# Random Vectors Assignment

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Consider the vertices,

$$\mathbf{A} = \begin{pmatrix} 2 \\ -5 \end{pmatrix} \tag{1}$$

$$\mathbf{B} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \tag{2}$$

$$\mathbf{C} = \begin{pmatrix} -3 \\ -1 \end{pmatrix} \tag{3}$$

## I. VECTORS

| **parameter** | **value** | **description** |
|---|---|---|
| $\mathbf{m_1}$ | $\begin{pmatrix} -1 \\ 8 \end{pmatrix}$ | AB |
| $\mathbf{m_2}$ | $\begin{pmatrix} -4 \\ -4 \end{pmatrix}$ | BC |
| $\mathbf{m_3}$ | $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$ | AC |
| $\|\|B-A\|\|$ | 8.06 | Length of AB |
| $\|\|C-B\|\|$ | 5.66 | Length of BC |
| $\|\|A-C\|\|$ | 6.40 | Length of AC |
| rank | 3 | Points are not collinear |
| $\mathbf{n_1^\top}$ | $\begin{pmatrix} 8 & 1 \end{pmatrix}$ | AB |
| $c_1$ | 11 | |
| $\mathbf{n_2^\top}$ | $\begin{pmatrix} -4 & 4 \end{pmatrix}$ | BC |
| $c_2$ | 8 | |
| $\mathbf{n_3^\top}$ | $\begin{pmatrix} -4 & -5 \end{pmatrix}$ | AC |
| $c_3$ | 17 | |
| area | 18 | area of triangle |
| $\angle A$ | 44.22° | Angle |
| $\angle B$ | 52.13° | |
| $\angle C$ | 83.66° | |

