# NCERT Solutions for Class-XII Maths

## Chapter-4.3

# NCERT Math Class 12

**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)

**1.** 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)

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

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

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

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

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

(iii) (-2,-3), (3,2),(-1,-8)

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

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

**2.** Given vertices of the triangle are A (a, b + c), B (b, c + a), C (c, a + b)

Let the vertices of the triangle be given by $(x_1, y_1)$, $(x_2, y_2)$, $(x_3, y_3)$

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

For points to be collinear area of triangle = $\Delta = 0$

So, we have to show that area of triangle formed by ABC is 0

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

Expanding the determinant along Row 1

$\Delta = \frac{1}{2} \times [a \times \{(c + a) \times 1 - (a + b) \times 1) - (b + c) \times \{b \times 1 - c \times 1\} + 1 \times \{b \times (a + b) - c \times (c + a)\}]$

$\Delta = \frac{1}{2} \times [a \times (c + a - a - b) - (b + c) \times (b - c) + 1 \times (ab + b^2 - c^2 - ca)]$

$\Delta = \frac{1}{2} \times [a \times (c - b) - (b^2 - c^2) + 1 \times (ab + b^2 - c^2 - ca)]$

$\Delta = \frac{1}{2} \times (ac - ab - b^2 + c^2 + ab + b^2 - c^2 - ca)$ sq units

$\Delta = \frac{1}{2} \times 0$ sq units

$\therefore \Delta = 0$

$\therefore$ Given vertices of the triangle are A (a, b + c), B (b, c + a), C (c, a + b) are collinear

**3.** Find value 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)

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

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

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

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

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

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

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

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

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

Area of triangle $ABC = \frac{1}{2}\begin{vmatrix} -2 & 0 & 1 \\ 0 & 4 & 1 \\ 0 & 5 & 1 \end{vmatrix}$

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

According to question, area of triangle ABC = 4 square units

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

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

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

Hence, the value of k are 0 and 8.

**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.

**4.** (i)

Equation of line joining points $(x_1, y_1)$ & $(x_2, y_2)$ is given by $\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x & y & 1 \end{vmatrix} = 0$

Given points are (1, 2) and (3, 6)

Equation of line is given by $\frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ 3 & 6 & 1 \\ x & y & 1 \end{vmatrix} = 0$

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

$\Rightarrow [(6 - y) - 2 \times (3 - x) + (3y - 6x)] = 0 \times 2$

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

$\Rightarrow 2y - 4x = 0$

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

$\therefore$ Required Equation of line is $y = 2x$

(ii)

Equation of line joining points $(x_1, y_1)$ & $(x_2, y_2)$ is given by $\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x & y & 1 \end{vmatrix} = 0$

Given points are (3, 1) and (9, 3)

Equation of line is given by $\frac{1}{2}\begin{vmatrix} 3 & 1 & 1 \\ 9 & 3 & 1 \\ x & y & 1 \end{vmatrix} = 0$

⇒ ½ × [3 × (3 × 1 – y × 1) – 1 × (9 × 1 – x × 1) + 1 × (9 × y – x × 3)] = 0
⇒ [3 × (3 – y) – 1 × (9 – x) + (9y – 3x)] = 0 × 2
⇒ (9 – 3y – 9 + x + 9y – 3x) = 0
⇒ 6y – 2x = 0
⇒ 2x – 6y = 0 ⇒ x – 3y = 0
∴ Required Equation of line is x – 3y = 0

**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

**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 questions, area of triangle ABC = 35 square units
Therefore, |25 – 5k| = 35
⇒ 25 – 5x = ±35
⇒ 25 – 5k = 35 or 25 – 5k = –35
⇒ $k = \frac{-10}{5} = -2$ or $k = \frac{60}{5} = 12$
Hence, the option (d) is correct.