# Presentation Template

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1. Problem

2. Solution
   - Linear Equation
   - Matrix Equation
   - Row Reduction
   - Line Equation

# Problem Statement

Find equation of line joining (1,2) and (3,6) using determinants.

# Linear Equation

To construct a line joining $\mathrm{A} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\mathrm{B} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$

let n be the normal vector

$$\mathrm{n}^{\mathsf{T}}\mathrm{A} = c \tag{3.1}$$

$$\mathrm{n}^{\mathsf{T}}\mathrm{B} = c \tag{3.2}$$

which results in the following equations

$$\mathrm{A}^{T}\mathrm{n} = c \tag{3.3}$$

$$\mathrm{B}^{T}\mathrm{n} = c \tag{3.4}$$

$$\tag{3.5}$$

# Matrix Equation

Resulting in the matrix

$$\begin{pmatrix} \mathrm{A}^T \\ \mathrm{B}^T \end{pmatrix} \mathrm{n} = \begin{pmatrix} c \\ c \end{pmatrix} \tag{3.6}$$

$$\begin{pmatrix} 1 & 2 \\ 3 & 6 \end{pmatrix} \mathrm{n} = \begin{pmatrix} c \\ c \end{pmatrix} \tag{3.7}$$

where the augmented matrix formed is

$$\begin{pmatrix} 1 & 2 & c \\ 3 & 6 & c \end{pmatrix} \tag{3.8}$$

# Row Reduction

(3.8) can be row reduced as follows

$$\begin{pmatrix} 1 & 2 & c \\ 3 & 6 & c \end{pmatrix} \xleftrightarrow{R_2 \leftarrow 3R_1 - R_2} \begin{pmatrix} 1 & 2 & c \\ 0 & 0 & 2c \end{pmatrix} \tag{3.9}$$

Thus, from the above row reduced matrix has a solution iff "2c=0" ,then points are collinear

From (3.6)

$$\begin{pmatrix} 1 & 2 \end{pmatrix} \mathrm{n} = 0 \tag{3.10}$$

$$\mathrm{m}^T \mathrm{n} = 0 \tag{3.11}$$

Directional vector is

$$\mathrm{m} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \tag{3.12}$$

Normal vector

$$\mathrm{n} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} \tag{3.13}$$

# Line Equation

Thus,The line Equation is

$$\begin{pmatrix} -2 & 1 \end{pmatrix} x = 0 \tag{3.14}$$

The code in

https://github.com/Sekharjala/Assignments/blob/main/code/matrices1.76.1.py

# Figure :Line passing through points (1,2) and (3,6)