x} (B) e^{-y}

(C) $\frac{1}{x}$ (D) x

Q.24 The integrating factor of $x\frac{dy}{dx} + 2y = x^2$ is

(A) x (B) e^x (C) e^{x^2} (D) x^2

[*HP Board 2010*] **[1]**

Q.25 The integrating factor of $\frac{dy}{dx} - y = \cos x$ is

(A) e^{-x} (B) e^{x} (C) x (D) $\frac{-1}{x}$

[*HP Board 2010*] **[1]**

Q.26 Find the general solution $(e^x + e^{-x})dy - (e^x - e^{-x})dx = 0$.

[*HP Board 2013*] **[1]**

Q.27 Solve $\frac{dy}{dx} = (1 + x^2)(1 + y^2)$.

[*HP Board 2013, 2015*] **[1]**

2 Mark Questions

Q.28 Form the differential equation of the family of parabolas having vertex at origin and axis along positive y-axis.

[*HP Board 2018*] **[2]**

Q.29 Form the differential equation of the family of ellipses having foci on y-axis and centre at origin.

[*HP Board 2018*] **[2]**

Q.30 Form the differential equation of the family of hyperbola having focus on x-axis and centre at origin.

[*HP Board 2011, 2012*] **[2]**

Q.31 Form the differential equation representing the family of curves $y = mx$ where m is arbitrary constant.

[*HP Board 2016*] **[2]**

Q.32 Solve $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$.

[*HP Board 2013, 2015*] **[2]**

Q.33 Form the differential equation of the family of circles touching the X-axis at origin.

[*HP Board 2009, 2010*] **[2]**

3½ Mark Questions

Q.34 Solve the differential equation : $(x + 3y^2)\frac{dy}{dx} = y, (y > 0)$

[*HP Board 2018*] **[3½]**

Q.35 Solve the differential equation : $(x^2 - y^2)dx + 2xy\, dy = 0$.

[*HP Board 2018*] **[3½]**

Q.36 Solve the differential equation : $(x+y)\frac{dy}{dx} = 1$

[*HP Board 2018*] **[3½]**

Q.37 Solve the differential equation : $(x - y)dy - (x + y)dx = 0$

[*HP Board 2018*] **[3½]**

Q.38 Solve the differential equation : $\frac{dy}{dx} + 3y = e^{-2x}$

[*HP Board 2017*] **[3½]**

Q.39 Solve the differential equation $x\frac{dy}{dx} - y + x\sin\left(\frac{y}{x}\right) = 0$

[*HP Board 2016*] **[3½]**

Q.40 Solve the differential equation $x\frac{dy}{dx} + 2y = x^2$

[*HP Board 2016*] **[3½]**

Q.41 Show that the family of curves for which the slope of the tangent at any point (x, y) on it is $\frac{x^2 + y^2}{2xy}$ is given by $x^2 - y^2 = cx$. [*HP Board 2016*] **[3½]**

Q.42 Solve the differential equation : $(x + y)\frac{dy}{dx} = 1$

[*HP Board 2016*] **[3½]**

Q.43 Solve the differential equation and find the particular soklution satisying given condition $(x + y)\, dy + (x - y)\, dx = 0$; $y = 1$ when $x = 1$. [*HP Board 2016*] **[3½]**

Q.44 Solve the differential equation : $x\frac{dy}{dx} + 2y = x^2 \log x$

[*HP Board 2016*] **[3½]**

Q.45 Find a particular solution of the differential equation $(1 + x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$ satisfying the condition $y = 0$, when $x = 1$. [*HP Board 2015*] **[3½]**

Q.46 Solve the differential equation : $xdy - ydx = \sqrt{x^2 + y^2}\, dx$.

[*HP Board 2015*] **[3½]**

Q.47 Solve the differential equation : $\frac{dy}{dx} + 2y = \sin x$.

[*HP Board 2011, 2012, 2014*] **[3½]**

Q.48 Solve the differential equation : $\frac{dy}{dx} - y = \cos x$.

[*HP Board 2014*] **[3½]**

Q.49 Find the general solution of
$(1+x^2)dy + 2xy\,dx = \cot x\,dx;\ (x \neq 0)$.
[*HP Board 2013*] **[3½]**

Q.50 Solve the differential equation : $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$.
[*HP Board 2010, 2013*] **[3½]**

Q.51 Solve $\left(1+e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy = 0$.
[*HP Board 2013*] **[3½]**

Q.52 Solve $x^2 \frac{dy}{dx} = x^2 - 2y^2 + xy$. [*HP Board 2013*] **[3½]**

Q.53 Solve the differential equation :
$$x \cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x\ .$$
[*HP Board March 2012*] **[3½]**

Q.54 Solve the differential equation :
$y\,dx + x \log\left(\frac{y}{x}\right) dy - 2x\,dy = 0$.
[*HP Board March 2012*] **[3½]**

Q.55 $\frac{dy}{dx} + \frac{y}{x} = x^2$. [*HP Board March 2012*] **[3½]**

Q.56 Solve the differential equation :
$\cos^2 x \frac{dy}{dx} + y = \tan x,\ 0 \le x \le \frac{\pi}{2}$.
[*HP Board 2011*] **[3½]**

Q.57 Solve the differential equation :
$e^x \tan y\,dx + (1 - e^x)\sec^2 y\,dy = 0$.
[*HP Board 2011*] **[3½]**

4 Mark Questions

Q.58 Solve the differential equation :
$(x^2 + xy)dy = (x^2 + y^2)dx$ [*HP Board 2020*] **[4]**

Or

Find the particular solution of the differential equation
$\frac{dy}{dx} + 2y \tan x = \sin x,\ y = 0$ when $x = \frac{\pi}{3}$
[*HP Board 2020*] **[4]**

Q.59 Solve the differential equation :
$(x^2 - y^2)dx + 2xy\,dy = 0$ [*HP Board 2020*] **[4]**

Or

Find the particular solution of the differential equation
$(1 + x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$, $y = 0$ when $x = 1$.
[*HP Board 2020*] **[4]**

Q.60 Solve the differential equation :
$(x - y)dy - (x + y)\,dx = 0$ [*HP Board 2020*] **[4]**

Or

Find the particular solution of the differential equation
$\frac{dy}{dx} - 3y \cot x = \sin 2x$
$y = 2$ when $x = \frac{\pi}{2}$ [*HP Board 2020*] **[4]**

Q.61 Find the general solution of $\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x}$
[*HP Board 2019*] **[4]**

Q.62 Form the differential equation of family of circles having centre on y-axis and radius 3 units.
[*HP Board 2019*] **[4]**

Q.63 Find the general solution of
$\frac{dy}{dx} = \sqrt{4 - y^2}\ (-2 < y < 2)$ [*HP Board 2019*] **[4]**

Or

Form the differential equation of the family of circle touching the x-axis at origin. [*HP Board 2019*] **[4]**