TABLE I.1
VECTORS

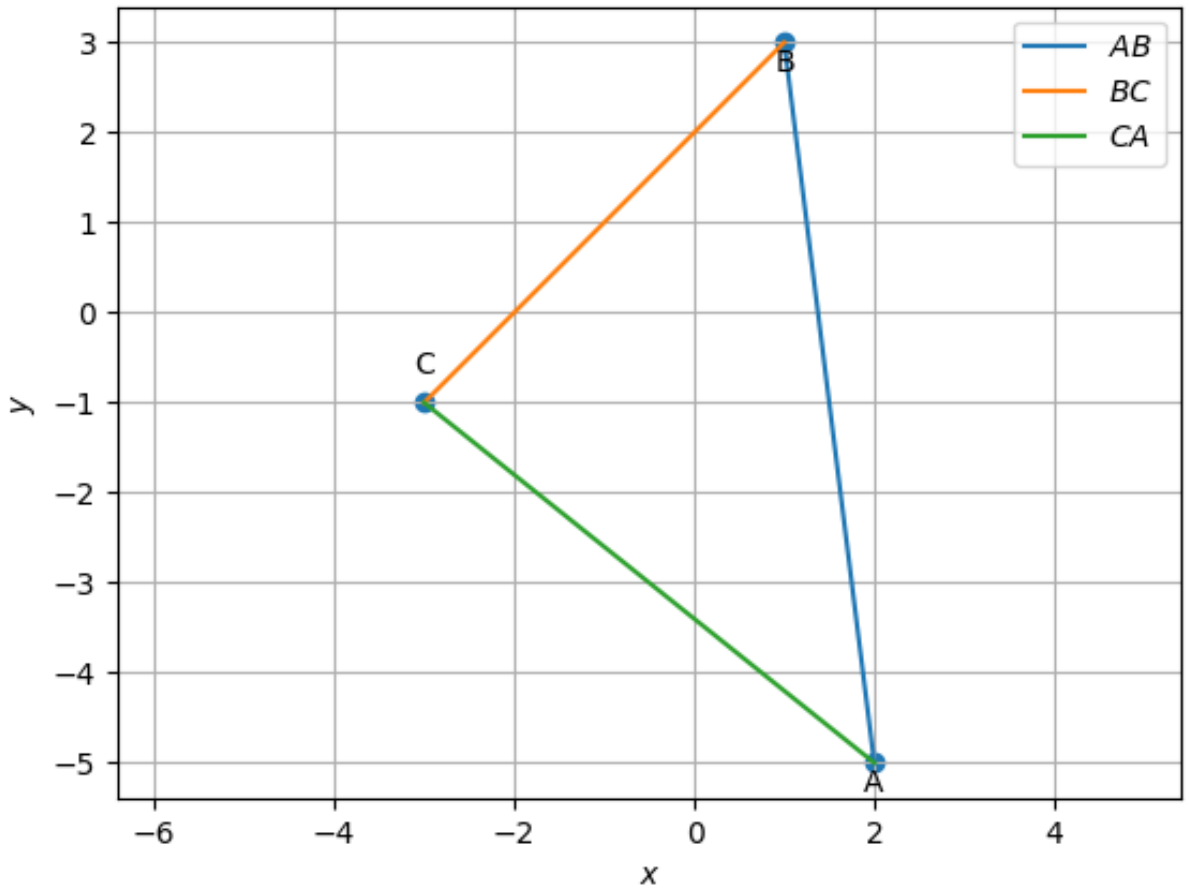


Fig. I.1. Triangle ABC

## II. MEDIANS

| parameter | value | description |
|---|---|---|
| **D** | $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ | midpoint of line BC |
| **E** | $\begin{pmatrix} -0.5 \\ -3 \end{pmatrix}$ | midpoint of line AC |
| **F** | $\begin{pmatrix} 1.5 \\ -1 \end{pmatrix}$ | midpoint of line AB |
| $\mathbf{n_4^\top}$ | $\begin{pmatrix} 6 & 3 \end{pmatrix}$ | AD |
| $c_4$ | -3 | |
| $\mathbf{n_5^\top}$ | $\begin{pmatrix} -6 & 1.5 \end{pmatrix}$ | BE |
| $c_5$ | -1.5 | |
| $\mathbf{n_6^\top}$ | $\begin{pmatrix} 0 & -4.5 \end{pmatrix}$ | CF |
| $c_6$ | 4.5 | |
| **G** | $\begin{pmatrix} 1.39 \\ -1 \end{pmatrix}$ | centroid of triangle |

