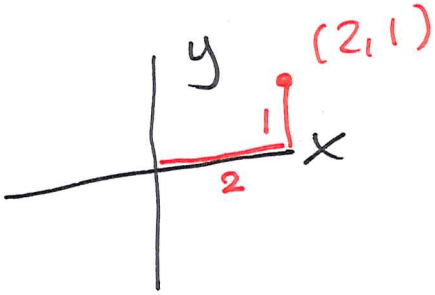
Math 105, Section 204

Pieces:

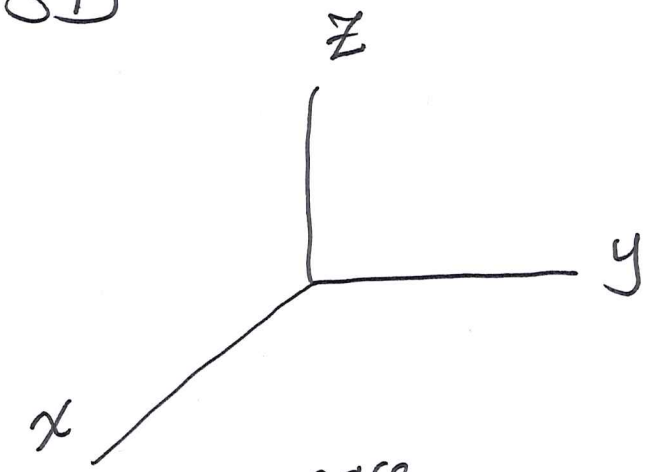
Integration
Series
} traditional 2nd-sem calculus

Vectors
Probability (continuous)
Deriv in multiple variables
} 3rd-sem calculus

Drawing vectors in 3D



plane
$\mathbb{R}^2$

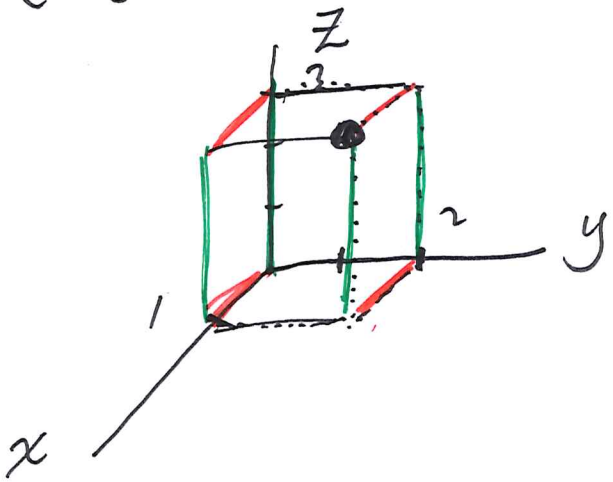


space
$\mathbb{R}^3$

eg

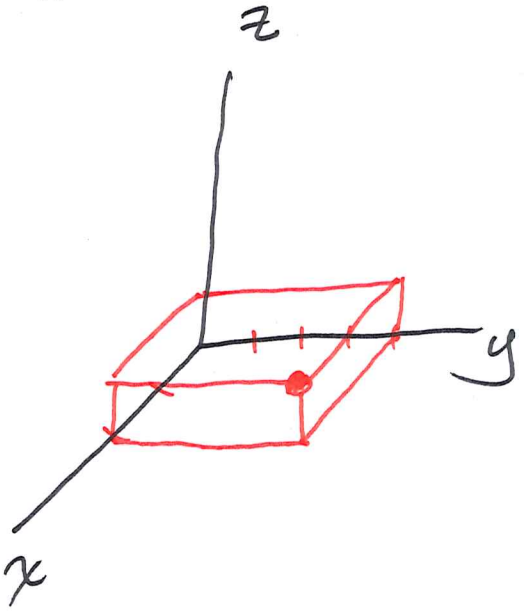
x y z

(1, 2, 3)