Q.64 Find the general solution of
$\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ [*HP Board 2019*] **[4]**

Or

Form the differential equation of the family of circles touching the y-axis at origin. [*HP Board 2019*] **[4]**

10 CHAPTER

Vector Algebra

1 Mark Questions

Q.1 The cross product of two vectors $\vec{a}$ and $\vec{b}$ is :

(A) $|\vec{a}||\vec{b}|\sin\theta\,\hat{n}$ (B) $|\vec{a}||\vec{b}|\sin\theta$

(C) $|\vec{a}||\vec{b}|\cos\theta\,\hat{n}$ (D) None of these

[*HP Board 2020*] **[1]**

Q.2 Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors. Then $\vec{a}\times\vec{b} = 0$, iff $\vec{a}$ and $\vec{b}$ are : [*HP Board 2020*] **[1]**

(A) Perpendicular

(B) Parallel

(C) Neither perpendicular Nor parallel

(D) None of these

Q.3 If $\vec{a}\cdot\vec{b} = |\vec{a}||\vec{b}|$, then θ = ? [*HP Board 2020*] **[1]**

(A) $\frac{\pi}{4}$ (B) 0 (C) π (D) $\frac{\pi}{2}$

Q.4 Let $\vec{a}$ and $\vec{b}$ are two non-zero vectors then $\vec{a}\cdot\vec{b} = -|\vec{a}||\vec{b}|$, if θ is equal to : [*HP Board 2020*] **[1]**

(A) – 2 (B) π

(C) 0 (D) None of these

Q.5 The vectors $\vec{a}$ and $\vec{b}$ are perpendicular if :

(A) $\vec{a}\cdot\vec{b} = 0$ (B) $\vec{a}\cdot\vec{b} \neq 0$

(C) $\vec{a}\times\vec{b} = 0$ (D) None of these

[*HP Board 2020*] **[1]**

Q.6 The area of parallelogram whose adjacent sides are given by vectors $\vec{a}$ and $\vec{b}$ is : [*HP Board 2020*] **[1]**

(A) $\vec{a}\times\vec{b}$ (B) $\vec{b}\times\vec{a}$ (C) $|\vec{a}\times\vec{b}|$ (D) $\frac{1}{2}|\vec{a}\times\vec{b}|$

Q.7 The value of $\hat{i}\cdot(\hat{j}\times\hat{k}) + \hat{j}\cdot(\hat{i}\times\hat{k}) + \hat{k}\cdot(\hat{i}\times\hat{j})$ is

(A) 0 (B) –1 (C) 1 (D) 3

[*HP Board 2019*] **[1]**

Q.8 For mutually perpendicular unit vectors $\hat{i}, \hat{j}, \hat{k}$ we have

(A) $\hat{i}\cdot\hat{i} = \hat{j}\cdot\hat{j} = \hat{k}\cdot\hat{k} = 3$ (B) $\hat{i}\cdot\hat{i} = \hat{j}\cdot\hat{j} = \hat{k}\cdot\hat{k} = 1$

(C) $\hat{i}\cdot\hat{i} = \hat{j}\cdot\hat{j} = \hat{k}\cdot\hat{k} = -1$ (D) $\hat{i}\cdot\hat{i} = \hat{j}\cdot\hat{j} = \hat{k}\cdot\hat{k} = 0$

[*HP Board 2019*] **[1]**

Q.9 For mutually perpendicular unit vectors $\hat{i}$, $\hat{j}$, $\hat{k}$ we have [*HP Board 2019*] **[1]**

(A) $\hat{i}.\hat{j} = \hat{j}.\hat{k} = \hat{k}.\hat{i} = 2$ (B) $\hat{i}.\hat{j} = \hat{j}.\hat{k} = \hat{k}.\hat{i} = 1$

(C) $\hat{i}.\hat{j} = \hat{j}.\hat{k} = \hat{k}.\hat{i} = 0$ (D) $\hat{i}.\hat{j} = \hat{j}.\hat{k} = \hat{k}.\hat{i} = -1$

Q.10 If $\vec{a} = \hat{i} + 2\hat{j}$ then $|\vec{a}|$ is [*HP Board 2019*] **[1]**

(A) 3 (B) –1

(C) 5 (D) $\sqrt{5}$

Q.11 If P(A) = 0.8, P(B) = 0.5 and P(B | A) = 0.4 then P(A ∪ B) is [*HP Board 2019*] **[1]**

(A) 0.15 (B) 0.1 (C) 0.32 (D) 0.98

Q.12 The scalar product is commutative if :

(A) $\vec{a}.\vec{b} = -\vec{b}.\vec{a}$ (B) $\vec{a}\times\vec{b} = \vec{b}\times\vec{a}$

(C) $\vec{a}\times\vec{b} = -\vec{b}\times\vec{a}$ (D) $\vec{a}.\vec{b} = \vec{b}.\vec{a}$

[*HP Board 2018*] **[1]**

Q.13 Angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\vec{a}.\vec{b} = 1$

(A) 3 (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

[*HP Board 2018*] **[1]**

Q.14 Two non-zero vectors $\vec{a}$ and $\vec{b}$ are parallel if :

(A) $\vec{a}.\vec{b} = 0$ (B) $\vec{a}.\vec{b} \neq 0$

(C) $\vec{a}\times\vec{b} = \vec{0}$ (D) $\vec{a}\times\vec{b} \neq \vec{0}$

[*HP Board 2018*] **[1]**

Q.15 Angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{3}$ and 2 respectively and when $\vec{a}.\vec{b} = \sqrt{6}$.

(A) 3 (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{3}$

[*HP Board 2018*] **[1]**

Q.16 The vectors $\vec{a}$ and $\vec{b}$ are perpendicular if :

(A) $\vec{a}.\vec{b} = 0$ (B) $\vec{a}.\vec{b} \neq 0$

(C) $\vec{a}\times\vec{b} = 0$ (D) $\vec{a}\times\vec{b} \neq 0$

[*HP Board 2018*] **[1]**

Q.17 Find $|\vec{a} - \vec{b}|$ if $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a}.\vec{b} = 4$.

(A) $\sqrt{3}$ (B) $\sqrt{2}$ (C) $\sqrt{5}$ (D) $\sqrt{7}$

[HP Board 2018] **[1]**

Q.18 The projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$ is *[HP Board 2017]* **[1]**

(A) 0 (B) –1

(C) $\frac{1}{\sqrt{2}}$ (D) None of the above

Q.19 If the angle between two vector $\vec{a}$ and $\vec{b}$ is zero, then

(A) $\vec{a}.\vec{b} = |\vec{a}||\vec{b}|$ (B) $\vec{a}.\vec{b} = 0$

(C) $|\vec{a}||\vec{b}| = 1$ (D) None of the above.

