

# Random Vector Assignment

Mayank Gupta

Consider a triangle with vertices,  
 $\mathbf{A} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$ ,  $\mathbf{B} = \begin{pmatrix} -5 \\ -3 \end{pmatrix}$ ,  $\mathbf{C} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

## I. VECTOR

### A. Table

parameter	value	description
$\mathbf{m}_{AB}$	$\begin{pmatrix} -8 \\ 2 \end{pmatrix}$	Direction vec of AB
$\mathbf{m}_{BC}$	$\begin{pmatrix} 8 \\ 2 \end{pmatrix}$	Direction vec of BC
$\mathbf{m}_{CA}$	$\begin{pmatrix} 0 \\ -4 \end{pmatrix}$	Direction vec of CA
$\ \mathbf{A} - \mathbf{B}\ $	8.246	length of AB
$\ \mathbf{B} - \mathbf{C}\ $	8.246	length of BC
$\ \mathbf{C} - \mathbf{A}\ $	4	length of CA
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix}$	3	non-collinear
$\mathbf{n}_{AB}^\top$	$\begin{pmatrix} 2 & 8 \end{pmatrix}$	AB
c	-34	
$\mathbf{n}_{BC}^\top$	$\begin{pmatrix} 2 & -8 \end{pmatrix}$	BC
c	14	
$\mathbf{n}_{CA}^\top$	$\begin{pmatrix} -4 & 0 \end{pmatrix}$	AC
c	-12	
Area	16	Area of $\triangle ABC$
Angle	75.96	$\angle BAC$
Angle	28.07	$\angle ABC$
Angle	75.96	$\angle ACB$

