Chapter 01

Basic Mathematics

Practice Section-01

Q.1 Solve for x :

$10x^2 - 27x + 5 = 0$

(1) $\frac{5}{3}, \frac{2}{5}$ (2) $\frac{5}{2}, \frac{1}{5}$ (3) $\frac{5}{4}, \frac{1}{8}$ (4) $\frac{5}{2}, \frac{1}{3}$

Q.2 Find $F_{net} = GMm\left[\frac{1}{r^2}+\frac{1}{2r^2}+\frac{1}{4r^2}+\text{.....up ot}\ \infty\right]$.

(1) $\frac{2GMm}{r^2}$ (2) $\frac{3GMm}{r^2}$ (3) $\frac{2GMm}{r^4}$ (4) $\frac{4GMm}{r^3}$

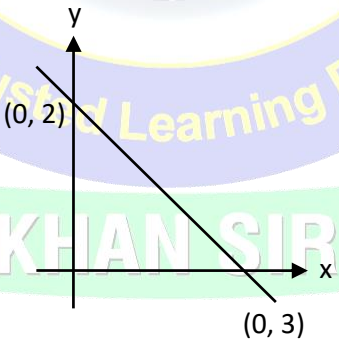
Q.3 Distance between two points (8, – 4) and (0, a) is 10. All the values are in the same unit of length. Find the positive value of a.

(1) 4 (2) 6 (3) 2 (4) 8

Q.4 Calculate the distance between two points (0, –1, 1) and (3, 3, 13).

(1) 13 (2) 16 (3) 19 (4) 15

Q.5 Calculate slope of shown line



(1) $\frac{2}{3}$ (2) $-\frac{2}{3}$ (3) $\frac{4}{7}$ (4) $-\frac{4}{7}$

Q.6 If $s = ut + \frac{1}{2}at^2$, where u and a are constants. Obtain the value of $\frac{ds}{dt}$.

(1) u + 2at (2) u + at (3) $u + at^2$ (4) $u^2 + 2at$

Q.7 The area of a blot of ink is growing such that after t seconds, its area is given by $A = (3t^2 + 7)\ cm^2$. Calculate the rate of increase of area at t = 5 second.

(1) 20 cm^2s^{-1} (2) 25 cm^2s^{-1} (3) 30 cm^2s^{-1} (4) 40 cm^2s^{-1}

Q.8 Find the values of :

(i) tan (–30°) (ii) sin 120° (iii) sin 135° (iv) cos 150° (v) sin 270° (vi) cos 120°

Q.9 Find $\frac{dy}{dx}$ for the following :

(i) $y = x^{7/2}$ (ii) $y = x^{-3}$ (iii) $y = x$ (vi) $y = x^5 + x^3 + 4x^{1/2} + 7$

(v) $y = 5x^4 + 6x^{3/2} + 9x$ (vi) $y = ax^2 + bx + c$ (vii) $y = 3x^5 - 3x - \frac{1}{x}$ (viii) $(x - 1)(2x + 5)$

(ix) $\frac{1}{2x+1}$ (x) $\frac{3x+4}{4x+5}$ (xi) $\frac{x^2}{x^3+1}$

Q.10 Evaluate the following integrals :

(i) $\int x^{15}dx$ (ii) $\int x^{-3/2}dx$ (iii) $\int(3x^{-7} + x^{-1})dx$ (iv) $\int\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2 dx$

(v) $\int\left(x + \frac{1}{x}\right)dx$ (vi) $\int\left(\frac{a}{x^2} + \frac{b}{x}\right)dx$ (vii) $\int_R^\infty \frac{GMm}{x^2}dx$ (viii) $\int_{r_1}^{r_2} -k\frac{q_1q_2}{x^2}dx$

(ix) $\int_u^v Mvdv$ (x) $\int_0^\infty x^{-1/2}dx$ (xi) $\int_0^{\pi/2} \sin x dx$ (xii) $\int_0^{\pi/2} \cos x dx$

(xiii) $\int_{-\pi/2}^{\pi/2} \cos x dx$

Practice Section-02

Q.1 If two forces act in opposite direction then their resultant is 10N and if they act mutually perpendicular then their resultant is 50N. Find the magnitudes of both the forces.

(1) 20 N, 10 N (2) 40 N, 30 N (3) 25 N, 15 N (4) 10 N, 5 N

Q.2 If $\left|\hat{a}-\hat{b}\right|=\sqrt{2}$ then calculate the value of $\left|\hat{a}+\sqrt{3}\hat{b}\right|$.