TABLE II.2
MEDIANS

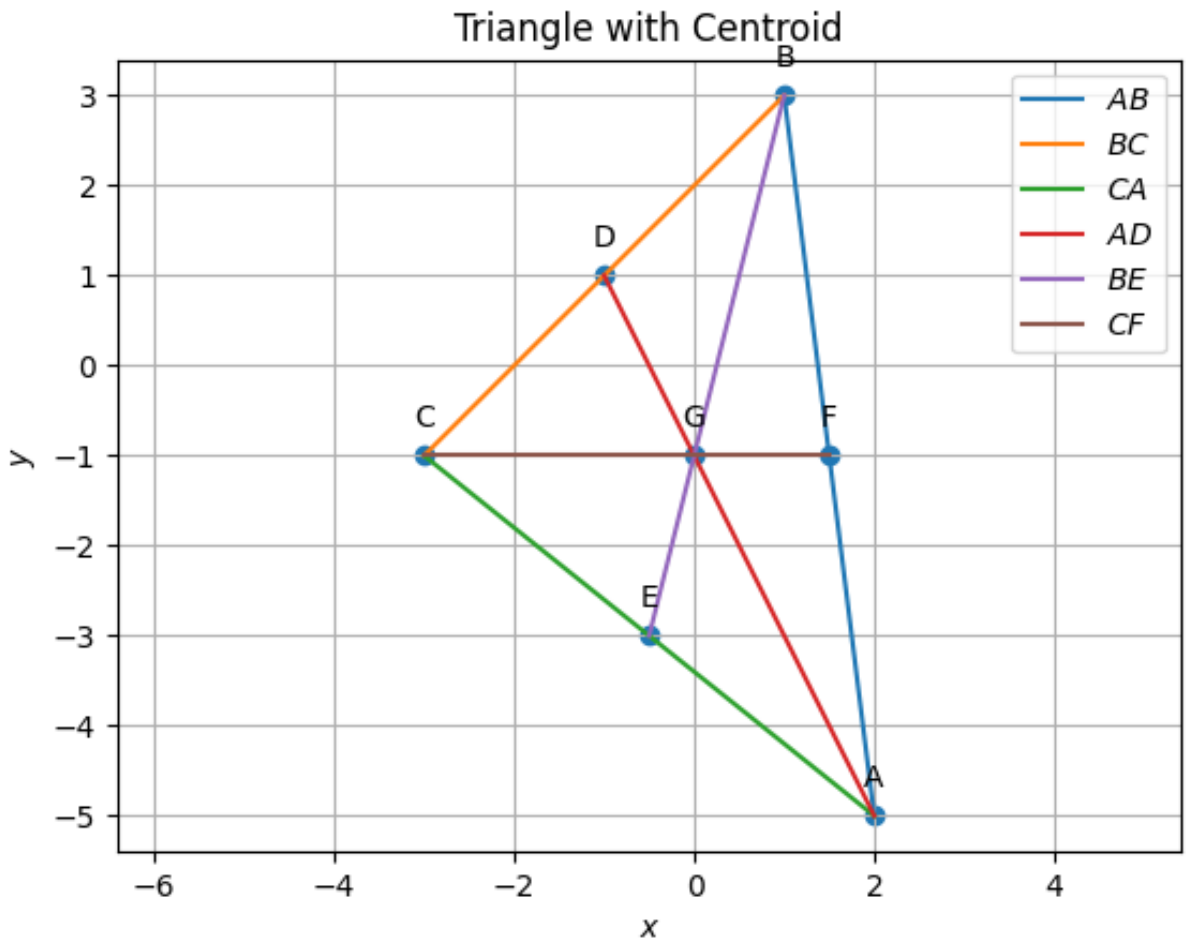


Fig. II.2. Triangle ABC with medians AD, BE and CF

## III. ALTITUDES

| parameter | value | description |
|---|---|---|
| $\mathbf{n_7^\top}$ | $\begin{pmatrix}-4 & -4\end{pmatrix}$ | A$D_1$ |
| $c_7$ | 12 | |
| $\mathbf{n_8^\top}$ | $\begin{pmatrix}5 & -4\end{pmatrix}$ | B$E_1$ |
| $c_8$ | -7 | |
| $\mathbf{n_9^\top}$ | $\begin{pmatrix}-1 & 8\end{pmatrix}$ | C$F_1$ |
| $c_9$ | -5 | |
| **H** | $\begin{pmatrix}-2.11\\-0.89\end{pmatrix}$ | orthocentre of triangle |