[HP Board 2017] **[1]**

Q.20 The projection of the vector $2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\hat{i} + 2\hat{j} + \hat{k}$ *[HP Board 2017]* **[1]**

(A) $\frac{5\sqrt{6}}{3}$ (B) $\frac{6\sqrt{5}}{3}$ (C) $\frac{8\sqrt{5}}{3}$ (D) 0

Q.21 The dot product of the two vectors $\vec{a}$ and $\vec{b}$ is

(A) $|\vec{a}||\vec{b}|\cos\theta$ (B) $|\vec{a}| = |\vec{b}|\cos\theta$

(C) $|\vec{b}| = |\vec{a}|\cos\theta$ (D) None of the above.

[HP Board 2017] **[1]**

Q.22 The projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $7\hat{i} - \hat{j} + 8\hat{k}$ is *[HP Board 2017]* **[1]**

(A) $\frac{60}{\sqrt{114}}$ (B) $\frac{60}{114}$

(C) $\frac{66}{\sqrt{114}}$ (D) None of the above

Q.23 The cross product of two vectors $\vec{a}$ and $\vec{b}$ is

(A) $|\vec{a}||\vec{b}|\sin\theta\hat{n}$ (B) $|\vec{a}| = |\vec{b}|\sin\theta\hat{n}$

(C) $|\vec{a}| = |\vec{b}|\tan\theta\hat{n}$ (D) None of the above.

[HP Board 2017] **[1]**

Q.24 Let $\vec{a}$ and $\vec{b}$ are to non zero vectors then $\vec{a}.\vec{b} = -|\vec{a}||\vec{b}|$ is θ is equal to *[HP Board 2016]* **[1]**

(A) 0 (B) $\frac{\pi}{2}$

(C) $\frac{\pi}{4}$ (D) π

Q.25 $\vec{a}$ and $\vec{b}$ represent the adjacent the adjacent sides of a triangle then its area is : *[HP Board 2016]* **[1]**

(A) $\frac{1}{2}|\vec{a} \times \vec{b}|$ (B) $|\vec{a} \times \vec{b}|$

(C) $\frac{1}{2}|\vec{a}.\vec{b}|$ (D) None of these

Q.26 If $\vec{a}$ and $\vec{b}$ are two collinear vectors then which of the following are incorrect [*HP Board 2016*] **[1]**

(A) $\vec{b} = \lambda\vec{a}$ for some scalar λ.

(B) $\vec{a} = \pm\vec{b}$

(C) The respective component of $\vec{a}$ and $\vec{b}$ are proportional

(D) both $\vec{a}$ and $\vec{b}$ have same direction but different magnitude

Q.27 The value of $\hat{i}.(\hat{j}\times\hat{k}) + \hat{j}.(\hat{i}\times\hat{k}) + \hat{k}.(\hat{i}\times\hat{j})$

(A) 0 (B) –1 (C) 1 (D) 3

[*HP Board 2016*] **[1]**

Q.28 If $\vec{a}\times\vec{b} = |\vec{a}||\vec{b}|\sin\theta\hat{n}$ which one is correct

(A) $\hat{n}$ is unit vector $\perp$ to both $\vec{a}$ and $\vec{b}$

(B) $\hat{n}$ is unit vector $\parallel$ to both $\vec{a}$ and $\vec{b}$

(C) $\hat{n}$ is unit vector neither $\perp$ nor $\parallel$ to $\vec{a}$ and $\vec{b}$

(D) none of these [*HP Board 2016*] **[1]**

Q.29 If $\vec{a}\cdot\vec{b} = |\vec{a}||\vec{b}|$, then θ = [*HP Board 2015*] **[1]**

(A) 2π (B) $\frac{\pi}{2}$ (C) 0 (D) π

Q.30 Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors. Then $\vec{a}\times\vec{b} = 0$, iff $\vec{a}$ and $\vec{b}$ are

(A) perpendicular

(B) parallel

(C) Neither perpendicular nor parallel

(D) None of these. [*HP Board 2015*] **[1]**

Q.31 If $\vec{a}$ is a non-zero vector of magnitude 'a' and λ is a non-zero scalar, then $\lambda\vec{a}$ is unit vector if

(A) $\lambda = 1$ (B) $\lambda = -1$

(C) $a = |\lambda|$ (D) $a = \frac{1}{|\lambda|}$

[*HP Board 2010, 2013, 2015*] **[1]**

Q.32 Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$, then $\vec{a}\times\vec{b}$ is a unit vector, if the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

[*HP Board 2010, 2015*] **[1]**

Q.33 Let $\vec{a}$ and $\vec{b}$ be two unit vectors and θ is the angle between them. Then $\vec{a}+\vec{b}$ is a unit vector if

(A) $\theta = \frac{\pi}{4}$ (B) $\theta = \frac{\pi}{3}$

(C) $\theta = \frac{\pi}{2}$ (D) $\theta = \frac{2\pi}{3}$

[*HP Board 2009, 2015*] **[1]**

Q.34 If θ is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\vec{a}\cdot\vec{b} \geq 0$ only when [*HP Board 2014*] **[1]**

(A) $0 < \theta < \frac{\pi}{2}$ (B) $0 \leq \theta \leq \frac{\pi}{2}$

(C) $0 < \theta < \pi$ (D) $0 \leq \theta \leq \pi$

Q.35 If θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $|\vec{a}.\vec{b}| = |\vec{a}\times\vec{b}|$ when θ is equal to

(A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π

[*HP Board 2011, 2013, 2014*] **[1]**

Q.36 Area of a rectangle having vertices $A\left(-\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}\right)$, $B\left(\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}\right)$, $C\left(\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}\right)$ and $D\left(-\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}\right)$ is

(A) $\frac{1}{2}$ (B) 1

(C) 2 (D) 4

[*HP Board 2013*] **[1]**

Q.36 The angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\vec{a}\cdot\vec{b} = 1$ is

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$

(C) $\frac{\pi}{2}$ (D) None [*HP Board 2012*] **[1]**

Q.37 The anlge between two vectors $\vec{a}=\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$

(A) $\cos^{-1}\left(\frac{1}{3}\right)$ (B) $\sin^{-1}\left(\frac{1}{3}\right)$

(C) $\sin^{-1}\left(\frac{-1}{3}\right)$ (D) $\cos^{-1}\left(\frac{-1}{3}\right)$

[*HP Board March 2011, 2012*] **[1]**

Q.39 The angle between vectors $\vec{a}\times\vec{b}$ and $\vec{b}\times\vec{a}$ is

(A) 180° (B) 90°
(C) 45° (D) None of these.

[*HP Board 2011*] **[1]**

Q.40 The area of the parallelogram with $\vec{a}$ and $\vec{b}$ as diagonals is given by [*HP Board 2011*] **[1]**

(A) $|\vec{a}\times\vec{b}|$ (B) $\frac{1}{2}|\vec{a}\times\vec{b}|$

(C) $\frac{1}{3}|\vec{a}\times\vec{b}|$ (D) None of these.

