Straight Lines Assignment

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***Abstract*—This document contains the solution to Question 1 of Exercise 1 in Chapter 10 of the class 11 NCERT textbook.**

1) Draw a quadrilateral in the Cartesian plane, whose vertices are

$$\mathbf{A} = \begin{pmatrix} -4 \\ 5 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} 0 \\ 7 \end{pmatrix} \tag{1}$$

$$\mathbf{C} = \begin{pmatrix} 5 \\ -5 \end{pmatrix} \quad \mathbf{D} = \begin{pmatrix} -4 \\ -2 \end{pmatrix} \tag{2}$$

Also, find its area.

Solution: The points are plotted in Fig. 1. The plot is generated using the Python code `codes/quad.py`.

The area of the quadrilateral is given by

$$\text{ar}\,(ABCD) = \text{ar}\,(\triangle ABC) + \text{ar}\,(\triangle ACD) \tag{3}$$

$$= \frac{1}{2}\left((\mathbf{B}-\mathbf{A}) \times (\mathbf{C}-\mathbf{A}) + (\mathbf{C}-\mathbf{A}) \times (\mathbf{D}-\mathbf{A})\right) \tag{4}$$

$$= \frac{1}{2}\left((\mathbf{C}-\mathbf{A}) \times (\mathbf{D}-\mathbf{A}+\mathbf{A}-\mathbf{B})\right) \tag{5}$$

$$= \frac{1}{2}\left((\mathbf{C}-\mathbf{A}) \times (\mathbf{D}-\mathbf{B})\right) \tag{6}$$

$$= \frac{1}{2}\begin{vmatrix} 9 & -4 \\ -10 & -9 \end{vmatrix} = \frac{121}{2} = 60.5 \text{ sq. units.} \tag{7}$$

This is verified in the Python code `codes/area.py`.

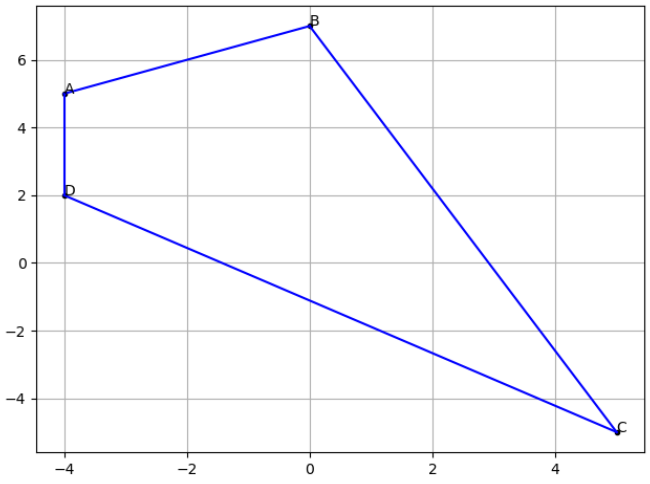

Fig. 1: Plot of quadrilateral $ABCD$