Consider a triangle with vertices

$$\mathbf{A} = \begin{pmatrix} -1 \\ -4 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \tag{1}$$

1 Vectors

parameters	values	description
$\mathbf{m_1}$	$\begin{pmatrix} 5 \\ -2 \end{pmatrix}$	AB
$\mathbf{m_2}$	$\begin{pmatrix} -1 \\ 6 \end{pmatrix}$	BC
$\mathbf{m_3}$	$\begin{pmatrix} -4 \\ -4 \end{pmatrix}$	CA
$\|\|A-B\|\|$	5.38	length of AB
$\|\|B-C\|\|$	6.08	length of BC
$\|\|C-A\|\|$	5.65	length of CA
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix}$	3	non collinear
$\mathbf{n_1}$	$\begin{pmatrix} -2 \\ -5 \end{pmatrix}$	AB
c_1	22	
$\mathbf{n_2}$	$\begin{pmatrix} 6 \\ 1 \end{pmatrix}$	BC
c_2	18	
$\mathbf{n_3}$	$\begin{pmatrix} -4 \\ 4 \end{pmatrix}$	CA
c_3	-12	
Area	14	Area of Triangle
$\angle A$	66.80°	Angles
$\angle B$	58.73°	
$\angle C$	54.46°	

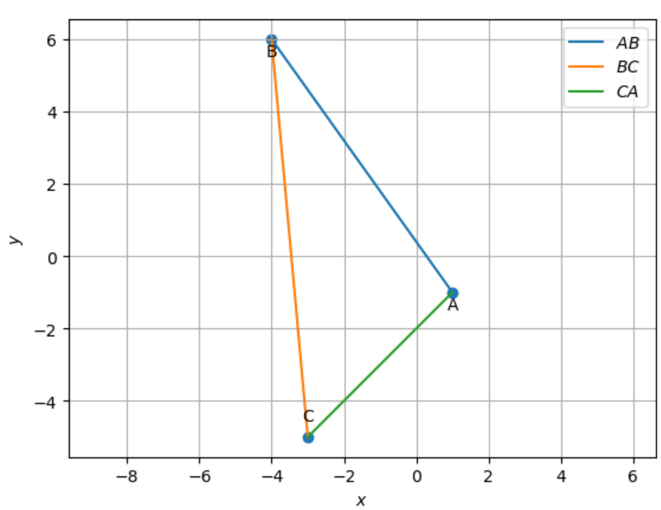

Fig. 1: traingle ABC

2 Median

parameters	value	description
$\mathbf{D}$	$\begin{pmatrix} 3.5 \\ -3 \end{pmatrix}$	BC midpoint
$\mathbf{E}$	$\begin{pmatrix} 1 \\ -2 \end{pmatrix}$	CA midpoint
$\mathbf{F}$	$\begin{pmatrix} 1.5 \\ -5 \end{pmatrix}$	AB midpoint
$\mathbf{m_4}$	$\begin{pmatrix} 4.5 \\ 1 \end{pmatrix}$	AD
$\mathbf{n_4}$	$\begin{pmatrix} 1 \\ -4.5 \end{pmatrix}$	
c_4	17	
$\mathbf{m_5}$	$\begin{pmatrix} -3 \\ 4 \end{pmatrix}$	BE
$\mathbf{n_5}$	$\begin{pmatrix} 4 \\ 3 \end{pmatrix}$	
c_5	-2	
$\mathbf{m_6}$	$\begin{pmatrix} 5 \\ -1.5 \end{pmatrix}$	CF
$\mathbf{n_6}$	$\begin{pmatrix} -1.5 \\ -5 \end{pmatrix}$	
c_6	-15	
$\mathbf{G}$	$\begin{pmatrix} 2 \\ 1 \end{pmatrix}$	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
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{B} & \mathbf{E} & \mathbf{G} \end{pmatrix}$		
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{C} & \mathbf{F} & \mathbf{G} \end{pmatrix}$		

