Triangle Assignment

G. Sai Harshith - EE22BTECH11022

Consider a triangle with vertices:

$$\mathbf{A} = \begin{pmatrix} -3 \\ 1 \end{pmatrix} \tag{1}$$

$$\mathbf{B} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} \tag{2}$$

$$\mathbf{C} = \begin{pmatrix} 1 \\ -4 \end{pmatrix} \tag{3}$$

I. VECTORS

parameter	value	description
$\mathbf{m_1}$	$\begin{pmatrix} 6 \\ 1 \end{pmatrix}$	Direction vector of AB
$\mathbf{n_1^\top}$	$\begin{pmatrix} 1 & -6 \end{pmatrix}$	Normal vector of AB
$\|\mathbf{B}-\mathbf{A}\|$	6.083	Length of AB
$\mathbf{m_2}$	$\begin{pmatrix} -2 \\ -6 \end{pmatrix}$	Direction vector of BC
$\mathbf{n_2^\top}$	$\begin{pmatrix} -6 & 2 \end{pmatrix}$	Normal vector of BC
$\|\mathbf{C}-\mathbf{B}\|$	6.325	Length of BC
$\mathbf{m_3}$	$\begin{pmatrix} -4 \\ 5 \end{pmatrix}$	Direction vector of CA
$\mathbf{n_3^\top}$	$\begin{pmatrix} 5 & 4 \end{pmatrix}$	Normal vector of CA
$\|\mathbf{A}-\mathbf{C}\|$	6.403	Length of CA
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix}$	3	Non Collinear
area	17	Area of Triangle
$\angle A$	60.80	angle between AB and AC
$\angle B$	62.10	angle between BA and BC
$\angle C$	57.10	angle between CB and CA

