Q1. If the matrix $A = \begin{bmatrix} 0 & x+y & 1 \\ 3 & z & 2 \\ x-y & -2 & 0 \end{bmatrix}$ is skew-symmetric, then:

(a) $x = 2, y = 1, z = 0$
(b) $x = 2, y = 2, z = 0$
(c) $x = -2, y = -1, z = 0$
(d) $x = -2, y = -1, z = -1$

Q2. If A, 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

Q3. If $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}\begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} -4 & 6 \\ -9 & x \end{bmatrix}$, then the value of x is:
(a) 13
(b) –13
(c) 9
(d) 5

Q4. For a 3 × 3 matrix A, if A(adj A) = $\begin{bmatrix} 99 & 0 & 0 \\ 0 & 99 & 0 \\ 0 & 0 & 99 \end{bmatrix}$ then det (A) is equal to:

(a) 3×99
(b) $(99)^3$
(c) $(99)^2$
(d) 99

Q5. If A is square matrix of order 3 and A. (Adj(A)) = 10I,
Then the value of $\frac{1}{25}|adj(A)|$ is
(a) 100
(b) 25
(c) 10
(d) 4

Q6. If A is a square matrix of order 3 such that |A| = 2, then |adj (adj A)|
(a) 0
(b) 2
(c) 16
(d) –16

Q7. If A is non-singular square matrix of order 3 and $|A^{-1}| = 24$, then the value of $|2A(\text{adj}(3A))|$, is
(a) $\frac{1}{64}$
(b) $\frac{9}{192}$
(c) $\frac{27}{64}$
(d) $\frac{9}{64}$

Q8. The function $f(x) = \begin{vmatrix} x^2 & x \\ 3 & 1 \end{vmatrix}, x \in$ IR has a:
(a) local maximum at x = 3
(b) local minimum at $x = \frac{3}{2}$
(c) local maximum at $x = \frac{3}{2}$
(d) local minimum at x = 0

Q9. The absolute maximum value of y = $x^3 - 3x + 2, 0 \leq x \leq 2$, is

(a) 4
(b) 6
(c) 2
(d) 0

Q10. The integral $\int \frac{dx}{\sqrt{\frac{1}{2}-5x-x^2}}$ is equal to:

(a) $\sin^{-1}\frac{2x+5}{3\sqrt{2}}+C$
(b) $\sin^{-1}\frac{2x+5}{3\sqrt{3}}+C$
(c) $\sin^{-1}\frac{2x-5}{3\sqrt{2}}+C$
(d) $\sin^{-1}\frac{2x-5}{3\sqrt{3}}+C$

Solutions:

S1. Ans. (c)

Sol. If matrix A $=\begin{bmatrix}0 & x+y & 1\\ 3 & z & 2\\ x-y & -2 & 0\end{bmatrix}$ is skew – symmetric, then

$x+y=-3$ .... (i)
$x-y=-1$ .... (ii)
$z=0$
Solving eq. (i) & (ii), we get
$2x=-4 \Rightarrow x=-2$
$-2+y=-3 \Rightarrow y=-1$

S2. Ans. (a)

Sol. Given
A and B are symmetric matrices, then
$A'=A$ & $B'=B$
Now
$(AB-BA)'=(AB)'-(BA)'$
$=B'A'-A'B'=BA-AB=-(AB-BA)$
$\Rightarrow$ $AB-BA$ skew – symmetric matrix

S3. Ans. (a)

Sol. Given
$\begin{bmatrix}2 & 3\\ 5 & 7\end{bmatrix}\begin{bmatrix}1 & -3\\ -2 & 4\end{bmatrix}=\begin{bmatrix}-4 & 6\\ -9 & x\end{bmatrix}$
$\begin{bmatrix}-4 & 6\\ -9 & 13\end{bmatrix}=\begin{bmatrix}-4 & 6\\ -9 & x\end{bmatrix}$
$x=13$

S4. Ans. (d)

Sol. We have
A(adj A) $=\begin{bmatrix}99 & 0 & 0\\ 0 & 99 & 0\\ 0 & 0 & 99\end{bmatrix}$
We know
$A(adjA)=|A|I$
$\Rightarrow$A(adj A) $=\begin{bmatrix}99 & 0 & 0\\ 0 & 99 & 0\\ 0 & 0 & 99\end{bmatrix}=99I$
$|A|=99$

S5. Ans. (d)

Sol. A(Adj(A)) = 10I
$|A|I=10I$
$\Rightarrow$ $|A|=10$

$$\frac{1}{25}|Adj(A)| = \frac{|A|^2}{25} = \frac{100}{25}$$
$=4$

S6. **Ans. (c)**

Sol. We have

$|\text{adj (adj A)}| = |A|^{(n-1)^2}$

$= (2)^{(3-1)^2} = 2^4 = 16$

S7. **Ans. (c)**

Sol. Given A is non-singular square matrix of order 3 and $|A^{-1}| = 24$. So, $|A| = \frac{1}{24}$

Now

$\left|2A\left(adj(3A)\right)\right| = |2A||adj(3A)|$

$$= 2^3|A||3A|^{3-1} = 8 \times \frac{1}{24} \times |3A|^2 = \frac{1}{3} \times |3A| \times |3A| = \frac{1}{3} \times 3^3|A| \times 3^3|A| = 3^5 \times \frac{1}{24} \times \frac{1}{24}$$

$$= 3^3 \times \frac{1}{8} \times \frac{1}{8} = \frac{27}{64}$$

S8. **Ans. (b)**

Sol. Given

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

$f'(x) = 2x - 3$

$f'(x) = 0$

$2x - 3 = 0$

$$x = \frac{3}{2}$$

$f''(x) = 2 > 0$ (minima)

Local minimum at $x = \frac{3}{2}$

S9. **Ans. (a)**

Sol. $\frac{dy}{dx} = 3x^2 - 3 = 0 \Rightarrow x = 1$

$y = f(x) = x^3 - 3x + 2$

$f(0) = 2$

$f(2) = 4$

$f(1) = 0$

S10. **Ans. (b)**

Sol. Given

$$\int \frac{dx}{\sqrt{\frac{1}{2} - 5x - x^2}} = \int \frac{dx}{\sqrt{-\left[x^2 + 2.x.\frac{5}{2} + \frac{25}{4} - \frac{25}{4} - \frac{1}{2}\right]}}$$

$$= \int \frac{dx}{\sqrt{-\left[\left(x+\frac{5}{2}\right)^2 - \frac{27}{4}\right]}}$$

$$\int \frac{dx}{\sqrt{\frac{27}{4} - \left(x+\frac{5}{2}\right)}} = \sin^{-1}\left(\frac{x+\frac{5}{2}}{\frac{3\sqrt{3}}{2}}\right) = \sin^{-1}\left(\frac{2x+5}{3\sqrt{3}}\right) + C$$