

Answer Key

Sameer Kendal - EE22BTECH11044*

Consider the vertices,

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

I. VECTORS

Parameter	Value	Description
\mathbf{m}_1	$\begin{pmatrix} 10 \\ -5 \end{pmatrix}$	$\mathbf{A} - \mathbf{B}$
\mathbf{m}_2	$\begin{pmatrix} -6 \\ -2 \end{pmatrix}$	$\mathbf{B} - \mathbf{C}$
\mathbf{m}_3	$\begin{pmatrix} -4 \\ 7 \end{pmatrix}$	$\mathbf{A} - \mathbf{C}$
$\ \mathbf{B} - \mathbf{A}\ $	11.80	AB
$\ \mathbf{C} - \mathbf{B}\ $	6.32	BC
$\ \mathbf{A} - \mathbf{C}\ $	8.06	AC
$\text{rank}\begin{pmatrix} 1 & 1 & 1 \\ \mathbf{A} & \mathbf{B} & \mathbf{C} \end{pmatrix}$	3	points are not collinear
\mathbf{n}_1^\top	$\begin{pmatrix} -5 & -10 \end{pmatrix}$	AB
c_1	-15	
\mathbf{n}_2^\top	$\begin{pmatrix} -2 & 6 \end{pmatrix}$	BC
c_2	-16	
\mathbf{n}_3^\top	$\begin{pmatrix} 7 & 4 \end{pmatrix}$	AC
c_3	-19	
area	25.00	area of triangle
$\angle A$	33.69°	Angle
$\angle B$	45.00°	
$\angle C$	101.30°	

TABLE I.1
VECTORS

II. MEDIANS

Parameter	Value	Description
D	$\begin{pmatrix} 2.0 \\ -2.0 \end{pmatrix}$	midpoint of line BC
E	$\begin{pmatrix} -3.0 \\ 0.5 \end{pmatrix}$	midpoint of line AC
F	$\begin{pmatrix} 0 \\ 1.5 \end{pmatrix}$	midpoint of line AB
\mathbf{n}_4^T	$\begin{pmatrix} -6 & -7 \end{pmatrix}$	AD
c_4	2	
\mathbf{n}_5^T	$\begin{pmatrix} 1.5 & 8 \end{pmatrix}$	BE
c_5	-0.5	
\mathbf{n}_6^T	$\begin{pmatrix} 4.5 & -1 \end{pmatrix}$	CF
c_6	-1.5	
G	$\begin{pmatrix} -0.33 \\ -6.93 \end{pmatrix}$	centroid of triangle

