

11.10.4.21

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CLASS 11, CHAPTER 10, EXERCISE 4.21

Q21. Find equation of the line which is equidistant from parallel lines $9x + 6y - 7 = 0$ and $3x + 2y + 6 = 0$

Solution: Equation of lines are

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

$$\Rightarrow \mathbf{n}_1 = \begin{pmatrix} 9 \\ 6 \end{pmatrix} \text{ and } c_1 = 7 \quad (2)$$

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

$$\Rightarrow \mathbf{n}_2 = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \text{ and } c_2 = -6 \quad (4)$$

Using the given equidistant condition for desired line

$$\frac{|\mathbf{n}_1^T \mathbf{x} - c_1|}{\|\mathbf{n}_1\|} = \frac{|\mathbf{n}_2^T \mathbf{x} - c_2|}{\|\mathbf{n}_2\|} \quad (5)$$

$$\frac{|(9 \ 6)\mathbf{x} - 7|}{\sqrt{117}} = \frac{|(3 \ 2)\mathbf{x} - (-6)|}{\sqrt{13}} \quad (6)$$

$$|(9 \ 6)\mathbf{x} - 7| = 3|(3 \ 2)\mathbf{x} + 6| \quad (7)$$

Case 1.

$$(9 \ 6)\mathbf{x} - 7 = 3(3 \ 2)\mathbf{x} + 18 \quad (8)$$

$$(9 \ 6)\mathbf{x} - 7 = (9 \ 6)\mathbf{x} + 18 \quad (9)$$

$$\Rightarrow -7 = 18 \text{ (not possible)} \quad (10)$$

Case 2.

$$(9 \ 6)\mathbf{x} - 7 = -3(3 \ 2)\mathbf{x} - 18 \quad (11)$$

$$(9 \ 6)\mathbf{x} - 7 = -(9 \ 6)\mathbf{x} - 18 \quad (12)$$

$$(18 \ 12)\mathbf{x} = -11 \quad (13)$$

The equation of desired line is (14)

$$(18 \ 12)\mathbf{x} + 11 = 0 \quad (15)$$