Assertion – Reasoning (2025-2026)

Class-XII

Subject: Mathematics

Full Syllabus

SET - 1

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):** Let R be a relation on the set N of the natural numbers defined by nRm $\Leftrightarrow$ n is a factor of m. Then R is not an equivalence relation.

Reason (R): R is not symmetric.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

2. **Assertion (A):** Let R be a real line. Consider the following subsets of the plane R × R.

$S = \{(x, y) : y = x + 1 \text{ and } 0 < x < 2\}$

$T = \{(x, y) : (x - y) \text{ is an integer}\}$

Now, T is an equivalence relation on R but S is not an equivalence relation on R.

Reason (R): S is neither reflexive nor symmetric but T is reflexive, symmetric and transitive.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

3. **Assertion (A):** Let $A = \{x \in R : -1 \leq x \leq 1\}$. If $f : A \to A$ be defined as $f(x) = x^2$ then f is not an onto function.

Reason (R): If $y = -1 \in A$ then $x \pm \sqrt{-1} \notin A$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

4. **Assertion (A):** Let $f(x) = e^x$ and $g(x) = \log_e^x \cdot$ Then $(f + g)\,x = e^x + \log_e^x$ where domain (f + g) is R.

Reason (R): Dom (f + g) = Dom (f) $\cap$ Dom (g).

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

5. **Assertion (A):** $\operatorname{cosec}^{-1}\left(\frac{1}{\sqrt{2}}+\frac{1}{2}\right) > \sec^{-1}\left(\frac{1}{\sqrt{2}}+\frac{1}{2}\right)$.

Reason (R): $\operatorname{cosec}^{-1}x < \sec^{-1}x$ if $1 \leq x < \sqrt{2}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

6. **Assertion (A):** $\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\frac{\pi}{4}$.

Reason (R): For $x > 0,\ y > 0$ $\tan^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y-x}{y+x}\right)=\frac{\pi}{4}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

7. **Assertion (A):** $\cos^{-1}\left(\cos\frac{13\pi}{6}\right) = \frac{\pi}{6}$.

Reason (R): Range of $\cos^{-1}x$ is $[0, \pi]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

8. **Assertion (A):** Domain of $y = \cos^{-1}(x)$ is $[-1, 1]$.

Reason (R): Range of $\cos^{-1}(x)$ is $[0,\pi]-\{\frac{\pi}{2}\}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

9. **Assertion (A):** All trigonometric functions have their inverses over their respective domains.

Reason (R): The inverse of $\tan^{-1}x$ exists for some $x \in R$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

10. **Assertion (A):** Maximum value of $(\cos^{-1}x)^2$ is π^2.

Reason (R): Range of $\cos^{-1}x$ is $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

11. **Assertion (A):** Range of $f(x)=2\sin^{-1}x+\frac{3\pi}{2},\ x\in[-1,1]$ is $\left[\frac{\pi}{2},\frac{5\pi}{2}\right]$.

Reason (R): Range of $\sin^{-1}(x)$ is $[0, \pi]$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

12. **Assertion (A):** The domain of the function $\sec^{-1}2x$ is $\left(-\infty,-\frac{1}{2}\right]\cup\left[\frac{1}{2},\infty\right)$.

Reason (R): $\sec^{-1}(-2)=-\frac{\pi}{4}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

13. **Assertion (A):** Let $A(\theta)=\begin{bmatrix}\cos\theta+\sin\theta & \sqrt{2}\sin\theta \\ -\sqrt{2}\sin\theta & \cos\theta-\sin\theta\end{bmatrix}$ then $A^3\left(\frac{\pi}{3}\right)=-1$.

Reason (R): $A(\theta).A(\phi)= A(\theta+\phi)$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

14. **Assertion (A):** Suppose $X=\begin{bmatrix}a & b\\ c & d\end{bmatrix}$ satisfies the equation $X^2 - 4x + 3I = 0$. If $a + d \neq 4$ then there are just two such matrices.

Reason (R): There are infinite number of matrices X, satisfying $X^2 - 4X + 3I = 0$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

15. **Assertion (A):** Let $A=[aij]=\begin{cases}K, & i=j\\ 0, & i\neq j\end{cases}$

when $K = 1$ then A is an identity matrix.

Reason (R): Every identity matrix is not a scalar matrix.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

16. **Assertion (A):** A = diag (3, 5, 2) then A is a scalar matrix of order 3×3.

Reason (R): If a diagonal matrix has all non-zero elements equal, it is known as a scalar matrix.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

17. **Assertion (A):** Let $A = (aij)_{2\times2}$ and $aij = i \times j$ then $A = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$.

Reason (R): If A is a 2 × 2 matrix, then the elements in A is 5.

Ⓐ A　　Ⓑ B　　Ⓒ C　　Ⓓ D

18. **Assertion (A):** Let $A = (aij)_{2\times2}$, $B = (bij)_{2\times2}$ then $(A+B)^2 = A^2 + B^2$.

Reason (R): Generally AB ≠ BA matrix multiplication is not commutative.

Ⓐ A　　Ⓑ B　　Ⓒ C　　Ⓓ D

ANSWER

1. Ⓐ	3. Ⓐ	5. Ⓒ	7. Ⓐ	9. Ⓓ	11. Ⓒ	13. Ⓐ	15. Ⓒ	17. Ⓒ
2. Ⓐ	4. Ⓓ	6. Ⓐ	8. Ⓒ	10. Ⓒ	12. Ⓒ	14. Ⓑ	16. Ⓓ	18. Ⓓ