TABLE II.1
MEDIAN

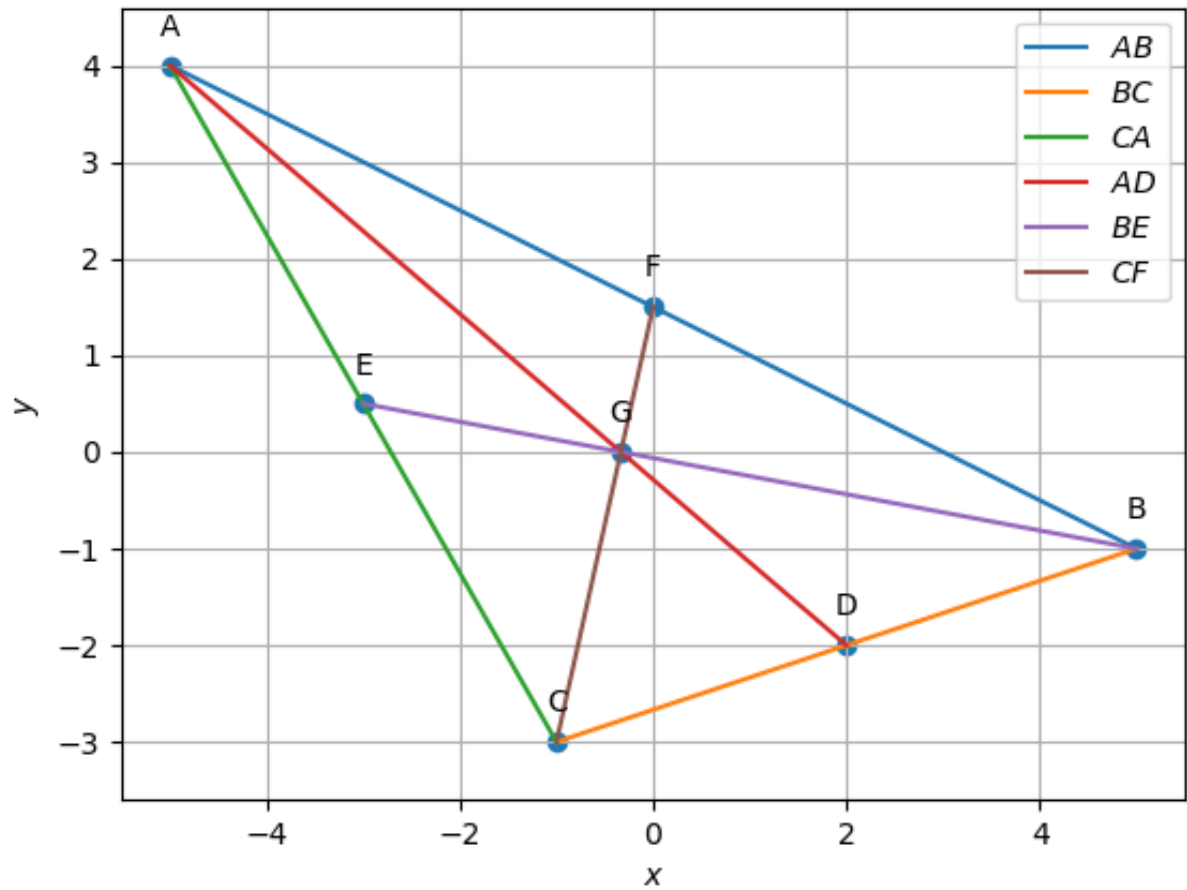


Fig. II.1. Triangle ABC with medians AD, BE and CF

III. ALTITUDES

Parameter	Value	Description
\mathbf{n}_7^\top	$(-6 \ -2)$	AD_1
c_7	22	
\mathbf{n}_8^\top	$(-4 \ 7)$	BE_1
c_8	-27	
\mathbf{n}_9^\top	$(10 \ -5)$	CF_1
c_9	5	
H	$\begin{pmatrix} -2. \\ -5 \end{pmatrix}$	orthocentre of triangle