TABLE I.1
VECTORS

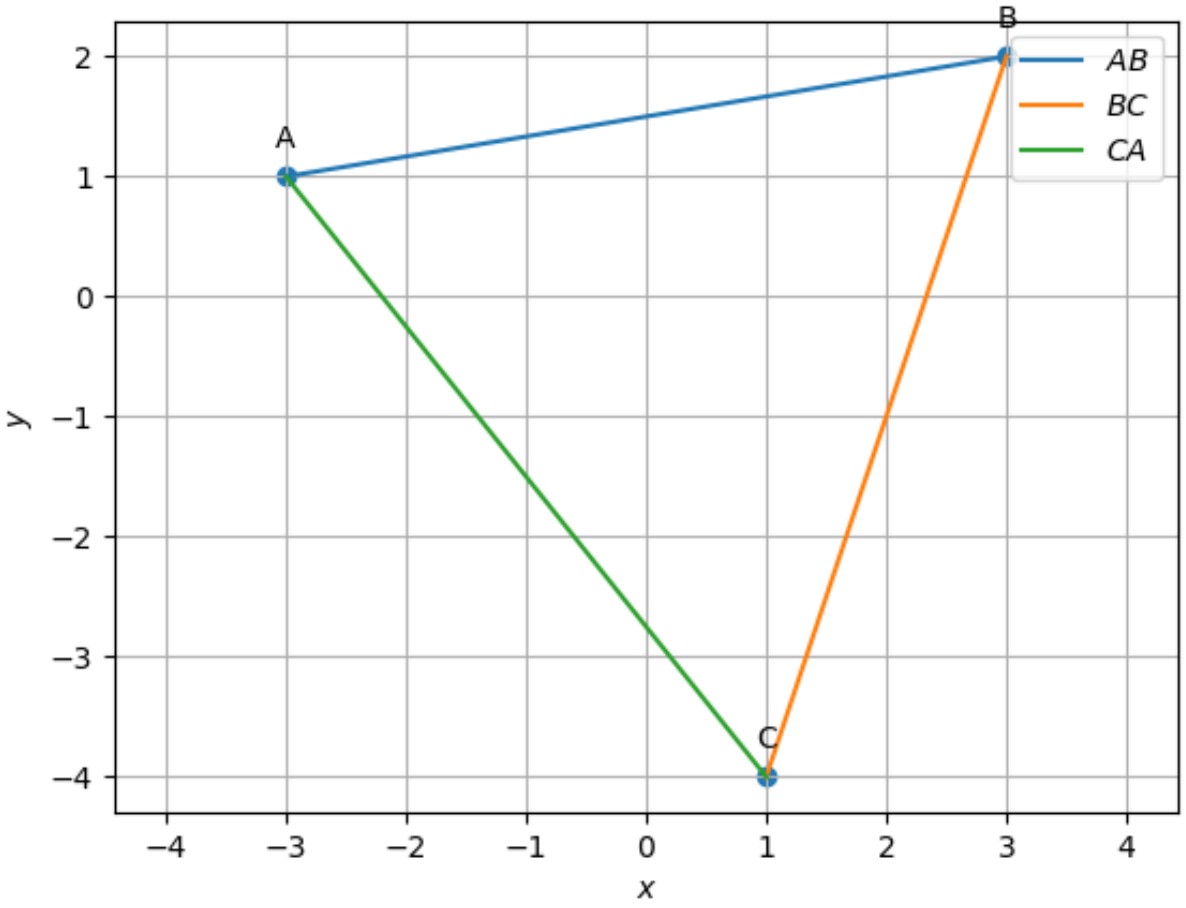

Fig. I.1. VECTORS

II. MEDIAN

parameter	value	description
D	$\begin{pmatrix} 2 \\ -1 \end{pmatrix}$	Midpoint of AD
E	$\begin{pmatrix} -1 \\ \frac{-3}{2} \end{pmatrix}$	Midpoint of BE
F	$\begin{pmatrix} 0 \\ \frac{3}{2} \end{pmatrix}$	Midpoint of CF
$\mathbf{n_1}^\top$	$\begin{pmatrix} -2 & -5 \end{pmatrix}$	normal form of AD
c_1	1	
$\mathbf{n_2}^\top$	$\begin{pmatrix} \frac{-7}{2} & 4 \end{pmatrix}$	normal form of BE
c_2	-2.5	
$\mathbf{n_3}^\top$	$\begin{pmatrix} \frac{11}{2} & 1 \end{pmatrix}$	normal form of CF
c_3	1.5	
G	$\begin{pmatrix} \frac{1}{3} \\ \frac{-1}{3} \end{pmatrix}$	Centroid of the triangle
$\frac{AG}{DG} = \frac{BG}{EG} = \frac{CG}{FG}$	2	**G** divides median in ratio 2:1
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{D} & \mathbf{G} \end{pmatrix}$	2	Points are collinear

TABLE II.1
MEDIAN

III. ALTITUDE

parameter	value	description
$\mathbf{n_1}^\top$	$\begin{pmatrix} -2 & -6 \end{pmatrix}$	normal form of AD_1
c_1	0	
$\mathbf{n_2}^\top$	$\begin{pmatrix} -4 & 5 \end{pmatrix}$	normal form of BE_1
c_2	-2	
$\mathbf{n_3}^\top$	$\begin{pmatrix} 6 & 1 \end{pmatrix}$	normal form of CF_1
c_3	2	
H	$\begin{pmatrix} 0.353 \\ -0.117 \end{pmatrix}$	Orthocentre of Triangle

TABLE III.1
ALTITUDE

IV. PERPENDICULAR BISECTOR

parameter	value	description
$\mathbf{n_1}^\top$	$\begin{pmatrix} -6 & -1 \end{pmatrix}$	Perpendicular bisector of AB
c_1	-1.5	
$\mathbf{n_2}^\top$	$\begin{pmatrix} 2 & 6 \end{pmatrix}$	Perpendicular bisector of BC
c_2	-2	
$\mathbf{n_3}^\top$	$\begin{pmatrix} 4 & -5 \end{pmatrix}$	Perpendicular bisector of CA
c_3	3.5	
O	$\begin{pmatrix} 0.323 \\ -0.441 \end{pmatrix}$	Circumcircle and Circumradius
radius	3.623	