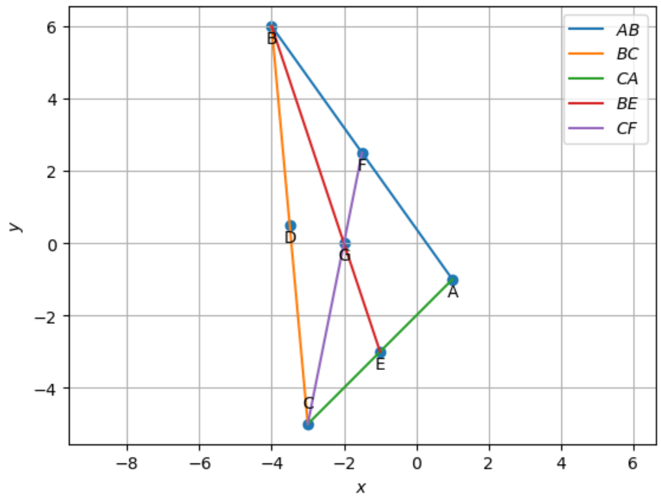

Fig. 2: traingle ABC with medians

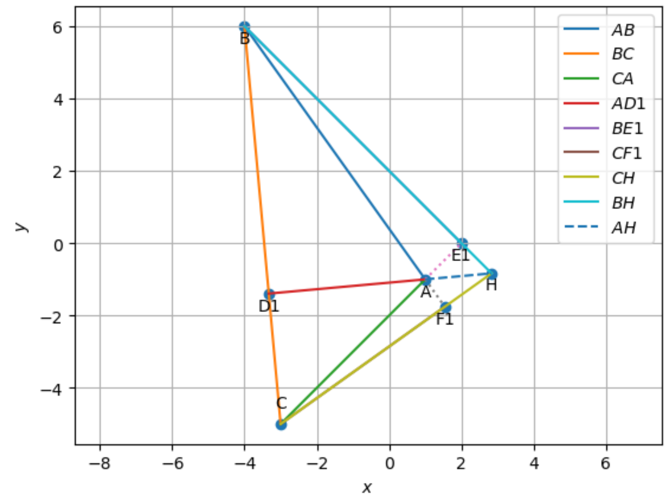

Fig. 3: traingle ABC with altitudes

3 Altitude

parameters	value	description
$\mathbf{D_1}$	$\begin{pmatrix}3.59\\-3.56\end{pmatrix}$	Foot of altitude from **A**
$\mathbf{E_1}$	$\begin{pmatrix}0.8, -4.4\end{pmatrix}$	Foot of altitude from **B**
$\mathbf{F_1}$	$\begin{pmatrix}0.54\\-3.69\end{pmatrix}$	Foot of altitude from **C**
$\mathbf{m_7}$	$\begin{pmatrix}-6\\-1\end{pmatrix}$	AD_1
$\mathbf{n_7}$	$\begin{pmatrix}-1\\6\end{pmatrix}$	
c_7	-25	
$\mathbf{m_8}$	$\begin{pmatrix}4\\-2\end{pmatrix}$	BE_1
$\mathbf{n_8}$	$\begin{pmatrix}-2\\-4\end{pmatrix}$	
c_8	16	
$\mathbf{m_9}$	$\begin{pmatrix}2\\3\end{pmatrix}$	CF_1
$\mathbf{n_9}$	$\begin{pmatrix}3\\-2\end{pmatrix}$	
c_9	9	
$\mathbf{H}$	$\begin{pmatrix}0.25\\-4.125\end{pmatrix}$	Orthocentre

4 Perpendicular Bisector

parameters	value	description
$\mathbf{m_{10}}$	$\begin{pmatrix}-6\\-1\end{pmatrix}$	AD_1
$\mathbf{n_{10}}$	$\begin{pmatrix}-1\\6\end{pmatrix}$	
c_{10}	-21.5	
$\mathbf{m_{11}}$	$\begin{pmatrix}4\\-2\end{pmatrix}$	BE_1
$\mathbf{n_{11}}$	$\begin{pmatrix}-2\\-4\end{pmatrix}$	
c_{11}	4	
$\mathbf{m_{12}}$	$\begin{pmatrix}2\\3\end{pmatrix}$	CF_1
$\mathbf{n_{12}}$	$\begin{pmatrix}3\\-2\end{pmatrix}$	
c_{12}	17.5	
$\mathbf{O}$	$\begin{pmatrix}3.875\\-2.9375\end{pmatrix}$	Circumcentre
$\|\mathbf{O}-\mathbf{A}\|$	3.06	$OA = OB = OC = R$
$\|\mathbf{O}-\mathbf{B}\|$		
$\|\mathbf{O}-\mathbf{C}\|$		
R		
$\angle BOC$	194.125°	$\angle BOC = 2\angle BAC$
$\angle BAC$	97.125°	
$\angle AOC$	93.69°	$\angle AOC = 2\angle ABC$
$\angle ABC$	46.84°	
$\angle AOB$	72.05°	$\angle AOB = 2\angle BCA$
$\angle BCA$	36.03°	

