2.10.30

EE25BTECH11001 - Aarush Dilawri

September 19, 2025

Solution

We have position vectors

$$\mathbf{A} = \begin{pmatrix} 60 \\ 3 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 40 \\ -6 \end{pmatrix}, \quad \mathbf{C} = \begin{pmatrix} a \\ -52 \end{pmatrix}. \tag{1}$$

Solution

Now,

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} -20 \\ -9 \end{pmatrix}, \tag{2}$$

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} a - 60 \\ -55 \end{pmatrix}. \tag{3}$$

Solution

For collinearity, we require

$$\mathbf{C} - \mathbf{A} = \lambda(\mathbf{B} - \mathbf{A}). \tag{4}$$

Thus,

$$\begin{pmatrix} a - 60 \\ -55 \end{pmatrix} = \lambda \begin{pmatrix} -20 \\ -9 \end{pmatrix}. \tag{5}$$

Solution

From the second component,

$$-55 = -9\lambda \tag{6}$$

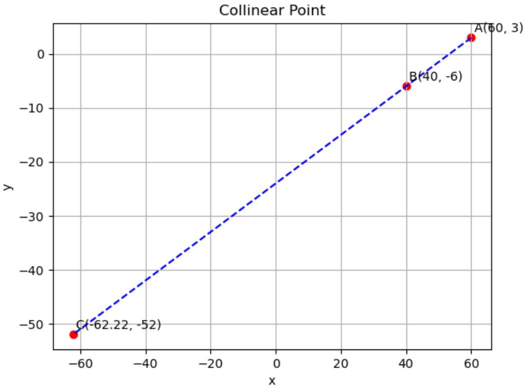
$$\Rightarrow \lambda = \frac{55}{9}. \tag{7}$$

Solution

Substituting in the first component,

$$a = -\frac{560}{9}. \tag{8}$$

Figure


Collinear Point
A(60, 3)
B(40, -6)
C(-62.22, -52)
0
−10
−20
−30
−40
−50
−60
−40
−20
0
20
40
60
x
y

C Code (code.c)

```
#include <stdio.h>

double find_a(double x1, double y1, double x2, double y2, double y3) {
    double u1 = x2 - x1;
    double u2 = y2 - y1;
    double v2 = y3 - y1;

    double lambda = v2 / u2;

    double a = x1 + lambda * u1;
    return a;
}
```

Python Code (code.py)

```
import numpy as np
import matplotlib.pyplot as plt

x1, y1 = 60, 3
x2, y2 = 40, -6
y3 = -52

u1, u2 = (x2 - x1), (y2 - y1)
lambda_val = (y3 - y1) / u2
a = x1 + lambda_val * u1
print("Value of a =", a)

A = np.array([x1, y1])
B = np.array([x2, y2])
C = np.array([a, y3])
```

Python Code (code.py)

```
plt.scatter([A[0], B[0], C[0]], [A[1], B[1], C[1]], color=”blue”)

plt.text(A[0] + 1, A[1] + 1, ”A(60,-3)”, fontsize=10, color=”black”)
plt.text(B[0] + 1, B[1] + 1, ”B(40,-—6)”, fontsize=10, color=”black”)
plt.text(C[0] + 1, C[1] + 1, f”C({a:.2f},-—52)”, fontsize=10, color=”black
    ”)

plt.plot([A[0], B[0], C[0]], [A[1], B[1], C[1]], linestyle=”——”, color=”red”)

plt.xlabel(”x”)
plt.ylabel(”y”)
plt.title(”Collinear-Points”)
plt.grid(True)
plt.show()
```

Python Code (nativecode.py)

```
import ctypes
import numpy as np
import matplotlib.pyplot as plt

lib = ctypes.CDLL("./code.so")
lib.find_a.argtypes = [ctypes.c_double, ctypes.c_double,
                       ctypes.c_double, ctypes.c_double,
                       ctypes.c_double]
lib.find_a.restype = ctypes.c_double

x1, y1 = 60, 3
x2, y2 = 40, -6
y3 = -52

a = lib.find_a(x1, y1, x2, y2, y3)
print("Value of a =", a)
```

Python Code (nativecode.py)

```
plt.scatter([A[0], B[0], C[0]], [A[1], B[1], C[1]], color="red")

plt.text(A[0] + 1, A[1] + 1, "A(60, 3)", fontsize=10, color="black")
plt.text(B[0] + 1, B[1] + 1, "B(40, −6)", fontsize=10, color="black")
plt.text(C[0] + 1, C[1] + 1, f"C({a:.2f}, −52)", fontsize=10, color="black
    ")

plt.plot([A[0], B[0], C[0]], [A[1], B[1], C[1]], linestyle="−−", color="blue"
    )

plt.xlabel("x")
plt.ylabel("y")
plt.title("Collinear Points")
plt.grid(True)
plt.show()
```