TABLE III.3
ALTITUDES

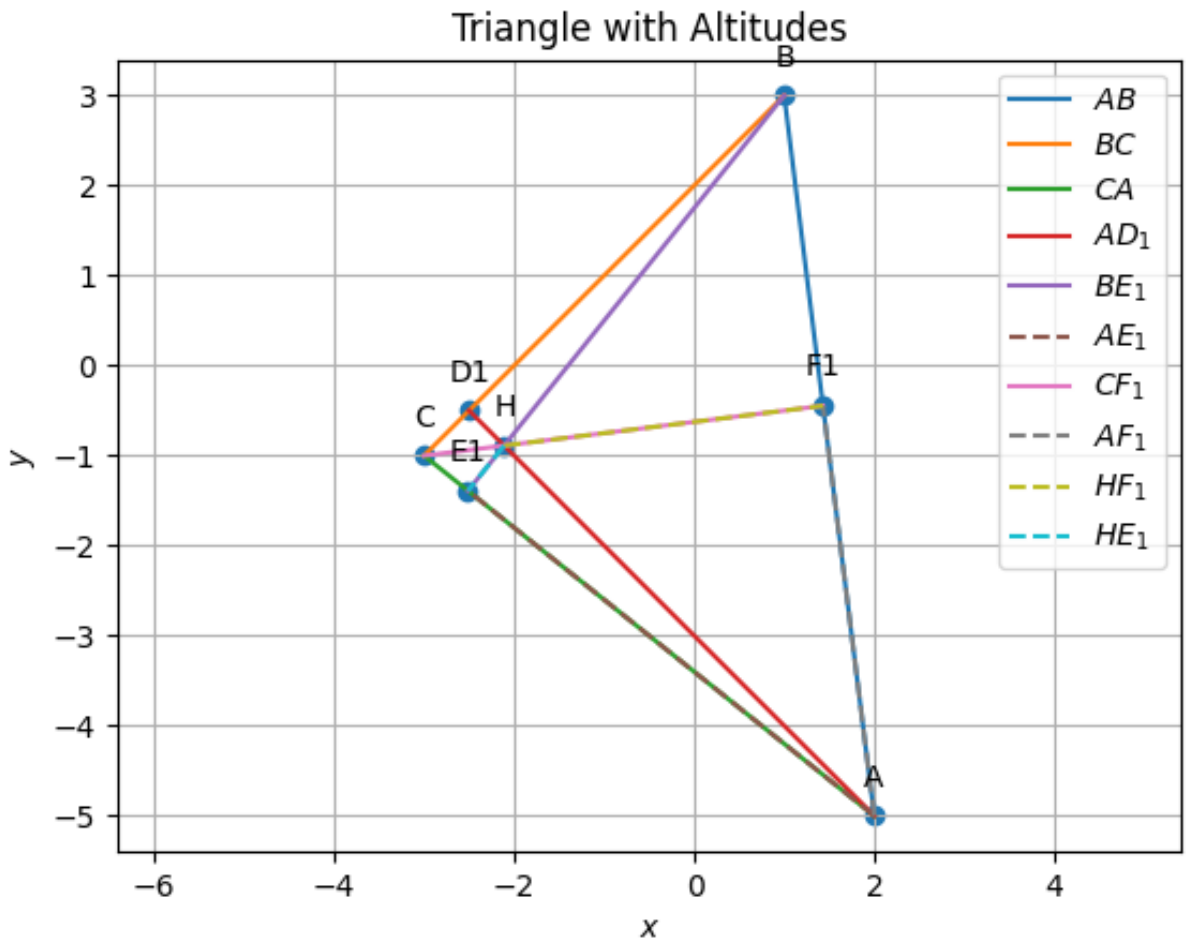


Fig. III.3. Triangle ABC with altitudes $AD_1$, $BE_1$ and $CF_1$

## IV. PERPENDICULAR BISECTOR

| parameter | value | description |
|---|---|---|
| $\mathbf{n}_{10}^{\top}$ | $\begin{pmatrix}1 & -8\end{pmatrix}$ | Perpendicular bisector of AB |
| $c_{10}$ | 9.5 | |
| $\mathbf{n}_{11}^{\top}$ | $\begin{pmatrix}4 & 4\end{pmatrix}$ | Perpendicular bisector of BC |
| $c_{11}$ | 0 | |
| $\mathbf{n}_{12}^{\top}$ | $\begin{pmatrix}-5 & -4\end{pmatrix}$ | Perpendicular bisector of CA |
| $c_{12}$ | -9.5 | |
| **O** | $\begin{pmatrix}1.06\\-1.06\end{pmatrix}$ | Circumcircle |
| radius | 4.06 | |

