

11.10.4.21

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CLASS 11, CHAPTER 10, EXERCISE 4.21

Case 1.

$$\frac{7}{9} - c = -c + 2 \quad (11)$$

$$\Rightarrow -\frac{7}{9} = 2 \quad (12)$$

$$\text{(not possible)} \quad (13)$$

Case 2.

$$\frac{7}{9} - c = c + 2 \quad (14)$$

$$\Rightarrow 2c = -\frac{11}{9} \quad (15)$$

$$\Rightarrow c = -\frac{11}{18} \quad (16)$$

The equation of line is

$$L : \left(1 \quad \frac{2}{3}\right) \mathbf{x} - c = 0 \quad (17)$$

$$L : x + \frac{2}{3}y + \frac{11}{18} = 0 \quad (18)$$

$$\Rightarrow L : 18x + 12y + 11 = 0 \quad (19)$$

Q.21. Find equation of the line which is equidistant from parallel lines $9x + 6y - 7 = 0$ and $3x + 2y + 6 = 0$.

Solution: Let's first rewrite the given equation of line in the form $x + by + c = 0$ where b, c are constants. Equation of lines are

$$L_1 : 9x + 6y - 7 = 0 \quad (1)$$

$$\Rightarrow L_1 : x + \frac{2}{3}y - \frac{7}{9} = 0 \quad (2)$$

$$\Rightarrow \mathbf{n}_1 = \left(\frac{1}{3}\right) \text{ and } c_1 = \frac{7}{9} \quad (3)$$

$$L_2 : 3x + 2y + 6 = 0 \quad (4)$$

$$\Rightarrow L_2 : x + \frac{2}{3}y + 2 = 0 \quad (5)$$

$$\Rightarrow \mathbf{n}_2 = \left(\frac{1}{3}\right) \text{ and } c_2 = -2 \quad (6)$$

The equation of desired line will be $\mathbf{n}^T \mathbf{x} + c = 0$. As it is given that lines are parallel, \mathbf{n} must be same as \mathbf{n}_1 and \mathbf{n}_2 .

$$L : \left(1 \quad \frac{2}{3}\right) \mathbf{x} - c = 0 \quad (7)$$

The distance between two parallel lines $\mathbf{n}^T \mathbf{x} + c_1 = 0$ and $\mathbf{n}^T \mathbf{x} + c_2 = 0$ is given as

$$d = \frac{|c_1 - c_2|}{\|\mathbf{n}\|} \quad (8)$$

So for given lines, we need to solve

$$\frac{|c_1 - c|}{\|\mathbf{n}\|} = \frac{|c - c_2|}{\|\mathbf{n}\|} \quad (9)$$

$$\Rightarrow \frac{\left|\frac{7}{9} - c\right|}{\left\|\left(\frac{1}{3}\right)\right\|} = \frac{|c + 2|}{\left\|\left(\frac{1}{3}\right)\right\|} \quad (10)$$