Random vectors generated:

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -5 \\ -3 \end{pmatrix} \quad (1)$$

Parameters	Value	Description
m1	$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$	Slope of AB
m2	$\begin{pmatrix} -3 \\ -5 \end{pmatrix}$	Slope of BC
m3	$\begin{pmatrix} 6 \\ 2 \end{pmatrix}$	Slope of CA
$\|\mathbf{B} - \mathbf{A}\|$	4.24	Length of AB
$\|\mathbf{C} - \mathbf{B}\|$	5.83	Length of BC
$\|\mathbf{A} - \mathbf{C}\|$	6.32	Length of CA
Rank	3	Non-collinear
n1	(3,3)	AB
c1	0	AB
n2	(-5,3)	BC
c2	-8	BC
n3	(2,-6)	CA
c3	8	CA
Area	12	Area of Triangle
$\angle A$	63.4349°	$\angle BAC$
$\angle B$	75.9637°	$\angle CBA$
$\angle C$	40.6013°	$\angle BCA$

TABLE 1: ABC plot
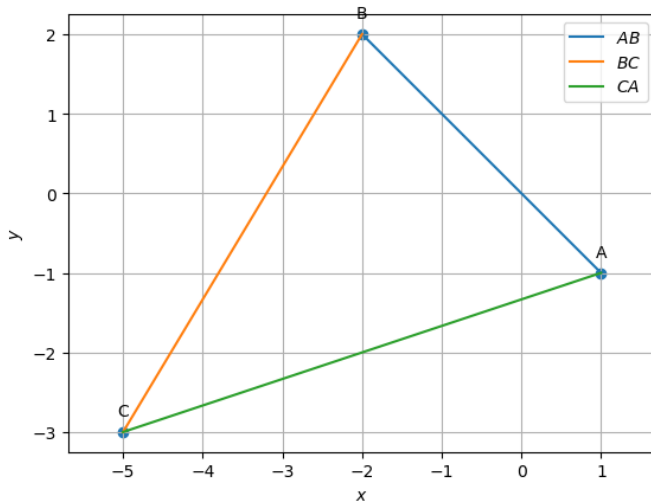
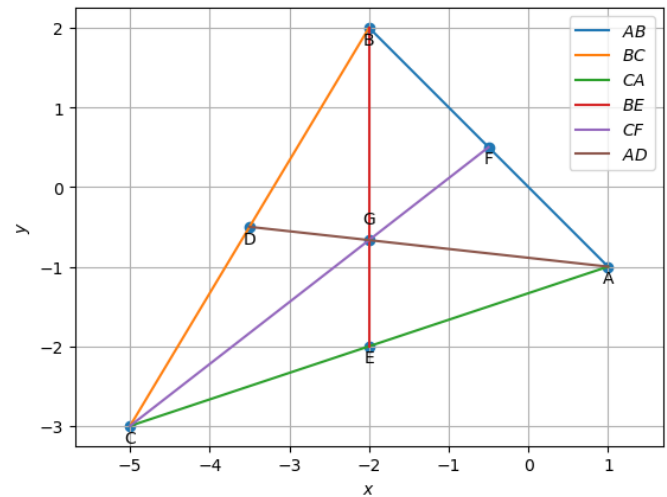| Parameter	Value	Description
D	$\begin{pmatrix} -3.5 \\ -0.5 \end{pmatrix}$	Midpoint of BC
E	$\begin{pmatrix} -2 \\ -2 \end{pmatrix}$	Midpoint of AC
F	$\begin{pmatrix} -0.5 \\ 0.5 \end{pmatrix}$	Midpoint of AB
N1	$\begin{pmatrix} 0.5 \\ 4.5 \end{pmatrix}$	Median AD
C1	-4	Median AD
N2	$\begin{pmatrix} -4 \\ 0 \end{pmatrix}$	Median BE
C2	8	Median BE
N3	$\begin{pmatrix} 3.5 \\ -4.5 \end{pmatrix}$	Median CF
C3	-4	Median CF
G	$\begin{pmatrix} -2 \\ -0.67 \end{pmatrix}$	Centroid
rank	3	non collinear

TABLE 2: medians and centroid.