TABLE IV.1
PERPENDICULAR BISECTOR

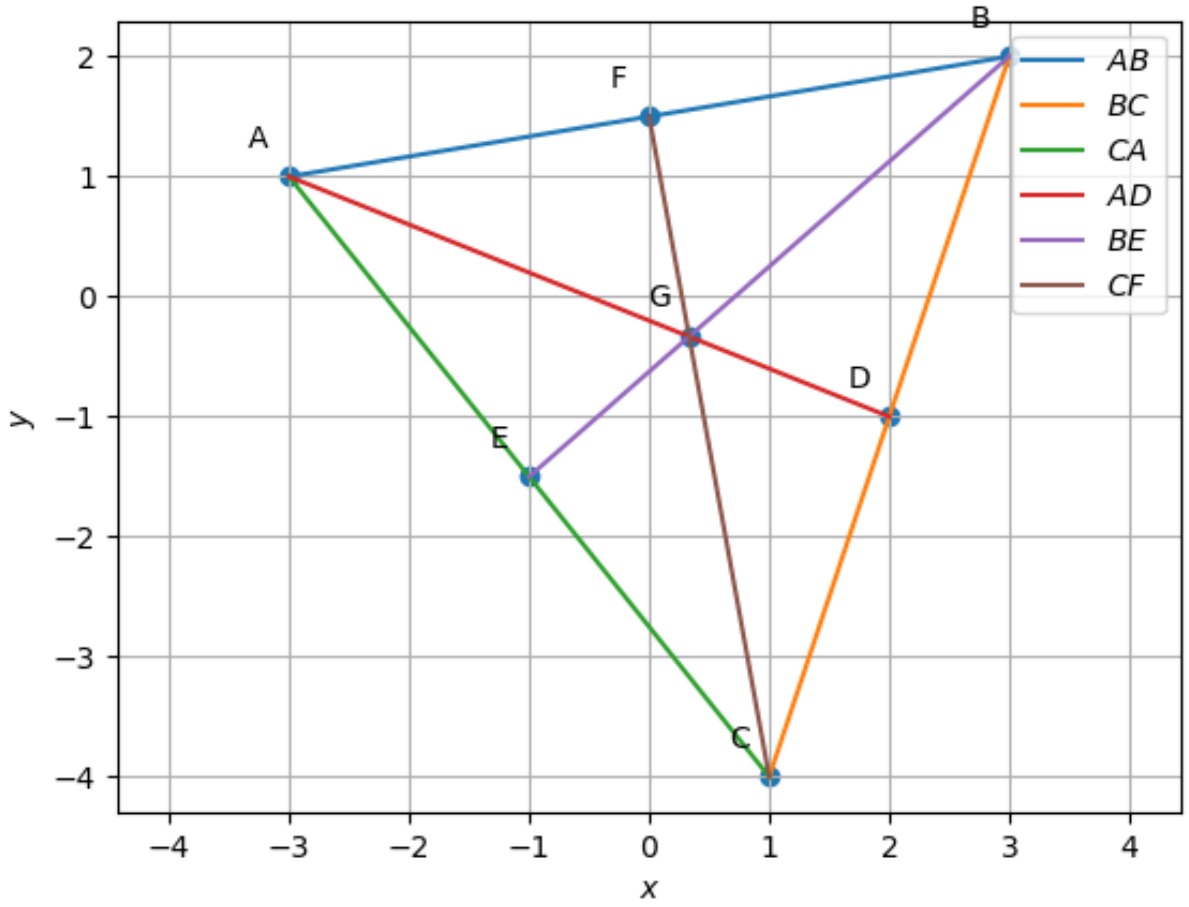

Fig. II.1. MEDIAN

V. ANGLE BISECTOR

parameter	value	description
$\mathbf{n_1}^\top$	$\begin{pmatrix}-0.616 & -1.611\end{pmatrix}$	Angular bisector of $\angle A$
c_1	0.238	
$\mathbf{n_2}^\top$	$\begin{pmatrix}-1.113 & 1.302\end{pmatrix}$	Angular bisector of $\angle B$
c_2	-0.734	
$\mathbf{n_3}^\top$	$\begin{pmatrix}1.729 & 0.308\end{pmatrix}$	Angular bisector of $\angle C$
c_3	0.496	
$\mathbf{I}$	$\begin{pmatrix}0.336 \\ -0.276\end{pmatrix}$	Incircle and Inradius
radius	1.807	

