Math 20C • Calculus and Analytic Geometry • Spring 2021

press record

GOAL • Develop calculus in 2D & 3D

SOME CLASS DETAILS •

- Course links are on the CANVAS page.

LINKS:

#1. Course website:
(syllabus: contact info/schedule)

#2. DISCORD SITE:
(A good place to ask questions)

#3. GRADESCOPE SITE:
(where quizzes will be released)

#4. ZOOM LINKS:
(class, discussion, SI, office hours...)

#5. WEBASSIGN:

(Where the HW happens.)

<u>YOUR GRADE.</u>

50% HOMEWORK SCORE.

50% QUIZ SCORE.

HOMEWORK SCORE.

= AVG OF TOP 8 HW %s

(AKA: Drop the lowest)

QUIZ SCORE.

= the <u>higher</u> of

#1. AVG QUIZ %

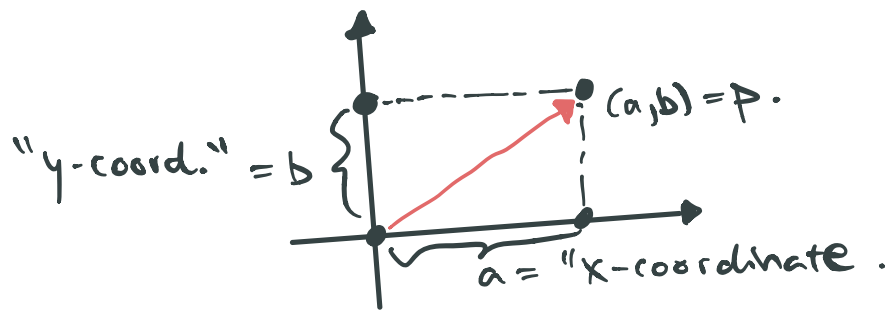
OR #2. $\frac{2}{3}$(AVG of TOP 4 QUIZ %)

+ $\frac{1}{3}$(FINAL %).

QUESTIONS?

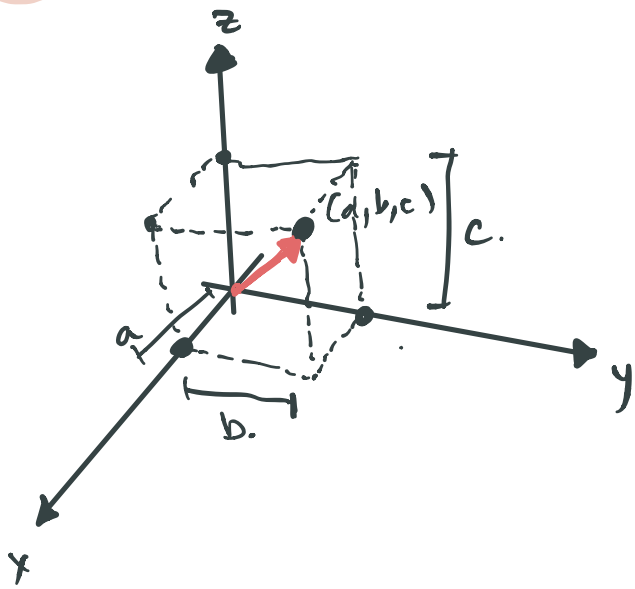
VECTORS in 2D & 3D

2D.



For any point (a,b) we make the vector from (0,0) to (a,b).

3D.



COMMON CONFUSION.

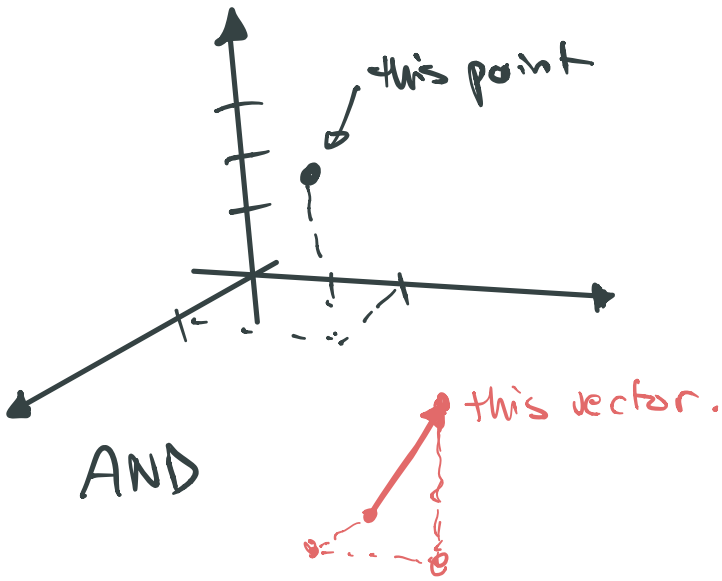
What is the difference between points and vectors?

A point: A spot in 2D / 3D.

A vector: A magnitude & direction.

EVEN WORSE.

We will use the notation $(1,2,3)$ to refer to both



AND

If you find that confusing or dishonest THAT IS OK.

SOME NOTATION.

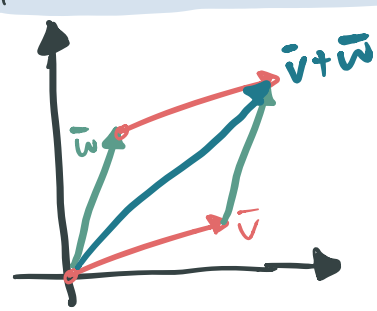
The set of real numbers is denoted by $\mathbb{R}$.