Fig. 1: Triangle ABC

Fig. 2: Medians and centroid

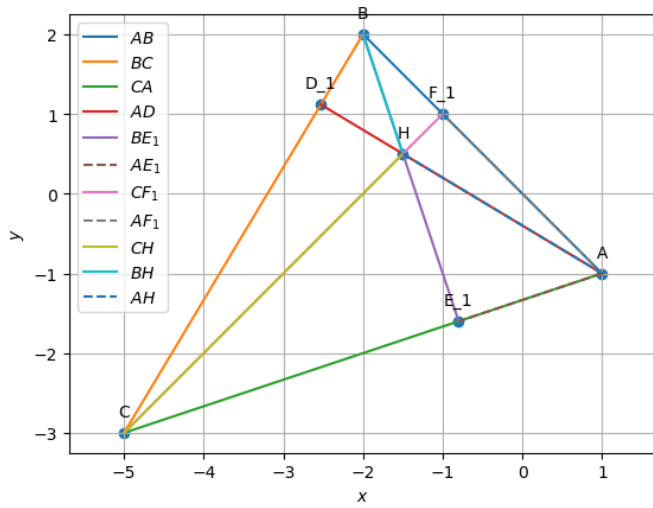| Parameters	Value	Description
N1	$\begin{pmatrix} 3 \\ 5 \end{pmatrix}$	Altitude AD
C1	-2	
N2	$\begin{pmatrix} 3 \\ -3 \end{pmatrix}$	Altitude CF
C2	-6	
N3	$\begin{pmatrix} -6 \\ -2 \end{pmatrix}$	Altitude BE
C3	8	
H	$\begin{pmatrix} -1.5 \\ 0.5 \end{pmatrix}$	Orthocentre

TABLE 3: Altitude and orthocentre.

Parameter	Value	Description
N1	$\begin{pmatrix} 3 \\ -3 \end{pmatrix}$	Perp bisector of AB
C1	-3	
N2	$\begin{pmatrix} 3 \\ 5 \end{pmatrix}$	Perp bisector of BC
C2	-13	
N3	$\begin{pmatrix} -6 \\ -2 \end{pmatrix}$	Perp bisector of CA
C3	16	
O	$\begin{pmatrix} -2.25 \\ -1.25 \end{pmatrix}$	Circumcentre
R	3.2596	Circumradius
$\angle BOC$	126.8699°	$\angle BOC$
$\angle BAC$	63.43495°	$\angle BAC$

TABLE 4: Perpendicular bisector and circumcentre

Fig. 3: Altitude and orthocentre

Parameter	Value	Description
n1	$\begin{pmatrix} 0.39 \\ 1.66 \end{pmatrix}$	AI
c1	-1.265	
n2	$\begin{pmatrix} -1.56 \\ -0.19 \end{pmatrix}$	BI
c2	2.744	
n3	$\begin{pmatrix} 1.17 \\ -1.46 \end{pmatrix}$	CI
c3	-1.479	
I	$\begin{pmatrix} -1.71 \\ -0.36 \end{pmatrix}$	Incentre
$\angle BAI$	31.7174°	$\angle BAI$
$\angle CAI$	31.7174°	$\angle CAI$
a	1.4636	ID3
b	1.4636	IF3
c	1.4636	IE3
r	1.4636	Inradius
D3	$\begin{pmatrix} -2.96 \\ 0.39 \end{pmatrix}$	Tangency point(BC)
E3	$\begin{pmatrix} -0.67 \\ 0.67 \end{pmatrix}$	Tangency point(AB)
F3	$\begin{pmatrix} -1.25 \\ -1.75 \end{pmatrix}$	Tangency point(AC)

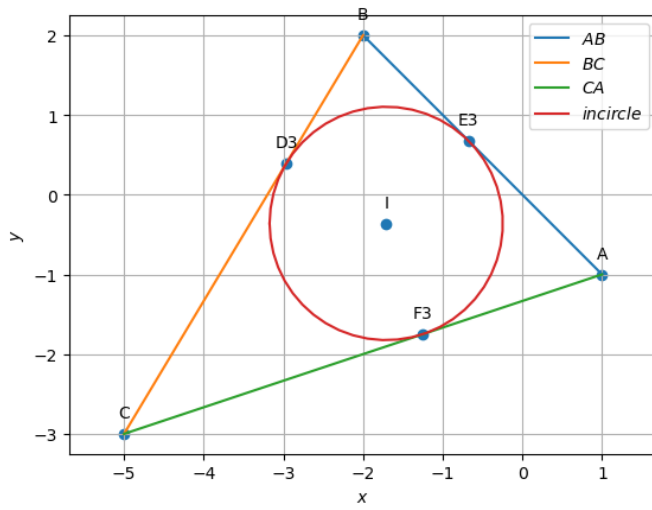TABLE 5: Angle bisector and Incentre

Fig. 4: Perpendicular bisector and Circumcentre

Fig. 5: Angle bisector and Incentre