1.3.10

Shivam Sawarkar
AI25BTECH110031

August 28, 2025

Question

Find the ratio in which the point $\mathbf{P}(8, y)$ divides the line segment joining the points $\mathbf{A}(1, 2)$ and $\mathbf{B}(2, 3)$. Also, find the value of y.

Theoretical Solution

Let the vectors be

$$\mathbf{P} = \begin{bmatrix} 8 \\ y \end{bmatrix}, \quad \mathbf{A} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$$

Equation

If $\mathbf{P}$ divides $\mathbf{B} - \mathbf{A}$ in the ratio $k : 1$, then

$$\mathbf{P} = \frac{k\mathbf{B} + \mathbf{A}}{k + 1}$$

Substitution

From the x-coordinate:

$$8 = \frac{2k+1}{k+1}$$

$$8(k+1) = 2k+1 \implies 8k+8 = 2k+1 \implies 6k = -7 \implies k = -\frac{7}{6}$$

From the y-coordinate:

$$y = \frac{3k+2}{k+1}$$

Substitute $k = -\frac{7}{6}$:

$$y = \frac{3(-\frac{7}{6})+2}{-\frac{7}{6}+1} = \frac{-\frac{7}{2}+2}{-\frac{1}{6}} = \frac{-\frac{3}{2}}{-\frac{1}{6}} = 9$$

Final Answer

$$\text{Ratio } = -7:6 \quad \text{(external division)}, \quad y = 9$$

C Code

```c
#include <stdio.h>

void find_y_and_ratio() {
    double x1=1, y1=2, x2=2, y2=3;
    double xp=8, yp;
    double k;

    // solve for ratio using x-coordinate
    k = (xp - x1) / (x2 - xp);

    // solve for y-coordinate
    yp = (k*y2 + y1) / (k+1);

    printf("Ratio = %.2f : 1\n", k);
    printf("y = %.2f\n", yp);
}
```

C Code

```
int main() {
    find_y_and_ratio();
    return 0;
}
```

Python Code

```
def find_y_and_ratio():
    A = (1,2)
    B = (2,3)
    Px = 8

    # solve for ratio using x-coordinate
    k = (Px - A[0]) / (B[0] - Px)

    # solve for y-coordinate
    y = (k*B[1] + A[1]) / (k+1)

    print("Ratio = {:.2f} : 1".format(k))
    print("y =", y)

find_y_and_ratio()
```

Plot

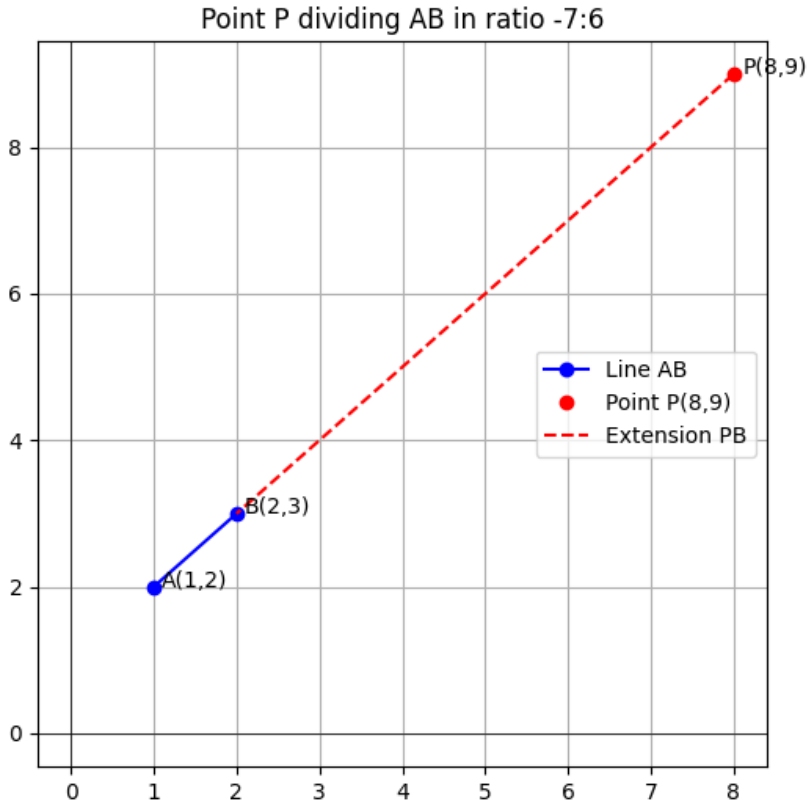
Point P dividing AB in ratio -7:6
P(8,9)
B(2,3)
A(1,2)
Line AB
Point P(8,9)
Extension PB
0
2
4
6
8
0
1
2
3
4
5
6
7
8

Figure: