Ch - 7 Coordinate geometry

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1 August 2023

Class10th Maths- chapter 7

This is problem 3 of exercise 7.3

1. Find the area of a triangle formed by joining the mid points of the sides of the triangle whose vertices are (0,-1) , (2,1) and (0,3). Find the ratio of this area to the area of the given triangle.

   Solution:
   Let the points be A(0,-1) , B(2,1) , C (0,3)

$$\mathbf{A} = \begin{pmatrix} 0 \\ -1 \end{pmatrix} \tag{1}$$

$$\mathbf{B} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} \tag{2}$$

$$\mathbf{C} = \begin{pmatrix} 0 \\ 3 \end{pmatrix} \tag{3}$$

$$\tag{4}$$

Let **D**,**E**,and **F** be the midpoints of **AB**, **BC** and **CA**

$$\mathbf{D} = \frac{(1)\mathbf{B} + (1)\mathbf{A}}{2} \tag{5}$$

$$\mathbf{D} = \frac{(1)\begin{pmatrix} 2 \\ 1 \end{pmatrix} + (1)\begin{pmatrix} 0 \\ -1 \end{pmatrix}}{2} \tag{6}$$

$$\mathbf{D} = \frac{\begin{pmatrix} 2 \\ 0 \end{pmatrix}}{2} \tag{7}$$

$$\mathbf{D} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{8}$$

$$\mathbf{E} = \frac{(1)\mathbf{C} + (1)\mathbf{B}}{2} \tag{9}$$

$$\mathbf{E} = \frac{(1)\begin{pmatrix} 0 \\ 3 \end{pmatrix} + (1)\begin{pmatrix} 2 \\ 1 \end{pmatrix}}{2} \tag{10}$$

$$\mathbf{E} = \frac{\begin{pmatrix} 2 \\ 4 \end{pmatrix}}{2} \tag{11}$$

$$\mathbf{E} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \tag{12}$$

$$\mathbf{F} = \frac{(1)\mathbf{A} + (1)\mathbf{C}}{2} \tag{13}$$

$$\mathbf{F} = \frac{(1)\begin{pmatrix} 0 \\ -1 \end{pmatrix} + (1)\begin{pmatrix} 0 \\ 3 \end{pmatrix}}{2} \tag{14}$$

$$\mathbf{F} = \frac{\begin{pmatrix} 0 \\ 2 \end{pmatrix}}{2} \tag{15}$$

$$\mathbf{F} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \tag{16}$$

$$\tag{17}$$

Area of triangle ABC=

$$= \frac{1}{2}\|\mathbf{AB} \times \mathbf{AC}\| \tag{18}$$

$$= \frac{1}{2}\begin{vmatrix} 2 & 0 \\ 2 & 4 \end{vmatrix} \tag{19}$$

$$= \frac{1}{2}\|8\| \tag{20}$$

$$= 4 sq.units \tag{21}$$

$$\tag{22}$$

Area of triangle DEF=

$$= \frac{1}{2} \left\| \mathbf{DE} \times \mathbf{DF} \right\| \tag{23}$$

$$= \frac{1}{2} \begin{vmatrix} 0 & -1 \\ 2 & 0 \end{vmatrix} \tag{24}$$

$$= \frac{1}{2} \left\| 2 \right\| \tag{25}$$

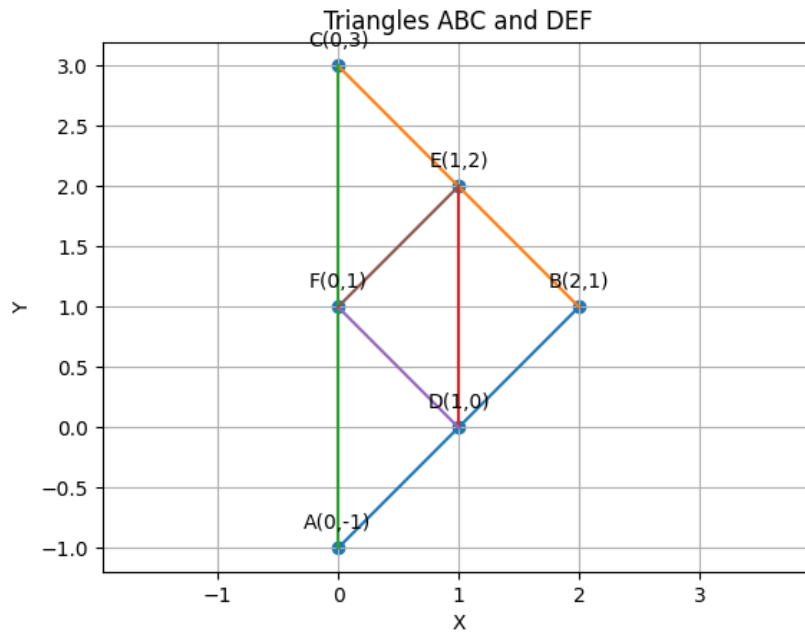$$= 1 sq.units \tag{26}$$

$$\tag{27}$$

Therefore, the ratio between the triangle DEF and ABC = 1:4

Figure 1: Triangles ABC and DEF