TABLE IV.4
PERPENDICULAR BISECTOR

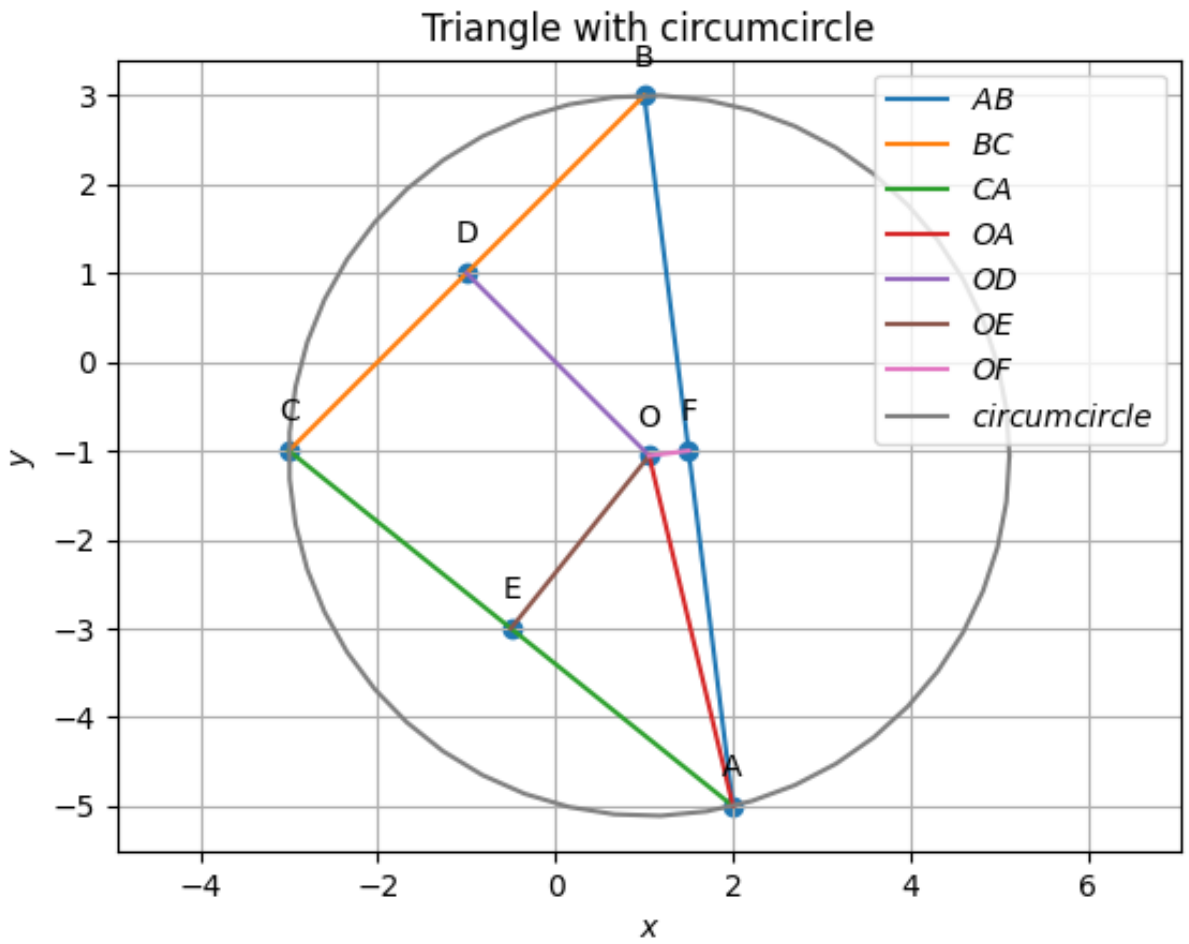


Fig. IV.4. circumcircle of triangle ABC with circumcentre O

## V. ANGULAR BISECTOR

| parameter | value | description |
|---|---|---|
| $\mathbf{n}_{13}^{\top}$ | $\begin{pmatrix}1.62 & 0.9\end{pmatrix}$ | Angular bisector of A |
| $c_{13}$ | -1.29 | |
| $\mathbf{n}_{14}^{\top}$ | $\begin{pmatrix}-1.7 & 0.58\end{pmatrix}$ | Angular bisector of B |
| $c_{14}$ | 0.05 | |
| $\mathbf{n}_{15}^{\top}$ | $\begin{pmatrix}0.08 & -1.49\end{pmatrix}$ | Angular bisector of C |
| $c_{15}$ | 1.24 | |
| $\mathbf{I}$ | $\begin{pmatrix}-0.32\\-0.85\end{pmatrix}$ | Incircle |
| radius | 1.79 | |
| $\mathbf{D}_3$ | $\begin{pmatrix}-1.59\\0.41\end{pmatrix}$ | Point of Contact on BC |
| $\mathbf{E}_3$ | $\begin{pmatrix}1.45\\-0.63\end{pmatrix}$ | Point of Contact on AB |
| $\mathbf{F}_3$ | $\begin{pmatrix}-1.44\\-2.25\end{pmatrix}$ | Point of Contact on CA |