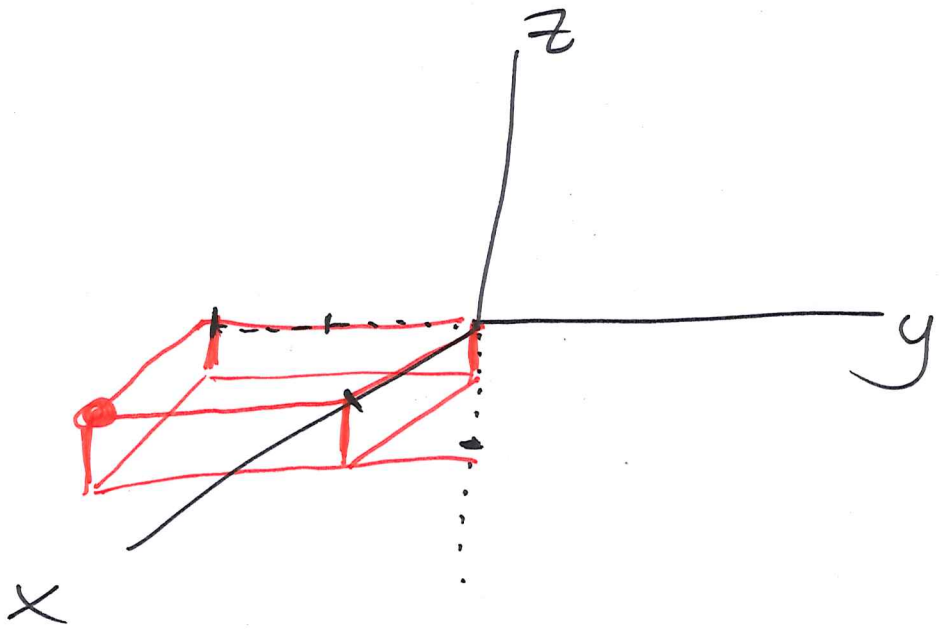


eg

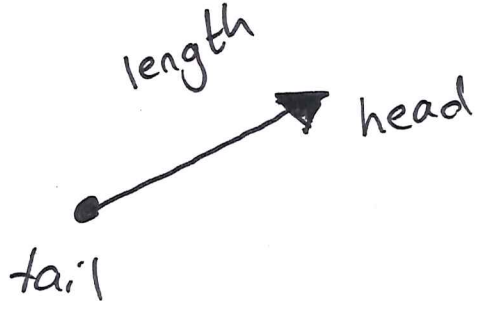
(2, 4, 1)



eg $(1, -2, -1)$



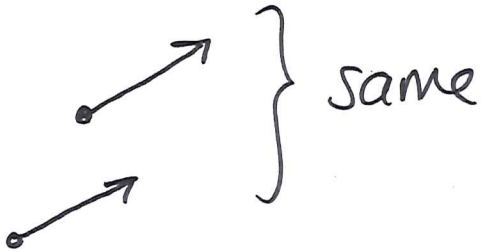
Vector has: length, direction



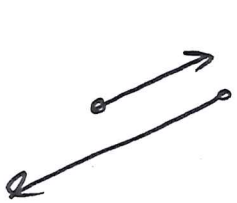
Physics:

big push right

small " "

