

Udacity Data

Welcome to AI Programming with Python Nanodegree

1 video

2-video

3- quiz(1)

4-quiz(2)

Why Python Programming

Vid1

Vid2

Data types and Operators

Vid1

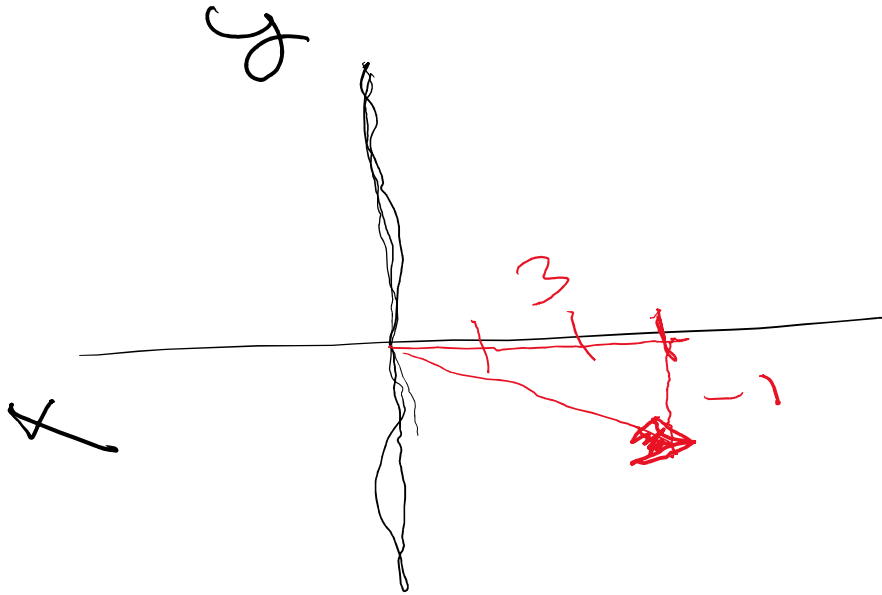
Vid2

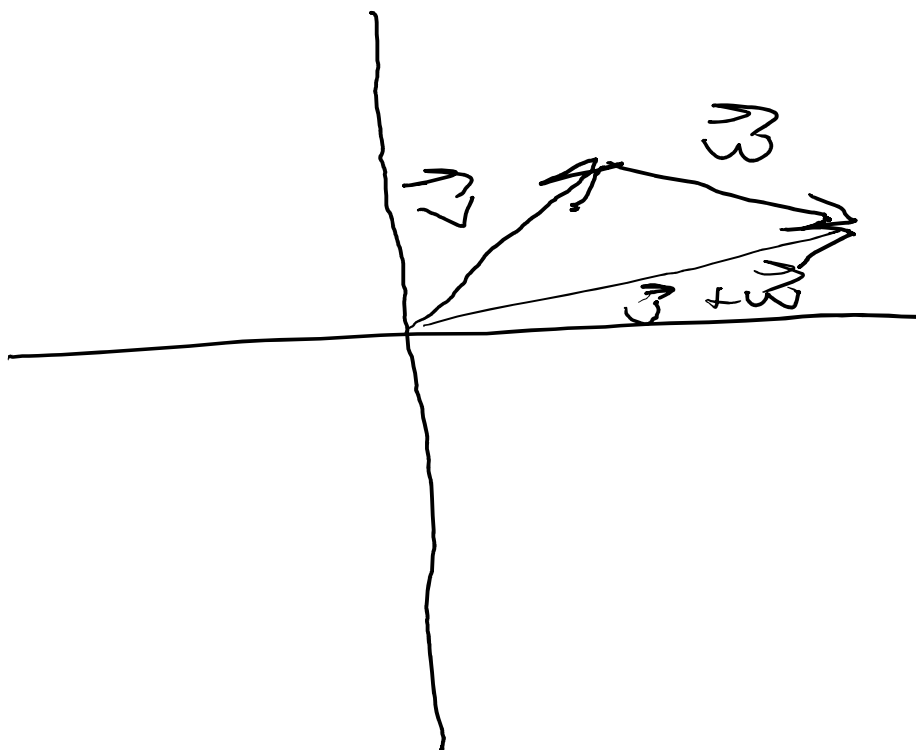
Quiz1

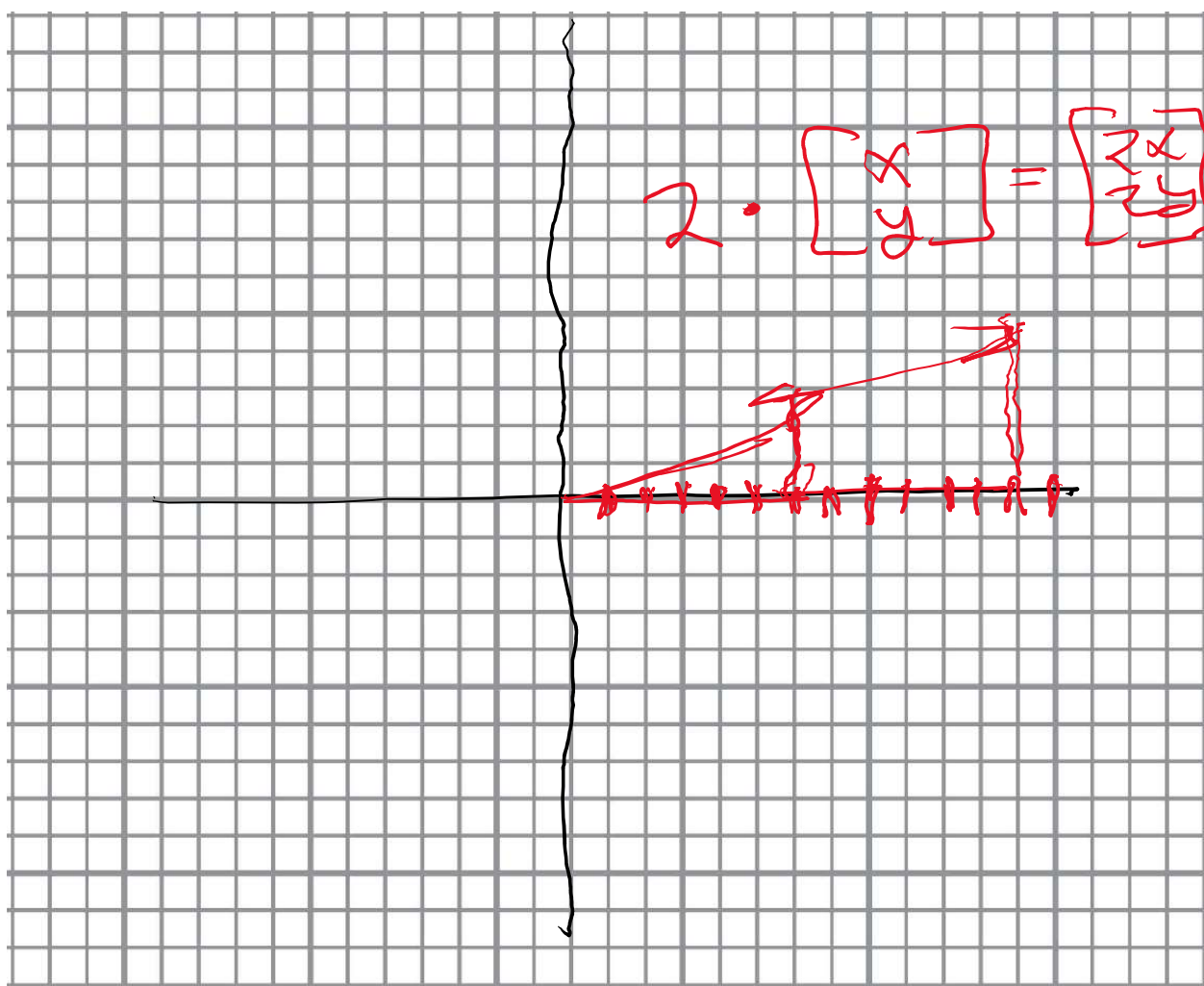
Quiz2

Linear Algebra

Vectors \Leftrightarrow list of numbers







Transpose

$$\begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ \vdots \\ a_n \end{bmatrix}^T = [a_1 a_2 a_3 \dots a_n]$$

Nice-version

$$[a_1 a_2 a_3 \dots a_n]^T = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ \vdots \\ a_n \end{bmatrix}$$

Operations in the Field

\mathbb{R}^n

Operations are

- Addition
- Multiplication

Zero Element: $\vec{x} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}$

One element $\vec{x} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$

- Associative
- Commutative
- Distributive
- Identity (defining zero addition and multiplication by one)
- Inverse