TABLE V.5
ANGULAR BISECTOR

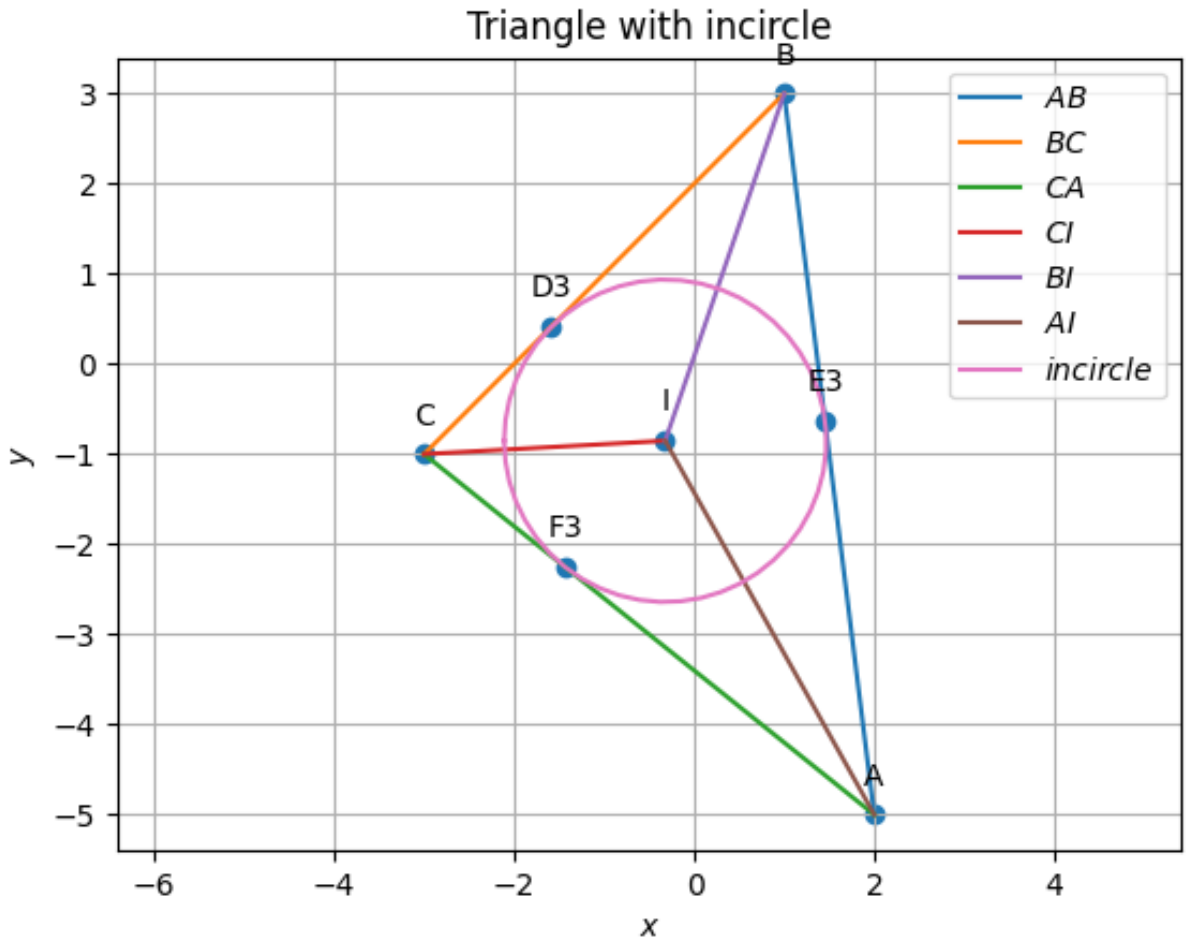


Fig. V.5. incircle of triangle ABC with incentre I