1106 DIS 208 Week 7 (#2) 3/6/2020

Discussion Outline

- Prelim Info
- Review
- Groups for Prelim 1 (passed around.)

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Office hours: 4:15–6:15 Thu

Upcoming Assessment

- Prelim 1! (Tuesday March 10th, 7:30pm, RCK 201)
- Weighting: 15%
- Course drop date:
  March 17
  (at least according to Registrar — check with specific college.)

Prelim 1 Study Resources include:

- 2019 exam (on Canvas)
- MATH1006 support course
- Office hours (now in combined schedule)
- Previous:
  - homework & solutions
  - recitations & solutions
  - quizzes & solutions
- Lectures & textbook

Last time: - Calculating the derivative for basic functions with rules

This time: Reviews!

QUIZ 1.

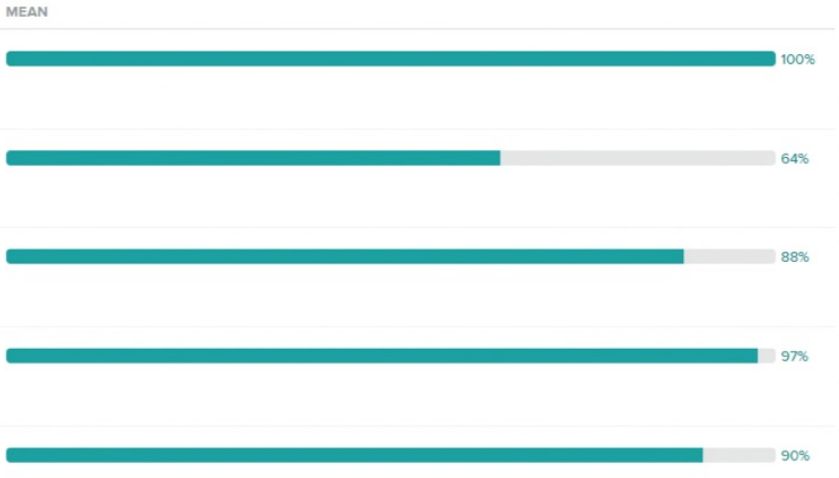
Pythagoras Thm

Vectors

Logistic Eqn.

Verbal Eqns.

Lokta – Volterra Eqn.



QUIZ 2.

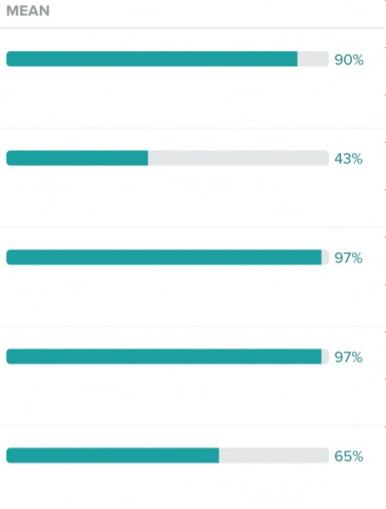
SIR Model

Vectors / Vector Fields

Euler's Method

Slope of line

Trajectories / Time Series



Vector Practice

Let $\vec{v} \in \mathbb{R}^n$ be a vector,

$\vec{v} = (v_1, v_2, v_3, \ldots, v_n)$.

Then the length of $\vec{v}$ is:

$$\|\vec{v}\| = \sqrt{v_1^2 + v_2^2 + \cdots + v_n^2}.$$ (choose positive value.)

Q.1 If $\vec{a} = (-3)$, what is $\|\vec{a}\|$?

Q.2 If $\vec{b} = (1, 2, 0, -1)$, what is $\|\vec{b}\|$?

Q.3 If $\vec{c} = (0, 1, 0, 1, 0, 1, 0)$, what is $\|\vec{c}\|$?

