

### Exercise 13(A)

1. Calculate the co-ordinates of the point P which divides the line segment joining:

(i) A (1, 3) and B (5, 9) in the ratio 1: 2.

(ii) A (-4, 6) and B (3, -5) in the ratio 3: 2.

**Solution:**

(i) Let's assume the co-ordinates of the point P be (x, y)

Then by section formula, we have

$$P(x, y) = (m_1x_2 + m_2x_1) / (m_1 + m_2), (m_1y_2 + m_2y_1) / (m_1 + m_2)$$

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2} = \frac{1 \times 5 + 2 \times 1}{1 + 2} = \frac{7}{3}$$

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = \frac{1 \times 9 + 2 \times 3}{1 + 2} = \frac{15}{3} = 5$$

Hence, the co-ordinates of point P are (7/3, 5).

(ii) Let's assume the co-ordinates of the point P be (x, y)

Then by section formula, we have

$$P(x, y) = (m_1x_2 + m_2x_1) / (m_1 + m_2), (m_1y_2 + m_2y_1) / (m_1 + m_2)$$

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2} = \frac{3 \times 3 + 2 \times (-4)}{3 + 2} = \frac{1}{5}$$

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = \frac{3 \times (-5) + 2 \times 6}{3 + 2} = \frac{-3}{5}$$

Hence, the co-ordinates of point P are (1/5, -3/5).

2. In what ratio is the line joining (2, -3) and (5, 6) divided by the x-axis.

**Solution:**

Let's assume the joining points as A(2, -3) and B(5, 6) be divided by point P(x, 0) in the ratio k: 1.

Then we have,

$$y = ky_2 + y_1 / (k + 1)$$

$$0 = 6k + (-3) / (k + 1)$$

$$0 = 6k - 3$$

$$k = \frac{1}{2}$$

Hence, the required ratio is 1: 2.

3. In what ratio is the line joining (2, -4) and (-3, 6) divided by the y-axis.

**Solution:**

Let's assume the line joining points A(2, -4) and B(-3, 6) be divided by point P (0, y) in the ratio k: 1.

Then we have,

$$x = kx_2 + x_1 / (k + 1)$$

$$0 = k(-3) + (1 \times 2) / (k + 1)$$

$$0 = -3k + 2$$

$$k = \frac{2}{3}$$

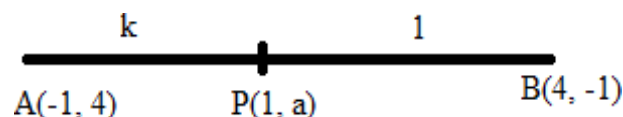
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**Chapter 13: Section and Mid-Point Formula**

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Hence, the required ratio is 2: 3.

**4. In what ratio does the point (1, a) divided the join of (-1, 4) and (4, -1)? Also, find the value of a.**

**Solution:**



Let's assume the point P (1, a) divide the line segment AB in the ratio k: 1.

Then by section formula, we have

$$1 = \frac{(4k - 1)}{(k + 1)},$$

$$k + 1 = 4k - 1$$

$$2 = 3k$$

$$k = \frac{2}{3} \dots\dots (1)$$

And,

$$a = \frac{(-k + 4)}{(k + 1)}$$

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

$$a = \frac{10}{5} = 2$$

Thus, the required ratio is 2: 3 and a = 2.

**5. In what ratio does the point (a, 6) divide the join of (-4, 3) and (2, 8)? Also, find the value of a.**

**Solution:**

Let's assume the point P (a, 6) divides the line segment joining A (-4, 3) and B (2, 8) in the ratio k: 1.

Then by section formula, we have

$$6 = \frac{(8k + 3)}{(k + 1)},$$

$$6k + 6 = 8k + 3$$

$$3 = 3k$$

$$k = \frac{3}{2} \dots\dots (1)$$

$$a = \frac{(2k - 4)}{(k + 1)}$$

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

$$a = -\frac{2}{5}$$

Thus, the required ratio is 3: 2 and a = -2/5

**6. In what ratio is the join of (4, 3) and (2, -6) divided by the x-axis. Also, find the co-ordinates of the point of intersection.**

**Solution:**

Let's assume the point P (x, 0) on x-axis divides the line segment joining A (4, 3) and B (2, -6) in the ratio k: 1.