Q.41 If $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, then find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$.

[*HP Board 2009*] **[1]**

3½ Mark Questions

Q.42 Find x if the four points A (3, 2, 1), B(4, x, 5), C(4, 2, –2) and D(6, 5, –1) are coplanar.

[*HP Board 2018*] **[3½]**

Q.43 Find λ if the vector $\hat{i}-\hat{j}+\hat{k}$, $3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}+\lambda\hat{j}-3\hat{k}$ are coplanar. [*HP Board 2016, 2018*] **[3½]**

Q.44 Show that the four points with position vectors $4\hat{i}+8\hat{j}+12\hat{k}$, $2\hat{i}+4\hat{j}+6\hat{k}$, $3\hat{i}+5\hat{j}+4\hat{k}$ and $5\hat{i}+8\hat{j}+5\hat{k}$ are coplanar. [*HP Board 2017*] **[3½]**

Q.45 Show that points A(1, 2, 7), B (2, 6, 3) and C(3, 10, –1) are collinear. [*HP Board 2016*] **[3½]**

Q.46 Show that the vectors $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$, $\vec{b}=-2\hat{i}+3\hat{j}-4\hat{k}$ and $\vec{c}=\hat{i}-3\hat{j}+5\hat{k}$ are coplanar.

[*HP Board 2016*] **[3½]**

Q.47 Find the area of a triangle having the points A(1, 1, 1), B(1, 2, 3) and C(2, 3, 1) as its vertices.

[*HP Board 2015*] **[3½]**

Q.48 Find the area of a parallelogram whose adjacent sides are given by the vector $\vec{a}=3\hat{i}+\hat{j}+4\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$.

[*HP Board 2015*] **[3½]**

Q.49 Find the area of a parallelogram whose adjacent sides are determined by the vectors $\vec{a}=\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=2\hat{i}-7\hat{j}+\hat{k}$. [*HP Board 2015*] **[3½]**

Q.50 Three vectors $\vec{a},\vec{b},\vec{c}$ satisfy the condition $\vec{a}+\vec{b}+\vec{c}=\vec{0}$. Evaluate the quantity $\mu = \vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$ if $|\vec{a}|=1$, $|\vec{b}|=4$ and $|\vec{c}|=2$. [*HP Board 2012*] **[3½]**

Q.51 Find $|\vec{a}-\vec{b}|$, if two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}|=2$, $|\vec{b}|=3$ and $\vec{a}\cdot\vec{b}=4$.

[*HP Board 2012*] **[3½]**

Q.52 Let $\vec{a},\vec{b}$ and $\vec{c}$ be three vectors such that $|\vec{a}|=3$, $|\vec{b}|=4$ and $|\vec{c}|=5$ and each of them being perpendicular to sum of other two find $|\vec{a}+\vec{b}+\vec{c}|$.

[*HP Board 20011, 2012*] **[3½]**

Q.53 Find $|\vec{x}|$, if for a unit vector $\vec{a}$, $(\vec{x}+\vec{a})\cdot(\vec{x}-\vec{a})=12$.

[*HP Board 2010*] **[3½]**

4 Mark Questions

Q.54 Two adjacent sides of a parallelogram are $2\hat{i}-4\hat{j}+5\hat{k}$ and $\hat{i}-2\hat{j}-3\hat{k}$. Find its area.

[*HP Board 2020*] **[4]**

Q.55 Find area of parallelogram whose adjacent sides are given by vectors $\vec{a}=3\hat{i}+\hat{j}+4\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$

[*HP Board 2020*] **[4]**

Q.56 Find area of parallelogram whose adjacent sides are given by vectors $\vec{a}=\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=2\hat{i}-7\hat{j}+\hat{k}$

[*HP Board 2020*] **[4]**

Q.57 Using vectors, find the area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C (1, 5, 5).

[*HP Board 2010, 2013*] **[4]**

Q.58 Show that the points $A(-2\hat{i}+3\hat{j}+5\hat{k})$, $B(\hat{i}+2\hat{j}+3\hat{k})$ and $C(7\hat{i}-\hat{k})$ are collinear. [*HP Board 2019*] **[4]**

Q.59 Find the angle 'θ' between the vectors $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$. [*HP Board 2019*] **[4]**

11 CHAPTER — Three Dimensional Geometry

1 Mark Questions

Q.1 If a line makes angles 90°, 60° and 30° with the +ve direction of X, Y and Z-axes respectively, then its direction cosines are : [*HP Board 2020*] **[1]**

(A) $\left(0, \frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ (B) $\left(1, \frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

(C) $\left(1, -\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ (D) None of these

Q.2 If a line passing through the two points (– 2, 4, – 5) and (1, 2, 3), then its direction cosines will be :

(A) $\left(\frac{3}{\sqrt{77}}, \frac{-2}{\sqrt{77}}, \frac{8}{\sqrt{77}}\right)$ (B) $\left(\frac{-2}{\sqrt{77}}, \frac{3}{\sqrt{77}}, \frac{8}{\sqrt{77}}\right)$

(C) $\left(\frac{3}{\sqrt{77}}, \frac{2}{\sqrt{77}}, \frac{8}{\sqrt{77}}\right)$ (D) None of these

[*HP Board 2020*] **[1]**

Q.3 Direction cosines of $\vec{a} = \hat{i} + \hat{j} - 2\hat{k}$ are

(A) $\frac{1}{6}, \frac{1}{6}, \frac{-2}{6}$ (B) $\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}$

(C) $\sqrt{6}, \sqrt{6}, -\sqrt{6}$ (D) $\sqrt{6}, \sqrt{6}, \frac{-\sqrt{6}}{2}$

[*HP Board 2019*] **[1]**

Q.4 The relation between Direction cosines ℓ, m and n of a line is [*HP Board 2019*] **[1]**

(A) $\ell^2 + m^2 + n^2 = 1$ (B) $\ell^2 + m^2 + n^2 = -1$
(C) $\ell^2 + m^2 + n^2 = 0$ (D) $\ell^2 + m^2 = n^2$

Q.5 Direction ratios of vector $\vec{a} = \hat{i} + \hat{j} - 2\hat{k}$ are

(A) 1, 2, 1 (B) 1, 1, –2

(C) $\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}$ (D) $\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}$

[*HP Board 2019*] **[1]**

Q.6 Direction cosines of x-axis are [*HP Board 2019*] **[1]**

(A) 1, 0, 0 (B) 0, 1, 0
(C) 0, 0, 1 (D) None of these

Q.7 If a line makes angle α, β, γ with positive direction of coordinates axes, then value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is:

(A) –1 (B) 2 (C) 1 (D) –2

[*HP Board 2018*] **[1]**

Q.8 If a line makes angle $\frac{\pi}{2}, \frac{3\pi}{4}$ and $\frac{\pi}{4}$ with x, y, z-axis, respectively then direction cosines of this line are :