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Sol 1: $\|\vec{a}\| = \sqrt{(-3)^2} = \sqrt{9} = 3$

Sol 2: $\|\vec{b}\| = \sqrt{1^2 + 2^2 + 0^2 + (-1)^2} = \sqrt{1 + 4 + 0 + 1} = \sqrt{6}$

Sol 3: $\|\vec{c}\| = \sqrt{1^2 + 1^2 + 1^2} = \sqrt{3}$

$\|\vec{v}\| = \sqrt{v_1^2 + v_2^2 + \cdots + v_n^2}$. (choose positive value)

Direction: If $\vec{v} = (v_1, \ldots, v_n)$,

if $k \in (-\infty, \infty)$

then $k \cdot \vec{v} = (kv_1, kv_2, \ldots, kv_n)$.

Ex: $\vec{v} = (2,3)$, $2 \cdot (2,3) = (4,6)$.

Definition: Vectors $\vec{v}, \vec{w}$ have the same direction if $\vec{v} = k\vec{w}$ for some scalar positive scalar k.

Q.4 $\vec{v} = (1,0,1)$, $\vec{w} = (-1,0,-2)$. Do $\vec{v}, \vec{w}$ have the same direction?

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If $\vec{v}, \vec{w}$ had the same direction, then they'd be some positive k such that

$$\vec{v} = k \cdot \vec{w}$$

$$(1,0,1) = k \cdot (-1,0,-2)$$
$$= (-k, 0, -2k)$$

$1 = -k \Rightarrow k = -1$
$1 = -2k \Rightarrow k = -1/2$

} Can't both happen.
$\therefore \vec{v}, \vec{w}$ don't have the same direction

Q.5 Do $(0,1,0,1,2)$ and $(0,2,0,2,4)$ have the same direction?

$2\cdot(0,1,0,1,2) = (0,2,0,2,4)$

$\vec{v}, \vec{w}$

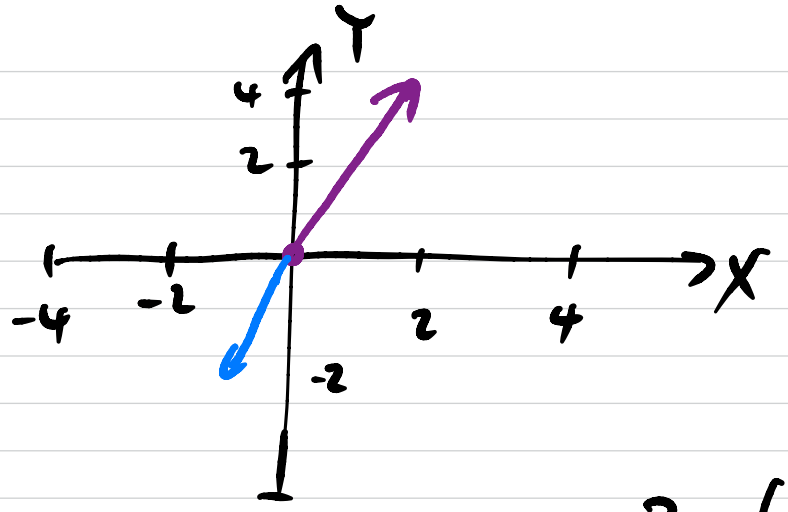
$\therefore$ Yes. $(k=2)$

[Actually, same direction $\Leftrightarrow k>0$ $\vec{v} = k\cdot\vec{w}$
opposite direction $\Leftrightarrow k<0$, $\vec{v} = k\cdot\vec{w}$]

Q.6 Do $(-1,1)$, $(1,-1)$ have opposite directions?

$-1\cdot(-1,1) = ((-1)^2, -1) = (1,-1)$

$\therefore$ Yes, $(k=-1)$



$(2,4)$

$(-1,-2)$

$-2 \cdot (-1,-2) = (2,4)$

So $(2,4)$, $(-1,-2)$ point in opposite directions.

Definitions. A zero vector is a vector where all components are 0

e.g. $(0,0,0,0,0,0)$.

Defin: A unit vector is a vector with a length of 1.

