

Consider a triangle with vertices

$$\mathbf{A} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} -4 \\ -6 \end{pmatrix} \quad (1)$$

1 VECTORS

parameters	values	description
\mathbf{m}_1	$\begin{pmatrix} -1 \\ -8 \end{pmatrix}$	AB
\mathbf{m}_2	$\begin{pmatrix} -7 \\ -1 \end{pmatrix}$	BC
\mathbf{m}_3	$\begin{pmatrix} 8 \\ 9 \end{pmatrix}$	CA
$\ A - B\ $	8.06	length of AB
$\ B - C\ $	7.07	length of BC
$\ C - A\ $	12.04	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
\mathbf{n}_2	$\begin{pmatrix} -1 \\ 7 \end{pmatrix}$	BC
\mathbf{n}_3	$\begin{pmatrix} -9 \\ 8 \end{pmatrix}$	CA
Area	27.5	Area of Triangle
$\angle A$	34.5°	Angles
$\angle B$	105.2°	
$\angle C$	40.2°	

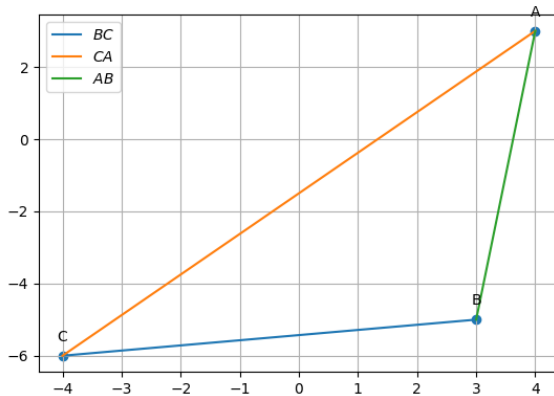


Fig. 1: sides

2 MEDIAN

parameters	value	description
\mathbf{D}	$\begin{pmatrix} -0.5 \\ -5.5 \end{pmatrix}$	BC midpoint
\mathbf{E}	$\begin{pmatrix} 0 \\ -1 \end{pmatrix}$	CA midpoint
\mathbf{F}	$\begin{pmatrix} 3.5 \\ -1 \end{pmatrix}$	AB midpoint
\mathbf{m}_4	$\begin{pmatrix} 4.5 \\ 8.5 \end{pmatrix}$	AD
\mathbf{n}_4	$\begin{pmatrix} -8.5 \\ 4.5 \end{pmatrix}$	
\mathbf{m}_5	$\begin{pmatrix} 3 \\ -3.5 \end{pmatrix}$	BE
\mathbf{n}_5	$\begin{pmatrix} 3.5 \\ 3 \end{pmatrix}$	
\mathbf{m}_6	$\begin{pmatrix} -7.5 \\ -5 \end{pmatrix}$	CF
\mathbf{n}_6	$\begin{pmatrix} -5 \\ 7.5 \end{pmatrix}$	
\mathbf{G}	$\begin{pmatrix} 1 \\ -2.66 \end{pmatrix}$	Centroid
$\frac{BG}{GE}$	2	Division ratio by \mathbf{G}
$\frac{CG}{GF}$		
$\frac{AG}{GD}$		
$\text{rank} \begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{D} & \mathbf{G} \end{pmatrix}$	2	collinear
$\text{rank} \begin{pmatrix} 1 & 1 & 1 \\ \mathbf{B} & \mathbf{E} & \mathbf{G} \end{pmatrix}$		
$\text{rank} \begin{pmatrix} 1 & 1 & 1 \\ \mathbf{C} & \mathbf{F} & \mathbf{G} \end{pmatrix}$		