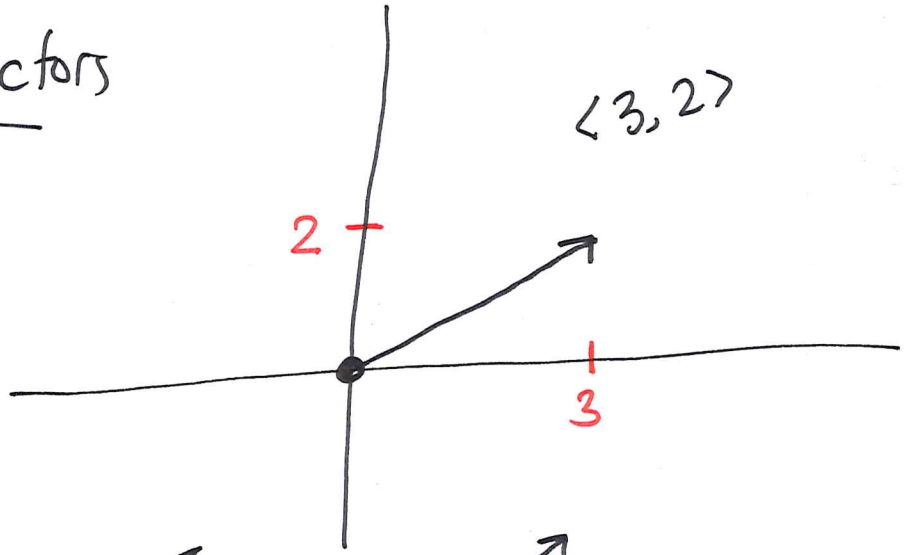


same



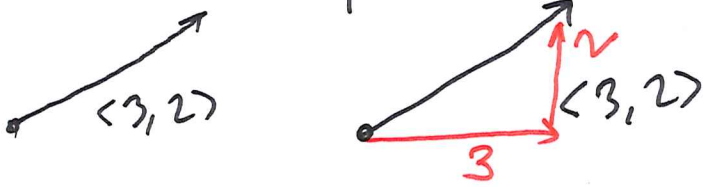
different

Naming Vectors

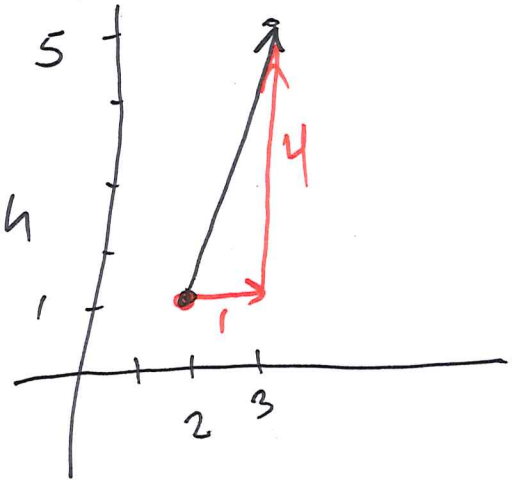


Drag tail to origin

Coordinates of head become name



Q: What is the name of the vector with tail at (2,1) and head at (3,5)?

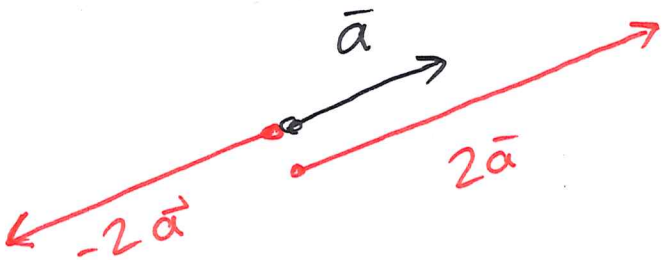


Name: $\langle 1, 4 \rangle$

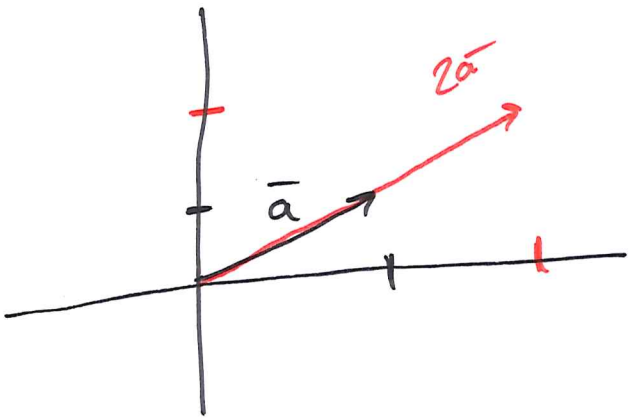
Multiplying Vectors & Scalars

(real number $\mathbb{R}$)

If we multiply a vector by a scalar, the result is a vector whose length is scaled and direction is parallel (same: + scalar; opp: − scalar)



eg say $b = \langle 1, -1 \rangle$
then $\frac{1}{2}b = \langle \frac{1}{2}, \frac{-1}{2} \rangle$



Say $\bar{a} = \langle 5, 2 \rangle$
then $2\bar{a} = \langle 10, 4 \rangle$

If two vectors are parallel, then they're scalar multiples of each other

$\mathbb{R}$

(ex) $\langle 2, 1, 5 \rangle$, $\langle 4, 2, 10 \rangle$, $\langle 10, 5, 1 \rangle$ — which are parallel?