Q.7 True/False $2\cdot(1,1,2)-(2,2,4)$ is a zero vector.

Q.8 $(0,0,0,1,0,1)$ is a unit vector.

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Q.8 $(0,0,0,1,0,1)$ is a unit vector.

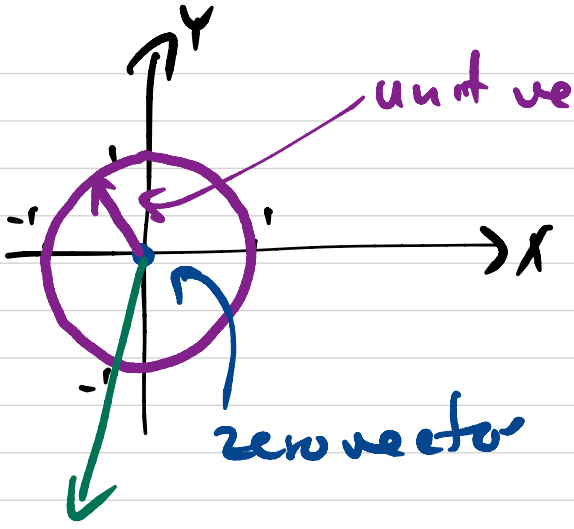
Q7 $2\cdot(1,1,2)-(2,2,4) = (2,2,4)-(2,2,4)$

$= (0,0,0)$. ∴ True.

Q.8 $\|(0,0,0,1,0,1)\| = \sqrt{1^2+1^2}$

$= \sqrt{2} \neq 1$.

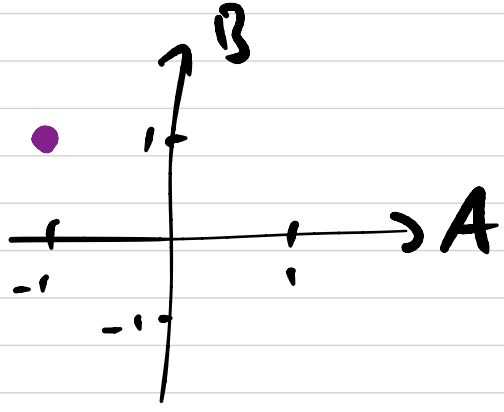
∴ False.

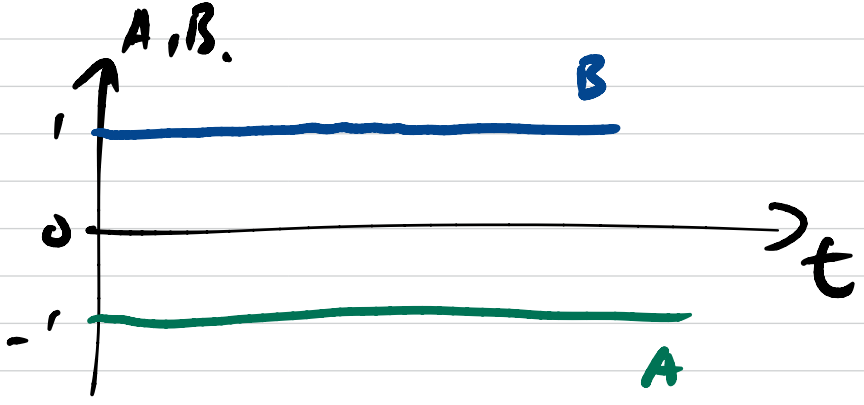


(x, y) a unit vector if it goes from $(0,0)$ to circle of radius 1.

Time-Series & Trajectories.