(A) ± (1, 1, 1) (B) $\pm\left(0, \frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

(C) $\pm\left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right)$ (D) $\pm\left(0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

[*HP Board 2018*] **[1]**

Q.9 The distance of the plane $3x - 4y + 12z = 3$ from the point (0, 0, 0) is [*HP Board 2017*] **[1]**

(A) $\frac{3}{13}$ (B) $\frac{13}{3}$ (C) –2 (D) 3

Q.10 The distance of the plane $x + 2y - 2z = 9$ from the point (2, 3, –5) is [*HP Board 2017*] **[1]**

(A) 3 (B) 4 (C) 0 (D) 5

Q.11 If a line has direction ratios (2, –1, –2) then its direction cosines will be [*HP Board 2016*] **[1]**

(A) $\left(\frac{2}{3}, -\frac{1}{3}, \frac{-2}{3}\right)$ (B) $\left(\frac{-1}{3}, \frac{2}{3}, \frac{-2}{3}\right)$

(C) $\left(\frac{-2}{3}, \frac{-1}{3}, \frac{2}{3}\right)$ (D) None of these

Q.12 The distance of the plane $2x - y + 2z + 3 = 0$ from the point (3, – 2, 1) is [*HP Board 2017*] **[1]**

(A) $\frac{3}{13}$ (B) $\frac{13}{3}$ (C) 0 (D) 13

Q.13 If a line passing through the two points (–2, 4, –5) and (1, 2, 3) then its direction cosine will be

(A) $\left(\frac{3}{\sqrt{77}}, \frac{-2}{\sqrt{77}}, \frac{8}{\sqrt{77}}\right)$ (B) $\left(\frac{-2}{\sqrt{77}}, \frac{3}{\sqrt{77}}, \frac{8}{\sqrt{77}}\right)$

(C) $\left(\frac{3}{\sqrt{77}}, \frac{+2}{\sqrt{77}}, \frac{8}{\sqrt{77}}\right)$ (D) None of these

[*HP Board 2016*] **[1]**

Q.14 The angle between two planes $7x + 5y + 6z + 30 = 0$ and $3x - y - 10z + 4 = 0$ is [*HP Board 2015*] **[1]**

(A) $\cos^{-1}\left(\frac{2}{5}\right)$ (B) $\cos^{-1}\left(\frac{5}{2}\right)$

(C) $\cos^{-1}\left(\frac{1}{5}\right)$ (D) None of these.

Q.15 Direction cosine of z-axis [*HP Board 2014*] **[1]**

(A) (0, 0, 1) (B) (1, 0, 0)
(C) (0, 0, 0) (D) (0, 1, 0)

Q.16 If a line has direction ratios (2, – 1, – 2), then its direction cosines are [*HP Board 2013*] **[1]**

(A) $\left(\frac{2}{3}, -\frac{1}{3}, \frac{-2}{3}\right)$ (B) $\left(-\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}\right)$

(C) $\left(-\frac{2}{3}, -\frac{1}{3}, \frac{-2}{3}\right)$ (D) None of these.

Q.17 If a line makes angle 90°, 60° and 30° with the positive direction of x, y and z axis respectively, then its direction cosines will be

(A) $\left(0, \frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ (B) $\left(\frac{1}{2}, 0, \frac{\sqrt{3}}{2}\right)$

(C) $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}, 0\right)$ (D) None of these.

[*HP Board 2011, 2013*] **[1]**

Q.18 The angle between the two diagonals of cube is

(A) 30° (B) 45°
(C) 60° (D) None of these.

[*HP Board 2011*] **[1]**

Q.19 The angle between the lines $\frac{x-5}{2} = \frac{y+1}{2} = \frac{z-6}{-6}$ and $\frac{x-5}{3} = \frac{y+4}{-4} = \frac{z+1}{12}$ is [*HP Board 2011*] **[1]**

(A) $\cos^{-1}\left(\frac{-14}{39}\right)$ (B) $\cos^{-1}\left(\frac{14}{39}\right)$

(C) $\sin^{-1}\left(\frac{14}{39}\right)$ (D) None of these.

Q.20 The planes $2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z - 1 = 0$ are

(A) parallel
(B) perpendicular
(C) Intersecting
(D) None of these. [*HP Board 2010*] **[1]**

Q.21 Write the vector equation of a line given by :

$$\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}.$$ [*HP Board 2011*] **[1]**

3 Mark Questions

Q.22 If A and B are two independent events, such that P(A) = 0.3 and P(B) = 0.6 Find P (neither A nor B).

[*HP Board 2020*] **[3]**

Q.23 Find the all points of discontinuous of f where f is defined by [*HP Board 2019*] **[3]**

$$f(x) = \begin{cases} x^{10} - 1, & \text{if } x \le 1 \\ x^2 & \text{, if } x > 1 \end{cases}$$

3½ Mark Questions

Q.24 Find the vector and Cartesian equations of planes that passes through the point (1, 0, –2) and the normal to the plane is $\hat{i} + \hat{j} - \hat{k}$. [*HP Board 2018*] **[3½]**

Q.25 Find the angle between the pair of lines $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$.

[*HP Board 2017*] **[3½]**

Q.26 Find the angle between the pair of lines

$\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda(3\hat{i} + 2\hat{j} + 6\hat{k})$ and

$\vec{r} = 7\hat{i} - 6\hat{k} + \mu(\hat{i} + 2\hat{j} + 2\hat{k})$ [*HP Board 2017*] **[3½]**

Q.27 Find the angle between the pairs of lines

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

$\vec{r} = 2\hat{i} - \hat{j} - 56\hat{k} + \mu(3\hat{i} - 5\hat{j} - 4\hat{k})$ [*HP Board 2016*] **[3½]**

Q.28 Find the angle between the two planes $3x - 6y + 2z = 7$ and $2x + 2y - 2z = 5$. [*HP Board 2016*] **[3½]**

Q.29 Find the equation of the plane passing through (a, b, c) and parallel to the plane $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 2$.

[*HP Board 2015*] **[3½]**

Q.30 Find the equation of the plane that contains the point $(1, -1, 2)$ and is perpendicular to each of the planes $2x + 3y - 2z = 5$ and $x + 2y - 3z = 8$.

[*HP Board 2010, 2015*] **[3½]**

Q.31 Find the vector equation of the line passing through $(1, 2, 3)$ and parallel to the planes $\vec{r} \cdot (\hat{i} - \hat{j} + 2\hat{k}) = 5$ and $\vec{r} \cdot (3\hat{i} + \hat{j} + \hat{k}) = 6$. [*HP Board 2009, 2015*] **[3½]**

Q.32 Find vector equation of the plane passing through intersection of the plane $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 6$ and $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = -5$ and the point $(1, 1, 1)$.

[*HP Board 2011, 2014*] **[3½]**

Q.33 Find the co-ordinates of the foot of perpendicular drawn from the origin to $2x + 3y + 4z - 12 = 0$.

