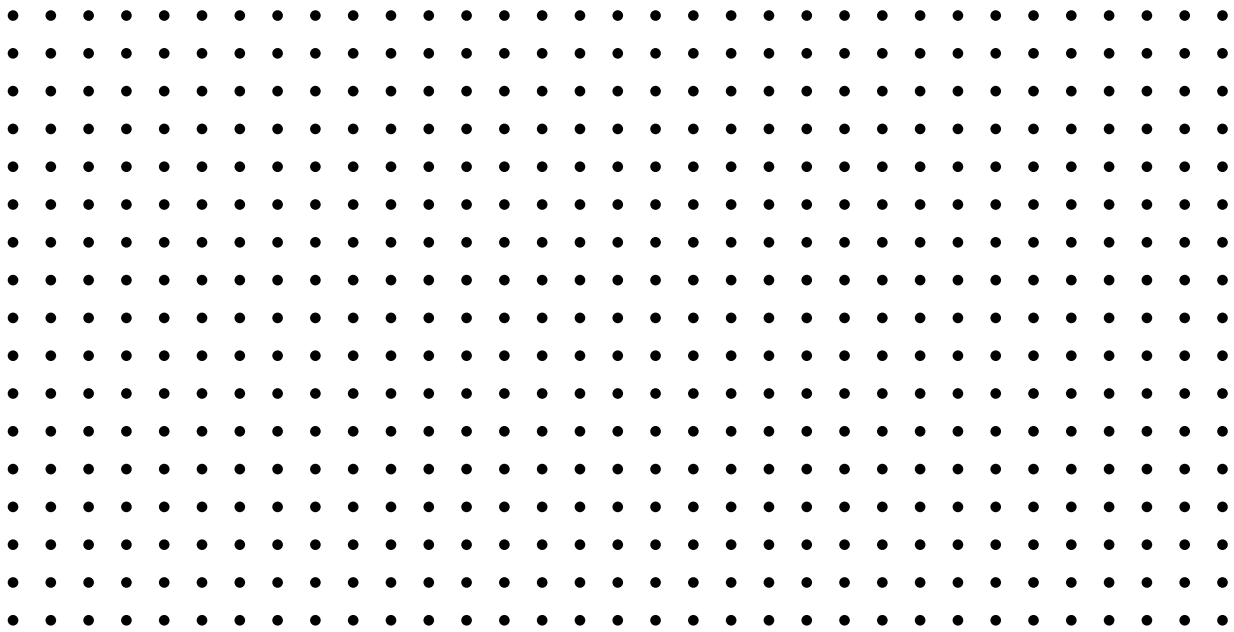
Video Assignment #1

November 26, 2022

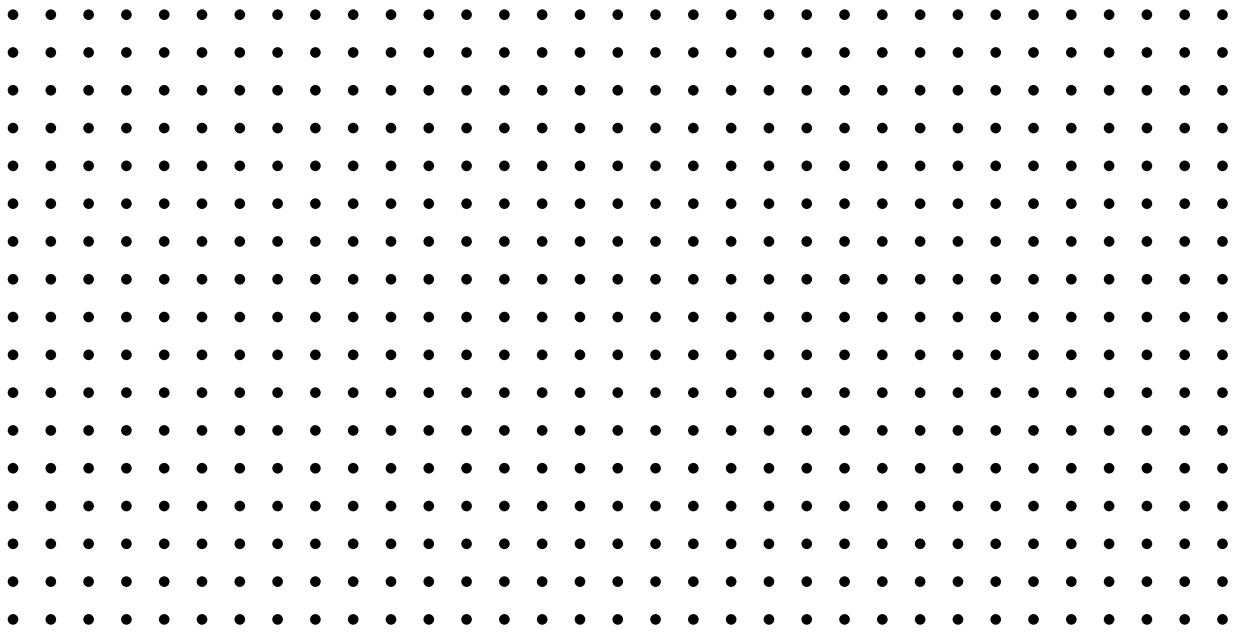
1. Draw each of the following vectors on the grid below. You may redefine the origin for each example.

