1.6.23

AI25BTECH11008
Chiruvella Harshith Sharan

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Question

Are the points A(3,1), B(6,4), and C(8,6) collinear?

Theoretical Solution

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 6-3 \\ 4-1 \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

$$\mathbf{C} - \mathbf{A} = \begin{pmatrix} 8-3 \\ 6-1 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix}$$

Clearly, $\mathbf{C} - \mathbf{A} = \frac{5}{3}(\mathbf{B} - \mathbf{A})$

$\implies$ The two vectors are linearly dependent.

Therefore, the points A(3,1), B(6,4), and C(8,6) are collinear. (1)

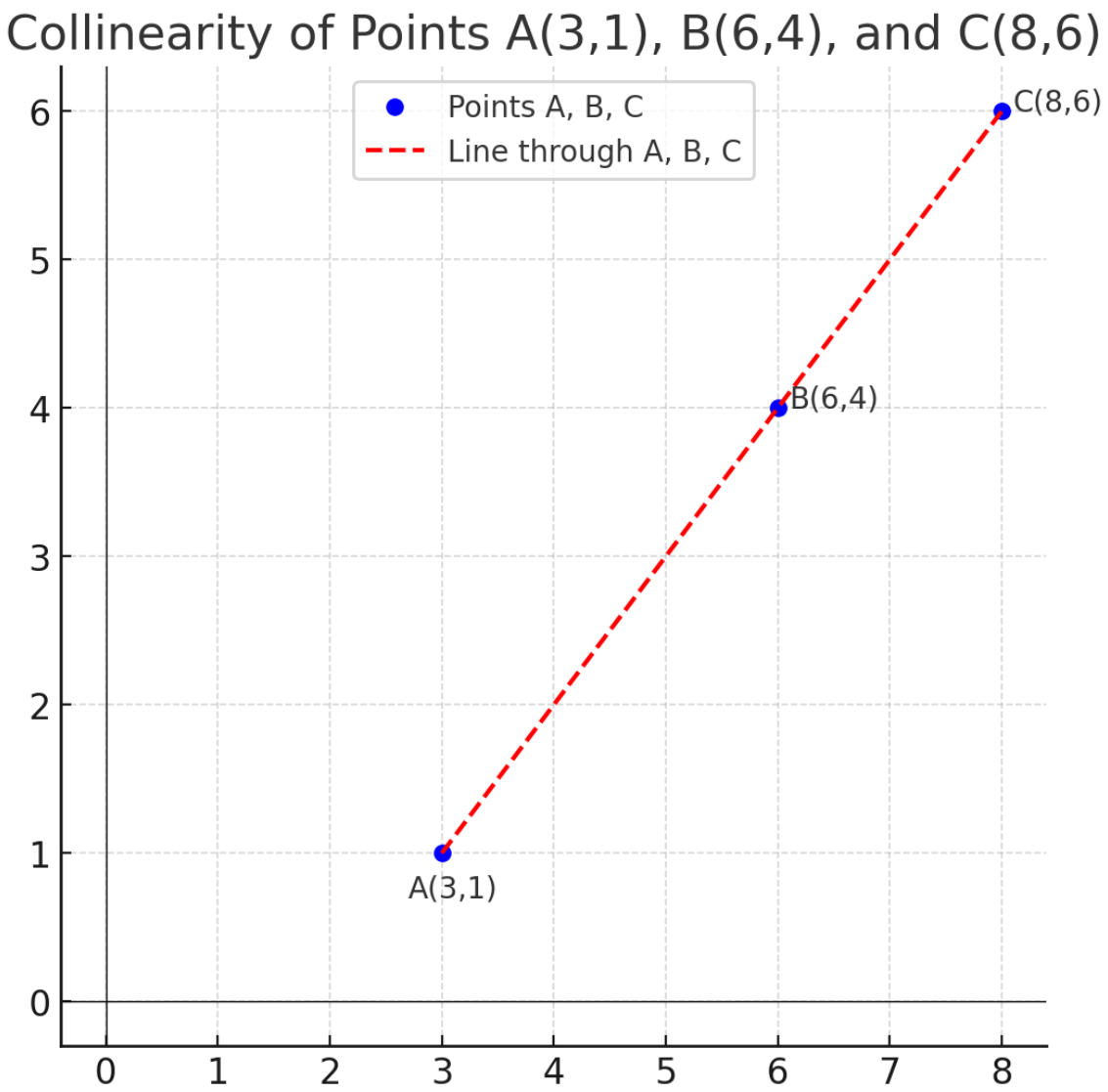
C Code

```c
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
#include libs/matfun.h
#include libs/geofun.h

int main(void) {
    // Points as 2x1 column vectors
    double **A = createMat(2,1);
    double **B = createMat(2,1);
    double **C = createMat(2,1);

    // Set coordinates
    A[0][0] = 3.0; A[1][0] = 1.0;
    B[0][0] = 6.0; B[1][0] = 4.0;
    C[0][0] = 8.0; C[1][0] = 6.0;

    // Calculate direction vectors B-A and C-A
    double **BA = Matsub(B, A, 2, 1);
```

Python Code

```
import matplotlib.pyplot as plt

# Points
A = (3, 1)
B = (6, 4)
C = (8, 6)

# Plot points
points = [A, B, C]
labels = ['A(3,1)', 'B(6,4)', 'C(8,6)']
colors = ['blue', 'orange', 'green']

plt.figure(figsize=(6,6))
for (x,y), label, color in zip(points, labels, colors):
    plt.scatter(x, y, color=color, s=100)
    plt.text(x+0.1, y+0.1, label, fontsize=12)

# Draw line through A, B, C
x_coords = [p[0] for p in points]
```

Plot


Collinearity of Points A(3,1), B(6,4), and C(8,6)
Points A, B, C
Line through A, B, C
C(8,6)
B(6,4)
A(3,1)
0
1
2
3
4
5
6
7
8