$2\langle 2, 1, 5 \rangle = \langle 4, 2, 10 \rangle$

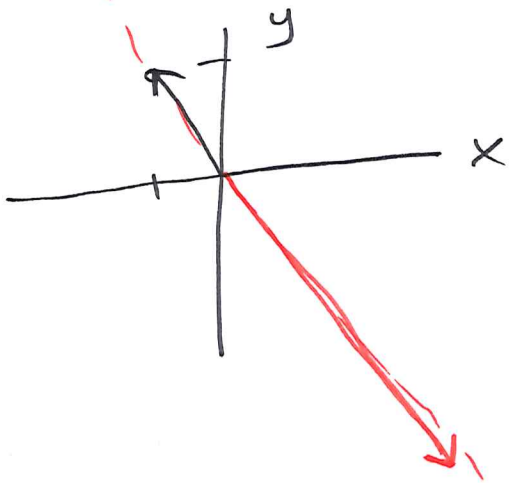
(ex) Calculate and draw $-3\langle -1, 2 \rangle$

Algebraic:

$-3\langle -1, 2 \rangle =$

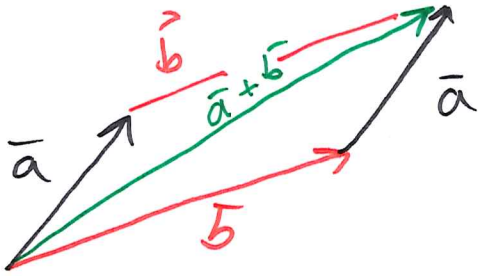
$\langle 3, -6 \rangle$

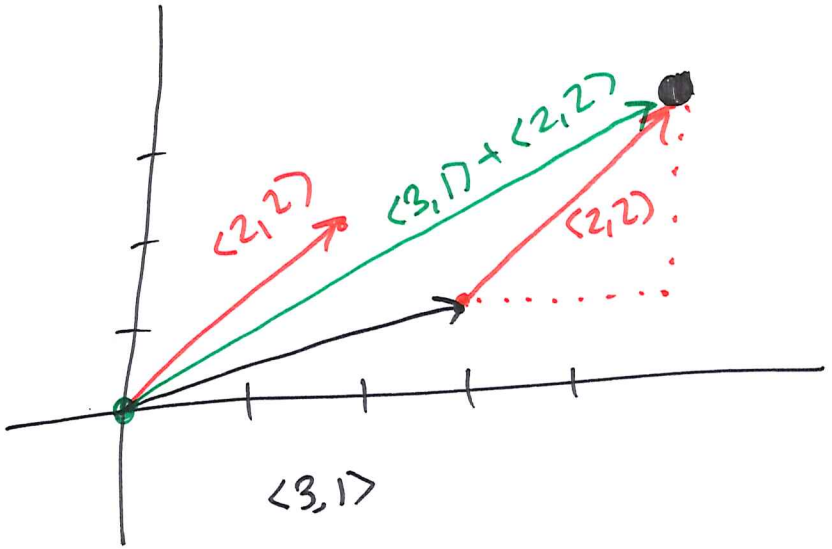
Geometric:



Adding Vectors

Grapically, to add $\bar{a} + \bar{b}$:
place them head-to-tail





Geometric

ex $\langle 1, 2, 17\rangle + \langle -10, 3, 0\rangle$

$= \langle -9, 5, 17\rangle$

$\langle 3,1\rangle + \langle 2,2\rangle = \langle 3+2, 1+2\rangle$

$= \langle 5, 3\rangle$