$\begin{bmatrix}2\\3\end{bmatrix}$ $\begin{bmatrix}-1\\-3\end{bmatrix}$ $\begin{bmatrix}4\\1\end{bmatrix}$ $\begin{bmatrix}-5\\2\end{bmatrix}$



2. For each example below, draw both vectors and the resulting vector of the sum/difference.

$\begin{bmatrix}1\\1\end{bmatrix}+\begin{bmatrix}1\\2\end{bmatrix}$ $\begin{bmatrix}-1\\-3\end{bmatrix}+\begin{bmatrix}2\\3\end{bmatrix}$ $\begin{bmatrix}4\\1\end{bmatrix}+\begin{bmatrix}-1\\-3\end{bmatrix}$ $\begin{bmatrix}-5\\2\end{bmatrix}+\begin{bmatrix}2\\-4\end{bmatrix}$

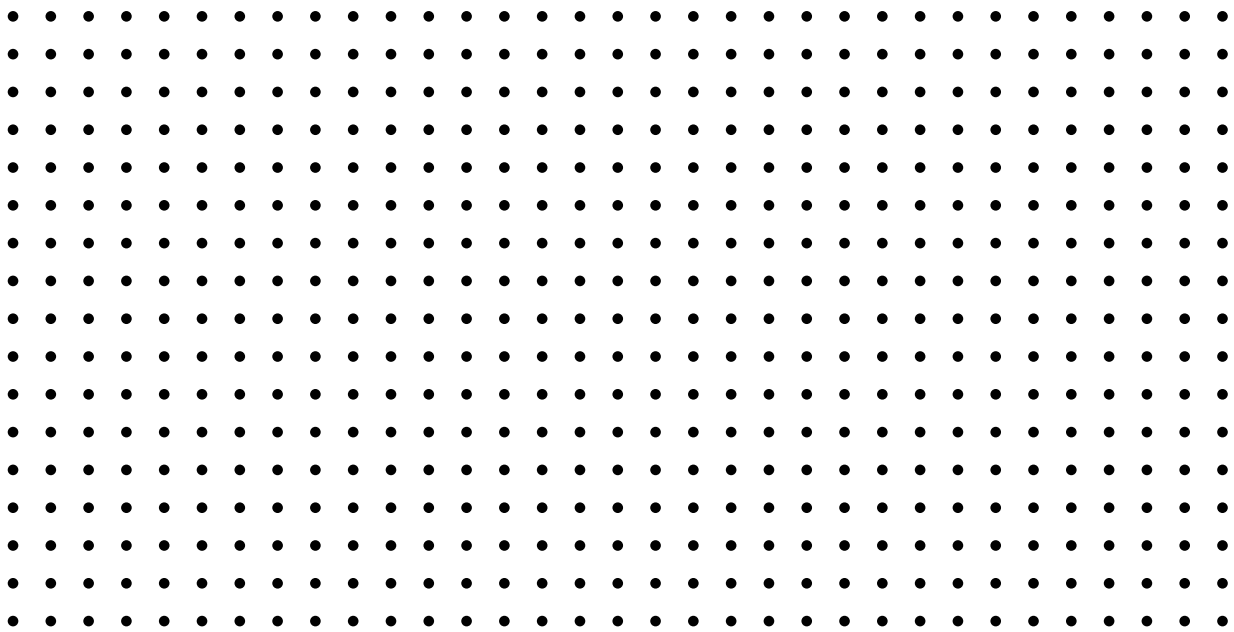


3. Consider the vectors below:

$$\vec{u} = \begin{bmatrix} 2 \\ -3 \end{bmatrix} \quad \vec{v} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \quad \vec{w} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$$

Draw Each Linear combination of the vectors using the grid below:

$2\vec{u} + \vec{v}$ $\qquad$ $-\vec{u} + 2\vec{v}$ $\qquad$ $-\vec{u} - \vec{v} + \vec{w}$



4. Consider the vectors below:

$$\vec{u} = \begin{bmatrix} 2 \\ -3 \end{bmatrix} \quad \vec{v} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

(a) Can the vector $\begin{bmatrix} 1 & 0 \end{bmatrix}^T$ be written as a linear combination of $\vec{u}$ and $\vec{v}$?

