

ASSIGNMENT 1

EE22BTECH11050 - Snehil Singh

Consider a triangle with vertices

$$\mathbf{A} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -6 \\ -6 \end{pmatrix} \quad (1)$$

1 VECTORS

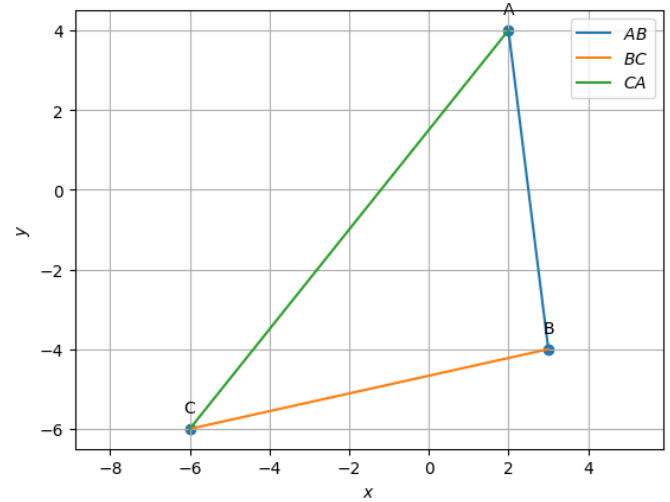


Fig. 1: triangle plotted using python

parameters	values	description
\mathbf{m}_1	$\begin{pmatrix} 1 \\ -8 \end{pmatrix}$	AB
\mathbf{m}_2	$\begin{pmatrix} -9 \\ -2 \end{pmatrix}$	BC
\mathbf{m}_3	$\begin{pmatrix} 8 \\ 10 \end{pmatrix}$	CA
$\ A - B\ $	8.06	length of AB
$\ B - C\ $	9.21	length of BC
$\ C - A\ $	12.81	length of CA
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix}$	3	non collinear
\mathbf{n}_1	$\begin{pmatrix} -8 \\ -1 \end{pmatrix}$	AB
c_1	-12	
\mathbf{n}_2	$\begin{pmatrix} -2 \\ 9 \end{pmatrix}$	BC
c_2	30	
\mathbf{n}_3	$\begin{pmatrix} 10 \\ -8 \end{pmatrix}$	CA
c_3	-108	
Area	37	Area of Triangle
$\angle A$	45.78°	Angles
$\angle B$	95.40°	
$\angle C$	38.81°	

TABLE 1: Vectors.

2 MEDIAN

parameters	value	description
D	$\begin{pmatrix} -1.5 \\ -5 \end{pmatrix}$	BC midpoint
E	$(-2, -1)$	CA midpoint
F	$\begin{pmatrix} 2.5 \\ 0 \end{pmatrix}$	AB midpoint
m₄	$\begin{pmatrix} -3.5 \\ -9 \end{pmatrix}$	AD
n₄	$\begin{pmatrix} -9 \\ 3.5 \end{pmatrix}$	
c_4	-4	
m₅	$\begin{pmatrix} -5 \\ 3 \end{pmatrix}$	BE
n₅	$\begin{pmatrix} 3 \\ 5 \end{pmatrix}$	
c_5	-11	
m₆	$\begin{pmatrix} 8.5 \\ 6 \end{pmatrix}$	CF
n₆	$\begin{pmatrix} 6 \\ -8.5 \end{pmatrix}$	
c_6	15	
G	$\begin{pmatrix} -0.33 \\ -2 \end{pmatrix}$	Centroid
$\frac{BG}{GE}$	2	Division ratio by G
$\frac{CG}{GF}$		
$\frac{AG}{GD}$		
$\text{rank} \begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{D} & \mathbf{G} \end{pmatrix}$	2	collinear
$\text{rank} \begin{pmatrix} 1 & 1 & 1 \\ \mathbf{B} & \mathbf{E} & \mathbf{G} \end{pmatrix}$		
$\text{rank} \begin{pmatrix} 1 & 1 & 1 \\ \mathbf{C} & \mathbf{F} & \mathbf{G} \end{pmatrix}$		

TABLE 2: Median.