TABLE I.1  
EQUATIONS RELATED TO TRIANGLE

### B. Figure

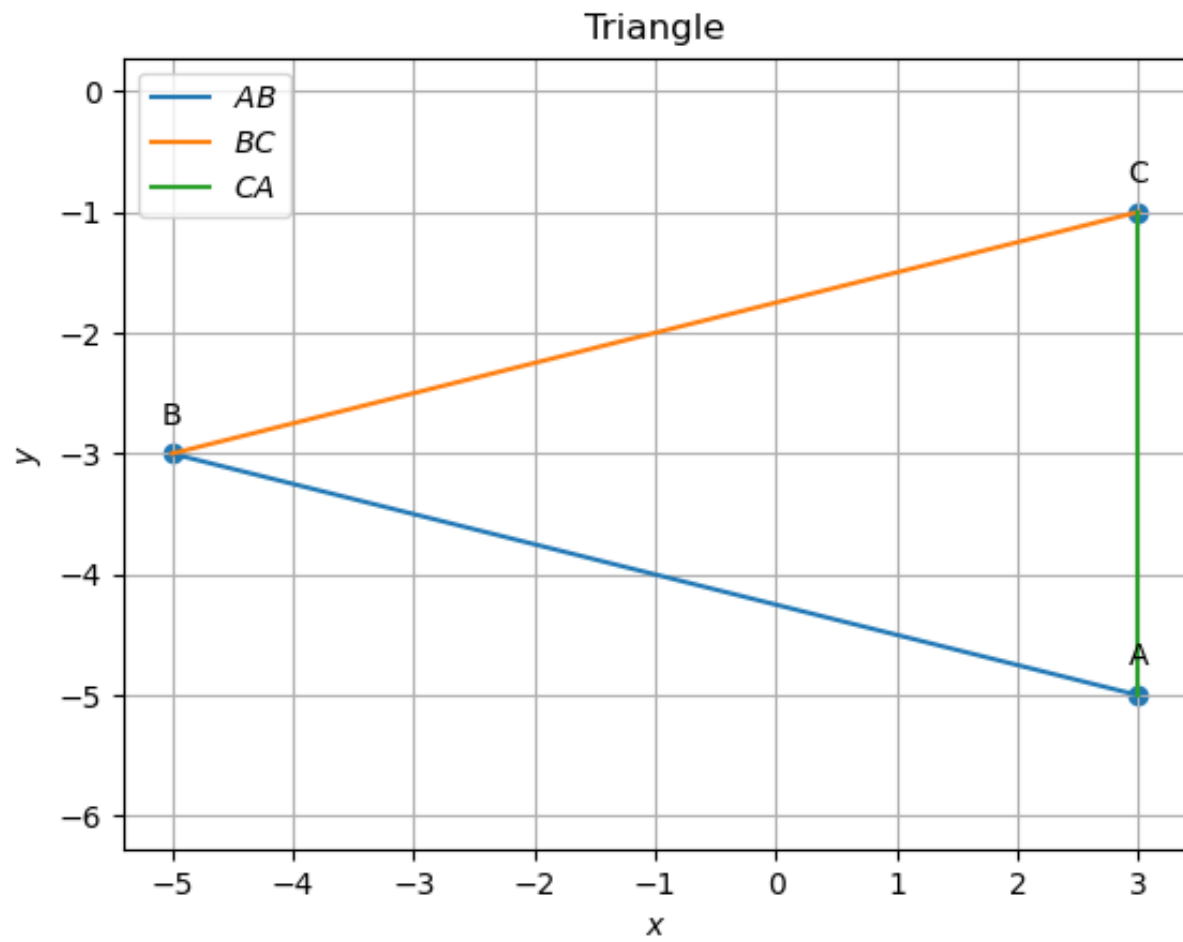


Fig. I.1. Triangle generated using python

## II. MEDIAN

### A. Table

parameter	value	description
<b>D</b>	$\begin{pmatrix} -1 \\ -2 \end{pmatrix}$	Midpoint AB
<b>E</b>	$\begin{pmatrix} 3 \\ -3 \end{pmatrix}$	Midpoint BC
<b>F</b>	$\begin{pmatrix} -1 \\ -4 \end{pmatrix}$	Midpoint CA
$\mathbf{n}_{AD}^T$	$\begin{pmatrix} 3 & 4 \end{pmatrix}$	AD
c	-11	
$\mathbf{n}_{BE}^T$	$\begin{pmatrix} 0 & -8 \end{pmatrix}$	BE
c	24	
$\mathbf{n}_{CF}^T$	$\begin{pmatrix} -3 & 4 \end{pmatrix}$	CF
c	-13	
<b>G</b>	$\begin{pmatrix} 0.33 \\ -3 \end{pmatrix}$	Centroid

TABLE II.I  
EQUATIONS RELATED TO MEDIAN

### B. Figure

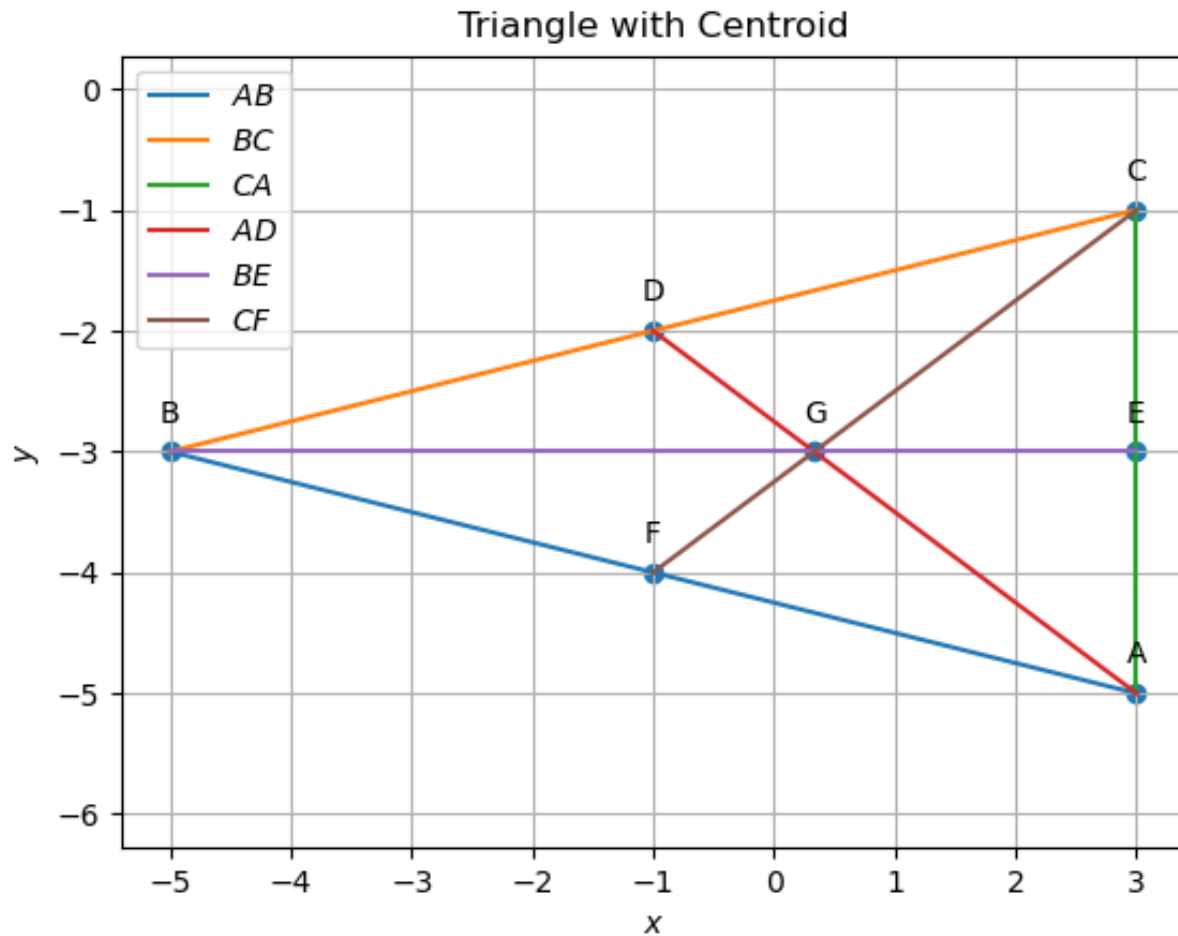


Fig. II.1. Triangle with centroid generated using python

### III. ALTITUDE

#### A. Table

parameter	value	description
$\mathbf{n}_{AD_1}^\top$	$\begin{pmatrix} 8 & 2 \end{pmatrix}$	$AD_1$
c	14	
$\mathbf{n}_{BE_1}^\top$	$\begin{pmatrix} 0 & -4 \end{pmatrix}$	$BE_1$
c	12	
$\mathbf{n}_{CF_1}^\top$	$\begin{pmatrix} -8 & -2 \end{pmatrix}$	$CF_1$
c	-26	
<b>H</b>	$\begin{pmatrix} 2.5 \\ -3 \end{pmatrix}$	Orthocenter

