Assignment 1

Adarsh Sai - AI20BTECH11001

Download all python codes from

https://github.com/Adarsh541/EE3900/blob/main/EE3900_As1/codes/EE3900_As1.py

Download latex-tikz codes from

https://github.com/Adarsh541/EE3900/blob/main/EE3900_As1/EE3900_As1.tex

1 Problem(Vectors Q2.1)

The vertices of △ABC are $\mathbf{A} = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} 7 \\ 2 \end{pmatrix}$. A line drawn to intersect sides AB and AC at D and E respectively, such that

$$\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{4} \tag{1.0.1}$$

Find

$$\frac{\text{area of } \triangle ADE}{\text{area of } \triangle ABC} \tag{1.0.2}$$

2 Solution

$$\frac{AD}{AB} = \frac{1}{4} \tag{2.0.1}$$

$$\frac{AD}{AD + DB} = \frac{1}{4} \tag{2.0.2}$$

$$\implies \frac{AD}{DB} = \frac{1}{3} \tag{2.0.3}$$

Similarly

$$\frac{AE}{EC} = \frac{1}{3} \tag{2.0.4}$$

D divides AB in the ratio 1 : 3 internally. **E** divides AE in the ratio 1 : 3 internally

$$\implies \mathbf{D} = \frac{3\mathbf{A} + \mathbf{B}}{4} \tag{2.0.5}$$

$$= \begin{pmatrix} \frac{13}{4} \\ \frac{23}{4} \end{pmatrix} \tag{2.0.6}$$

$$\mathbf{E} = \frac{3\mathbf{A} + \mathbf{C}}{4} \tag{2.0.7}$$

$$= \begin{pmatrix} \frac{19}{4} \\ \frac{20}{4} \end{pmatrix} \tag{2.0.8}$$

$$\text{Area of } \triangle ABC = \frac{1}{2}\|(\mathbf{B} - \mathbf{A}) \times (\mathbf{C} - \mathbf{A})\| \tag{2.0.9}$$

$$= \frac{1}{2}\|\begin{pmatrix} -3 \\ -1 \end{pmatrix} \times \begin{pmatrix} 3 \\ -4 \end{pmatrix}\| \tag{2.0.10}$$

$$= \frac{15}{2} \tag{2.0.11}$$

$$\text{Area of } \triangle ADE = \frac{1}{2}\|(\mathbf{D} - \mathbf{A}) \times (\mathbf{E} - \mathbf{A})\| \tag{2.0.12}$$

$$= \frac{1}{2}\|\begin{pmatrix} \frac{-3}{4} \\ \frac{-1}{4} \end{pmatrix} \times \begin{pmatrix} \frac{3}{4} \\ \frac{-4}{4} \end{pmatrix}\| \tag{2.0.13}$$

$$= \frac{15}{2 \times 16} \tag{2.0.14}$$

$$\frac{\text{area of } \triangle ADE}{\text{area of } \triangle ABC} = \frac{1}{16} \tag{2.0.15}$$

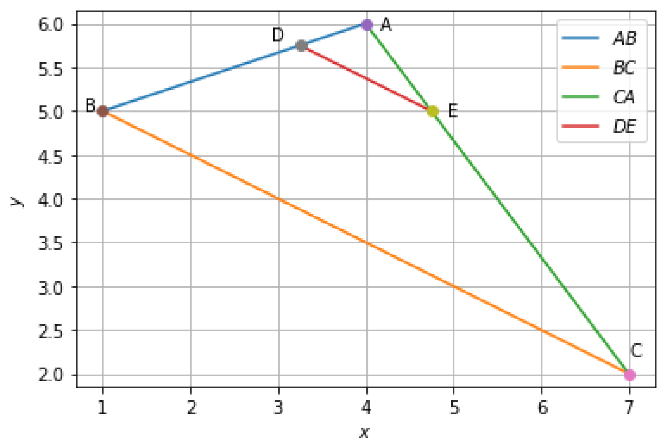

Fig. 0: Plot of the triangles