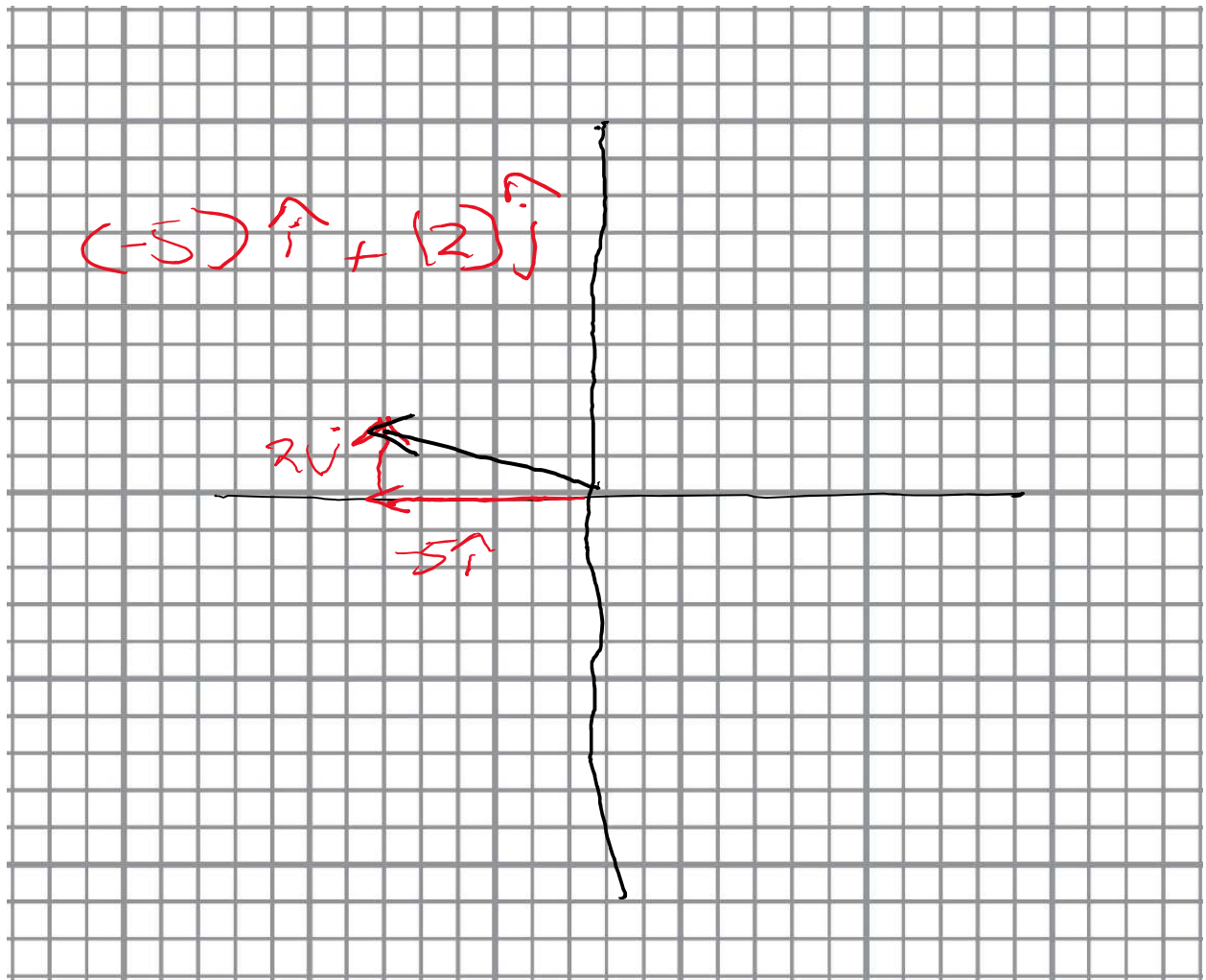
Scalar by Vector Multiplication

$$\text{if } \alpha \in \mathbb{R}$$

and

$$\vec{x} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ \vdots \\ a_n \end{bmatrix} \in \mathbb{R}^n$$

$$\text{then } \vec{y} = \alpha \vec{x} = \begin{bmatrix} \alpha a_1 \\ \alpha a_2 \\ \vdots \\ \alpha a_n \end{bmatrix} \in \mathbb{R}^n$$



\hat{i} and \hat{j} are the "basis vectors" of the xy coordinate system.

Linear Combination

Vectors Vs Points

Linear Combination and Span = Theoretical Definition

$$\vec{v} = a_1 \vec{x} + a_2 \vec{y} + a_3 \vec{z}$$

"Linear combination" of \vec{v} and \vec{w}

$$a\vec{v} + b\vec{w}$$

$\uparrow \quad \uparrow$
scalar

The span of \vec{v} and \vec{w} is the set of all their linear combination

$$\vec{v} = p \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + r \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} + t \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$\begin{cases} -14a + 5b = -13 \\ 2a - b = 3 \Rightarrow \times 5 \end{cases}$$

$$\Rightarrow \begin{cases} -14a + 5b = -13 \\ 10a - 5b = 15 \end{cases}$$

$$-4a + 0b = 2$$

$$a = -0.5$$

sub a in any eq ✓

$$b = -4$$

$\times -1$

$$\begin{cases} -a + 3b = 1 \\ -a + 3b = 5 \end{cases}$$

$$a - 3b = -1$$

$$-a + 3b = 5$$

0 0

Matrix

Matrix- is a two dimensional array that contains the same elements as the vector

M rows and n columns

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & & & a_{2n} \\ a_{31} & & & a_{3n} \\ \vdots & & & \vdots \\ a_{m1} & & & a_{mn} \end{bmatrix}$$

Matrix Addition

Scalar Multiplication of a Matrix

Matrix Multiplication

$$0 - 2(8 - 6)$$

2x2 matrix.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = x \begin{bmatrix} a \\ c \end{bmatrix} + y \begin{bmatrix} b \\ d \end{bmatrix}$$

$$= \begin{bmatrix} ax + by \\ cx + dy \end{bmatrix}$$