TABLE III.1  
EQUATIONS RELATED TO ALTITUDE

#### B. Figure

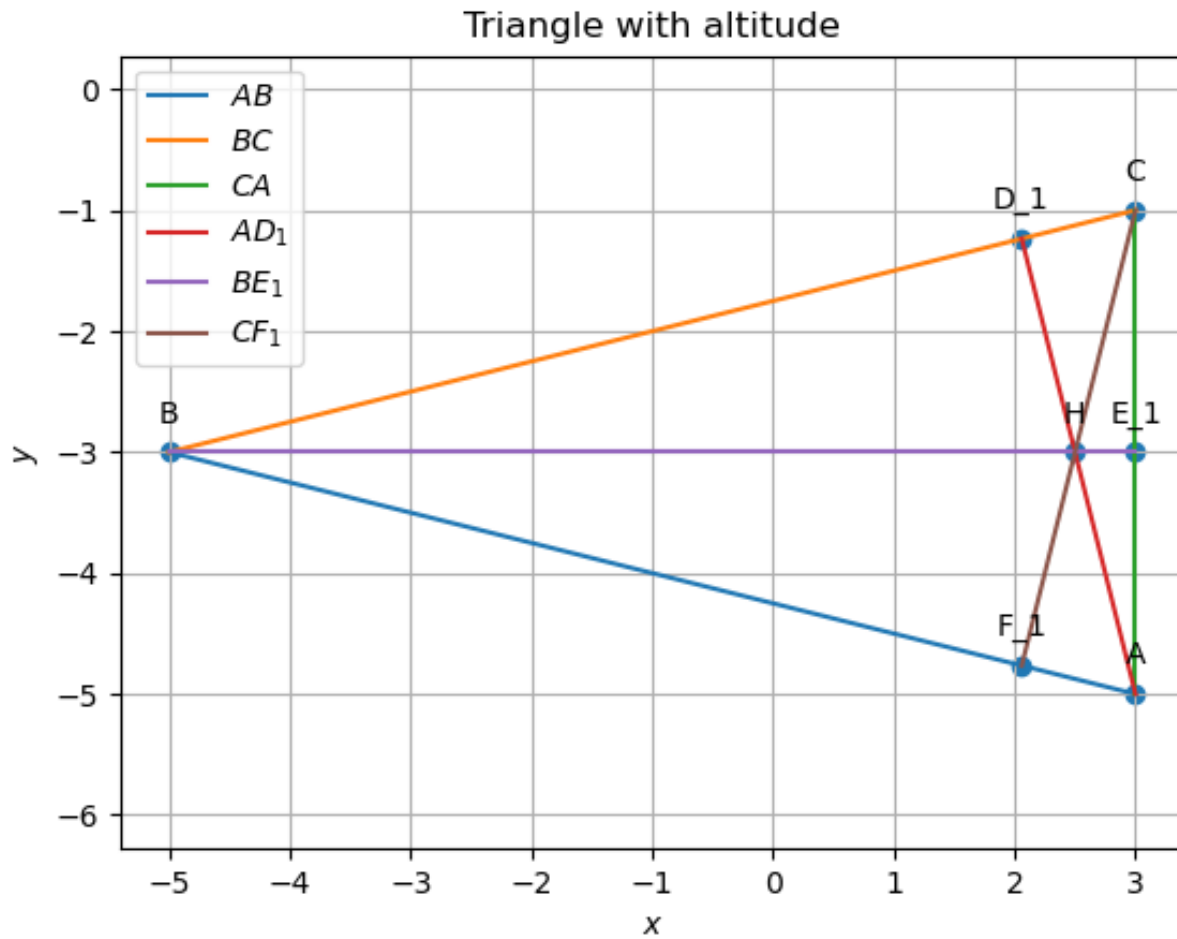


Fig. III.1. Triangle with altitude generated using python

## IV. PERPENDICULAR BISECTOR

## A. Table

parameter	value	description
$\mathbf{n}^T$	$(8 \ -2)$	Perpendicular bisector of AB
c	0	
$\mathbf{n}^T$	$(-8 \ -2)$	Perpendicular bisector of BC
c	12	
$\mathbf{n}^T$	$(0 \ 4)$	Perpendicular bisector of CA
c	-12	
center(O)	$\begin{pmatrix} -0.75 \\ -3 \end{pmatrix}$	Circumcircle
radius	4.25	

