SAMPLE HINTS AND SOLUTIONS

INSTITUTE NAME & LOGO

MHT-CET – EXAM YEAR		
Time : 90 Min	**Maths : Full Portion Paper**	**Marks : 100**
Hints and Solutions		

201) Ans: **C)** 2

Sol: The curves y = x and $y = x + \sin x$ intersect at (0, 0) and (π, π).

$\therefore$ Area bounded by the two curves

$= \int_0^\pi (x + \sin x)\,dx - \int_0^\pi x\,dx = \int_0^\pi \sin x\,dx$

$= [-\cos x]_0^\pi = -\cos\pi + \cos 0$ = -(-1) +(1) = 2

202) Ans: **B)** $-\frac{1}{5}\cos^5 x + \frac{2}{7}\cos^7 x - \frac{1}{9}\cos^9 x + c$

Sol: Put $\cos x = t \Rightarrow -\sin x\,dx = dt$, in the given integral

$\int (1-\cos^2 x)^2.\cos^4 x \sin x\,dx = -\int (1-t^2)^2.\,t^4 dt$

$= -\frac{t^5}{5} + \frac{2}{7}t^7 - \frac{1}{9}t^9 + c$

$= -\frac{\cos^5 x}{5} + \frac{2}{7}\cos^7 x - \frac{1}{9}\cos^9 x + c$

203) Ans: **B)** $2\bar{a} + 5\bar{b} + 3\bar{c}$

Sol: Let us suppose that $\bar{R} = x\bar{a} + y\bar{b} + z\bar{c}$

$\Rightarrow \bar{R} = x(2\bar{p} + 3\bar{q} - \bar{r}) + y(\bar{p} - 2\bar{q} + 2\bar{r}) + z(-2\bar{p} + \bar{q} - 2\bar{r})$

$\Rightarrow 3\bar{p} - \bar{q} + 2\bar{r} = (2x + y - 2z)\,\bar{p} + (3x - 2y + z)\bar{q}$

$+(-x + 2y - 2z)\,\bar{r}$

Comparing... we get,

2x + y - 2z = 3, 3x - 2y + z = -1,

-x + 2y - 2z = 2

Solving above equations, we get

X = 2, y = 5, z = 3

$\therefore \bar{R} = 2\bar{a} + 5\bar{b} + 3\bar{c}$

204) Ans: **C)** $\frac{5}{\sqrt{2}}$

Sol: Equations of lines are

$\bar{r} = (-\hat{i} + \hat{j} - \hat{k}) + \lambda(\hat{i} + \hat{j} - \hat{k})$ and

$\bar{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(-\hat{i} + 2\hat{j} + \hat{k})$

Shortest distance

$$= \frac{\begin{vmatrix} 1+1 & -1-1 & 2+1 \\ 1 & 1 & -1 \\ -1 & 2 & 1 \end{vmatrix}}{\sqrt{(1+2)^2 + (1-1)^2 + (2+1)^2}}$$

$$= \frac{2(3) + 2(0) + 3(3)}{3\sqrt{2}} = \frac{5}{\sqrt{2}}$$

205) Ans: **A)** a - b - c

Sol: $\begin{vmatrix} a & 1 & 1 \\ 1 & -b & 1 \\ 1 & 1 & -c \end{vmatrix} = 0$

$\therefore$ a(bc - 1) - 1(- c -1) + 1(1 + b) = 0

abc - a + c + 1 + 1 + b = 0

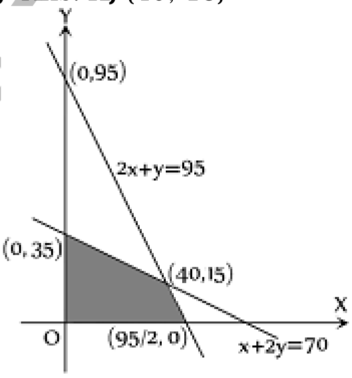
$\Rightarrow$ abc + 2 = a - b - c

206) Ans: **C)** $n\pi \pm \frac{\pi}{4}$

Sol: $2\tan^2\theta = \sec^2\theta \quad \Rightarrow 2\tan^2\theta = \tan^2\theta + 1$

$\Rightarrow \tan^2\theta = 1 = \tan^2\left(\frac{\pi}{4}\right) \qquad \therefore \theta = n\pi \pm \frac{\pi}{4}$

207) Ans: **A)** (40, 15)



Sol:

The shaded region represents feasible region.