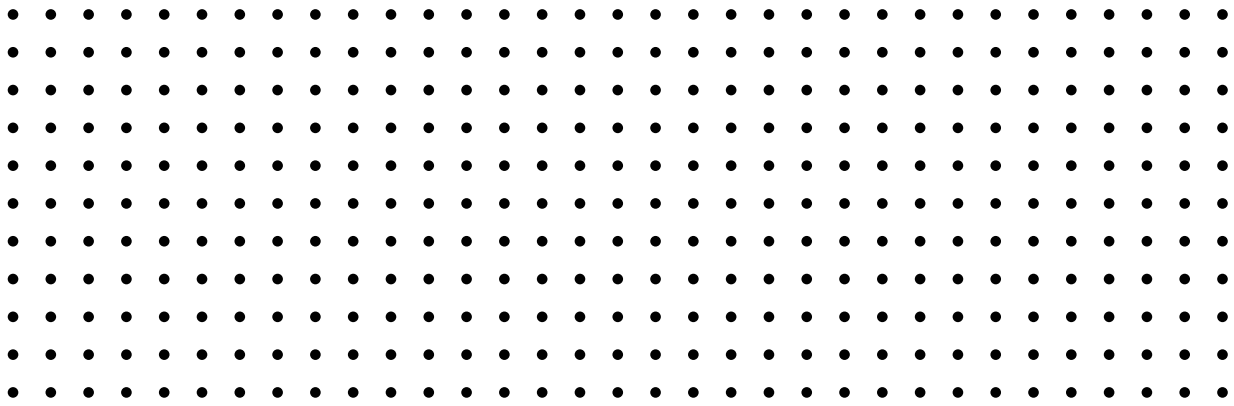
(b) Can the vector $\begin{bmatrix} 4 & 1 \end{bmatrix}^T$ be written as a linear combination of $\vec{u}$ and $\vec{v}$?

(c) Can the vector $\begin{bmatrix} x_1 & x_2 \end{bmatrix}^T$, $x_i \in \mathbb{R}$ for $i = 1, 2$, be written as a linear combination of $\vec{u}$ and $\vec{v}$? Written more simply does the span of $\vec{u}$ and $\vec{v}$ equal $\mathbb{R}^2$?

Video Assignment #2
November 26, 2022

1. Draw the vector $\vec{a}$ and, transformed version $\vec{b}$ corresponding with matrix product $\vec{b} = A\vec{a}$

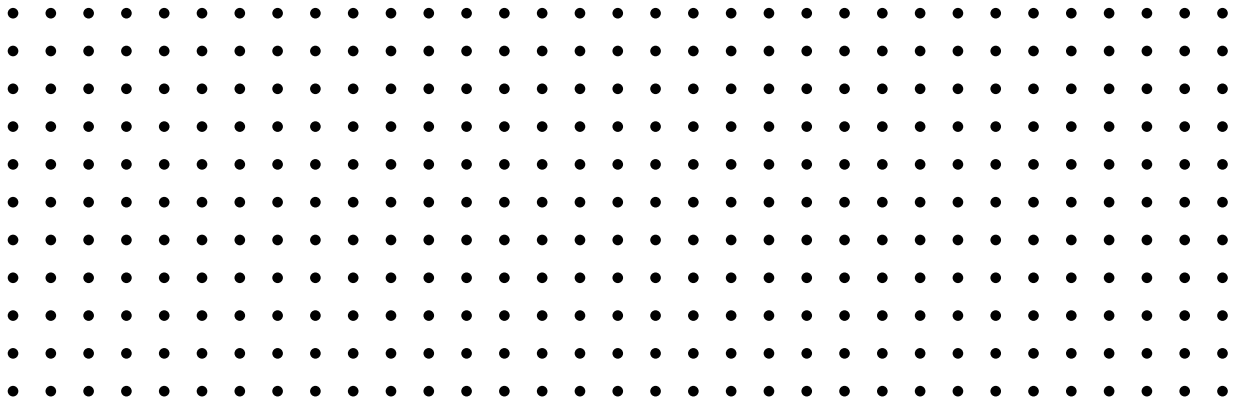
$$\vec{a} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad A = \begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix}$$



Is the transformation linear? Linearly independent?