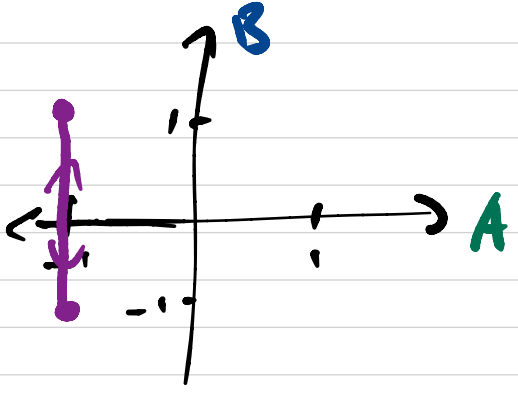
Q.1 Plot the trajectory

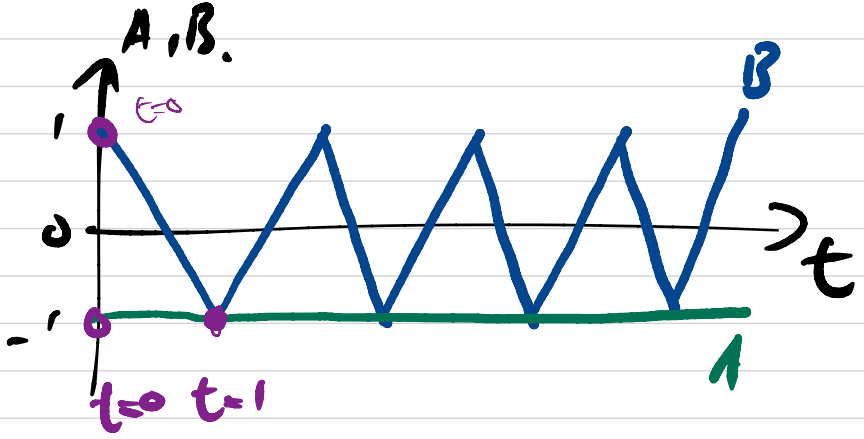




Time-Series & Trajectories.

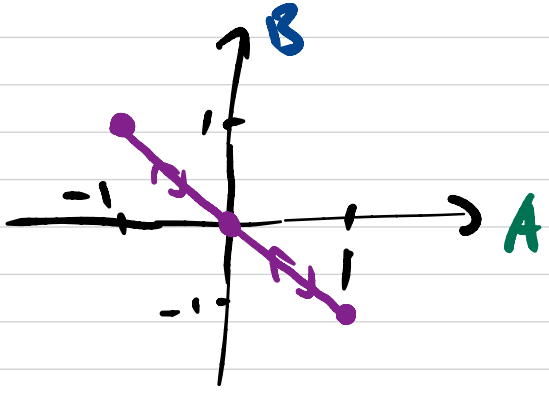
Q.2 Plot the trajectory

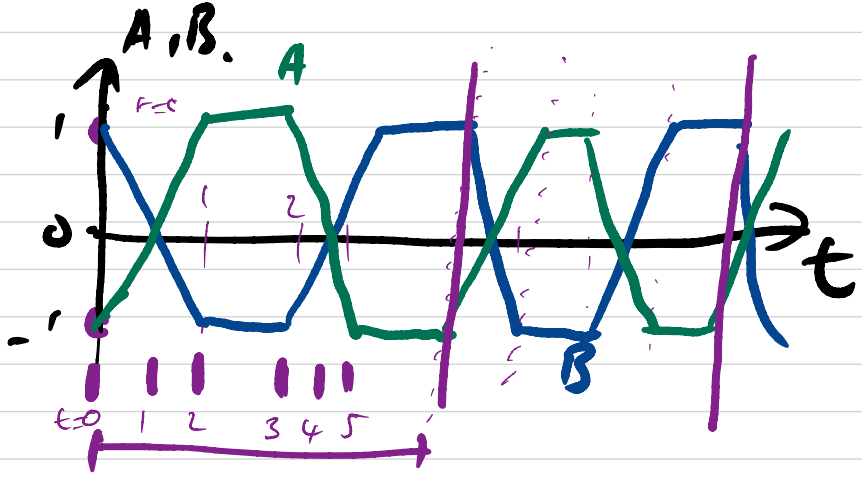




Time-Series & Trajectories.

Q.3 Plot the trajectory





Q.4 Plot the time series.