$\therefore$ Max $z = x + y$.

It is obvious that, it is maximum at (40, 15).

208) Ans: **A)** 8, 8

Sol:

$x + y = 16 \quad \Rightarrow y = 16 - x \Rightarrow x^2 + y^2 = x^2 + (16-x)^2$

Let, z = x^2 + $(16 - x)^2$ $\Rightarrow z' = 4x - 32$

To be minimum of z, z''>0,

$\therefore\ 4x - 32 = 0 \quad \Rightarrow x = 8\ y = 8$

209) Ans: **B)** $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - 2\hat{j} + 3\hat{k})$;

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

Sol: Since, the required line passes through the point (1, 2, 3) and parallel to $\hat{i} - 2\hat{j} + 3\hat{k}$, the vector equation of the line is $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - 2\hat{j} + 3\hat{k})$;

The Cartesian equation of the line is

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

210) Ans: **B)** $(1, \pm 2)$

Sol: $\frac{d}{dx}(x^2 + y^2 - 2x - 3) = 0 \quad \Rightarrow 2x + 2y\frac{dy}{dx} - - = 0$

$\therefore \frac{dy}{dx} = \frac{1-x}{y}$

As the tangent is parallel to X-axis,

$\therefore \frac{1-x}{y} = 0$ i.e. $x = 1 \quad \therefore y = \pm 2$

Thus the point is (1, ± 2).

211) Ans: **B)** $\frac{16}{27}$

Sol: Probability of failure = $\frac{1}{3}$

and Probability for getting success $= \frac{2}{3}$

$\therefore$ Required probability

$= {}^4C_4\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^0 + {}^4C_3\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right)$

$= \left(\frac{2}{3}\right)^4 + 4\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right) = \frac{16}{27}$

212) Ans: **D)**

X :	0	1	2	3	4
P(X) :	0.1	0.3	0.6	0.75	1

Sol: $F(x_1) = p_1 = 0.1$

$F(x_2) = p_1+p_2 = 0.1+0.2 = 0.3$

$F(x_3) = p_1+p_2+p_3 = 0.1+0.2+0.3 = 0.6$

$F(x_4) = p_1+p_2+p_3+p_4 = 0.1+0.2+0.3+0.15 = 0.75$

$F(x_5) = p_1+p_2+p_3+p_4+p_5 = 0.1+0.2+0.3+0.15+0.25 =1$

213) Ans: **D)** $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x^2+1}{\sqrt{3}}\right) + c$

Sol: Let $I = \int \frac{x}{x^4 + x^2 + 1}dx$

Put $x^2 = t \quad \Rightarrow 2x\,dx = dt \quad \Rightarrow x\,dx = \frac{1}{2}dt$

$\therefore I = \frac{1}{2}\int \frac{dt}{t^2 + t + 1} = \frac{1}{2}\int \frac{dt}{t^2 + t + \frac{1}{4} + \frac{3}{4}}$

$= \frac{1}{2}\int \frac{dt}{(t + 1/2)^2 + \left(\frac{\sqrt{3}}{2}\right)^2}$

$= \frac{1}{2}.\frac{1}{(\sqrt{3}/2)}\tan^{-1}\left(\frac{t+1/2}{\sqrt{3}/2}\right) + c$

$= \frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2t+1}{\sqrt{3}}\right) + c = \frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x^2+1}{\sqrt{3}}\right) + c$

214) Ans: **A)** $1 - (2.9)(0.9)^{19}$

Sol: Let p denotes the probability that light has not useful life and q denotes useful life, then

q = 0.9   p = 1 - q = 1 - 0.9 = 0.1

Here n = 20

The probability that at least 2 lights will not have a useful life is

$P(X \ge 2) = 1 - (X < 2)$

$P(X \ge 2) = 1 - (P(X = 0) + P(X = 1))$

$P(X \ge 2) = 1 - {}^{20}C_0(0.1)^0(0.9)^{20} - {}^{20}C_1(0.1)^1(0.9)^{19}$

$P(X \ge 2) = 1 - (1)(1)(0.9)^{20} - (20)(0.1)(0.9)^{19}$

$P(X \ge 2) = 1 - (0.9 + 2)(0.9)^{19}$

$P(X \ge 2) = 1 - (2.9)(0.9)^{19}$

215) Ans: **B)** $\frac{-4 \pm 3\sqrt{2}}{3}$

Sol: $\cos\theta = \frac{a_1a_2 + b_1b_2 + c_1c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2}\sqrt{a_2^2 + b_2^2 + c_2^2}}$