[*HP Board 2012*] **[3½]**

4 Mark Questions

Q.34 There are 5% defective items in a large bulk of items. What is the probability that a sample of 10 items will include not more than one defective item ?

[*HP Board 2020*] **[4]**

Q.35 Show that A(1, 2, 7), B = (2, 6, 3) and C(3, 10, –1) are collinear. [*HP Board 2019*] **[4]**

3½, 5 Mark Questions

Q.36 Find the vector equation of plane passing through the intersection of the planes $\vec{r} \cdot (2\hat{i} + 2\hat{j} - 3\hat{k}) = 7$ and $\vec{r} \cdot (2\hat{i} + 5\hat{j} + 3\hat{k}) = 9$ and through the point (2, 1, 3).

[*HP Board 2011, 2013, 2014*] **[3½, 5]**

Q.37 Find the equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point (2, 2, 1).

[*HP Board 2011, 2013, 2014*] **[3½, 5]**

Q.38 Find the angle between two lines

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

[*HP Board 2011, 2013*] **[5, 3½]**

Q.39 Find the angle between the lines $\frac{x}{2} = \frac{y}{2} = \frac{z}{1}$ and $\frac{x-5}{4} = \frac{y-2}{1} = \frac{z-3}{8}$. [*HP Board 2010, 2013*] **[5, 3½]**

5 Mark Questions

Q.40 Find the equation of the plane that passes through three points (1, 1, – 1), (6, 4, – 5) and (– 4, – 2, 3).

[*HP Board 2018*] **[5]**

Q.41 Find the shortest distance beween the lines whose sector equations are

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

$\vec{r} = (4\hat{i} + 5\hat{j} + 6\hat{k}) + \mu(2\hat{i} + 3\hat{j} + \hat{k})$.

[*HP Board 2016, 2018*] **[5]**

Q.42 Find the shortest distance between the lines

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

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

[*HP Board 2016, 2018*] **[5]**

Q.43 Find the equation of plane through the line of intersection of plane $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to the plane $x - y + z = 0$

[*HP Board 2016*] **[5]**

Q.44 Find the sortest distance between the lines

$$\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1} \text{ and } \frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$$

[*HP Board 2016*] **[5]**

Q.45 Find the distance of the point (–1, – 5, – 10) from the point of intersection of the line

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

$\vec{r}\cdot(\hat{i}-\hat{j}+2\hat{k})=5$. [*HP Board 2015*] **[5]**

Q.46 Find vector equation of line passing through (1, 2, 3) and perpendicular to plane $r.(\hat{i}+2\hat{j}-5\hat{k})+9=0$.

[*HP Board 2012, 2015*] **[5]**

Q.47 The vector equation of two lines are $\vec{r}=\hat{i}+2\hat{j}+\hat{k}+\lambda(\hat{i}-\hat{j}+\hat{k})$ and $\vec{r}=2\hat{i}-\hat{j}-\hat{k}+\mu(2\hat{i}+\hat{j}+2\hat{k})$.

Find the shortest distance between these lines.

[*HP Board 2009, 2010, 2011, 2012, 2014*] **[5]**

Q.48 The vector equation of two lines are

$\vec{r}=(1-t)\hat{i}+(t-2)\hat{j}+(3-2t)\hat{k}$ and

$\vec{r}=(s+1)\hat{i}+(2s-1)\hat{j}-(2s+1)\hat{k}$.

Find the shortest distance between these lines.

[*HP Board 2010, 2012, 2013*] **[5]**

Q.49 Find the angle between the line $\frac{x+1}{2}=\frac{y}{3}=\frac{z-3}{6}$ and the plane $10x + 2y - 11z = 3$. [*HP Board 2011*] **[5]**

Q.50 Find the shortest distance between the following two lines $\vec{r}=(1+2\lambda)\hat{i}+(1-\lambda)\hat{j}+\lambda\hat{k}$,

$\vec{r}=2\hat{i}+\hat{j}-\hat{k}+\mu(3\hat{i}-5\hat{j}+2\hat{k})$. [*HP Board 2011*] **[5]**

Q.51 Prove that if a plane has intercept has intercepts a, b, c and is at distance of 'p' units from the origin then

$\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\frac{1}{p^2}$. [*HP Board 2011*] **[5]**

6 Mark Questions

Q.52 Find the shortest distance between pair of lines whose equations are :

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

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

[*HP Board 2020*] **[6]**

Or

Find the equations of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point (2, 2, 1). [*HP Board 2020*] **[6]**

Q.53 Find shortest distance between pair of lines whose equations :

$\vec{r}=6\hat{i}+2\hat{j}+2\hat{k}+\lambda(\hat{i}-2\hat{j}+2\hat{k})$

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

[*HP Board 2020*] **[6]**

Or

Find equation of plane through the line of intersection of planes $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to plane $x - y + z = 0$

[*HP Board 2020*] **[6]**

Q.54 Find shortest distance between pair of lines whose equations are

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

$\vec{r}=4\hat{i}+5\hat{j}+6\hat{k}+\mu(2\hat{i}+3\hat{j}+\hat{k})$

[*HP Board 2020*] **[6]**

Or

Find vector equation of plane passing through the intersection of planes :

$\vec{r} = (\hat{i} + \hat{j} + \hat{k}) = 6,\ \vec{r}\cdot(2\hat{i} + 3\hat{j} + 4\hat{k}) = -5$ and the point (1, 1, 1). [*HP Board 2020*] **[6]**

Q.55 Find the shortest distance between the lines whose vectors equations are

$\vec{r} = (1-t)\hat{i} + (t-2)\hat{j} + (3-2t)\hat{k}$ and

$\vec{r} = (s+1)\hat{i} + (2s-1)\hat{j} - (2s+1)\hat{k}$

[*HP Board 2019*] **[6]**

Or

Find the vector and Cartesian equation of the plane that passes through the point (1, 0, –2) and normal to the plane is $\hat{i} + \hat{j} - \hat{k}$. [*HP Board 2019*] **[6]**

Q.56 Find the shortest distance between the lines

$\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$

$\vec{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + \mu(2\hat{i} + 3\hat{j} + 6\hat{k})$

[*HP Board 2019*] **[6]**

Or

Find the vector and Cartesian equation of the plane that passes through the point (1, 4, 6) and the normal vector to the plane is $\hat{i} - 2\hat{j} + \hat{k}$.

[*HP Board 2019*] **[6]**

Q.57 Find the shortest distance between the lines

$\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$

[*HP Board 2019*] **[6]**

Or

Find the vector and Cartesian equations of the plane which passes through the point (5, 2, –4) and perpendicular to the line with direction ratios 2, 3, –1.