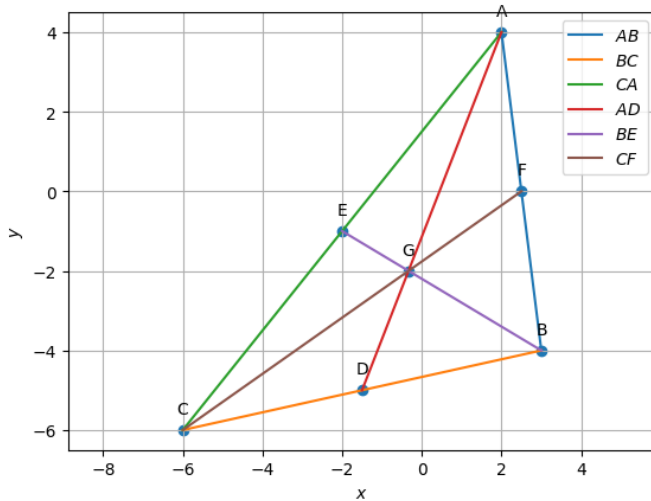


Fig. 2: medians plotted using python

3 ALTITUDE

parameters	value	description
D₁	$\begin{pmatrix} 3.74 \\ -3.83 \end{pmatrix}$	Foot of altitude from A
E₁	$(-1.51, -0.39)$	Foot of altitude from B
F₁	$\begin{pmatrix} 3.11 \\ -4.86 \end{pmatrix}$	Foot of altitude from C
m₇	$\begin{pmatrix} 1.74 \\ -7.83 \end{pmatrix}$	AD_1
n₇	$\begin{pmatrix} -7.83 \\ -1.74 \end{pmatrix}$	
c_7	-8.7	
m₈	$\begin{pmatrix} -4.51 \\ 3.61 \end{pmatrix}$	BE_1
n₈	$\begin{pmatrix} 3.61 \\ 4.51 \end{pmatrix}$	
c_8	-7.21	
m₉	$\begin{pmatrix} 9.1 \\ 1.14 \end{pmatrix}$	CF_1
n₉	$\begin{pmatrix} 1.14 \\ -9.1 \end{pmatrix}$	
c_9	47.82	
H	$\begin{pmatrix} 3.95 \\ -4.76 \end{pmatrix}$	Orthocentre

TABLE 3: Altitude.

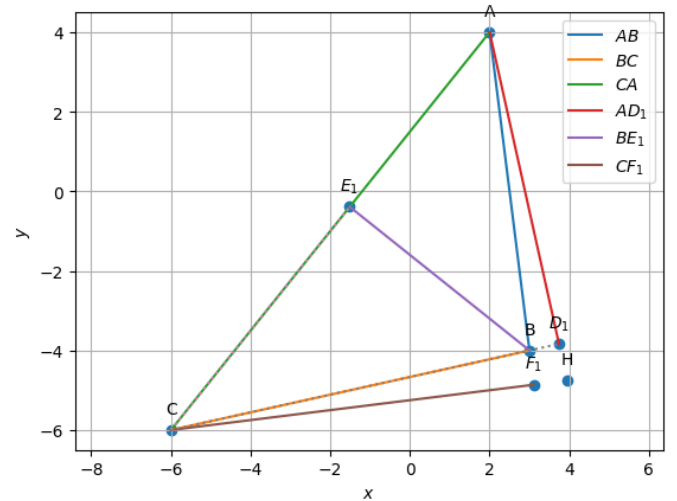


Fig. 3: altitudes plotted using python

4 PERPENDICULAR BISECTOR

parameters	value	description
\mathbf{m}_{10}	$\begin{pmatrix} -2 \\ 9 \end{pmatrix}$	AD_1
\mathbf{n}_{10}	$\begin{pmatrix} 9 \\ 2 \end{pmatrix}$	
c_{10}	-23.50	
\mathbf{m}_{11}	$\begin{pmatrix} 10 \\ -8 \end{pmatrix}$	BE_1
\mathbf{n}_{11}	$\begin{pmatrix} -8 \\ -10 \end{pmatrix}$	
c_{11}	26	
\mathbf{m}_{12}	$\begin{pmatrix} -8 \\ -1 \end{pmatrix}$	CF_1
\mathbf{n}_{12}	$\begin{pmatrix} -1 \\ 8 \end{pmatrix}$	
c_{12}	-2.5	
\mathbf{O}	$\begin{pmatrix} -2.47 \\ -0.62 \end{pmatrix}$	Circumcentre
$\ \mathbf{O} - \mathbf{A}\ $	6.43	$OA = OB = OC = R$
$\ \mathbf{O} - \mathbf{B}\ $		
$\ \mathbf{O} - \mathbf{C}\ $		
R		
$\angle BOC$	91.57°	$\angle BOC = 2\angle BAC$
$\angle BAC$	45.78°	
$\angle AOC$	169.19°	$\angle AOC = 2\angle ABC$
$\angle ABC$	95.40°	
$\angle AOB$	282.37°	$\angle AOB = 2\angle BCA$
$\angle BCA$	$^\circ$	

TABLE 4: Perpendicular Bisector.