Then by section formula, we have

$$0 = \frac{(-6k + 3)}{(k + 1)}$$

$$0 = -6k + 3$$

$$k = \frac{1}{2}$$

Hence, the required ratio is 1: 2

## Chapter 13: Section and Mid-Point Formula

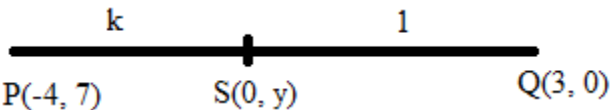
And,

$$\begin{aligned}x &= (2k + 4)/(k + 1) \\ &= \{2(1/2) + 4\} / \{k + 1\} \\ &= 10/3\end{aligned}$$

Therefore, the required co-ordinates of the point of intersection are  $(10/3, 0)$ .

**7. Find the ratio in which the join of  $(-4, 7)$  and  $(3, 0)$  is divided by the y-axis. Also, find the coordinates of the point of intersection.**

**Solution:**



Let's assume S  $(0, y)$  be the point on y-axis which divides the line segment PQ in the ratio k: 1.

Then by section formula, we have

$$0 = (3k - 4)/(k + 1)$$

$$3k = 4$$

$$k = 4/3 \dots (1)$$

$$y = (0 + 7)/(k + 1)$$

$$y = 7/(4/3 + 1) \quad [\text{From (1)}]$$

$$y = 3$$

Thus, the required ratio is 4: 3 and the required point is S $(0, 3)$ .

**8. Points A, B, C and D divide the line segment joining the point  $(5, -10)$  and the origin in five equal parts. Find the co-ordinates of A, B, C and D.**

**Solution:**



Point A divides PO in the ratio 1: 4.

So, the co-ordinates of point A are

$$\left( \frac{1 \times 0 + 4 \times 5}{1 + 4}, \frac{1 \times 0 + 4 \times (-10)}{1 + 4} \right) = \left( \frac{20}{5}, \frac{-40}{5} \right) = (4, -8)$$

Next, point B divides PO in the ratio 2: 3.

So, co-ordinates of point B are

$$\left( \frac{2 \times 0 + 3 \times 5}{2 + 3}, \frac{2 \times 0 + 3 \times (-10)}{2 + 3} \right) = \left( \frac{15}{5}, \frac{-30}{5} \right) = (3, -6)$$

And, point C divides PO in the ratio 3: 2.

Co-ordinates of point C are

$$\left( \frac{3 \times 0 + 2 \times 5}{3 + 2}, \frac{3 \times 0 + 2 \times (-10)}{3 + 2} \right) = \left( \frac{10}{5}, \frac{-20}{5} \right) = (2, -4)$$

Lastly, point D divides PO in the ratio 4: 1.

Co-ordinates of point D are

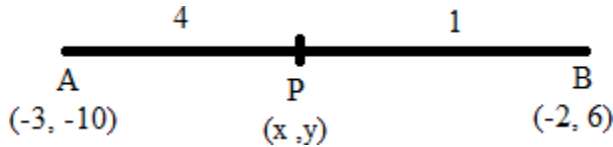
$$\left( \frac{4 \times 0 + 1 \times 5}{4 + 1}, \frac{4 \times 0 + 1 \times (-10)}{4 + 1} \right) = \left( \frac{5}{5}, \frac{-10}{5} \right) = (1, -2)$$

## Chapter 13: Section and Mid-Point Formula

9. The line joining the points A (-3, -10) and B (-2, 6) is divided by the point P such that  $PB/AB = 1/5$  Find the co-ordinates of P.

**Solution:**

Let the coordinates of point P be taken as (x, y).