[*HP Board 2019*] **[6]**

12 CHAPTER

Linear Programming

5 Mark Questions

Q.1 Minimize

$Z = -3x + 4y$

Subject to constraints :

$x + 2y \leq 8$

$3x + 2y \leq 12$

$x \geq 0$

$y \geq 0$

graphically. [*HP Board 2015, 2018*] **[5]**

Q.2 Solve the following linear programming problem graphically : Maximize $Z = 5x + 3y$

subject to the constraints

$3x + 5y \leq 15$

$5x + 2y \leq 10$

$x \geq 0$

$y \geq 0$ [*HP Board 2017*] **[5]**

Q.3 Maximize $z = 5x + 10y$ subject to constraints

$x + 2y \leq 120, x + y \geq 60, x - 2y \geq 0, x, y \geq 0$ graphically.

[*HP Board 2016*] **[5]**

Q.4 Solve the following linear programming problems graphically :

Minimise $Z = 3x + 5y$

Subject to the constraints :

$x + 3y \geq 3,$

$x + y \geq 2,$

$x \geq 0; y \geq 0.$

[*HP Board 2009, 2012, 2015*] **[5]**

Q.5 Maximise $z = 3x + 9y$

Subject to the constraints

$x + y \leq 60$

$x + y \geq 10$

$x \leq y$

$x \geq 0, y \geq 0$ [*HP Board 2011, 2015*] **[5]**

Q.6 Maximise $z = 4x + y$

$x + y \leq 50$

$3x + y \leq 90$

$x \geq 0$

$y \geq 0$ [*HP Board 2011, 2014*] **[5]**

Q.7 Minimize $z = x + 2y$ subject to the constraints

$2x + y \geq 3$

$x + 2y \geq 6$

$x, y \geq 0$ [*HP Board 2010, 2013*] **[5]**

Q.8 Maximize $z = 3x + 4y$

subject to the constraints

$x + y \leq 4$

$x \geq 0$

$y \geq 0.$ [*HP Board 2010*] **[5]**

6 Mark Questions

Q.9 Minimize and maximize

$Z = 5x + 10y$ subject to

$x + 2y \leq 120$

$x + y \geq 60$

$x - 2y \geq 0$

$x > 0, y > 0$ graphically [*HP Board 2020*] **[6]**

Q.10 Minimize and maximize, $Z = 200x + 500y$

subject to $x + 2y \geq 10$

$3x + 4y \leq 24$

$x \geq 0, y \geq 0$

graphically. [*HP Board 2020*] **[6]**

Q.11 Minimize $z = x + 2y$

subject to $2x + y \geq 3$

$x + 2y \geq 6$

$x, y \geq 0$ [*HP Board 2019*] **[6]**

Q.12 Minimize $z = -3x + 4y$

subject to $x + 2y \leq 8$

$3x + 2y \leq 12$

$x \geq 0, y \geq 0$ [*HP Board 2019*] **[6]**

Q.13 Minimize $z = 5x + 3y$

subject to $3x + 5y \leq 15$

$5x + 2y \leq 10$

$x \geq 0, y \geq 0$ [*HP Board 2019*] **[6]**

13 CHAPTER

Probability

1 Mark Questions

Q.1 If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$, then $P(A \mid B)$ is : [*HP Board 2020*] **[1]**

(A) $\frac{4}{9}$ (B) $\frac{9}{4}$ (C) $\frac{7}{9}$ (D) $\frac{4}{7}$

Q.2 If $P(A) = \frac{3}{5}$ and $P(B) = \frac{1}{5}$, A and B are independent events, then $P(A \cap B) = ?$ [*HP Board 2020*] **[1]**

(A) $\frac{3}{25}$ (B) $\frac{1}{3}$

(C) $\frac{25}{3}$ (D) None of these

Q.3 If $P(A) = \frac{1}{2}$, $P(B) = 0$, then $P(A \mid B)$ is :

(A) $\frac{1}{6}$ (B) $\frac{1}{3}$

(C) $\frac{1}{2}$ (D) None of these

[*HP Board 2020*] **[1]**

Q.4 The probability of obtaining an even prime number on each die, when a pair of dice is rolled is :

(A) 0 (B) $\frac{1}{3}$ (C) $\frac{1}{12}$ (D) $\frac{1}{36}$

[*HP Board 2019*] **[1]**

Q.5 If $P(A) = 0.8$, $P(B) = 0.5$ and $P(B \mid A) = 0.4$, then $P(A \cap B)$ [*HP Board 2019*] **[1]**

(A) 0.15 (B) 0.23 (C) 0.32 (D) 0.51

Q.6 If A and B are two independent events and $P(A) = \frac{3}{5}$, $P(B) = \frac{1}{5}$, then $P(A \cap B)$ is : [*HP Board 2018*] **[1]**

(A) $\frac{3}{5}$ (B) $\frac{3}{25}$ (C) $\frac{1}{25}$ (D) $\frac{1}{5}$

Q.7 The probability of obtaining an even prime number on each die, when a pair of die is rolled, is :

(A) 0 (B) $\frac{1}{3}$

(C) $\frac{1}{12}$ (D) $\frac{1}{36}$

[*HP Board 2018*] **[1]**

Q.8 If A and B are independent events, then :

(A) $P(A \cap B) = P(A) \cdot P(B)$

(B) $P(A \cup B) = P(A) \cdot P(B)$

(C) $P(A \cap B) = P(A) + P(B)$

(D) $P(A \cup B) = P(A) + P(B)$ [*HP Board 2018*] **[1]**

Q.9 If $P(A/B) > P(A)$, then [*HP Board 2017*] **[1]**

(A) $P(B/A) < P(B)$ (B) $P(A \cap B) < P(A).P(B)$

(C) $P(B/A) > P(B)$ (D) $P(B/A) = P(B)$

Q.10 If A and B are two events such that $P(A) \neq 0$ and $P(B/A) = 1$, then [*HP Board 2017*] **[1]**

(A) $A \subset B$ (B) $B \subset A$

(C) $B = \phi$ (D) $A = \phi$

Q.11 If A and B are any two events such that $P(A) + P(B) - P(A \text{ and } B) = P(A)$, then

(A) $P(B/A) = 1$ (B) $P(A/B) = 1$

(C) $P(B/A) = 0$ (D) $P(A/B) = 0$

[*HP Board 2017*] **[1]**

Q.12 If A and B are two events such that $P(A/B) = P(B/A)$ then [*HP Board 2016*] **[1]**

(A) $A \subset B$ But $A \neq B$ (B) $A = B$

(C) $A \cap B$ (D) $P(A) = P(B)$

Q.13 Two events A and B will be independent if

(A) A and B are mutually exclusive

(B) $P(A'B') = [1 - P(A)]\,[1 - P(B)]$

(C) $P(A) = P(B)$

(D) $P(A) + P(B) = 1$ [*HP Board 2016*] **[1]**

Q.14 If $P(A) = \frac{1}{2}$, $P(B) = 0$ then $P(A/B)$

(A) 0 (B) $\frac{1}{2}$

(C) Not defined (D) 1

[*HP Board 2016*] **[1]**

Q.15 If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$ then $P(A \mid B)$

(A) $\frac{9}{4}$ (B) $\frac{9}{13}$ (C) $\frac{4}{9}$ (D) $\frac{7}{13}$

[*HP Board March 2012, 2015*] **[1]**

Q.16 If $2P(A) = P(B) = \frac{5}{13}$ and $P(A|B) = \frac{2}{5}$ then $P(A \cup B)$ is [*HP Board 2012*] **[1]**

(A) $\frac{11}{26}$ (B) $\frac{26}{11}$ (C) $\frac{5}{13}$ (D) $\frac{2}{5}$

Q.17 If $P(A) = \frac{6}{11}$, $P(B) = \frac{5}{11}$, $P(A \cup B) = \frac{7}{11}$, then $P(A \cap B)$ equals to

(A) $\frac{4}{11}$ (B) $\frac{4}{5}$

(C) $\frac{2}{3}$ (D) None of these.