$\Rightarrow \cos\left(\frac{\pi}{4}\right) = \frac{(1)(1) + (2)(3k) + (1)(1)}{\sqrt{1+4+1}\sqrt{1+9k^2+1}}$

$\Rightarrow \frac{1}{\sqrt{2}} = \frac{1+6k+1}{\sqrt{6}\sqrt{9k^2+2}} \Rightarrow \frac{1}{2} = \frac{(6k+2)^2}{6(9k^2+2)}$

$\Rightarrow 6(9k^2 + 2) = 8(3k+1)^2 \Rightarrow 27k^2 + 6 = 36k^2 + 24k + 4$

$\Rightarrow 9k^2 + 24k - 2 = 0$

$\Rightarrow k = \frac{-24 \pm \sqrt{576 + 72}}{18} = \frac{-24 \pm \sqrt{648}}{18}$

$\Rightarrow k = \frac{-24 \pm 18\sqrt{2}}{18} = \frac{-4 \pm 3\sqrt{2}}{3}$

216) Ans: **C)** 3 : 2

Sol: $2\bar{a} + 3\bar{b} - 5\bar{c} = \bar{0}$

$\therefore 5\bar{c} = 2\bar{a} + 3\bar{b} \quad \therefore \bar{c} = \frac{3\bar{b} + 2\bar{a}}{3+2}$

217) Ans: **C)** $\frac{2xy}{2y - x^2}$

Sol: $y = x^2 + \frac{1}{y} \quad \Rightarrow y^2 = x^2y + 1$

$\Rightarrow 2y\frac{dy}{dx} = y.2x + x^2\frac{dy}{dx} \qquad \therefore \frac{dy}{dx} = \frac{2xy}{2y - x^2}$

218) Ans: **D)** $y'' = -\omega^2 y$

Sol: $y = A\cos\omega t + B\sin\omega t$

$\therefore y' = -A\omega\sin\omega t + B\omega\cos\omega t$

$\therefore y'' = -A\omega^2\cos\omega t - B\omega^2\sin\omega t$

$\Rightarrow y'' = -\omega^2(A\cos\omega t + B\sin\omega t) \quad \therefore y = -\omega^2 y$

219) Ans: **B)** $-\frac{2}{5}$

Sol: From given, $|A| = -20$

$\therefore a_{23} = \frac{\text{Co-factor of } 6}{-20} = \frac{-8}{20} = \frac{-2}{5}$

220) Ans: **C)** tan x + c

Sol: Since, $a^{\log_a m} = m$

$\therefore \int 9^{\log_3(\sec x)}dx = \int \sec^2 x\,dx \quad ..... \left[\begin{array}{l}\because 3^{2\log_3(\sec x)} \\ = 3^{\log_3(\sec x)^2} \\ = (\sec x)^2\end{array}\right]$

= tan x + c

221) Ans: **D)** 4/3

Sol: Suppose, $I = \int_0^{\pi} |\sin^3\theta|\, d\theta$

As $\sin\theta$ is positive in interval $(0, \pi)$

$\therefore I = \int_0^{\pi} \sin^3\theta\, d\theta = \int_0^{\pi} \sin\theta(1-\cos^2\theta) d\theta$

$= \int_0^{\pi} \sin\theta\, d\theta + \int_0^{\pi} (-\sin\theta)\cos^2\theta\, d\theta$

$= [-\cos\theta]_0^{\pi} + \left[\frac{\cos^3\theta}{3}\right]_0^{\pi} = \frac{4}{3}$

222) Ans: **A)** $\tan^{-1}(-2)$

Sol: Here, $m_1 + m_2 = \frac{2\tan A}{-1} = 4$

$\Rightarrow \tan A = -2 \qquad \therefore \angle A = \tan^{-1}(-2)$

223) Ans: **D)** 2

Sol: $\cot\frac{B}{2}.\cot\frac{C}{2} = \sqrt{\frac{s(s-b)}{(s-a)(s-c)}.\frac{s(s-c)}{(s-a)(s-b)}}$

$= \frac{s}{s-a}$, {As $3a = b + c$ or $a + b + c = 2s = 4a$}

$= 2a/a = 2$

224) Ans: **A)** 2

Sol: Since f(x) is continuous at x = 0, therefore

$f(0) = \lim_{x\to 0} f(x) = \lim_{x\to 0} \frac{(27-2x)^{1/3} - 3}{9 - 3(243+5x)^{1/5}}, \left(\text{form}\frac{0}{0}\right)$