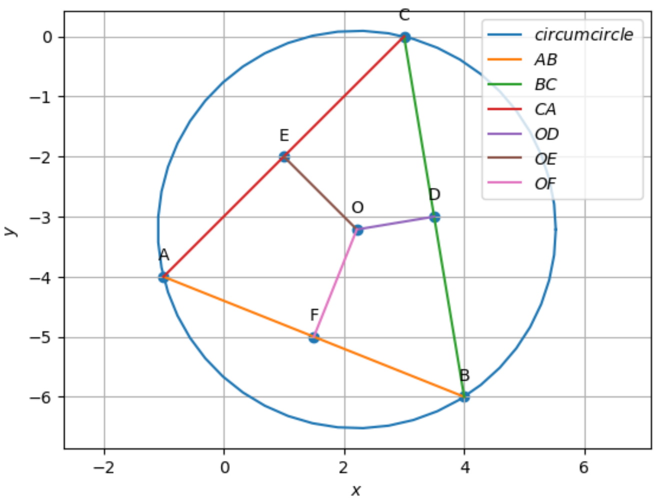

Fig. 4: traingle ABC with circumcircle

5 Angle Bisector

parameters	values	description
$\mathbf{m_{13}}$	$\begin{pmatrix}1.28\\0.34\end{pmatrix}$	AI
$\mathbf{n_{13}}$	$\begin{pmatrix}0.34\\-1.28\end{pmatrix}$	
c_{13}	5.46	
$\mathbf{m_{14}}$	$\begin{pmatrix}-0.99\\1.54\end{pmatrix}$	BI
$\mathbf{n_{14}}$	$\begin{pmatrix}1.54\\0.99\end{pmatrix}$	
c_{14}	0.18	
$\mathbf{m_{15}}$	$\begin{pmatrix}-0.28\\-1.88\end{pmatrix}$	CI
$\mathbf{n_{15}}$	$\begin{pmatrix}-1.88\\0.28\end{pmatrix}$	
c_{15}	-5.64	
$\mathbf{I}$	$\begin{pmatrix}2.46\\-3.61\end{pmatrix}$	Incentre
$\mathbf{D_3}$	$\begin{pmatrix}3.57\\-3.42\end{pmatrix}$	Point of contact with BC
$\mathbf{E_3}$	$\begin{pmatrix}1.83\\-4.55\end{pmatrix}$	Point of contact with AC
$\mathbf{F_3}$	$\begin{pmatrix}1.45\\-3.11\end{pmatrix}$	Point of contact with AB
$\|\mathbf{I}-\mathbf{D_3}\|$	1.13	$ID_3 = IE_3 = IF_3 = r$
$\|\mathbf{I}-\mathbf{E_3}\|$		
$\|\mathbf{I}-\mathbf{F_3}\|$		
r		
$\angle BAI$	48.56°	$\angle BAI = \angle CAI$
$\angle CAI$		
$\angle ABI$	23.42°	$\angle ABI = \angle CBI$
$\angle CBI$		
$\angle ACI$	18.01°	$\angle ACI = \angle BCI$
$\angle BCI$		

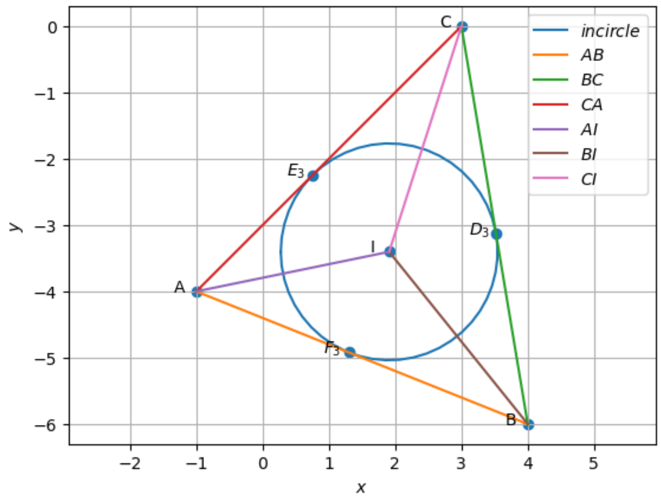

Fig. 5: traingle ABC with angle bisectors and incentre