[*HP Board 2010, 2012*] **[1]**

Q.18 Three coins are tossed then probability of at least one head [*HP Board 2011*] **[1]**

(A) $\frac{1}{8}$ (B) $\frac{3}{8}$

(C) $\frac{7}{8}$ (D) None of these.

3 Mark Questions

Q.19 Events A and B are such that $P(A) = \frac{1}{2}$, $P(B) = \frac{7}{12}$ and P (not A or not B) = $\frac{1}{4}$. State whether A and B are independent. [*HP Board 2020*] **[3]**

Q.20 If $P(A) = 0.8$, $P(B) = 0.5$ and $P(B \mid A) = 0.4$. Find $P(A \cap B)$ [*HP Board 2020*] **[3]**

Q.21 Two coins are tossed once, where

E : tail appears on one coin

F : one coin shows head.

Find $P(E \mid F)$. [*HP Board 2019*] **[3]**

Q.22 Given two independent events A and B such that $P(A) = 0.3$, $P(B) = 0.6$ then find P(A and B). [*HP Board 2019*] **[3]**

Q.23 Given two independent events A and B such that $P(A) = 0.3$, $P(B) = 0.6$ then find P(A or B). [*HP Board 2019*] **[3]**

3½ Mark Questions

Q.24 If a fair coin is tossed 10 times, find the probability of (*i*) exactly six heads (*ii*) at least six heads (*iii*) at most six heads [*HP Board 2018*] **[3½]**

Q.25 A die marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let A be the event, 'the number is even' and B be the event, 'the number is red'. Are A and B independent? [*HP Board 2018*] **[3½]**

Q.26 If pair of dice is thrown 4 times. If getting a doublet is considered a success, find the probability of two successes. [*HP Board 2018*] **[3½]**

Q.27 Two cards drawn ar random without replacement from a deck of 52 cards. Find probability that both the cards are black. [*HP Board 2016, 2018*] **[3½]**

Q.28 Events A and B are such that $P(A) = \frac{1}{2}$, $P(B) = \frac{7}{12}$ and $P(\text{not A or not B}) = \frac{1}{4}$. State whether A and B are independent. [*HP Board 2015, 2018*] **[3½]**

Q.29 If A and B are two events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{8}$, find P(not A and not B).

[*HP Board 2015, 2018*] **[3½]**

Q.30 Find the probability distribution of number of heads in two tosses of a coin. [*HP Board 2017*] **[3½]**

Q.31 Assume that each child born is equally likely to be a boy or a girl. If a family has two children, what is the conditional probability that both are girls? Given that (*i*) the youngest is a girl, (*ii*) at least one is a girl.

[*HP Board 2017*] **[3½]**

Q.32 A bag contains 4 red and 4 black balls another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

[*HP Board 2016*] **[3½]**

Q.33 Find the mean numner of heads in three tosses of a fair coin. [*HP Board 2016*] **[3½]**

Q.34 From a lot of 30 bulbs which include 6 defectives, a sample of 4-bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs. [*HP Board 2016*] **[3½]**

Q.35 Five cards are drawn successively with replacement from a well shuffled deck of 52 cards. What is the probability that

(*i*) all five cards are spade (*ii*) none is a spade

(*iii*) only three cards are spade

[*HP Board 2016*] **[3½]**

Q.36 Find the probability distribution of the number of successes in two tosses of a die where a success is defined as :

Number greater than 4. [*HP Board 2016*] **[3½]**

Q.37 Two cards are drawn successively with replacement form a well-shuffled deck of 52 cards. Find the probability distribution of number of aces.

[*HP Board 2011, 2015*] **[3½]**

Q.38 A die is thrown 6 times,. If getting an odd number "is a success", what is the probability of

(*i*) 5 successes (*ii*) at least 5 successes

(*iii*) at most 5 successes ?

[*HP Board 2009, 2010, 2015*] **[3½]**

Q.39 Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is atleast one defective egg.

[*HP Board 2014*] **[3½]**

Q.40 Let E and F events with $P(E) = \frac{3}{5}$, $P(F) = \frac{3}{10}$ and $P(E \cap F) = \frac{1}{5}$, are E and F independent ?

[*HP Board 2011, 2014*] **[3½]**

Q.41 Find the probability distribution of

i) number of heads in two tosses of a coin.

ii) number of tails in the simultaneous tosses of three coins. [*HP Board 2011, 2012, 2014*] **[3½]**

Q.42 Find the probability distribution of the number of successes in two tosses of dice where success is six-appear on atleast one die. [*HP Board 2013*] **[3½]**

Q.43 A die is tossed thrice. Find the probability of getting an odd number at least once.

[*HP Board March 2012, 2013*] **[3½]**

Q.44 Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that the problem is solved.

[*HP Board 2010, 2012, 2013*] **[3½]**

Q.45 Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that

i) both balls are red

ii) first ball is black and second is red

iii) one of them is black and other is red.

[*HP Board 2010, 2012*] **[3½]**

4 Mark Questions

Q.46 Find the probability of getting 5 exactly twice in 7 throws of a die. [*HP Board 2020*] **[4]**

Q.47 A pair of dice is thrown 4 times. If getting a doublet is considered a success. Find the probability of two successes. [*HP Board 2020*] **[4]**

Q.48 Find the mean number of heads in three tosses of a fair coin. [*HP Board 2019*] **[4]**

Q.49 Find the mean of the number obtained on a throw of an unbiased die. [*HP Board 2019*] **[4]**

Q.50 Two dice are thrown simulataneously. If X denotes the number of sixes. Find the mean of X.

[*HP Board 2019*] **[4]**

6 Mark Questions

Q.51 Minimize and Maximize

$Z = x + 2y$ subject to

$x + 2y \geq 100$

$2x - y \leq 0$

$2x + y \leq 200$

$x \geq 0, y \geq 0$

graphically. [*HP Board 2020*] **[6]**