DIVISION OF A LINE SEGMENT IN A GIVEN RATIO IN THE PLANE

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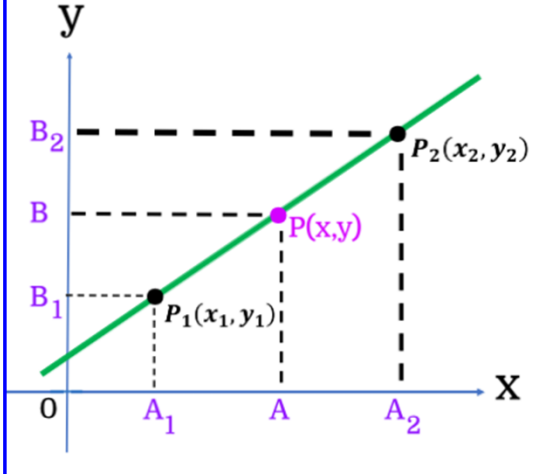
Given a line defined by the points $P_1(x_1, y_1)$, $P(x,y) \wedge P_2(x_2, y_2)$:



Hence: $r = \dfrac{\overline{P_1P}}{\overline{PP_2}} \vee r = \overline{P_1P} : \overline{PP_2}$

$$r = \frac{x - x_1}{x_2 - x}$$
$$r(x_2 - x) = x - x_1$$
$$rx_2 - rx = x - x_1$$
$$-x - rx = -x_1 - rx_2$$
$$(-1)(-x - rx) = (-x_1 - rx_2)(-1)$$
$$x + rx = x_1 + rx_2$$
$$x(1 + r) = x_1 + rx_2$$

$$\boxed{x = \frac{x_1 + rx_2}{1 + r}} \qquad r \neq -1$$

Analogously:

$$\boxed{y = \frac{y_1 + ry_2}{1 + r}} \qquad r \neq -1$$

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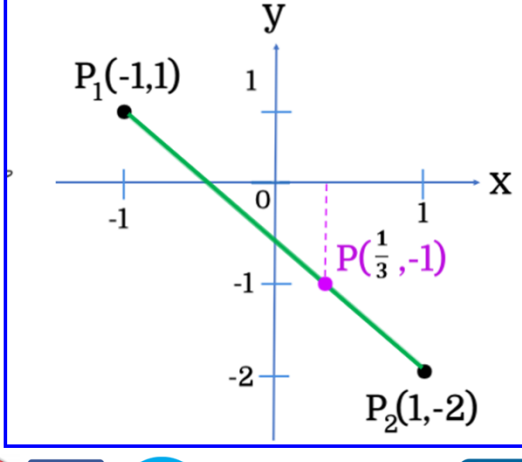
EXAMPLE: What is the coordinate of the division point of the line segment defined by the endpoints $P_1(-1,1)$ and $P_2(1,-2)$ in a given ratio $r = \frac{\overline{P_1P}}{\overline{PP_2}} = 2$?

SOLUTION:



Finding the abscissa and ordinate of the point:

$$x = \frac{x_1 + rx_2}{1 + r}$$

$$x = \frac{-1 + (2)(1)}{1 + (2)}$$

$$x = \frac{-1 + 2}{1 + 2}$$

$$x = \frac{1}{3}$$

$$y = \frac{y_1 + ry_2}{1 + r}$$

$$y = \frac{1 + (2)(-2)}{1 + (2)}$$

$$y = \frac{1 - 4}{1 + 2}$$

$$y = \frac{-3}{3}$$

$$y = -1$$

$P(x,y) = P(\frac{1}{3}, -1)$ ✓

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