## Question 1:

Find area of the triangle with vertices at the point given in each of the following:
**(i)** $(1, 0), (6, 0), (4, 3)$
**(ii)** $(2, 7), (1, 1), (10, 8)$
**(iii)** $(-2, -3), (3, 2), (-1, -8)$

## Answer 1:

$$\text{Area of triangle} = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

**(i)** $A(1, 0), B(6, 0), C(4, 3)$

$$\text{Area of triangle } ABC = \frac{1}{2}\begin{vmatrix} 1 & 0 & 1 \\ 6 & 0 & 1 \\ 4 & 3 & 1 \end{vmatrix}$$

$$= \frac{1}{2}[1(0-3) - 0(6-4) + 1(18-0)] = \frac{1}{2}(15) = 7.5 \text{ square units}$$

**(ii)** $A(2, 7),\ B(1, 1),\ C(10, 8)$

$$\text{Area of triangle } ABC = \frac{1}{2}\begin{vmatrix} 2 & 7 & 1 \\ 1 & 1 & 1 \\ 10 & 8 & 1 \end{vmatrix}$$

$$= \frac{1}{2}[2(1-8) - 7(1-10) + 1(8-10)] = \frac{1}{2}(47) = 25.5 \text{ square units}$$

**(iii)** $A(-2, -3), B(3, 2), C(-1, -8)$

$$\text{Area of triangle } ABC = \frac{1}{2}\begin{vmatrix} -2 & -3 & 1 \\ 3 & 2 & 1 \\ -1 & -8 & 1 \end{vmatrix}$$

$$= \frac{1}{2}[-2(2+8) + 3(3+1) + 1(-24+2)] = \frac{1}{2}(-30) = -15$$

Area of triangle $ABC = 15$ square units

## Question 2:

Show that points $A(a, b+c), B(b, c+a), C(c, a+b)$ are collinear.

## Answer 2:

If the points $A(a, b+c), B(b, c+a)$ and $C(c, a+b)$ are collinear, the area of triangle $ABC$ will be zero.

$$\text{Area of triangle } ABC = \frac{1}{2}\begin{vmatrix} a & b+c & 1 \\ b & c+a & 1 \\ c & a+b & 1 \end{vmatrix}$$

$$= \frac{1}{2}\begin{vmatrix} a & a+b+c & 1 \\ b & a+b+c & 1 \\ c & a+b+c & 1 \end{vmatrix} \qquad [\text{Applying } C_2 \to C_1 + C_2]$$

$$= \frac{1}{2}(a+b+c)\begin{vmatrix} a & 1 & 1 \\ b & 1 & 1 \\ c & 1 & 1 \end{vmatrix} \qquad [\text{Taking } a+b+c \text{ as common from } C_2]$$

$$= 0 \qquad [\because\ C_1 = C_3\ ]$$

Hence, the points $A(a, b+c), B(b, c+a)$ and $C(c, a+b)$ are collinear.

## Question 3:

Find values of $k$ if area of triangle is 4 sq. units and vertices are

**(i)** $(k, 0), (4, 0), (0, 2)$ **(ii)** $(-2, 0), (0, 4), (0, k)$

### Answer 3:

**(i)** $A(k, 0), B(4, 0), C(0, 2)$

Area of triangle $ABC = \frac{1}{2}\begin{vmatrix} k & 0 & 1 \\ 4 & 0 & 1 \\ 0 & 2 & 1 \end{vmatrix}$

$= \frac{1}{2}[k(0-2) - 0(4-0) + 1(8-0)] = \frac{1}{2}(-2k+8) = -k+4$

According to question, Area of triangle $ABC = 4$ square units

Therefore, $|-k+4| = 4 \quad \Rightarrow -k+4 = \pm 4$

$\Rightarrow -k+4 = 4 \quad$ or $\quad -k+4 = -4$

$\Rightarrow k = 0 \quad$ or $\quad k = 8$

Hence, the value of $k$ are 0 and 8.

**(ii)** $A(-2, 0), B(0, 4), C(0, k)$

Area of triangle $ABC = \frac{1}{2}\begin{vmatrix} -2 & 0 & 1 \\ 0 & 4 & 1 \\ 0 & k & 1 \end{vmatrix}$

$= \frac{1}{2}[-2(4-k) - 0(0-0) + 1(0-0)] = \frac{1}{2}(-8+2k) = -4+k$

According to question, Area of triangle $ABC = 4$ square units

Therefore, $|-4+k| = 4 \quad \Rightarrow -4+k = \pm 4$

$\Rightarrow -4+k = 4 \quad$ or $\quad -4+k = -4$

$\Rightarrow k = 8 \quad$ or $\quad k = 0$

Hence, the value of $k$ are 0 and 8.

## Question 4:

**(i)** Find equation of line joining (1, 2) and (3, 6) using determinants.

**(ii)** Find equation of line joining (3, 1) and (9, 3) using determinants.

### Answer 4:

**(i)** Let, $P(x, y)$ be any point lie on the line joining $A(1, 2)$ and $B(3, 6)$. Hence, the points A, B and P will be collinear and area of triangle ABC will be zero.

Therefore, Area of triangle $ABP = \frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ 3 & 6 & 1 \\ x & y & 1 \end{vmatrix} = 0$

$\Rightarrow \frac{1}{2}[1(6-y) - 2(3-x) + 1(3y-6x)] = 0$

$\Rightarrow 6 - y - 6 + 2x + 3y - 6x = 0$

$\Rightarrow -4x + 2y = 0$

$\Rightarrow 2x = y$

**(ii)** Let, $P(x, y)$ be any point lie on the line joining $A(3, 1)$ and $B(9, 3)$. Hence, the points A, B and P will be collinear and area of triangle ABC will be zero.

Therefore, Area of triangle $ABP = \frac{1}{2}\begin{vmatrix} 3 & 1 & 1 \\ 9 & 3 & 1 \\ x & y & 1 \end{vmatrix} = 0$

$\Rightarrow \frac{1}{2}[3(3-y) - 1(9-x) + 1(9y - 3x)] = 0$

$\Rightarrow 9 - 3y - 9 + x + 9y - 3x = 0$

$\Rightarrow -2x + 6y = 0$

$\Rightarrow x = 3y$

## Question 5:

If area of triangle is 35 sq. units with vertices (2, – 6), (5, 4) and ($k$, 4). Then $k$ is

(A) 12 (B) $-2$ (C) $-12, -2$ (D) $12, -2$

## Answer 5:

$A(2, -6), B(5, 4), C(k, 4)$

Area of triangle $ABC = \frac{1}{2}\begin{vmatrix} 2 & -6 & 1 \\ 5 & 4 & 1 \\ k & 4 & 1 \end{vmatrix}$

$= \frac{1}{2}[2(4-4) + 6(5-k) + 1(20-4k)] = \frac{1}{2}(30 - 6k + 20 - 4k) = 25 - 5k$

According to question, Area of triangle $ABC = 35$ square units

Therefore, $|25 - 5k| = 35$

$\Rightarrow 25 - 5k = \pm 35$

$\Rightarrow 25 - 5k = 35$ or $25 - 5k = -35$

$\Rightarrow k = \frac{-10}{5} = -2$ or $k = \frac{60}{5} = 12$

Hence, the option (D) is correct.