

## Problem 1.4.5

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## Question

**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) .

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

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 :

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

In matrix form:

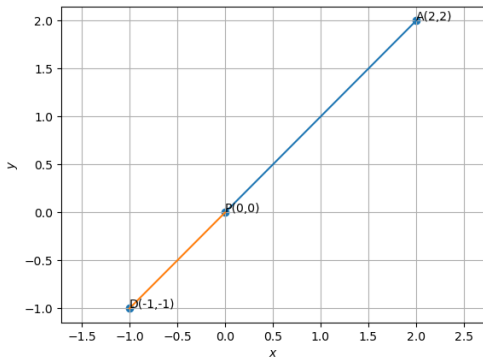
$$\mathbf{P} = \frac{1}{3} (\mathbf{D} \quad \mathbf{A}) \begin{pmatrix} 2 \\ 1 \end{pmatrix} \quad (0.2)$$

## Solution

$$\mathbf{P} = \frac{1}{3} \begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \end{pmatrix} \quad (0.3)$$

$$= \frac{1}{3} \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (0.4)$$

$$= \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (0.5)$$



## C Code

```
#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

```
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

```
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

```
plt.xlabel('$x$')  
plt.ylabel('$y$')  
plt.legend(loc='best')  
plt.grid() # minor  
plt.axis('equal')  
  
plt.savefig('../figs/img.png')
```