TABLE V.1
ANGLE BISECTOR

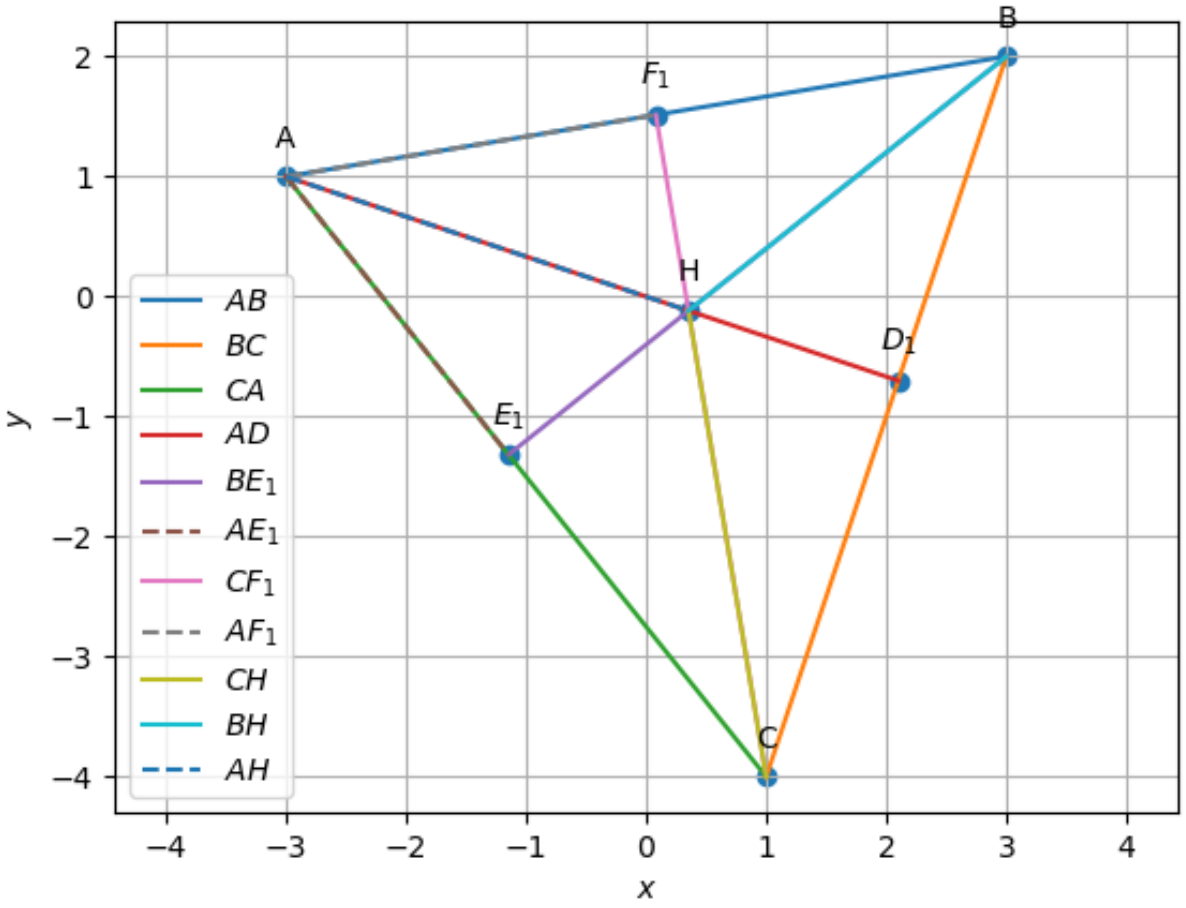