By L - Hospital rule

$f(0) = \lim_{x\to 0} \frac{\frac{1}{3}(27-2x)^{-2/3}(-2)}{-\frac{3}{5}(243+5x)^{-4/5}(5)} = 2$

225) Ans: **B)** sinx

Sol: Considering the f(x) = sinx

$\therefore$ f(0) = 0 and f'(x) = cos x $\Rightarrow f'(0) = 1$

Also, f''(x) = -sin x = -f(x)

226) Ans: **A)** 0

Sol: Suppose, $f(\theta) = \log(\sec\theta - \tan\theta)$

$\Rightarrow f(-\theta) = \log(\sec\theta + \tan\theta)$

$= \log\left(\frac{1}{\sec\theta - \tan\theta}\right) = \log(\sec\theta - \tan\theta) = -f(\theta)$

$\therefore f(\theta)$ is an odd function

$\Rightarrow \int_{-\pi/4}^{\pi/4} \log(\sec\theta - \tan\theta) d\theta = 0$

227) Ans: **D)** $\frac{4}{3}$

Sol: $y^2 = x$ and $2y = x \quad \Rightarrow y^2 = 2y \quad \therefore y = 0, 2$

$\therefore$ Required area $= \int_0^2 (y^2 - 2y)\, dy$

$= \left(\frac{y^3}{3} - y^2\right)_0^2 = \frac{4}{3}$ sq. unit.

228) Ans: **C)** 2

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

By squaring, we get $9\left(\frac{d^2y}{dx^2}\right)^2 = \left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^3$

So, the highest derivative is with power 2.

$\therefore$ Degree = 2

229) Ans: **D)** obtuse angled

Sol: Here, $\cos\theta = \frac{36 + 100 - (-14)^2}{2.6.10} \quad \therefore \theta = 120^\circ$

230) Ans: **D)**

$\frac{3}{2}(x\cot^3 x)^{1/2}[\cot^3 x - 3x\cot^2 x\,\mathrm{cosec}^2 x]$

Sol: $y = (x\cot^3 x)^{3/2}$

$\Rightarrow \frac{dy}{dx} = \frac{3}{2}(x\cot^3 x)^{1/2}[\cot^3 x + 3x\cot^2 x(-\mathrm{cosec}^2 x)]$

$= \frac{3}{2}(x\cot^3 x)^{1/2}[\cot^3 x - 3x\cot^2 x\,\mathrm{cosec}^2 x]$

231) Ans: **B)** $\frac{\pi}{4}$

Sol: Let $I = \int_0^1 \frac{dx}{x + \sqrt{1-x^2}}$,

Putting $x = \sin\theta, dx = \cos\theta\, d\theta$,

$I = \int_0^{\pi/2} \frac{\cos\theta\, d\theta}{\sin\theta + \cos\theta} = \frac{\pi}{4}$

232) Ans: **B)** $\frac{\pi}{3}$

Sol: The principal value of $\sin^{-1}\left[\sin\left(\pi - \frac{2\pi}{3}\right)\right]$

$= \sin^{-1}\left[\sin\left(\frac{\pi}{3}\right)\right] = \frac{\pi}{3}$

233) Ans: **C)** 4

Sol: $A = \begin{bmatrix} x & -2 \\ 3 & 7 \end{bmatrix}$ adj A= $\begin{bmatrix} 7 & 2 \\ -3 & x \end{bmatrix}$ $|A| = 7x + 6$

$A^{-1} = \frac{\text{adj}A}{|A|} = \begin{bmatrix} \frac{7}{(7x+6)} & \frac{2}{(7x+6)} \\ \frac{-3}{7x+6} & \frac{x}{7x+6} \end{bmatrix}$ ....(i)

$A^{-1} = \begin{bmatrix} \frac{7}{34} & \frac{1}{17} \\ \frac{-3}{34} & \frac{2}{17} \end{bmatrix}$ .....(ii) [Given]

From (i) and (ii), we get

$\begin{bmatrix} \frac{7}{7x+6} & \frac{2}{7x+6} \\ \frac{-3}{7x+6} & \frac{x}{7x+6} \end{bmatrix} = \begin{bmatrix} \frac{7}{34} & \frac{1}{17} \\ \frac{-3}{34} & \frac{2}{17} \end{bmatrix}$

