Problem 1.4.5

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Question:
Find the coordinates of the point **P** on AD such that AP : PD = 2 : 1.

Solution

Solution:
As nothing is mentioned in the question about the coordinates of A and D , so we are assuming the coordinates of A as (2,2) ,D as (-1,-1) .

$$\mathbf{A} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} -1 \\ -1 \end{pmatrix}. \tag{0.1}$$

as mentioned in the question **P** is dividing the join of A and D in $2:1$. so for finding the position vector of **P** we are using section formula

section formula

section formula
If **D** divides BC in the ratio k : 1

$$\mathbf{D} = \frac{k\mathbf{C} + \mathbf{B}}{k + 1}$$

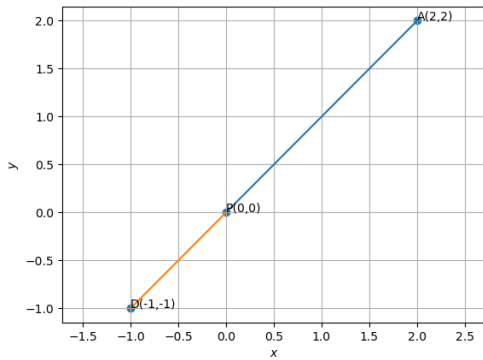# OBTAINING COORDINATES

k=2
the position vector of **P** is :

$$\mathbf{P} = \frac{2\mathbf{D} + \mathbf{A}}{2 + 1}$$

$$\mathbf{P} = \frac{2\begin{pmatrix} -1 \\ -1 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix}}{2 + 1} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

hence the position vector of **P** is : $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$

C Code

```c
#include <stdio.h>

int main() {
    // Coordinates of A and D
    float Ax = 2.0, Ay = 2.0;
    float Dx = -1.0, Dy = -1.0;

    // Ratio AP:PD = 2:1
    float m = 2.0, n = 1.0;

    // Section formula: P = (m*D + n*A)/(m+n)
    float Px = (m*Dx + n*Ax) / (m + n);
    float Py = (m*Dy + n*Ay) / (m + n);

    printf("The coordinates of point P are: (%.2f, %.2f)\n", Px,
        Py);
    return 0;
}
```

Python Code for Plotting

```python
import math
import sys

import numpy as np
import numpy.linalg as LA
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
from line.funcs import *
#from triangle.funcs import *
#from conics.funcs import circ_gen
#if using termux
import subprocess
import shlex
#end if

A = np.array([2,2]).reshape(-1,1)
P = np.array([0,0]).reshape(-1,1)
D = np.array([-1,-1]).reshape(-1,1)
coords = np.block([[A,P,D]])
```

Python Code for Plotting

```python
AP = line_gen(A,P)
PD = line_gen(P,D)

plt.plot(AP[0,:],AP[1,:])
plt.plot(PD[0,:],PD[1,:])

plt.scatter(coords[0,:],coords[1,:])


plt.text(A[0],A[1],"A(2,2)")
plt.text(P[0],P[1],"P(0,0)")
plt.text(D[0],D[1],"D(-1,-1)")
```

Python Code for Plotting

```python
plt.xlabel('$x$')
plt.ylabel('$y$')
plt.legend(loc='best')
plt.grid() # minor
plt.axis('equal')

plt.savefig('../figs/img.png')
```