Probability and Random Processes

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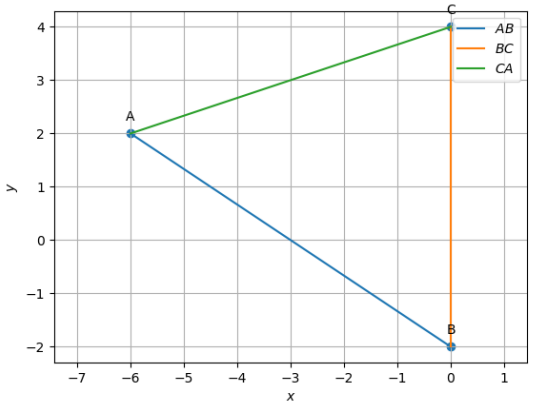
$$\mathbf{A} = \begin{pmatrix} -6 \\ 2 \end{pmatrix}; \mathbf{B} = \begin{pmatrix} 0 \\ -2 \end{pmatrix}; \mathbf{C} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$$

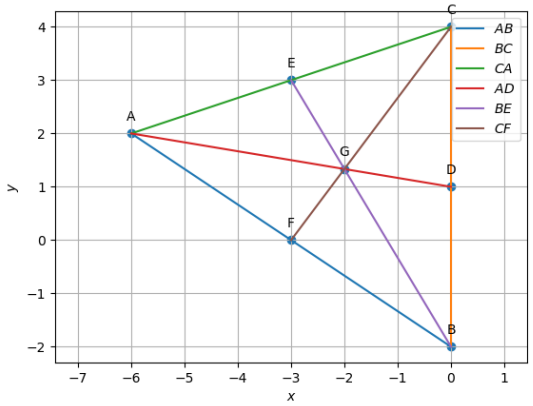


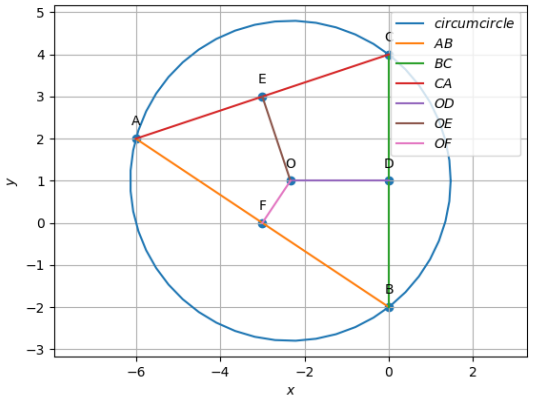
I. Vertices

Parameters	Values	Description
$\mathbf{m_1}$	$\begin{pmatrix} 6 \\ -4 \end{pmatrix}$	$\mathbf{B} - \mathbf{A}$
$\mathbf{m_2}$	$\begin{pmatrix} 0 \\ 6 \end{pmatrix}$	$\mathbf{C} - \mathbf{B}$
$\mathbf{m_3}$	$\begin{pmatrix} -6 \\ -2 \end{pmatrix}$	$\mathbf{A} - \mathbf{C}$
$\|\mathbf{B} - \mathbf{A}\|$	$\sqrt{52}$	length of AB
$\|\mathbf{C} - \mathbf{B}\|$	6	length of BC
$\|\mathbf{A} - \mathbf{C}\|$	$\sqrt{40}$	length of CA
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix}$	3	Non-collinear
$\mathbf{n_1}$	$\begin{pmatrix} -4 \\ -6 \end{pmatrix}$	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\mathbf{m_1}$
$\mathbf{n_2}$	$\begin{pmatrix} 6 \\ 0 \end{pmatrix}$	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\mathbf{m_2}$
$\mathbf{n_3}$	$\begin{pmatrix} -2 \\ 6 \end{pmatrix}$	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\mathbf{m_3}$
$\frac{1}{2}\|\mathbf{m_1} \times \mathbf{m_2}\|$	18	Area
$\angle A$	52.125°	Angle A
$\angle B$	56.310°	Angle B
$\angle C$	71.565°	Angle C