TABLE III.1
ALTITUDES

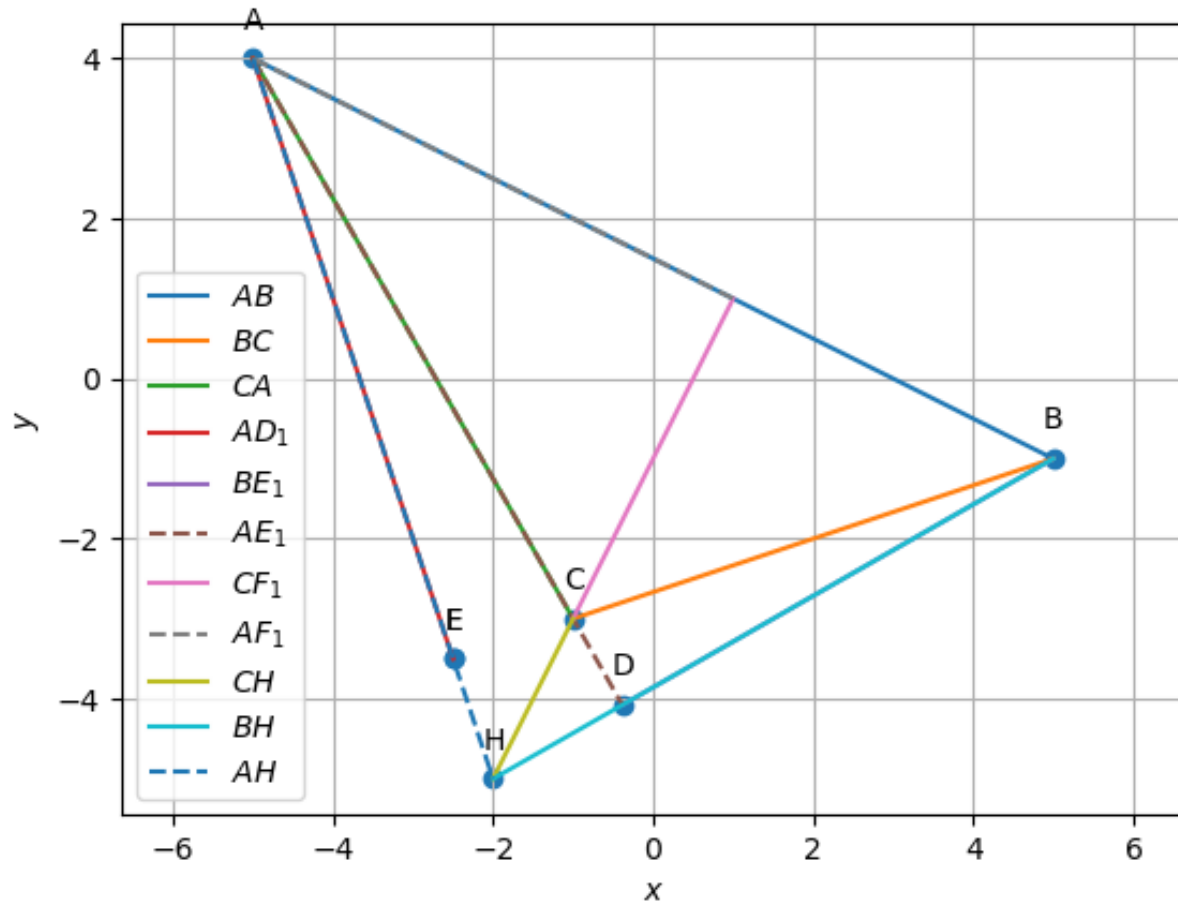


Fig. III.1. Triangle ABC with altitudes AD_1 , BE_1 and CF_1

IV. PERPENDICULAR BISECTOR

Parameter	Value	Description
\mathbf{n}_{10}^T	$(-10 \ 5)$	Perpendicular bisector of AB
c_{10}	7.5	
\mathbf{n}_{11}^T	$(6 \ 2)$	Perpendicular bisector of BC
c_{11}	8	
\mathbf{n}_{12}^T	$(4 \ -7)$	Perpendicular bisector of CA
c_{12}	-15.5	
\mathbf{O}	$\begin{pmatrix} 0.5 \\ 2.5 \end{pmatrix}$	Circumcircle
radius	5.70	