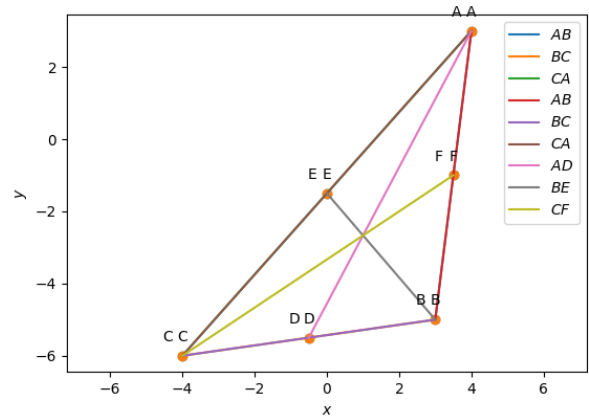


Fig. 2: Midpoints

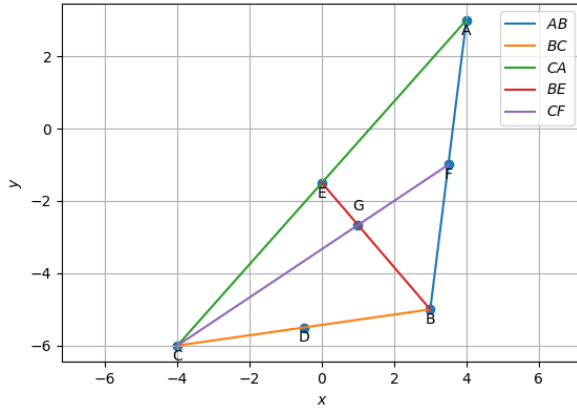


Fig. 3: centroid

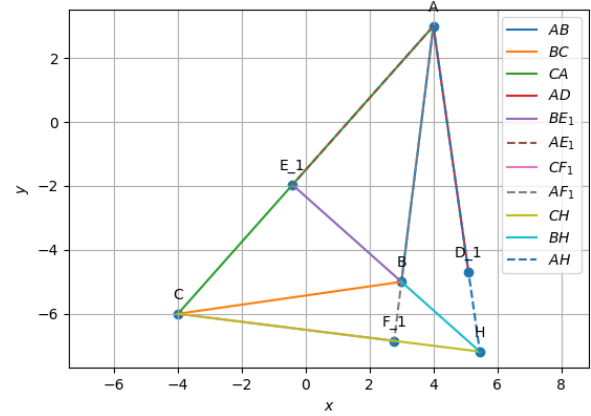


Fig. 4: altitudes

3 ALTITUDE

parameters	value	description
D_1	$(5.14, 7)$	Foot of altitude from A
E_1	$(-0.41, -1.96)$	Foot of altitude from B
F_1	$\begin{pmatrix} 2.7 \\ -6.8 \end{pmatrix}$	Foot of altitude from C
m_7	$\begin{pmatrix} 1.1 \\ -4.7 \end{pmatrix}$	AD_1
n_7	$\begin{pmatrix} 4.7 \\ 1.1 \end{pmatrix}$	
m_8	$\begin{pmatrix} -3.41 \\ 3.03 \end{pmatrix}$	BE_1
n_8	$\begin{pmatrix} 3.03 \\ 3.41 \end{pmatrix}$	
m_9	$\begin{pmatrix} 6.76 \\ -0.84 \end{pmatrix}$	CF_1
n_9	$\begin{pmatrix} 0.84 \\ 6.76 \end{pmatrix}$	
H	$\begin{pmatrix} 5.45 \\ -7.18 \end{pmatrix}$	Orthocentre

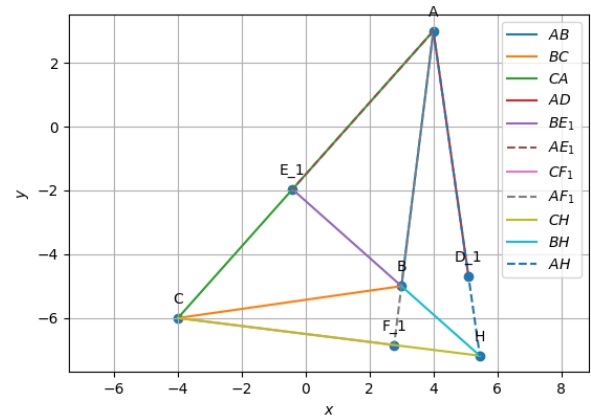


Fig. 5: orthocentre

4 PERPENDICULAR BISECTOR

parameters	value	description
O	$\begin{pmatrix} -1.22 \\ -0.40 \end{pmatrix}$	Circumcentre
$\ O - A\ $	6.24	$OA = OB = OC = R$
$\ O - B\ $		
$\ O - C\ $		
R		
$\angle BOC$	69.01°	$\angle BOC = 2\angle BAC$
$\angle BAC$	34.5°	