Given,

$$PB: AB = 1: 5$$

$$\text{So, } PB: PA = 1: 4$$

Hence, the coordinates of P are

$$(x, y) = \left( \frac{4 \times (-2) + 1 \times (-3)}{5}, \frac{4 \times 6 + 1 \times (-10)}{5} \right) = \left( -\frac{11}{5}, \frac{14}{5} \right)$$

10. P is a point on the line joining A (4, 3) and B (-2, 6) such that  $5AP = 2BP$ . Find the co-ordinates of P.

**Solution:**

$$5AP = 2BP$$

$$\text{So, } AP/BP = 2/5$$

Hence, the co-ordinates of the point P are

$$\left( \frac{2x(-2) + 5x4}{2 + 5}, \frac{2x6 + 5x3}{2 + 5} \right)$$

$$(16/7, 27/7)$$

11. Calculate the ratio in which the line joining the points (-3, -1) and (5, 7) is divided by the line  $x = 2$ . Also, find the co-ordinates of the point of intersection.

**Solution:**

We know that,

The co-ordinates of every point on the line  $x = 2$  will be of the type (2, y).

So from section formula, we have

$$x = m_1 \times 5 + m_2 \times (-3) / (m_1 + m_2)$$

$$2 = 5m_1 - 3m_2 / m_1 + m_2$$

$$2m_1 + 2m_2 = 5m_1 - 3m_2$$

$$5m_2 = 3m_1$$

Hence, the required ratio is 5: 3.

$$y = (m_1 \times 7 + m_2 \times (-1)) / (m_1 + m_2)$$

$$y = 5 \times 7 + 3 \times (-1) / 5 + 3$$

$$y = 35 - 3 / 8$$

$$y = 32/8 = 4$$

Therefore, the required co-ordinates of the point of intersection are (2, 4).

12. Calculate the ratio in which the line joining A (6, 5) and B (4, -3) is divided by the line  $y = 2$ .

**Solution:**

We know that,

The co-ordinates of every point on the line  $y = 2$  will be of the type  $(x, 2)$ .

So, by section formula, we have

$$y = \frac{m_1 \times (-3) + m_2 \times 5}{m_1 + m_2}$$

$$2 = \frac{-3m_1 + 5m_2}{m_1 + m_2}$$

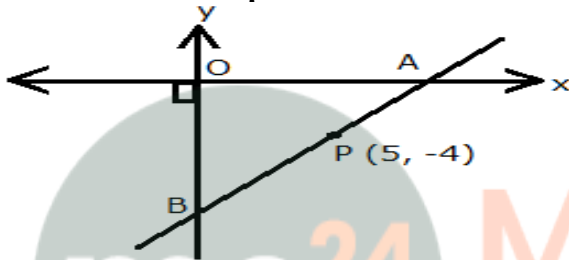
$$2m_1 + 2m_2 = -3m_1 + 5m_2$$

$$5m_1 = 3m_2$$

$$m_1 / m_2 = 3/5$$

Hence, the required ratio is 3: 5.

**13. The point P (5, -4) divides the line segment AB, as shown in the figure, in the ratio 2: 5. Find the co-ordinates of points A and B. Given AP is smaller than BP**



**Solution:**

From the diagram we can see that,

Point A lies on x-axis. So, its co-ordinates can be taken as A  $(x, 0)$ .

Point B lies on y-axis. So, its co-ordinates can be taken as B  $(0, y)$ .

And, P divides AB in the ratio 2: 5. (Given)

Now, we have

$$x = \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}$$

$$5 = \frac{2 \times 0 + 5 \times x}{2 + 5}$$

$$5 = 5x/7$$

$$x = 7$$

Hence, the co-ordinates of point A are  $(7, 0)$ .

$$y = \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$$

$$-4 = \frac{2 \times y + 5 \times 0}{2 + 5}$$

$$-4 = 2y/7$$

$$-2 = y/7$$

$$y = -14$$

Hence, the co-ordinates of point B are  $(0, -14)$