$\Rightarrow \frac{7}{7x+6} = \frac{7}{34} \Rightarrow 7x + 6 = 34 \Rightarrow x = 4$

234) Ans: **D)** $\frac{7}{3}$

Sol: P(1) = k; P(2) = 2k; P(3) = 3k

$$\sum_{x_i=S} P(X=x) = 1 \Rightarrow k + 2k + 3k = 1 \quad \therefore k = \frac{1}{6}$$

$$E(X) = \sum xP(x)$$

$$\Rightarrow E(X) = (1)(k) + (2)(2k) + (3)(3k) = k + 4k + 9k$$

$$\Rightarrow E(X) = 14k = \frac{14}{6} = \frac{7}{3}$$

235) Ans: **D)** continuous at x = 2 and discontinuous at x = 3

Sol: $\lim_{x\to 2^-}(4-3x) = 4-6 = -2$

$\lim_{x\to 2^+}(2x-6) = 4-6 = -2$

$\lim_{x\to 3^-}(2x-6) = 6-6 = 0$

$\lim_{x\to 3^+}(x+5) = 3+5 = 8$

$\therefore \lim_{x\to 3^-} f(x) \neq \lim_{x\to 3^+} f(x)$

236) Ans: **C)** $(-\infty, \infty)$

Sol: $f(x) = \frac{x}{1+|x|}$

$$f'(x) = \frac{1+|x| - x\frac{|x|}{x}}{(1+|x|)^2} = \frac{1}{(1+|x|)^2}$$

Hence, it is differentiable at $(-\infty, \infty)$

237) Ans: **C)** coplanar

Sol: $\frac{x}{1} = \frac{y-2}{2} = \frac{z+3}{3}$ and $\frac{x-2}{1} = \frac{y-6}{3} = \frac{z-3}{4}$

The direction ratios of the first line are (1, 2, 3)
The direction ratios of the second line are (2, 3, 4)

i.e. $\frac{2}{1} \neq \frac{3}{2} \neq \frac{4}{3}$

$\therefore$ The lines are not parallel.
Sum of the products of the direction ratios are not same. i.e. $2\times 1 + 2\times 3 + 3\times 4 \neq 0$
$\therefore$ The lines are not perpendicular.

Let $L_1 : \frac{x}{1} = \frac{2y-2}{2} = \frac{x+3}{3}$

$L_2 : \frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{4}$

Consider $\begin{vmatrix} 0+2 & -2+6 & 3+3 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{vmatrix} = \begin{vmatrix} 2 & 4 & 6 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{vmatrix}$

$= 2\begin{vmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{vmatrix} = 0$

Since two rows are same, $\therefore$ Determinant is 0.
$\therefore$ The two lines are coplanar

238) Ans: **A)** $\sim(\sim p \wedge \sim q)$
Sol: p: Intelligent persons are polite.
q: Intelligent persons are helpful.

239) Ans: **A)** c(a + b) = 0

Sol: $ab(0) + 2\left(\frac{c}{2}\right)\left(\frac{c}{2}\right)(0) - a\left(\frac{c}{2}\right)^2 - b\left(\frac{c}{2}\right)^2 - 0(0)^2 = 0$

$\therefore ac^2 + bc^2 = 0 \quad \Rightarrow c^2(a+b) = 0 \quad \therefore c(a+b) = 0$

240) Ans: **D)** 2 cos 2x

Sol: $\frac{d}{dx}\{\sin(2\cos^{-1}(\sin x))\}$

$$= \frac{d}{dx}\left\{\sin\left(2\cos^{-1}\left(\cos\left(\frac{\pi}{2}-x\right)\right)\right)\right\}$$

$$= \frac{d}{dx}\left\{\sin\left(2\left(\frac{\pi}{2}-x\right)\right)\right\} = \frac{d}{dx}\{\sin(\pi-2x)\}$$

$= -2, \cos(\pi - 2x)\}$ = 2 cos 2x

241) Ans: **B)** $\log\left(\frac{x}{1-x}\right) - \frac{1}{x} + c$

Sol: $\int \frac{dx}{x^2 - x^3} = \int \frac{(1-x)dx}{x^2(1-x)} + \int \frac{xdx}{x^2(1-x)}$

$$= -\frac{1}{x} + \int \frac{dx}{x(1-x)} = -\frac{1}{x} + \int \frac{dx}{x} + \int \frac{dx}{1-x}$$

$$= -\frac{1}{x} + \log x - \log(1-x) + c = \log\left(\frac{x}{1-x}\right) - \frac{1}{x} + c$$

