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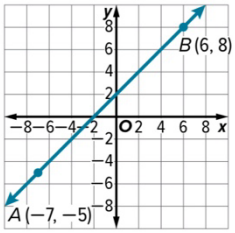
§1.6 Locating Points on a Coordinate Plane

Today we will learn how to find a point on a directed line segment that is a fractional distance of a total distance or a ratio of two segments.

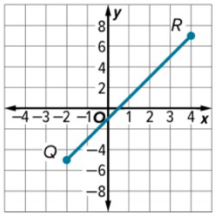
Key Concept • Locating a Point at a Fractional Distance on the Coordinate Plane

The coordinates of a point on a line segment that is $\frac{a}{b}$ of the distance from initial endpoint $A(x_1, y_1)$ to terminal endpoint $C(x_2, y_2)$ are given by $\left(x_1 + \frac{a}{b}(x_2 - x_1), y_1 + \frac{a}{b}(y_2 - y_1)\right)$, where $\frac{a}{b}$ is the fraction of the distance if $b \neq 0$.

Example 1.6.1: Find C on AB that is $\frac{3}{4}$ of the distance from A to B.

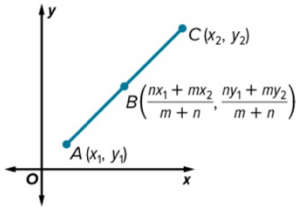


Example 1.6.2: Find P on QR that is $\frac{1}{6}$ of the distance from Q to R.



Key Concept • Section Formula on the Coordinate Plane

If A has coordinates (x_1, y_1) and C has coordinates (x_2, y_2), then a point B that partitions the line segment in a ratio of $m:n$ has coordinates $B\left(\frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n}\right)$, where $m \neq n$.



Activity 1.6.3: Find C on AB such that the ratio of AC to CB is $1:2$.

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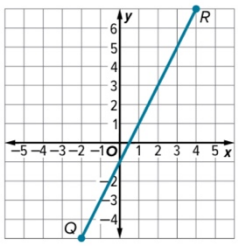
Example 1.6.4: Find S on QR such that the ratio of QS to SR is $2:1$.

Ⓐ (4, 8)
Ⓑ (2, 3)
Ⓒ (1, 1)
Ⓓ (0, −1)



Activity 1.6.5: CITY PLANNING The United States Capitol is located at $(2, -4)$ on a coordinate grid. The White House is located at $(-10, 16)$ on the same coordinate grid. Find a point on the line between the United States Capitol and the White House such that the ratio is $1:3$.

Activity 1.6.6: TRAVEL Andre is traveling from Jeffersonville to Springfield. He plans to stop for a break when the distance he has traveled and the distance he has left to travel have a ratio of 3:7. Where should Andre stop for a break?

Ⓐ (13, 12.5)
Ⓑ (22, 12.5)
Ⓒ (−3, 6.5)
Ⓓ (−12, 6.5)