

# MatGeo Presentation

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# Problem Statement

Show that the points  $(-2, 3, 5)$ ,  $(1, 2, 3)$  and  $(7, 0, -1)$  are collinear.

# Given Information

Given Points	Description
$(-2, 3, 5)$	Point <b>A</b>
$(1, 2, 3)$	Point <b>B</b>
$(7, 0, -1)$	Point <b>C</b>

# Solution

The matrix

$$(\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^{\top} = \begin{pmatrix} 3 & -1 & -2 \\ 9 & -3 & -6 \end{pmatrix} \quad (1)$$

$$R_2 \implies R_2 - 3R_1 \begin{pmatrix} 3 & -1 & -2 \\ 0 & 0 & 0 \end{pmatrix} \quad (2)$$

has rank of 1.

Hence, it has been proved that the three given points are collinear.

# Why this works:

With reference to the previous slide,

$$\begin{aligned} R_2 - 3R_1 &= \mathbf{0} \\ \implies R_2 &= 3R_1 \end{aligned}$$

$$\implies \mathbf{C} - \mathbf{A} = 3(\mathbf{B} - \mathbf{A}) \implies \mathbf{C} = 3\mathbf{B} - 2\mathbf{A}$$

# C code

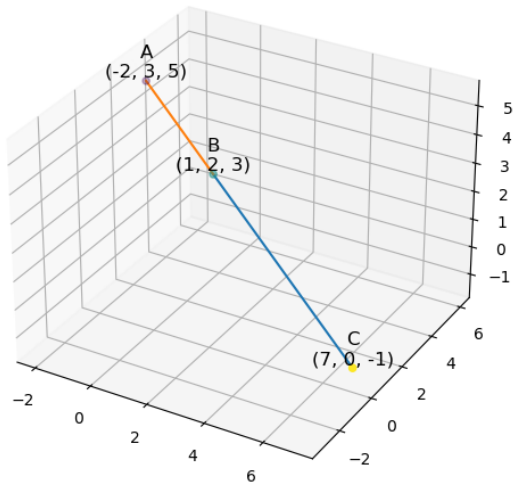
```
#include <stdio.h>
#include <stdlib.h>

double **createMat(int m,int n) {
    int i;
    double **a;
    a = (double **)malloc(m * sizeof( *a));
    for (i=0; i<m; i++)
        a[i] = (double *)malloc(n * sizeof( *a[i]));
    return a;
}

int checkLin(){
    double A[3] = {-2,3,5}, B[3] = {1,2,3}, C[3] = {7,0,-1};
    double **M = createMat(2, 3);
    for(int i=0; i<3; i++){
        M[0][i] = B[i] - A[i];
        M[1][i] = C[i] - A[i]; }
}
```

```
double k = M[1][0] / M[0][0];
for(int i=0; i<3; i++){
    M[1][i] -= k * M[0][i];
}
if(M[1][0]==0){
    if(M[1][1]==0){
        if(M[1][2]==0){
            return 1;
        }
    }
}
else{
    return 0;
}
}
```

# Plot





# Python Code to find RREF of a 3x3 matrix

```
import numpy as np

def rref(A):
    A = A.astype(float)
    rows, cols = A.shape
    r = 0

    for c in range(cols):
        if r >= rows:
            break

        max_row = np.argmax(np.abs(A[r:rows, c])) + r
        if A[max_row, c] == 0:
            continue

        A[[r, max_row]] = A[[max_row, r]]

        A[r] = A[r] / A[r, c]
```

# Python Code to find RREF of a 3x3 matrix

```
for i in range(rows):  
    if i != r:  
        A[i] -= A[i, c] * A[r]  
  
    r += 1  
  
return A
```

```
A = np.array([[ -2,  3,  5],  
              [ 1,  2,  3],  
              [ 7,  0, -1]])
```

```
rref_mat = rref(A)  
print(rref_mat)
```