TABLE IV.1  
EQUATIONS RELATED TO CIRCUMCIRCLE

## B. Figure

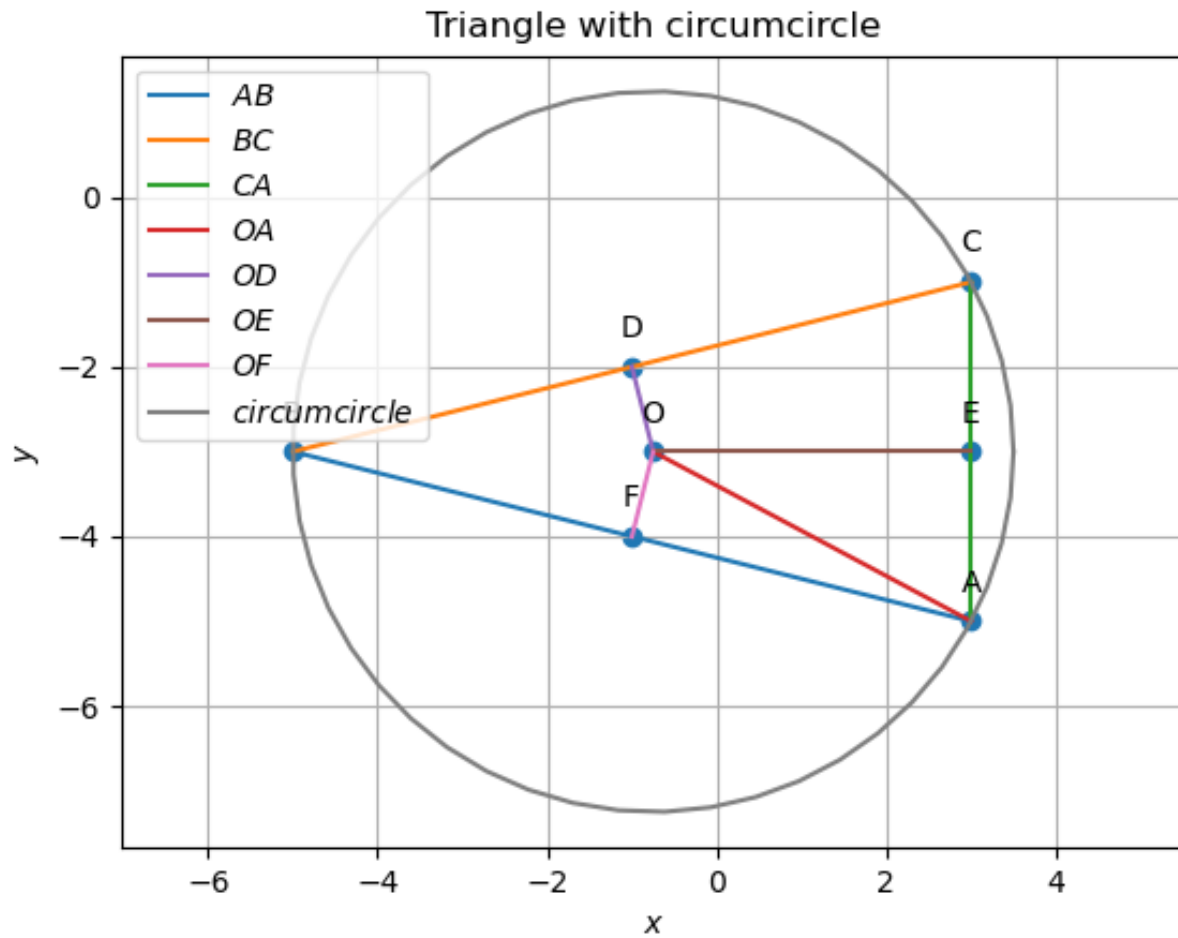


Fig. IV.1. Triangle with circumcircle generated using python

## V. ANGULAR BISECTOR

## A. Table

parameter	value	description
$\mathbf{n}^T$	$\begin{pmatrix} 1.24 & 0.97 \end{pmatrix}$	Angular bisector of A
c	-1.12	
$\mathbf{n}^T$	$\begin{pmatrix} 0 & -1.94 \end{pmatrix}$	Angular bisector of B
c	5.82	
$\mathbf{n}^T$	$\begin{pmatrix} -1.24 & -0.97 \end{pmatrix}$	Angular bisector of C
c	-8.58	
center(I)	$\begin{pmatrix} 1.44 \\ -3 \end{pmatrix}$	Incircle
radius	1.56	
Angle	37.98	$\angle BAI$
Angle	37.98	$\angle CAI$
$\mathbf{D}_3$	$\begin{pmatrix} 1.06 \\ -1.48 \end{pmatrix}$	POC with AB
$\mathbf{E}_3$	$\begin{pmatrix} 1.06 \\ -4.51 \end{pmatrix}$	POC with BC
$\mathbf{F}_3$	$\begin{pmatrix} 3 \\ -3 \end{pmatrix}$	POC with CA
Length	2	$AF_3, CE_3$
Length	6.246	$BD_3, BE_3$
Length	2	$CF_3, CD_3$

