Assertion – Reasoning (2025-2026)

Class-XII

Subject: Mathematics

Full Syllabus

SET – 3

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 $A = \{x \in R : -1 \le x \le 1\}$. 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

2. **Assertion (A):** The relation $f : \{1, 2, 3, 4\} \to \{x, y, z, p\}$ defined by

   $f = \{1, x), (2, y), (3, z)\}$ is a bijective function.

   Reason (R): The function $f : \{1, 2, 3\} \to \{x, y, z, p\}$ such that $f = \{1, x), (2, y), (3, z)\}$ is one-one.

   Ⓐ A　　Ⓑ B　　Ⓒ C　　Ⓓ D

3. **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

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

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

   Ⓐ A　　Ⓑ B　　Ⓒ C　　Ⓓ D

5. **Assertion (A):** A = diag [3 5 2] 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

6. **Assertion (A):** Function $f(x) = 2x^2 - 1$ is continuous at $x = 3$.

   Reason (R): f(x) is continuous at x = a, if $(LHL)_{x=a} = (RHL)_{x=a} = f(a)$.

   Ⓐ A　　Ⓑ B　　Ⓒ C　　Ⓓ D

7. **Assertion (A):** $f(x) = |x - 5|$ is not continuous at $x = 5$.

Reason (R): Every constant function is continuous.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

8. Let f(x) be a polynomial function of degree 6 such that $\frac{d}{dx}[f(x)] = (x-1)^3(x-3)^2$, then

Assertion (A): f(x) has a minimum at $x = 1$.

Reason (R): When $\frac{d}{dx}(f(x)) < 0, \forall x \in (a-h, a)$ and $\frac{d}{dx}[f(x)] > 0, \forall x \in (a, a+h)$; where 'h' is an infinitestimally small positive quantity, then f(x) has a minimum at $x = a$, provided f(x) is continuous at $x = a$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

9. **Assertion (A):** The maximum value of the function $\sin x + \cos x$ is $2\sqrt{2}$.

Reason (R): The function $\sin x + \cos x$ is maximum at $x = \frac{\pi}{4}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

10. **Assertion (A):** The values of a for the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $a\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear.

Reason (R): Vectors $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$ are collinear iff $\frac{b_1}{a_1} = \frac{b_2}{a_2} = \frac{b_3}{a_3}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

11. **Assertion (A):** Vector in the direction of vector $\vec{a} = \hat{i} - 2\hat{j}$ that has magnitude 7 units is $\frac{7}{5}\hat{i} - \frac{14}{5}\hat{j}$.

Reason (R): The unit vector in the direction of vector $\vec{a}$ is $\hat{a} = \frac{1}{|\vec{a}|}.\vec{a}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

12. **Assertion (A):** The area of the triangle whose two adjacent sides are $\vec{a} = -2\hat{i} - 5\hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} - \hat{k}$ is $\frac{\sqrt{165}}{2}$ sq units.

Reason (R): Area of triangle is given by $\frac{1}{2}|\vec{a} \cdot \vec{b}|$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

13. **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 $\vec{r} = x_2\hat{i} + y_2\hat{j} + z_2\hat{k} + \mu(a_2\hat{i} + b_2\hat{j} + c_2\hat{k})$ is given by $\cos\theta = \frac{|a_1a_2 + b_1b_2 + c_1c_2|}{\sqrt{a_1^2 + b_1^2 + c_1^2}\sqrt{a_2^2 + b_2^2 + c_2^2}}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

14. **Assertion (A):** The direction ratios and direction cosines of the line passing through two points (2, –4, 5) and (0, –1, –1) are $\left(\frac{2}{\sqrt{17}}, \frac{2}{\sqrt{17}}, \frac{3}{\sqrt{17}}\right)$.

Reason (R): If a, b and c are direction ratios, then direction cosines are $\left[\frac{a}{\sqrt{a^2+b^2+c^2}}, \frac{b}{\sqrt{a^2+b^2+c^2}}, \frac{c}{\sqrt{a^2+b^2+c^2}}\right]$.

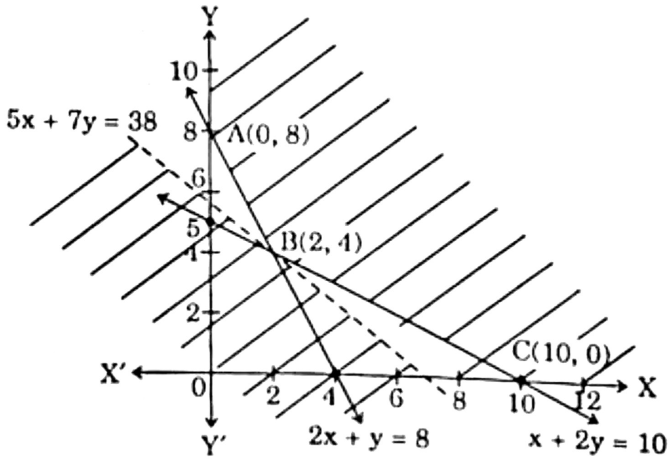
Ⓐ A Ⓑ B Ⓒ C Ⓓ D

15. Assertion (A): In a linear programming problem, if the feasible region is empty, then the linear programming problem has no solution.

Reason (R): A feasible region is defined as the region that satisfies all the constraints.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

16. Assertion (A): The shaded portion of the graph represents the feasible region for the given linear programming problem (LPP).



Maximise $Z = 50x + 70y$

Subject to constraints

$2x + y \geq 8$, $x + 2y \geq 10$ and $x, y \geq 0$

$Z = 50x + 70y$ has a minimum value = 380 at B(2, 4).

Reason (R): The region representing $50x + 70y < 380$ does not have any point common with the feasible region.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

17. Assertion (A): If R and S are two events such that $P(R|S) = 1$ and $P(S) > 0$ then $S \subset R$.

Reason (R): If two events A and B are such that $P(A \cap B) = P(B)$ then $A \subset B$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

18. Assertion (A): Two coins are tossed simultaneously. The probability of getting two heads, if it is known that at lost one head comes up, is $\frac{1}{3}$.

Reason (R): Let E and F be two events with a random experiment, then $P(F/E) = \frac{P(E \cap F)}{P(E)}$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

19. Assertion (A): The degree of differential equation $\left(\frac{d^3y}{dx^3}\right)^3 + \frac{d^2y}{dx^2} = \log\left(\frac{dy}{dx}\right)$ is 3.

Reason (R): The given differential equation is not a polynomial equation in derivatives of y, so its degree is not defined.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

20. **Assertion (A):** The relation f : {1, 2, 3, 4} → {x, y, z, p} defined by f = {(1, x), (2, y), (3, z), (4, p)} is a bijective function.

Reason (R): Each element of the set {1, 2, 3, 4} has image over the set {x, y, z, p}. Also, each element of set {x, y, z, p} has pre-image in {1, 2, 3, 4}. So, it is bijective.

Ⓐ A　　Ⓑ B　　Ⓒ C　　Ⓓ D

ANSWER

1. Ⓐ	5. Ⓓ	9. Ⓓ	13. Ⓐ	17. Ⓒ
2. Ⓓ	6. Ⓐ	10. Ⓐ	14. Ⓓ	18. Ⓐ
3. Ⓒ	7. Ⓓ	11. Ⓓ	15. Ⓐ	19. Ⓓ
4. Ⓒ	8. Ⓐ	12. Ⓒ	16. Ⓐ	20. Ⓐ