

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 $\triangle ABC$ 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

$$\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{4} \quad (1.0.1)$$

Find

$$\frac{\text{area of } \triangle ADE}{\text{area of } \triangle ABC} \quad (1.0.2)$$

2 SOLUTION

$$\frac{AD}{AB} = \frac{1}{4} \quad (2.0.1)$$

$$\frac{AD}{AD + DB} = \frac{1}{4} \quad (2.0.2)$$

$$\Rightarrow \frac{AD}{DB} = \frac{1}{3} \quad (2.0.3)$$

Similarly

$$\frac{AE}{EC} = \frac{1}{3} \quad (2.0.4)$$

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

$$\Rightarrow \mathbf{D} = \frac{3\mathbf{A} + \mathbf{B}}{4} \quad (2.0.5)$$

$$= \begin{pmatrix} \frac{13}{4} \\ \frac{23}{4} \end{pmatrix} \quad (2.0.6)$$

$$\mathbf{E} = \frac{3\mathbf{A} + \mathbf{C}}{4} \quad (2.0.7)$$

$$= \begin{pmatrix} \frac{19}{4} \\ \frac{20}{4} \end{pmatrix} \quad (2.0.8)$$

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

$$= \frac{1}{2} \left\| \begin{pmatrix} -3 \\ -1 \end{pmatrix} \times \begin{pmatrix} 3 \\ -4 \end{pmatrix} \right\| \quad (2.0.10)$$

$$= \frac{1}{2} \begin{vmatrix} -3 & 3 \\ -1 & -4 \end{vmatrix} \quad (2.0.11)$$

$$= \frac{1}{2} [(-3 \times -4) - (-1 \times 3)] \quad (2.0.12)$$

$$= \frac{15}{2} \quad (2.0.13)$$

$$\text{Area of } \triangle ADE = \frac{1}{2} \|(\mathbf{D} - \mathbf{A}) \times (\mathbf{E} - \mathbf{A})\| \quad (2.0.14)$$

$$= \frac{1}{2} \left\| \begin{pmatrix} \frac{-3}{4} \\ \frac{-1}{4} \end{pmatrix} \times \begin{pmatrix} \frac{3}{4} \\ \frac{-4}{4} \end{pmatrix} \right\| \quad (2.0.15)$$

$$= \frac{1}{2} \begin{vmatrix} \frac{-3}{4} & \frac{3}{4} \\ \frac{-1}{4} & \frac{-4}{4} \end{vmatrix} \quad (2.0.16)$$

$$= \frac{1}{2} \left[\left(\frac{-3}{4} \times \frac{-4}{4} \right) - \left(\frac{-1}{4} \times \frac{3}{4} \right) \right] \quad (2.0.17)$$

$$= \frac{15}{2 \times 16} \quad (2.0.18)$$

$$\frac{\text{area of } \triangle ADE}{\text{area of } \triangle ABC} = \frac{1}{16} \quad (2.0.19)$$

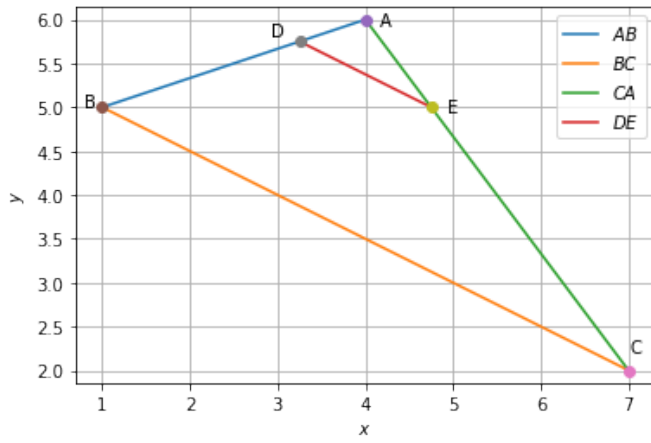


Fig. 0: Plot of the triangles