(1) 3 (2) 2 (3) 4 (4) 5

Q.3 If $\vec{A}=3\hat{i}+2\hat{j}$ and $\vec{B}=3\hat{i}+3\hat{j}-\hat{k}$, then find a unit vector along $(\vec{A}-\vec{B})$.

(1) $\frac{\hat{j}+\hat{k}}{\sqrt{2}}$ (2) $\frac{-\hat{j}+\hat{k}}{\sqrt{2}}$ (3) $\frac{\hat{j}-\hat{k}}{\sqrt{2}}$ (4) $\frac{\hat{j}+\hat{k}}{\sqrt{3}}$

Q.4 If $\vec{a}$ and $\vec{b}$ are two non collinear unit vectors and $|\vec{a}+\vec{b}|=\sqrt{3}$, then find the value of $(\vec{a}-\vec{b}).(2\vec{a}+\vec{b})$

(1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) $\frac{1}{6}$ (4) $\frac{1}{8}$

Q.5 If $\vec{A}=4\hat{i}-2\hat{j}+4\hat{k}$ and $\vec{B}=-4\hat{i}+2\hat{j}+a\hat{k}$ are perpendicular to each other then find value of a?

(1) 7 (2) 5 (3) 3 (4) 2

Q.6 If vector $\left(\vec{a}+2\vec{b}\right)$ is perpendicular to vector $\left(5\vec{a}-4\vec{b}\right)$, then find the angle between $\vec{a}$ and $\vec{b}$.

(1) 60° (2) 30° (3) 90° (4) 120°

Q.7 If $\sqrt{3}|\vec{A}\times\vec{B}|=\vec{A}\cdot\vec{B}$, then find the angle between $\vec{A}$ and $\vec{B}$.

(1) 40° (2) 30° (3) 65° (4) 90°

Q.8 If the area of a triangle of sides $\vec{A}$ and $\vec{B}$ is equal to $\frac{AB}{4}$, then find the angle between $\vec{A}$ & $\vec{B}$.

(1) 40° (2) 90° (3) 30° (4) 60°

Q.9 Find $\vec{A}\cdot\vec{B}$ if $|\vec{A}|$ = 2, $|\vec{B}|$ = 5, and $|\vec{A}\times\vec{B}|=8$.

(1) 6 (2) 4 (3) 2 (4) 8

Q.10 The x and y components of vector $\vec{A}$ and 4m and 6m respectively. Then x and y components of vector $\vec{A}+\vec{B}$ are 10m and 9m respectively. For the vector $\vec{B}$ calculate the following –

(a) x and y components

(b) length and

(c) the angle it makes with x-axis

ANSWER KEY

PRACTICE SECTION-01

Que.	1	2	3	4	5	6	7
Ans.	2	1	3	1	2	2	3

Q.8 (i) $-\frac{1}{\sqrt{3}}$ (ii) $\frac{\sqrt{3}}{2}$ (iii) $\frac{1}{\sqrt{2}}$ (iv) $\frac{-\sqrt{3}}{2}$ (v) -1 (vi) $-1/2$

Q.9 (i) $\frac{7}{2}x^{5/2}$ (ii) $-3x^{-4}$ (iii) 1 (iv) $5x^4 + 3x^2 + 2x^{-1/2}$ (v) $20x^3 + 9x^{1/2} + 9$

(vi) $2ax + b$; (vii) $15x^4 - 3 + \frac{1}{x^2}$ (viii) $4x + 3$ (ix) $\frac{-2}{(2x+1)^2}$

(x) $-\frac{1}{(4x+5)^2}$ (xi) $\frac{2x - x^4}{(x^3+1)^2}$

Q.10 (i) $\frac{x^{16}}{16} + c$ (ii) $-2x^{-1/2} + c$ (iii) $-\frac{x^{-6}}{2} + \log_e x + c$ (iv) $\frac{x^2}{2} + 2x + \log_e x + c$

(v) $\frac{x^2}{2} + \log_e x + c$ (vi) $-\frac{a}{x} + b\log_e x + c$ (vii) $\frac{GMm}{R}$ (viii) $kq_1q_2\left(\frac{1}{r_2} - \frac{1}{r_1}\right)$

(ix) $\frac{1}{2}M(v^2 - u^2)$ (x) ∞ (xi) 1 (xii) 1

(xiii) 2

PRACTICE SECTION-02

Que.	1	2	3	4	5	6	7	8	9
Ans.	2	2	2	2	2	1	2	3	1

Q.10 (a) 6 m and 3 m ; (b) $\sqrt{45}$ m ; (c) $\tan^{-1}\left(\frac{1}{2}\right)$