Problem 1.5.5

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Problem Statement

Find the coordinates of the point which divides the line segment joining the points **A** $(7, -1)$ and **B** $(-3, -4)$ in the ratio $2 : 3$ is . . . .

Section Formula

Formula:

$$\mathbf{P} = \frac{k(\mathbf{B}) + (\mathbf{A})}{k + 1} \tag{3.1}$$

Where:

'k' is the ratio in which the point divides the line segment

$$\mathbf{A} = \begin{pmatrix} 7 \\ -1 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} -3 \\ -4 \end{pmatrix} \tag{3.2}$$

Obtaining k Value

According to the problem , The point **P** divides the line segment joining **A** and **B** in the ratio 2 : 3
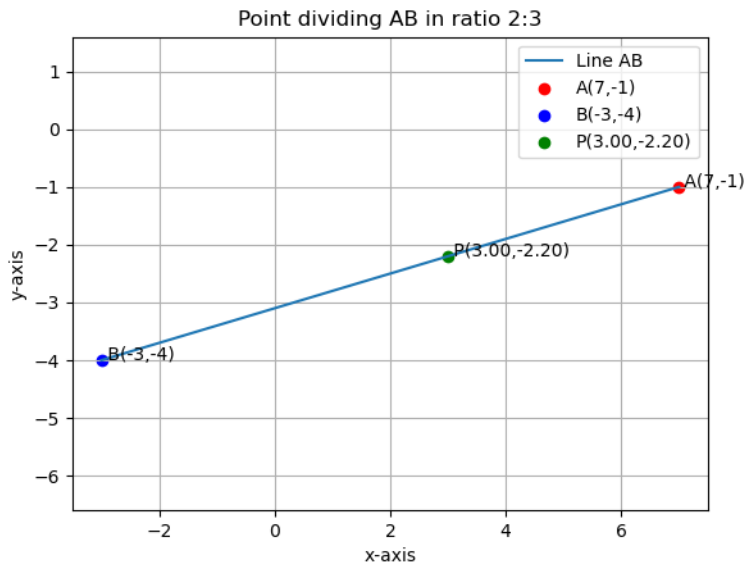
$$\text{Hence , } k = 2/3$$

Obtaining Point

$$\mathbf{P} = \frac{2\mathbf{B} + 3\mathbf{A}}{5} = \frac{2\begin{pmatrix} 7 \\ -1 \end{pmatrix} + \begin{pmatrix} -3 \\ -4 \end{pmatrix}}{5} = \frac{\begin{pmatrix} 15 \\ -11 \end{pmatrix}}{5} \tag{3.3}$$

$$\mathbf{P} = \begin{pmatrix} \frac{15}{5} \\ \frac{-11}{5} \end{pmatrix} \tag{3.4}$$

Hence the coordinates of $\mathbf{P}$ are $\left(3, \frac{-11}{5}\right)$

Plot

Point dividing AB in ratio 2:3

C Code for generating points on line

```c
  #include <stdio.h>

//Store the given values as global constants
const int Ax = 7, Ay = -1;
 const int bx = -3 , By =-4 ;
 const int m =2,n=3;

 // Function to compute the dividing point
 void get_dividing_point(float *Px, float *Py)
 {
 *Px=(n*Ax + m*Bx)/(float)(m+n);
 *Py=(n*Ay + m*By)/(float)(m+n);
 }

 //Function to print stored values
```

C Code for generating points on line

```c
void print_values()
{
printf("Point A = (%d,%d)\n",Ax,Ay);
printf("Point B = (%d,%d)\n",Bx,By);
printf("Ratio m;n = %d:%d\n",m,n);
}
```

Python Code for Plotting

```python
import sys
import math
sys.path.insert(0, '/home/mahesh-chollangi/Downloads/matgeo/codes/CoordGeo')

import numpy as np
import numpy.linalg as LA
import matplotlib.pyplot as plt
import matplotlib.image as mpimg

# local imports
from line.funcs import *
from triangle.funcs import *

# Points A and B
A = np.array([7, -1])
B = np.array([-3, -4])
```

Python Code for Plotting

```python
# Ratio m:n = 2:3
m, n = 2, 3

# Section formula in vector form: P = (nA + mB) / (m+n)
P = (n*A + m*B) / (m+n)

# Generate line coordinates for plotting
line_AB = line_gen(A, B)

# Plotting
plt.plot(line_AB[0,:], line_AB[1,:], label="Line AB") # Line AB
plt.scatter(A[0], A[1], color='red', label='A(7,-1)')
plt.scatter(B[0], B[1], color='blue', label='B(-3,-4)')
plt.scatter(P[0], P[1], color='green', label=f'P({P[0]:.2f},{P
    [1]:.2f})')

# Add text labels
plt.text(A[0], A[1], ' A(7,-1)', fontsize=10)
```

Python Code for Plotting

```python
plt.text(B[0], B[1], ' B(-3,-4)', fontsize=10)
plt.text(P[0], P[1], f' P({P[0]:.2f},{P[1]:.2f})', fontsize=10)

# Formatting
plt.xlabel('x-axis')
plt.ylabel('y-axis')
plt.legend()
plt.grid(True)
plt.axis('equal')
plt.title("Point dividing AB in ratio 2:3")
plt.savefig("../figs/plot.png")
plt.show()
```