Assertion – Reasoning (2025-2026)

Class-XII

Subject: Mathematics

Full Syllabus

SET – 2

ASSERTION-REASON BASED QUESTIONS:

DIRECTIONS: In each of the questions given below, there are two statements marked as Assertion (A) and Reason (R). Mark your answer as per the codes provided below:

a. Both A and R are true and R is the correct explanation of A.

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

1. **Assertion (A):** Value of the expression $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)+\tan^{-1}1-\sec^{-1}(\sqrt{2})$ is $\frac{\pi}{4}$.

   Reason (R): Principal value branch of $\sin^{-1}x$ is $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ and that of $\sec^{-1}x$ is $[0,\pi]-\left\{\frac{\pi}{2}\right\}$.

   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

2. **Assertion (A):** Given two non-zero vectors $\vec{a}$ and $\vec{b}$. If $\vec{r}$ is another non-zero vector such that $\vec{r}\times(\vec{a}+\vec{b})=\vec{0}$. Then $\vec{r}$ is perpendicular to $\vec{a}\times\vec{b}$.

   Reason (R): The vector $(\vec{a}+\vec{b})$ is perpendicular to the plane of $\vec{a}$ and $\vec{b}$.

   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

3. **Assertion (A):** Let Z be the set of integers. A function $f: Z \to Z$ defined as, $f(x) = 3x - 5$, $\forall x \in Z$ is a bijective.

   Reason (R): A function is a bijective if it is both surjective and injective.

   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

4. **Assertion (A):** $f(x)=\begin{cases}3x-8, & x\le 5\\ 2k, & x>5\end{cases}$ is continuous at $x=5$ for $k=\frac{5}{2}$.

   Reason (R): For a function f to be continuous at $x=a$, $\lim\limits_{x\to a^-} f(x)=\lim\limits_{x\to a^+} f(x)=f(a)$.

   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

5. **Assertion (A):** For any symmetric matrix A, B′ AB is a skew-symmetric matrix.

   Reason (R): A square matrix P is skew-symmetric if P′ = –P.

   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

6. **Assertion (A):** For two non-zero vectors $\vec{a}$ and $\vec{b}$, $\vec{a}\cdot\vec{b}=\vec{b}\cdot\vec{a}$.

   Reason (R): For two non-zero vectors $\vec{a}$ and $\vec{b}$, $\vec{a}\times\vec{b}=\vec{b}\times\vec{a}$.

   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

7. **Assertion (A):** $\sin^{-1}\left[\sin\left(\frac{2\pi}{3}\right)\right]=\frac{2\pi}{3}$

Reason (R): $\sin^{-1}[\sin(\theta)]=\theta$, if $\theta=\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

8. **Assertion (A):** The acute angle between the line $\vec{r}=\hat{i}+\hat{j}+2\hat{k}+\lambda(\hat{i}-\hat{j})$ and the x-axis is $\frac{\pi}{4}$.

Reason (R): The acute angle θ between the lines

$$\vec{r}=x_1\hat{i}+y_1\hat{j}+z_1\hat{k}+\lambda(a_1\hat{i}+b_1\hat{j}+c_1\hat{k})$$

and

$$\vec{r}=x_2\hat{i}+y_2\hat{j}+z_2\hat{k}+\mu(a_2\hat{i}+b_2\hat{j}+c_2\hat{k})$$

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

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

9. **Assertion (A):** If A is an invertible square matrix, then A^T is invertible.

Reason (R): Inverse of invertible symmetric matrix is a symmetric matrix.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

10. **Assertion (A):** Consider the function $f(x)=\sin^4x+\cos^4x$, $0\le x\le\frac{\pi}{2}$.

$f(x)$ is decreasing in $\left[0,\frac{\pi}{4}\right]$.

Reason (R): $f(x)$ is increasing in $\left[\frac{\pi}{4},\frac{\pi}{2}\right]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

11. **Assertion (A):** $\sin^{-1}(1.01)$ exists.

Reason (R): Domain of $\sin^{-1}x$ is $x\in[-1,1]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

12. **Assertion (A):** Line $\vec{r}=(2\vec{j}-\vec{k})+\lambda(\hat{i}-2\hat{j}+\hat{k})$ makes acute angle with the y-axis.

Reason (R): Vector $a\hat{i}+b\hat{j}+c\hat{k}$ makes acute angle with the y-axis if $b>0$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

13. **Assertion (A):** $(\sin^{-1}x)^2\ne\sin^{-2}x$.

Reason (R): $\sin^{-1}x$ represents inverse of sine function, we can't use exponent laws.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

14. **Assertion (A):** Line $\vec{r}=(\hat{i}-\hat{j}-\hat{k})+\lambda(2\hat{i}+\hat{j}+2\hat{k})$ passes through a fixed point (1, –1, –1).

Reason (R): In vector equation of a line $\vec{r}=\vec{a}+\lambda\vec{b}$, $\vec{a}$ represents position vector of fixed point, through which line passes.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

15. **Assertion (A):** If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$ then $x^2+y^2+z^2=3$.

Reason (R): Principal value of $\sin^{-1}x$ lies in $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

16. **Assertion (A):** The scalar projection of vector $\hat{i}+\hat{j}+2\hat{k}$ along vector $\hat{i}$ is 1.

Reason (R): The scalar projection of $\vec{a}$ along $\vec{b}$ is $\frac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

17. **Assertion (A):** Matrix $A=\begin{bmatrix}2x+4 & 4\\ x+5 & 3\end{bmatrix}$ is a non-invertible matrix for x = 2.

Reason (R): If A is a singular matrix then A is a non-invertible matrix.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

18. **Assertion (A):** $\int e^x\left(\frac{1+\sin x.\cos x}{\cos^2 x}\right)dx = e^x\tan x+C.$

Reason (R): $\int e^x[f(x)+f'(x)]dx = e^x f(x)+C.$

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

19. **Assertion (A):** $\begin{bmatrix}-7 & 0 & 0\\ 0 & -7 & 0\\ 0 & 0 & -7\end{bmatrix}$ is a scalar matrix.

Reason (R): In a matrix, if all the elements of the principal diagonal are equal, it is called a scalar matrix.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

20. **Assertion (A):** If A and B are independent events then $P\{(A\cap B)'\} = P(A')\cdot P(B')$.

Reason (R): $P\{(A\cup B)'\} = 1-P(A\cup B)$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

21. **Assertion (A):** The domain of $\cos^{-1}(3x-1)$ is $\left[0, \frac{2}{3}\right]$.

Reason (R): Domain of $\cos^{-1}x$ is $[-1, 1]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

22. **Assertion (A):** Linear programming problem is to optimise objective functions.

Reason (R): Maximum or minimum of objective function lies at the corner points of bounded feasible region.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

23. **Assertion (A):** $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)=\frac{\pi}{3}.$

Reason (R): $\sin^{-1}(\sin\theta)=\theta$ when $\theta\in\left[-\frac{\pi}{2},\frac{\pi}{2}\right].$

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

24. **Assertion (A):** Vector equation of line $\frac{x-5}{3}=\frac{y+4}{7}=\frac{6-z}{2}$ is $\vec{r}=(5\hat{i}-4\hat{j}+6\hat{k})+\lambda(3\hat{i}+7\hat{j}-2\hat{k}).$

Reason (R): Cartesian equation of a line passing through point (x_1, y_1, z_1) is $\frac{x-x_1}{a}=\frac{y-y_1}{b}=\frac{z-z_1}{c}$, a, b, c are direction ratios of a line.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

25. **Assertion (A):** $\int_0^{10} \frac{\sqrt{x}}{\sqrt{x}+\sqrt{10-x}}dx = 10$.

Reason (R): $\int_0^a f(x)dx = \int_0^a f(a-x)dx$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

26. **Assertion (A):** The vectors $\vec{a} = 2\hat{i} - \hat{j} + 5\hat{k}$ and $\vec{b} = 5\hat{i} + \hat{j} - 3\hat{k}$ are perpendicular to each other.

Reason (R): $\vec{a} \times \vec{b}$ is a vector perpendicular to both $\vec{a}$ and $\vec{b}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

27. **Assertion (A):** For non-zero vectors $\vec{a}, \vec{b}$ if $\vec{a} \times \vec{b} = 0$ then $\vec{a} \perp \vec{b}$.

Reason (R): If $\vec{a} \perp \vec{b} \Rightarrow \vec{a} \cdot \vec{b} = 0$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

28. **Assertion (A):** The function $f : R - \left\{(2n+1)\frac{\pi}{2} : n \in Z\right\} \to (-\infty, -1] \cup [1, \infty)$ defined by f(x) = sec x is not one-one function in its domain.

Reason (R): The line y = 2 meets the graph of the function at more than one point.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

ANSWER

1. Ⓓ	5. Ⓓ	9. Ⓑ	13. Ⓐ	17. Ⓓ	21. Ⓐ	25. Ⓓ
2. Ⓒ	6. Ⓒ	10. Ⓑ	14. Ⓐ	18. Ⓐ	22. Ⓑ	26. Ⓓ
3. Ⓓ	7. Ⓓ	11. Ⓓ	15. Ⓐ	19. Ⓒ	23. Ⓐ	27. Ⓓ
4. Ⓓ	8. Ⓐ	12. Ⓓ	16. Ⓐ	20. Ⓓ	24. Ⓑ	28. Ⓒ