Fig. III.1. ALTITUDE

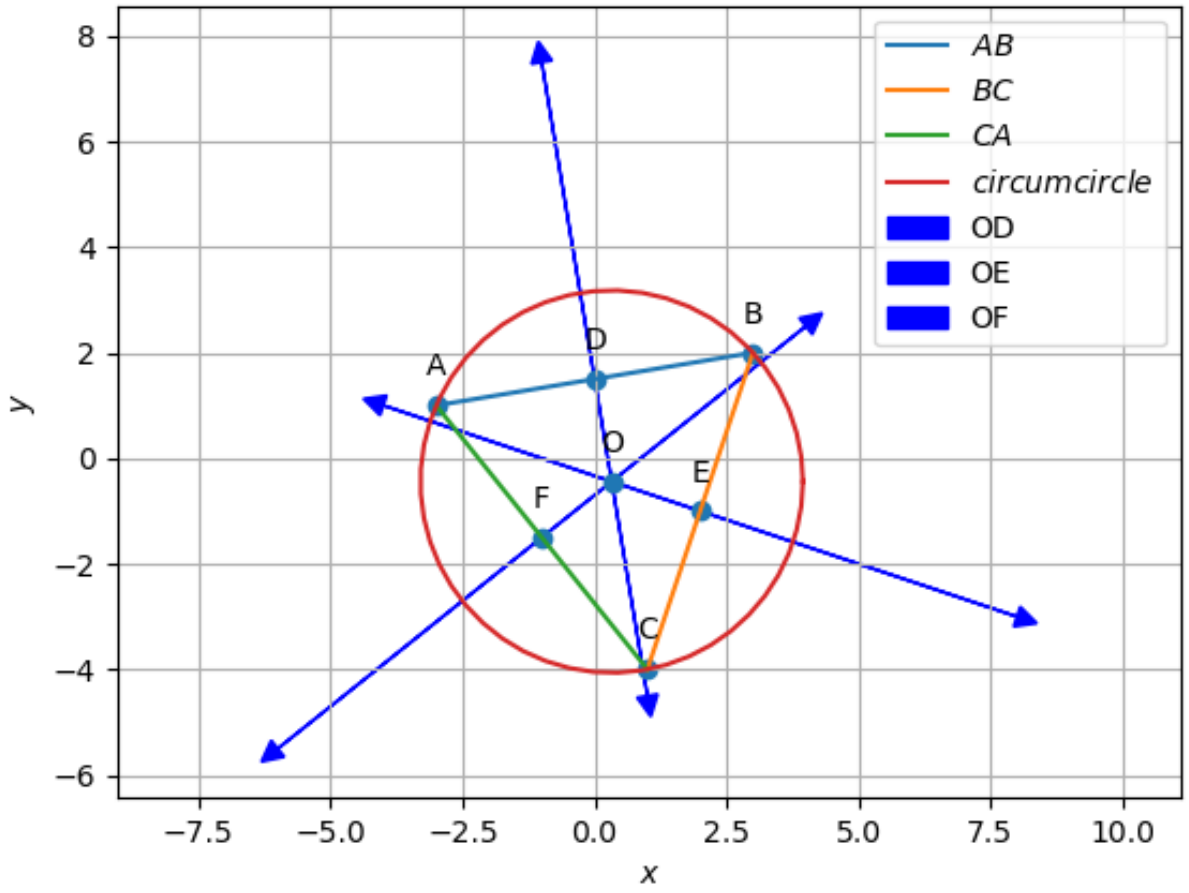

Fig. IV.1. PERPENDICULAR