

Mathematics

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(Chapter - 7) (Coordinate Geometry)

(Class 10)

Exercise 7.3

Question 1:

Find the area of the triangle whose vertices are:

(i) $(2, 3), (-1, 0), (2, -4)$

(ii) $(-5, -1), (3, -5), (5, 2)$

Answer 1:

(i) $(2, 3), (-1, 0), (2, -4)$

Vertices of triangle: $A(2, 3), B(-1, 0)$ and $C(2, -4)$

Using the formula for area of triangle $\Delta = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$

$$\text{Area of triangle } ABC = \frac{1}{2}[2\{0 - (-4)\} + (-1)\{(-4) - 3\} + 2\{3 - 0\}]$$

$$= \frac{1}{2}[8 + 7 + 6]$$

$$= \frac{21}{2} = 10.5 \text{ square units}$$

(ii) $(-5, -1), (3, -5), (5, 2)$

Vertices of triangle: $A(-5, -1), B(3, -5)$ and $C(5, 2)$

Using the formula for area of triangle $\Delta = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$

$$\text{Area of triangle } ABC = \frac{1}{2}[(-5)(-5 - 2) + 3\{2 - (-1)\} + 5\{-1 - (-5)\}]$$

$$= \frac{1}{2}[35 + 9 + 20]$$

$$= \frac{64}{2} = 32 \text{ square units}$$

Question 2:

In each of the following find the value of 'k', for which the points are collinear.

(i) $(7, -2), (5, 1), (3, k)$

(ii) $(8, 1), (k, -4), (2, -5)$

Answer 2:

(i) $A(7, -2), B(5, 1), C(3, k)$

Area of triangle formed by three collinear points is zero.

Therefore, the area of triangle $ABC = 0$

$$\Rightarrow \frac{1}{2}[7(1 - k) + 5\{k - (-2)\} + 3(-2 - 1)] = 0$$

$$\Rightarrow 7 - 7k + 5k + 10 - 9 = 0$$

$$\Rightarrow -2k = -8$$

$$\Rightarrow k = 4$$

(ii) $P(8, 1), Q(k, -4), R(2, -5)$

Area of triangle formed by three collinear points is zero.

Therefore, the area of triangle $PQR = 0$

$$\Rightarrow \frac{1}{2}[8\{-4 - (-5)\} + k(-5 - 1) + 2\{1 - (-4)\}] = 0$$

$$\Rightarrow 8 - 6k + 10 = 0$$

$$\Rightarrow -6k = -18$$

$$\Rightarrow k = 3$$

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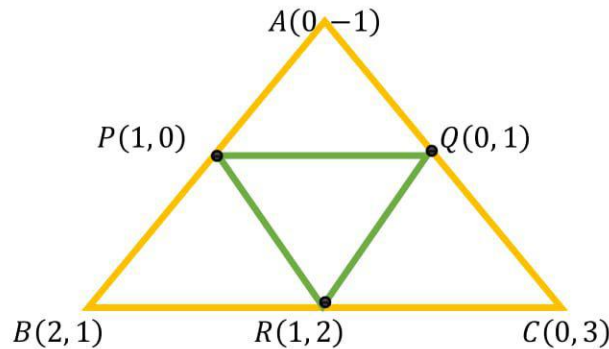
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Question 3:

Find the area of the triangle formed by joining the mid-points of the sides of the triangle whose vertices are $(0, -1)$, $(2, 1)$ and $(0, 3)$. Find the ratio of this area to the area of the given triangle.

Answer 3:

Let PQR be the triangle formed by the mid-points of triangle whose vertices are $A(0, -1)$, $B(2, 1)$ and $C(0, 3)$.