TABLE IV.1
PERPENDICULAR BISECTOR

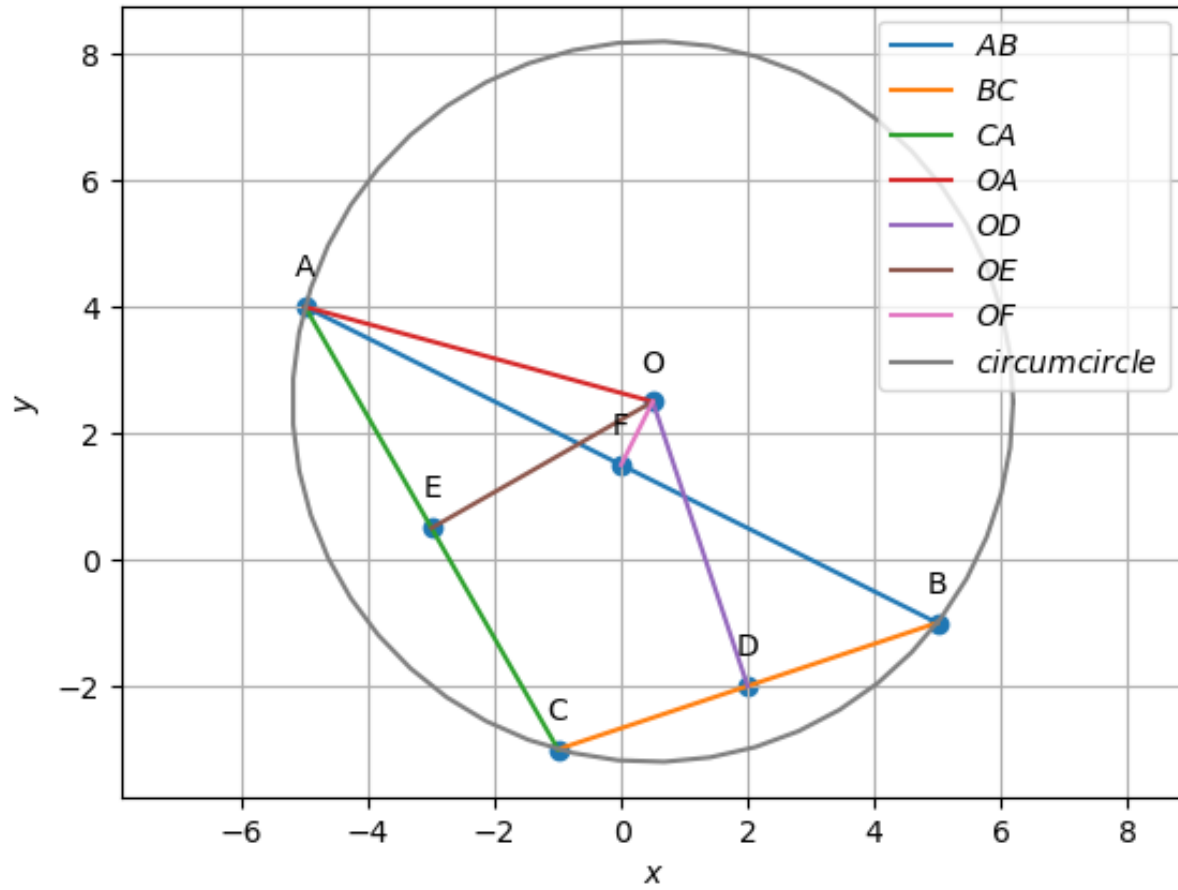


Fig. IV.1. circumcircle of triangle ABC with circumcentre O

V. ANGULAR BISECTOR

Parameter	Value	Description
\mathbf{n}_{13}^T	$(-1.315 \quad -1.39)$	Angular bisector of A
c_{13}	1.015	
\mathbf{n}_{14}^T	$(0.13 \quad 1.84)$	Angular bisector of B
c_{14}	-1.18	
\mathbf{n}_{15}^T	$(1.184 \quad -0.45)$	Angular bisector of C
c_{15}	-7.73	
\mathbf{I}	$\begin{pmatrix} -0.09 \\ -0.637 \end{pmatrix}$	Incircle
radius	-1.955	

TABLE V.1
ANGULAR BISECTOR

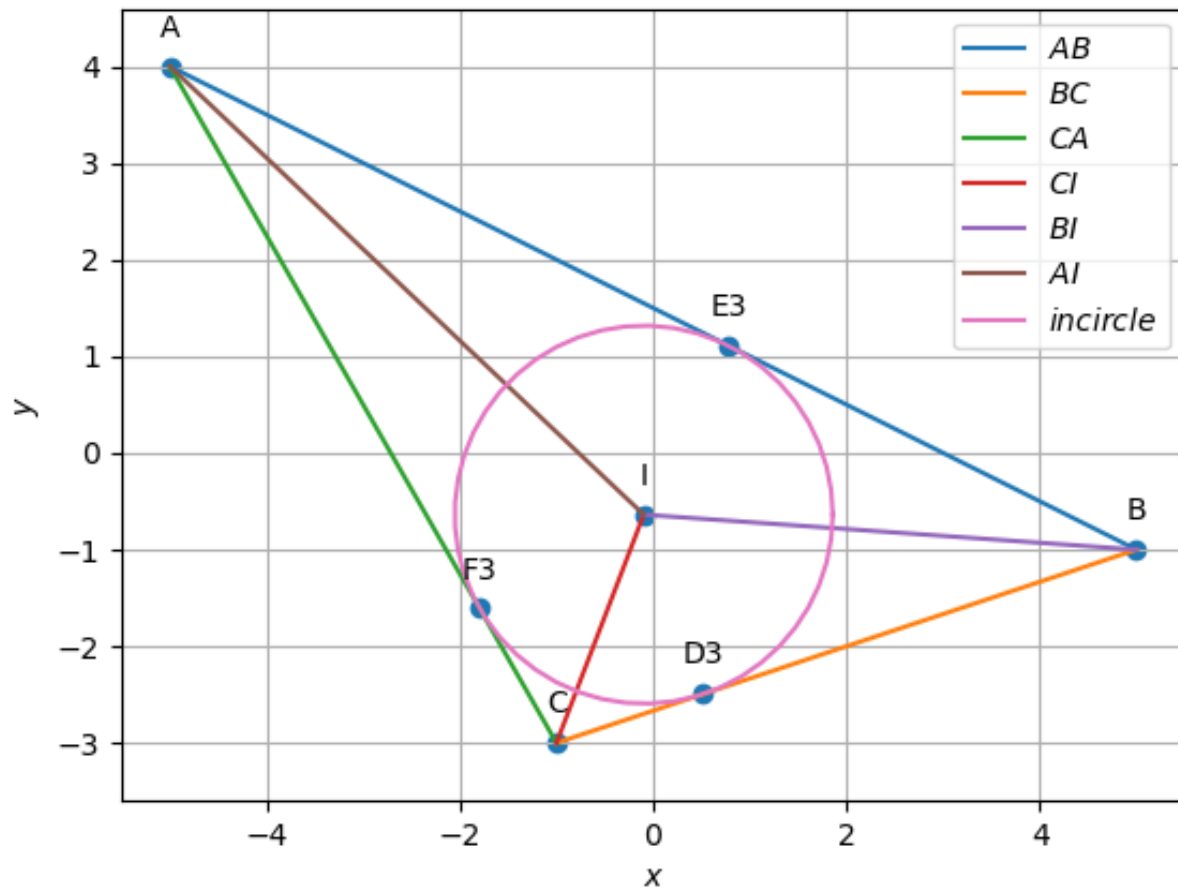


Fig. V.1. incircle of triangle ABC with incentre I