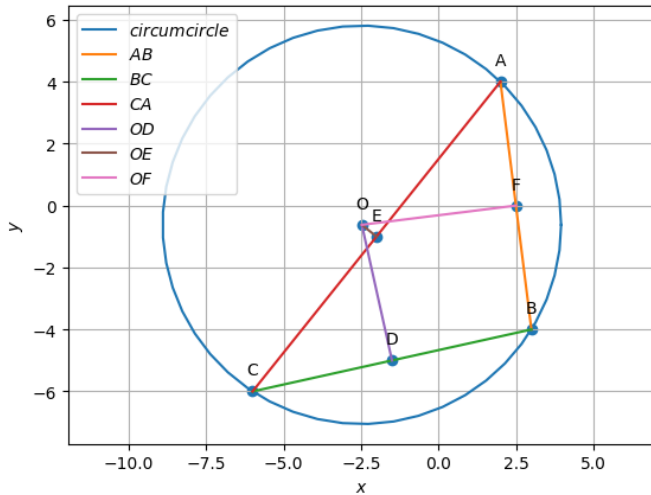


Fig. 4: perpendicular bisectors plotted using python

5 ANGLE BISECTOR

parameters	value	description
\mathbf{m}_{13}	$\begin{pmatrix} -0.5 \\ 1.77 \end{pmatrix}$	AI
\mathbf{n}_{13}	$\begin{pmatrix} 1.77 \\ -0.5 \end{pmatrix}$	
c_{13}	1.54	
\mathbf{m}_{14}	$\begin{pmatrix} -1.10 \\ 0.77 \end{pmatrix}$	BI
\mathbf{m}_{14}	$\begin{pmatrix} -0.77 \\ -1.10 \end{pmatrix}$	
c_{14}	2.07	
\mathbf{m}_{15}	$\begin{pmatrix} -1.60 \\ -0.99 \end{pmatrix}$	CI
\mathbf{n}_{15}	$\begin{pmatrix} 0.99 \\ -1.60 \end{pmatrix}$	
c_{15}	3.62	
\mathbf{I}	$\begin{pmatrix} 0.28 \\ -2.08 \end{pmatrix}$	Incentre
\mathbf{D}_3	$\begin{pmatrix} 0.82 \\ -4.49 \end{pmatrix}$	Point of contact with BC
\mathbf{E}_3	$\begin{pmatrix} -1.64 \\ -0.55 \end{pmatrix}$	Point of contact with AC
\mathbf{F}_3	$\begin{pmatrix} 2.72 \\ -1.78 \end{pmatrix}$	Point of contact with AB
$\ \mathbf{I} - \mathbf{D}_3\ $	2.46	$ID_3 = IE_3 = IF_3 = r$
$\ \mathbf{I} - \mathbf{E}_3\ $		
$\ \mathbf{I} - \mathbf{F}_3\ $		
r		
$\angle BAI$	22.89°	$\angle BAI = \angle CAI$
$\angle CAI$		
$\angle ABI$	47.70°	$\angle ABI = \angle CBI$
$\angle CBI$		
$\angle ACI$	19.40°	$\angle ACI = \angle BCI$
$\angle BCI$		

TABLE 5: Angle Bisectors.

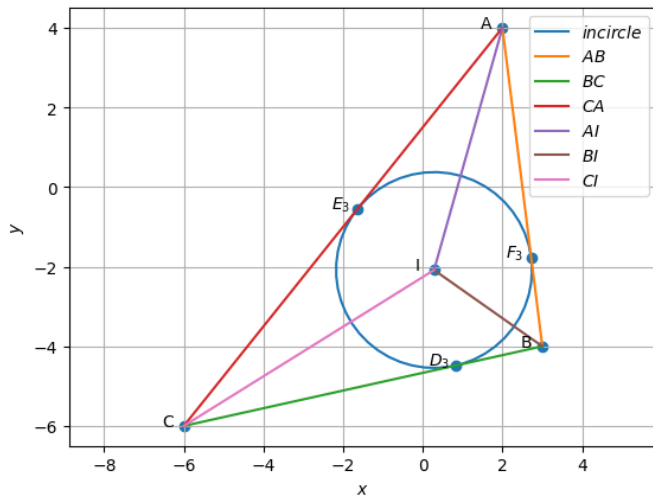


Fig. 5: Angle bisectors plotted using python