Coordinates of mid-points of $AB = P\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = P\left(\frac{0+2}{2}, \frac{-1+1}{2}\right) = P(1, 0)$

Coordinates of mid-points of $BC = R\left(\frac{2+0}{2}, \frac{1+3}{2}\right) = R(1, 2)$

Coordinates of mid-points of $AC = Q\left(\frac{0+0}{2}, \frac{-1+3}{2}\right) = Q(0, 1)$

Area of triangle PQR, formed by mid-points of sides of triangle ABC

$$= \frac{1}{2} [1(2 - 1) + 1(1 - 0) + 0(0 - 1)] = \frac{1}{2} [2] = 1 \text{ square units}$$

Area of triangle ABC

$$= \frac{1}{2} [0(1 - 3) + 2\{3 - (-1)\} + 0(-1 - 1)] = \frac{1}{2} [8] = 4 \text{ square units}$$

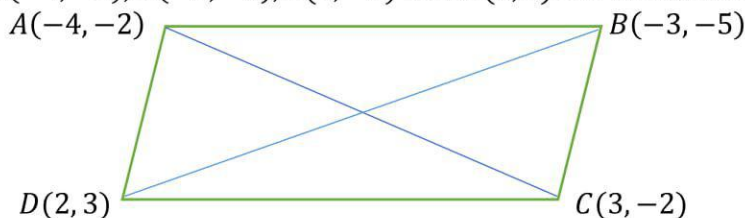
Hence, $\frac{\text{Area of triangle PQR}}{\text{Area of triangle ABC}} = \frac{1}{4}$

Question 4:

Find the area of the quadrilateral whose vertices, taken in order, are $(-4, -2)$, $(-3, -5)$, $(3, -2)$ and $(2, 3)$.

Answer 4:

Given: Points $A(-4, -2)$, $B(-3, -5)$, $C(3, -2)$ and $D(2, 3)$ are the vertices of quadrilateral.



Area of triangle ABC

$$= \frac{1}{2} [(-4)\{-5 - (-2)\} + (-3)\{-2 - (-2)\} + 3\{-2 - (-5)\}]$$
$$= \frac{1}{2} [12 + 0 + 9]$$

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$$= \frac{1}{2} [21] = 10.5 \text{ square units}$$

Area of triangle ACD

$$= \frac{1}{2} [(-4)(-2 - 3) + 3\{3 - (-2)\} + 2\{-2 - (-2)\}]$$

$$= \frac{1}{2} [20 + 15 + 0] = \frac{1}{2} [35] = 17.5 \text{ square units}$$

Area of quadrilateral $ABCD$ = Area of triangle ABC + Area of triangle ACD

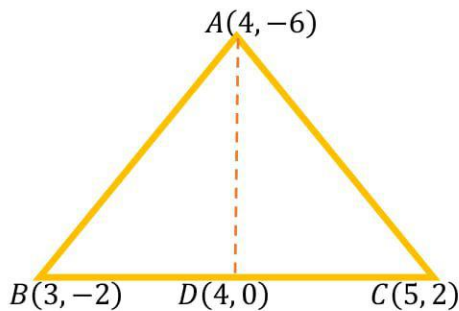
$$\Rightarrow \text{Area of quadrilateral } ABCD = (10.5 + 17.5) \text{ square units} = 28 \text{ square units}$$

Question 5:

You have studied in Class IX, (Chapter 9, Example 3), that a median of a triangle divides it into two triangles of equal areas. Verify this result for ΔABC whose vertices are $A(4, -6)$, $B(3, -2)$ and $C(5, 2)$.

Answer 5:

The vertices of triangle ABC are $A(4, -6)$, $B(3, -2)$ and $C(5, 2)$.



$$\text{Coordinates of mid-points of } BC = D \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) = D \left(\frac{3+5}{2}, \frac{-2+2}{2} \right) = D(4, 0)$$

Area of triangle ABD

$$= \frac{1}{2} [4(-2 - 0) + 3\{0 - (-6)\} + 4\{-6 - (-2)\}]$$

$$= \frac{1}{2} [-8 + 18 - 16] = \frac{1}{2} [-6] = -3 = 3 \text{ square units}$$

Area of triangle ACD

$$= \frac{1}{2} [4(2 - 0) + 5\{0 - (-6)\} + 4(-6 - 2)]$$

$$= \frac{1}{2} [8 + 30 - 32] = \frac{1}{2} [6] = 3 \text{ square units}$$

\Rightarrow Area of triangle ABD = Area of triangle ACD = 3 square units

Hence, a median of a triangle divides it into two triangles of equal areas.