Straight Lines

Assertion Reason Questions

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Choose the correct answer out of the following choices.

(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): The angle between the line

$x+2y-3=0$ and $3x + y + 1 = 0$

is $\tan^1(1)$.

Reason (R): Angle between two lines is

given by $\tan\theta = \pm\left(\frac{m_2 - m_1}{1 + m_1 m_2}\right)$

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

Explanation: Let m1 and m_2 be the slopes of the

straight lines $x+2y-3=0$ and $3x + y +1=0$.

Then, $m_1 = -\frac{1}{2}$ and $m_2 = -3$

Let θ be the angle between the given lines.

Then, $\tan\theta = \pm\left(\frac{m_2 - m_1}{1+m_1 m_2}\right)$

$$= \pm\left(\frac{-3+\frac{1}{2}}{1+\frac{3}{2}}\right) = \pm 1$$

$\Rightarrow \quad \theta = \tan^{-1}(1)$

2. Assertion (A): A slope of line $3x-4y+ 10 = 0$

is $\frac{3}{4}$.

Reason (R): x-intercepts and y-intercepts of 3x-4y+ 10 = 0 respectively are

$$y = \frac{3}{4}x + \frac{5}{2}$$

Ans. (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
Explanation: Given equation 3x-4y+ 10 = 0 can be written as

$$y = \frac{3}{4}x + \frac{5}{2}$$

Comparing eq. (1) with y = mx + c, we have slope of the given line as $m = \frac{3}{4}$.

Equation 3x-4y+10= 0 can be written as

$$3x - 4y = -10 \text{ or } \frac{x}{-\frac{10}{3}} + \frac{y}{\frac{5}{2}} = 1 \quad \text{...(ii)}$$

Comparing eq. (ii) with $\frac{x}{a} + \frac{y}{b} = 1$, we have x-intercept as $a = -\frac{10}{3}$ and y-intersect as $b = \frac{5}{2}$.

3. Assertion (A): If x cos + y sin 0 = 2 is perpendicular to the line x - y = 3 then one of the values of θ is $\frac{\pi}{4}$.

Reason (R): If two lines $y = mx + c_1$ and $y = m^2 + c_2$ are perpendicular then $m_1 = m_2$

Ans. (c) (A) is true but (R) is false.
Explanation: Since, slope of line x cos θ + y sin θ = 2 is cot θ and slope of line x - y = 3 is 1.
Also, these lines are perpendicular to each other.

$\therefore \quad (-\cot\theta)(1) = -1$

$\Rightarrow \quad \cot\theta = 1$

$\Rightarrow \quad \theta = \cot^{-1}\left(\cot\frac{\pi}{4}\right)$

$\Rightarrow \quad \theta = \frac{\pi}{4}$

Condition of perpendicularity of two lines is m_1.
$m_2 = -1$ and not $m_1 = m_2$

4. Assertion (A): The slope of the line $x + 7y = 0$

is $\frac{1}{5}$ and y-intercept is 0.

Reason (R): The slope of the line $6x + 3y - 5 = 0$

is -2 and y – intercept is $\frac{5}{2}$.

Ans. (d) (A) is false but (R) is true.
Explanation: Given equation is $x + 7y = 0$

$\Rightarrow \quad y = \frac{-x}{7} + 0$

On comparing with $y = mx + c$, we get

Slope $(m) = \frac{-1}{7}$, y – intercept $= 0$

Given equation is $6x + 3y - 5 = 0$

$\Rightarrow \quad y = -2x + \frac{5}{3}$

On comparing with $y = mx + c$, we get

Slope $(m) = -2$, y – intercept $= \frac{5}{3}$

5. Assertion (A): Slope of x-axis is zero and slope of y-axis is not defined.
Reason (R): Slope of x-axis is defined and slope of y-axis is zero.

Ans. (c) (A) is true but (R) is false.

Explanation: slope of x-axis is zero and hence defined but slope of y-axis is not defined.

6. Assertion (A): The distance between the line

$4x + 3y = 11$ and $8x + 6y = 15$

is $\frac{7}{10}$.

Reason (R): The distance between the line

$ax + by = c_1$ and $ax + by = c_2$ is

given by $\left|\frac{c_1 - c_2}{\sqrt{a^2 + b^2}}\right|$.

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

Explanation: Given lines are

$$4x + 3y = 11$$

and $$2(4x + 3y) = 15$$

i.e., $$4x + 3y = \frac{15}{2}$$

Distance between them is

$$= \left|\frac{11 - \frac{15}{2}}{\sqrt{16 + 9}}\right|$$

$$= \left|\frac{7}{10}\right| = \frac{7}{10}$$