BISECTOR

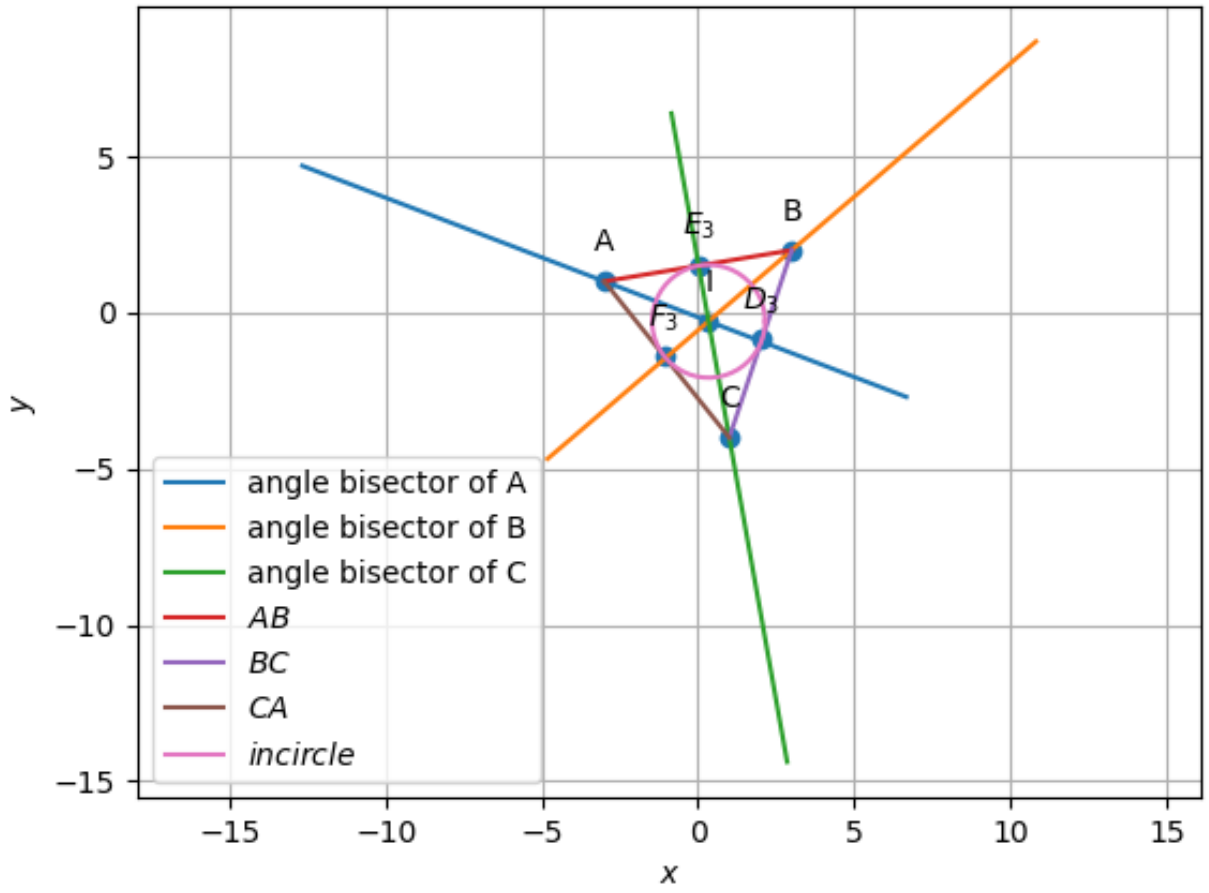

Fig. V.1. ANGLE BISECTOR