2. Draw the vector $\vec{a}$ and, transformed version $\vec{b}$ corresponding with matrix product $\vec{b} = A\vec{a}$

$$\vec{a} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad A = \begin{bmatrix} 1 & -1 \\ 1 & -1 \end{bmatrix}$$



Is the transformation linear? Linearly indepedent?

3. Consider the matrices A_1, and A_2 corresponding to the following transformations:

   - Rotation by angle θ.
   - Stretch about the y-axis by a factor of 2, and about x-axis by a factor of 3.

   (a) Find A_1 and A_2

   (b) What effect does the product $A_1A_2\vec{x}$ have on the vector $\vec{x}$?

   (c) What effect does the product $A_2A_1\vec{x}$ have on the vector $\vec{x}$?

   (d) For what values of θ is $A_1A_2 = A_2A_1$? Describe what this means in the context of a transformation.

   (e) For what values of θ is the matrix $B = A_1A_2$ invertible?

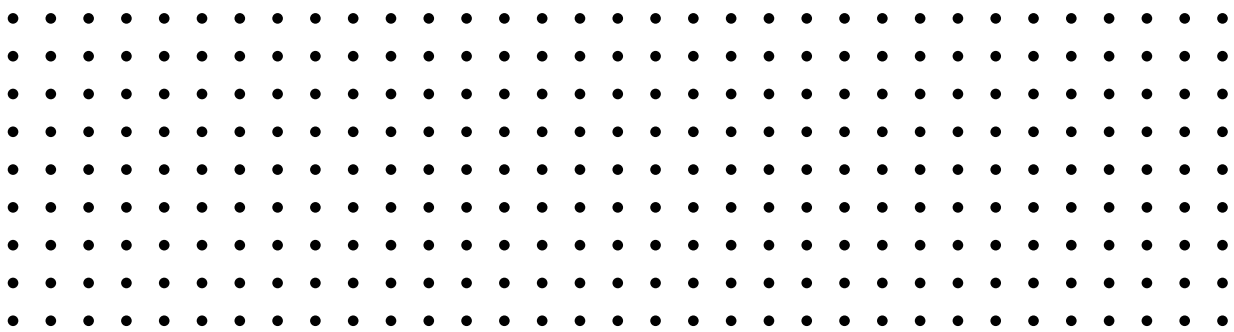
   (f) What effect does the matrix $B^{-1}\vec{x}$ have on the matrix $\vec{x}$?

Video Assignment #3

November 26, 2022

1. Draw the parallelogram created by the basis vectors $\hat{i}$ and $\hat{j}$ after they undergo the transformation corresponding with the following matrix

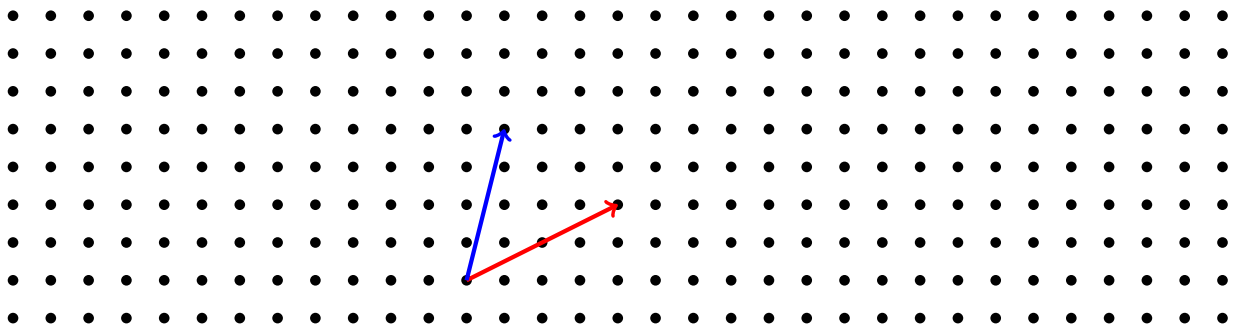
$$A = \begin{bmatrix} 2 & 1 \\ 2 & -1 \end{bmatrix}$$



What is the area of the parallelogram?

2. Draw the parallelogram created by the basis vectors $\hat{i}$ and $\hat{j}$ after they undergo the transformation corresponding with the following matrix

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$



Show that the area of the parallelogram is $ad - bc$