II. Centroid

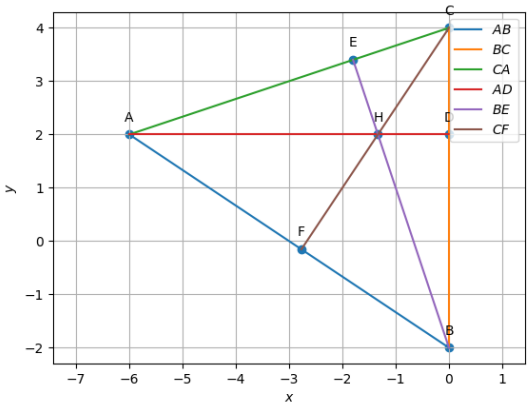
Parameters	Values	Description
$\mathbf{D}$	$\begin{pmatrix}0\\1\end{pmatrix}$	$\frac{\mathbf{A+B}}{2}$
$\mathbf{E}$	$\begin{pmatrix}-3\\3\end{pmatrix}$	$\frac{\mathbf{C+A}}{2}$
$\mathbf{F}$	$\begin{pmatrix}-3\\0\end{pmatrix}$	$\frac{\mathbf{B+C}}{2}$
$\mathbf{m_4}$	$\begin{pmatrix}6\\-1\end{pmatrix}$	$\mathbf{D-A}$
$\mathbf{m_5}$	$\begin{pmatrix}-3\\5\end{pmatrix}$	$\mathbf{E-B}$
$\mathbf{m_6}$	$\begin{pmatrix}-3\\-4\end{pmatrix}$	$\mathbf{F-C}$
$\mathbf{n_4}$	$\begin{pmatrix}-1\\-6\end{pmatrix}$	$\begin{pmatrix}0&1\\-1&0\end{pmatrix}\mathbf{m_4}$
$\mathbf{n_5}$	$\begin{pmatrix}5\\3\end{pmatrix}$	$\begin{pmatrix}0&1\\-1&0\end{pmatrix}\mathbf{m_5}$
$\mathbf{n_6}$	$\begin{pmatrix}-4\\3\end{pmatrix}$	$\begin{pmatrix}0&1\\-1&0\end{pmatrix}\mathbf{m_6}$
$\mathbf{G}$	$\begin{pmatrix}-2\\\frac{4}{3}\end{pmatrix}$	$\frac{\mathbf{A+B+C}}{3}$
$\|\mathbf{A-G}\|$	4.055	$\therefore \frac{AG}{GD}=\frac{BG}{GE}=\frac{CG}{GF}=2$
$\|\mathbf{D-G}\|$	2.027	
$\|\mathbf{B-G}\|$	3.887	
$\|\mathbf{E-G}\|$	1.943	
$\|\mathbf{C-G}\|$	3.333	
$\|\mathbf{F-G}\|$	1.667	
$\text{rank}\begin{pmatrix}1&1&1\\\mathbf{A}&\mathbf{D}&\mathbf{G}\end{pmatrix}$	2	The points are collinear
$\text{rank}\begin{pmatrix}1&1&1\\\mathbf{B}&\mathbf{E}&\mathbf{G}\end{pmatrix}$		
$\text{rank}\begin{pmatrix}1&1&1\\\mathbf{C}&\mathbf{F}&\mathbf{G}\end{pmatrix}$		
AF	$\begin{pmatrix}-3\\2\end{pmatrix}$	AFDE is a quadrilateral
ED		





III. Orthocentre

Parameters	Values	Description
$\mathbf{n_7}$	$\begin{pmatrix}0\\6\end{pmatrix}$	alt AD_1
$\mathbf{n_8}$	$\begin{pmatrix}-6\\-2\end{pmatrix}$	alt BE_1
$\mathbf{n_9}$	$\begin{pmatrix}6\\-4\end{pmatrix}$	alt CF_1
$\mathbf{H}$	$\begin{pmatrix}-\frac{4}{3}\\2\end{pmatrix}$	orthocentre

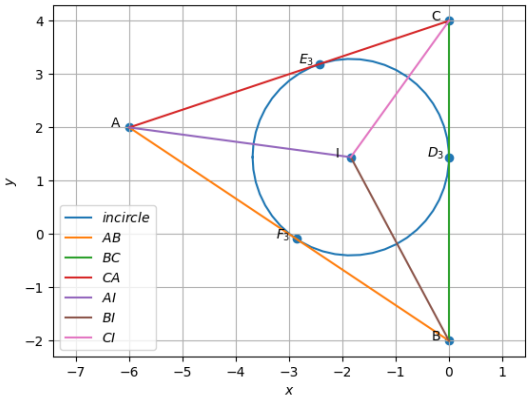


IV. Circumcentre

Parameters	Values	Description
$\mathbf{O}$	$\left(-\frac{7}{3}, 1\right)$	circumcentre
$\|\mathbf{O}-\mathbf{A}\|$	3.801	circumradius
$\|\mathbf{O}-\mathbf{B}\|$		
$\|\mathbf{O}-\mathbf{C}\|$		

V. Incentre

Parameters	Values	Description
$\mathbf{I}-\mathbf{A}$	$\begin{pmatrix}-1.780\\0.238\end{pmatrix}$	angle bisector of A
$\mathbf{I}-\mathbf{B}$	$\begin{pmatrix}-0.832\\1.554\end{pmatrix}$	angle bisector of B
$\mathbf{I}-\mathbf{C}$	$\begin{pmatrix}0.948\\1.316\end{pmatrix}$	angle bisector of C
$\mathbf{I}$	$\begin{pmatrix}-1.843\\1.443\end{pmatrix}$	incentre
r	1.843	incentre radius
$\angle BAI$	26.06°	bisector of A
$\angle CAI$		
$\angle ABI$	151.85°	bisector of B
$\angle CBI$		
$\angle BCI$	144.217°	bisector of C
$\angle ACI$		
$\mathbf{D_3}$	$\begin{pmatrix}0\\1.44\end{pmatrix}$	points of intersection
$\mathbf{E_3}$	$\begin{pmatrix}-2.425\\3.191\end{pmatrix}$	
$\mathbf{F_3}$	$\begin{pmatrix}-2.865\\-0.09\end{pmatrix}$	


C
E_3
A
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