242) Ans: **B)** $x^2y = c$

Sol: $x^2dy = -2xy\,dx \quad \Rightarrow \frac{1}{y}dy = -\frac{2x}{x^2}dx$

By integrating, we get,
log y = -2 log x + log c

$\Rightarrow \log y = \log x^{-2} + \log c$

$\Rightarrow \log y\, x^2 = \log c \quad \Rightarrow yx^2 = c$

243) Ans: **C)** singular matrix
Sol: A (adj A) = |A|I
$\therefore$ |A (adj A)| = $|A|^n$ (If A is of order $n\times n$)
$\therefore$ |A| |adj A| = $|A|^n$
|Adj A| = $|A|^{n-1}$
Since, A is singular
$\therefore$ |A| = 0
$\therefore$ |adj A| = 0
Hence, adj A is a singular matrix.

244) Ans: **C)** $\frac{-3}{2}$

Sol: Let
$A \equiv (4,1,2), B \equiv (5,k,0), C \equiv (2,1,1), D \equiv (3,3,-1)$
The direction ratio of line AB are
$a_1 = 5-4 = 1, b_1 = k-1, c_1 = 0-2 = -2$
The direction ratio of line CD are
$a_2 = 3-2 = 1, b_2 = 3-1 = 2, c_2 = -1-1 = -2$
Line AB $\perp$ Line CD, then
$a_1a_2 + b_1b_2 + c_1c_2 = 0$

$$\Rightarrow 1 + 2k - 2 + 4 = 0 \Rightarrow 2k = -3 \Rightarrow k = \frac{-3}{2}$$

245) Ans: **C)** $b < -1$

Sol: Let, $f(x) = \sin x - bx + c$

$\therefore f'(x) = \cos x - b > 0$ i.e. $\cos x > b$ or $b < -1$.

246) Ans: **A)** $ax + by + 1 = 0,\ x + y = 0$

Sol: $ax^2 + (a + b)xy + by^2 + x + y = 0$

$\Rightarrow ax^2 + bxy + x + axy + by^2 + y = 0$

$\Rightarrow x(ax + by + 1) + y(ax + by + 1) = 0$

$\Rightarrow (x + y)(ax + by + 1) = 0$

247) Ans: **D)** $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{-5}$

Sol: The line passing through point (1, 2, 3) is

$$\frac{x-1}{a} = \frac{y-2}{b} = \frac{z-3}{c}$$

Also, it is perpendicular to the plane

$x + 2y - 5z + 9 = 0$

$\therefore$ The equation of line becomes

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

248) Ans: **D)** $\frac{1}{2}(x\sec^2 x - \tan x) + c$

Sol: Let $I = \int x\sin x \sec^3 x\, dx$

$$= \int x\sin x.\frac{1}{\cos^3 x}dx = \int x\tan x.\sec^2 x dx$$

Put $\tan x = t \quad \Rightarrow \sec^2 x\, dx = dt$ and $x = \tan^{-1} t$

$$\therefore I = \int \tan^{-1}t.t\, dt = \tan^{-1} t.\frac{t^2}{2} - \int \frac{1}{1+t^2}.\frac{t^2}{2}dt$$

$$= \frac{t^2\tan^{-1}t}{2} - \frac{1}{2}\int\left(\frac{t^2+1-1}{1+t^2}\right)dt$$

$$= \frac{t^2\tan^{-1}t}{2} - \frac{1}{2}\int\left(1 - \frac{1}{1+t^2}\right)dt$$

$$= \frac{t^2\tan^{-1}t}{2} - \frac{1}{2}t + \frac{1}{2}\tan^{-1}t + c$$

$$= \frac{x\tan^2 x}{2} - \frac{1}{2}\tan x + \frac{1}{2}x + c$$

$$= \frac{x(\sec^2 x - 1)}{2} - \frac{1}{2}\tan x + \frac{1}{2}x + c$$

$$= \frac{1}{2}(x\sec^2 x - \tan x) + c$$

249) Ans: **C)** tautology

Sol:

p	q	$p \wedge q$	$p \vee q$	$(p \wedge q) \rightarrow (p \vee q)$
T	T	T	T	T
T	F	F	T	T
F	T	F	T	T
F	F	F	F	T

250) Ans: **D)** a quadrilateral

Sol: The common region is quadrilateral.