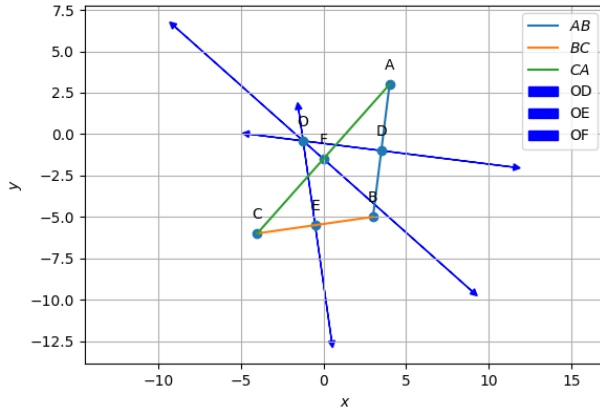


Fig. 6: perpendicular bisector

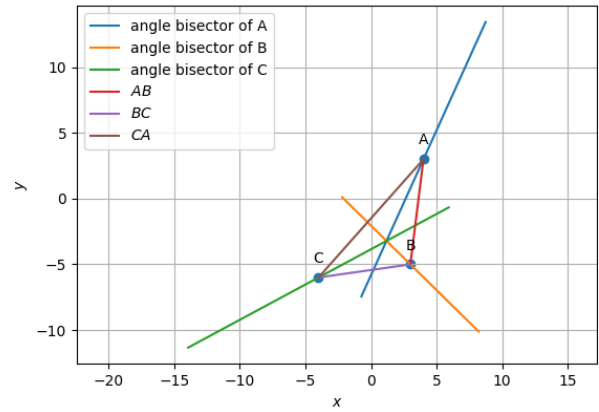


Fig. 8: angle bisector

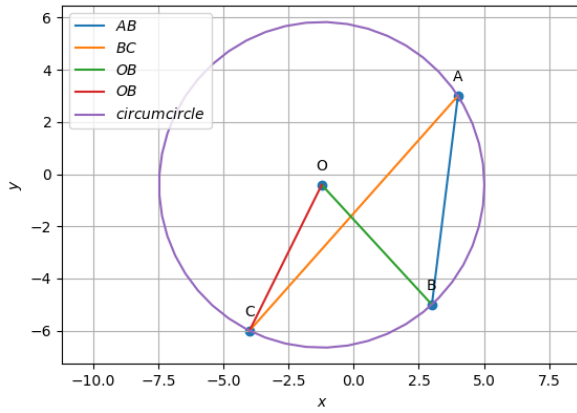


Fig. 7: circumcircle

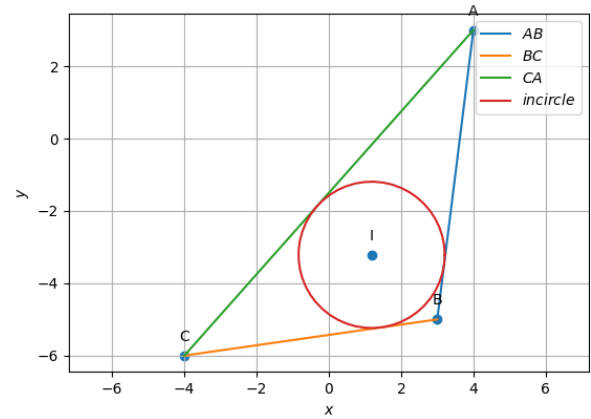


Fig. 9: incircle

5 ANGLE BISECTOR

parameters	value	description
I	$\begin{pmatrix} 1.18 \\ -3.21 \end{pmatrix}$	Incentre
D₃	$\begin{pmatrix} 1.46 \\ -5.21 \end{pmatrix}$	Point of contact with BC
E₃	$\begin{pmatrix} 3.19 \\ -3.46 \end{pmatrix}$	Point of contact with AC
F₃	$\begin{pmatrix} -0.32 \\ -1.87 \end{pmatrix}$	Point of contact with AB
$\ I - D_3\ $	2.02	$ID_3 = IE_3 = IF_3 = r$
$\ I - E_3\ $		
$\ I - F_3\ $		
r		
$\angle BAI$	17.25°	$\angle BAI = \angle CAI$
$\angle CAI$		

