# Week 08 Participation Part 1

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07 April 2023

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# 1 Part 1

Consider the set

$$S = \vec{v}_1, \vec{v}_2, \vec{v}_3,$$

where $\vec{v}_1 =< 1, 1, 0 >$, $\vec{v}_2 =< 0, 1, 1 >$, $\vec{v}_3 =< 2, -1, -3 >$.

Verify the following:

**a)** None of the pairs are parallel. That is $v_1$ is not a multiple of $v_2$ nor $v_3$, $v_2$ is not a multiple of $v_1$ nor $v_3$, $v_3$ is not a multiple of $v_1$ nor $v_2$.

**b)** Show that the set is linear dependent by finding a none zero solution to the dependence test equation.

## 1.1 a)

Find if $\vec{v}_1 \parallel \vec{v}_2$:

$$\vec{v}_1 \times \vec{v}_2 =< 1 \cdot 1 - 0 \cdot 1, -(1 \cdot 1 - 0 \cdot 0), 1 \cdot 1 - 1 \cdot 0 >$$
$$\vec{v}_1 \times \vec{v}_2 =< 1, -1, 1 >$$

$$\boxed{< 1, -1, 1 > \neq < 0, 0, 0 > \therefore \vec{v}_1 \nparallel \vec{v}_2}$$

Find if $\vec{v}_1 \parallel \vec{v}_3$:

$$\vec{v}_1 \times \vec{v}_3 =< 1 \cdot -3 - 0 \cdot -1, -(1 \cdot -3 - 0 \cdot 2), 1 \cdot -1 - 1 \cdot 2 >$$
$$\vec{v}_1 \times \vec{v}_3 =< -3, 3, -3 >$$

$$\boxed{< -3, 3, -3 > \neq < 0, 0, 0 > \therefore \vec{v}_1 \nparallel \vec{v}_3}$$

Find if $\vec{v}_2 \parallel \vec{v}_3$:

$$\vec{v}_2 \times \vec{v}_3 =< 1 \cdot -3 - 1 \cdot -1, -(0 \cdot -3 - 1 \cdot 2), 0 \cdot -1 - 1 \cdot 2 >$$
$$\vec{v}_2 \times \vec{v}_3 =< -2, 2, -2 >$$

$$\boxed{< -2, 2, -2 > \neq < 0, 0, 0 > \therefore \vec{v}_2 \nparallel \vec{v}_3}$$

## 1.2 b)

$$A = \left[\begin{array}{ccc|c} 1 & 0 & 2 & 0 \\ 1 & 1 & -1 & 0 \\ 0 & 1 & -3 & 0 \end{array}\right]$$

$$A_2 = A_2 - A_1$$

$$A = \left[\begin{array}{ccc|c} 1 & 0 & 2 & 0 \\ 0 & 1 & -3 & 0 \\ 0 & 1 & -3 & 0 \end{array}\right]$$

$$A_3 = A_3 - A_2$$

$$A = \left[\begin{array}{ccc|c} 1 & 0 & 2 & 0 \\ 0 & 1 & -3 & 0 \\ 0 & 0 & 0 & 0 \end{array}\right]$$

$$\begin{aligned} a + 2c &= 0 \\ b - 3c &= 0 \\ a &= -2c \\ b &= 3c \end{aligned}$$

$$\boxed{-2c\vec{v}_1 + 3c\vec{v}_2 + \vec{v}_3 = 0}$$