TABLE V.1  
EQUATIONS RELATED TO INCIRCLE

## B. Figure

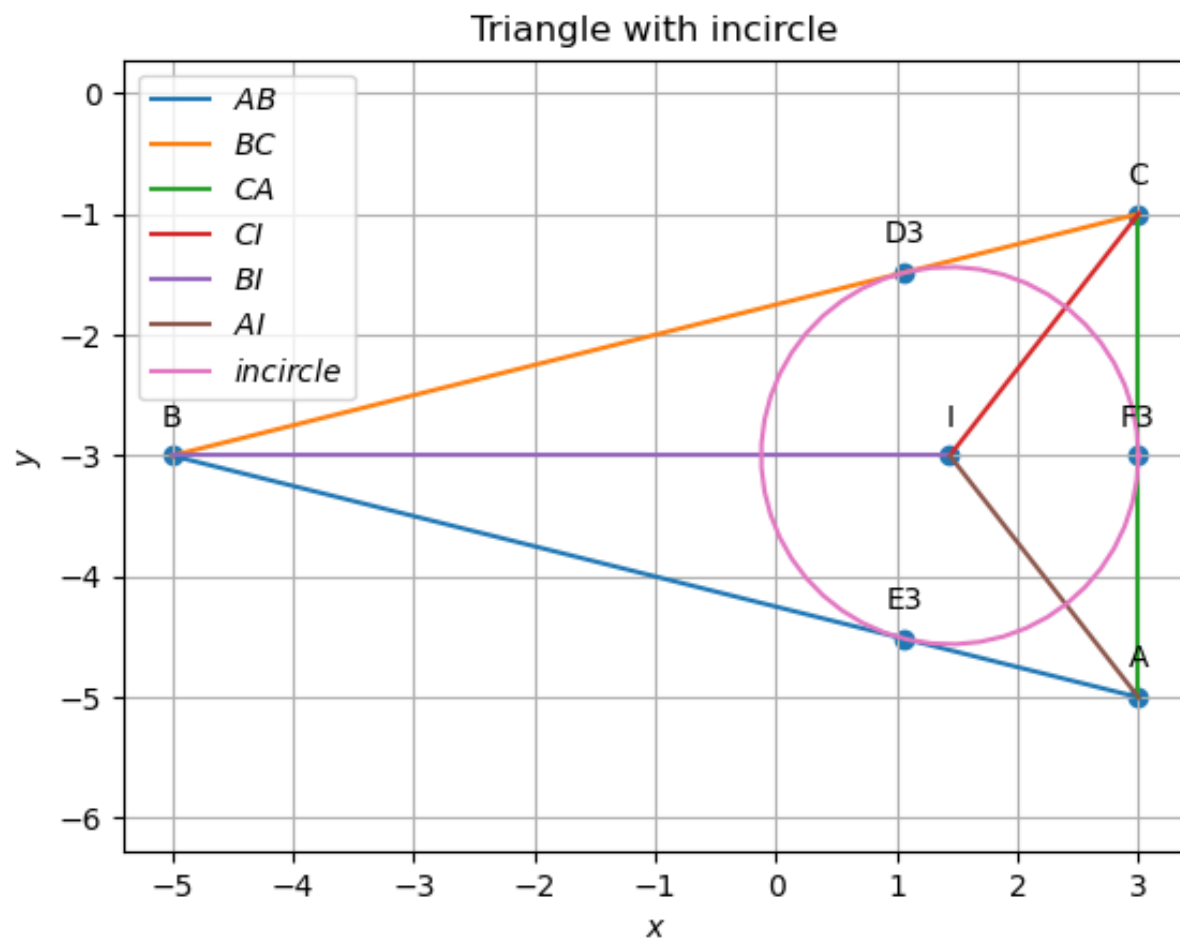


Fig. V.1. Triangle with incircle generated using python