The set of pairs of real #s is denoted by $\mathbb{R}^2$.

Triples of real #s (respectively n-tuples) are denoted by $\mathbb{R}^3$ (resp. $\mathbb{R}^n$).

VECTOR ADDITION.

GEOMETRICALLY IN 2D.



(SIMILARILY IN 3D)

THE FORMULA (IN 3D).

$\bar{v} = (-1, 2, \pi)$

$\bar{w} = (2, 2, 1)$

$\bar{v} + \bar{w} = (1, 4, \pi + 1)$

(ADD EACH COORDINATE).

COMMENT. You can't add 2D & 3D vectors (or scalar + vector).

MULTIPLYING VECTORS.

METHOD #1 SCALAR MULTIPLICATION.

Let $\bar{v} \in \mathbb{R}^2$, AND let $\lambda \in \mathbb{R}$.

(NOTATION $\in$ means "in", read it as "let $\bar{v}$ be an element in $\mathbb{R}^2$")

Scalar multiplication given a vector

$$\lambda \bar{v} \in \mathbb{R}^2$$

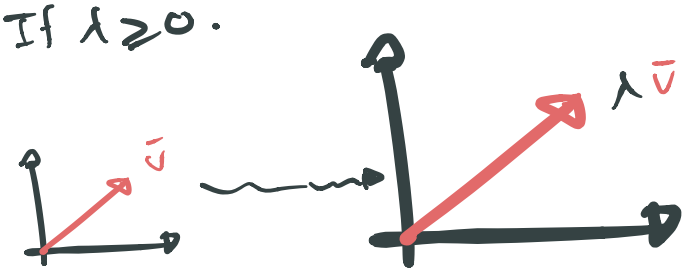
FORMULA. If $\bar{v} = (a, b)$ then

$$\lambda \bar{v} = (\lambda a, \lambda b) \in \mathbb{R}^2$$

(MULTIPLY each coord. by λ)

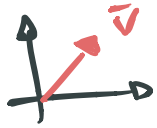
GEOMETRICALLY.

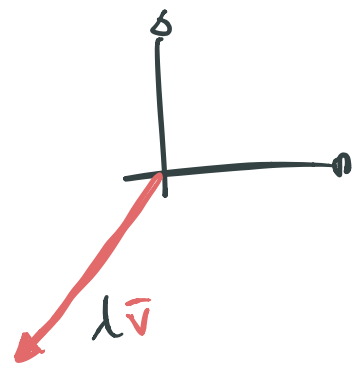
(A) If $\lambda \geq 0$.



λ times longer
& same direction.

(B) If $\lambda \leq 0$.



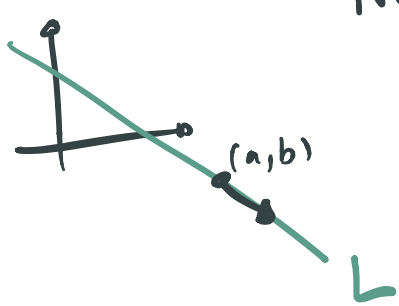


λ times longer
in opposite direction.

(SIMILAR IN 3D).

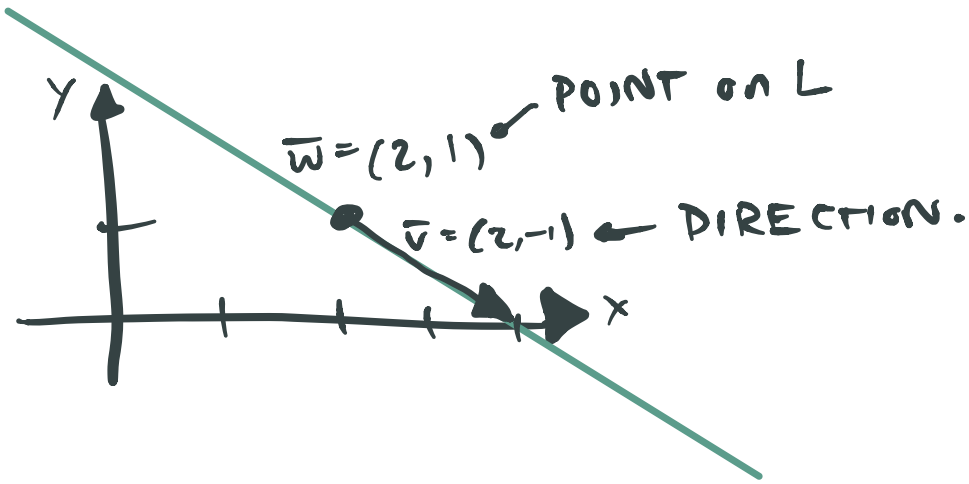
LINES IN 2D & 3D.

Need 1. A point
2. A direction.



gives a line.

PARAMETRIC EQUATION FOR L.



Every other point on L has the form $\bar{w} + t\bar{v}$ for some $t \in \mathbb{R}$.

(why??)

We can parametrize L by the function:

$$f(t) = \bar{w} + t\bar{v}.$$

(works for any line through a point $\bar{w}$ with direction $\bar{v}$)

In our example,

$$f(t) = (2,1) + t(2,-1).$$

$$= (2,1) + (2t,-t).$$

$$= (2+2t,\ 1-t).$$

This line has x-intercept when $1-t=0$ so $t=1$.

$$f(1) = (4,0) \leftarrow \text{x-intercept.}$$