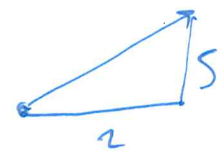
ANNOUNCEMENTS

- No Connect this term –
  access WebWork via link on
  main course webpage,
  www.math.ubc.ca/~kliu/common105.html

- First WebWork assignment has been posted.
  Due on the 14th (Saturday in a week)

- Check our course webpage for sections to be
  covered in **Quiz 1** on Monday
  www.math.ubc.ca/~elyse/2017Math105.html
  (this page is also linked to main course page)

- If you have a lab during our scheduled midterm, there will be a conflict test scheduled (details TBD)

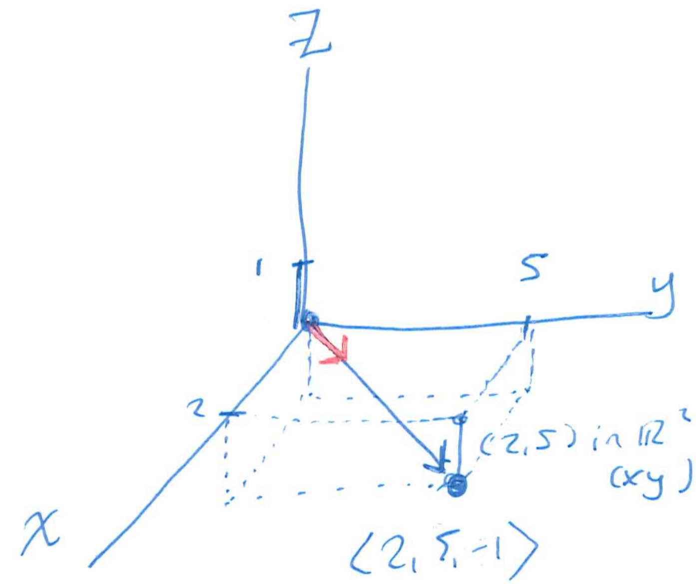


Length & Direction

Length ex $\underbrace{\| \langle 2, 5 \rangle \|}_{\text{length or norm of } \langle 2,5\rangle} = \sqrt{4+25} = \sqrt{29}$

ex $\vec{w} = \langle 2, 5, -1 \rangle$

$\| \vec{w} \| = \sqrt{4 + 25 + 1}$



Recall: two vectors are <u>parallel</u> if they are scalar multiples of each other

e.g. $\vec{a} = 2\vec{b}$

$\vec{a} = 1.7\,\vec{b}$

The direction of a vector is given by a <u>unit vector</u> (vector of length 1) in same direction.

ex) we saw $\| \langle 2, 5, -1 \rangle \| = \sqrt{4+25+1} = \sqrt{30}$

Let $\vec{u}$ be a unit vector in same direction as $\langle 2, 5, -1 \rangle$.

$$\vec{u} = \frac{1}{\sqrt{30}} \langle 2, 5, -1 \rangle = \underbrace{\left\langle \frac{2}{\sqrt{30}}, \frac{5}{\sqrt{30}}, \frac{-1}{\sqrt{30}} \right\rangle}.$$

check that $\|\vec{u}\| = 1$:

$$\|\vec{u}\| = \sqrt{\frac{4}{30} + \frac{25}{30} + \frac{1}{30}} = \sqrt{\frac{30}{30}} = \sqrt{1} = 1 \quad \checkmark$$

Adding Vectors

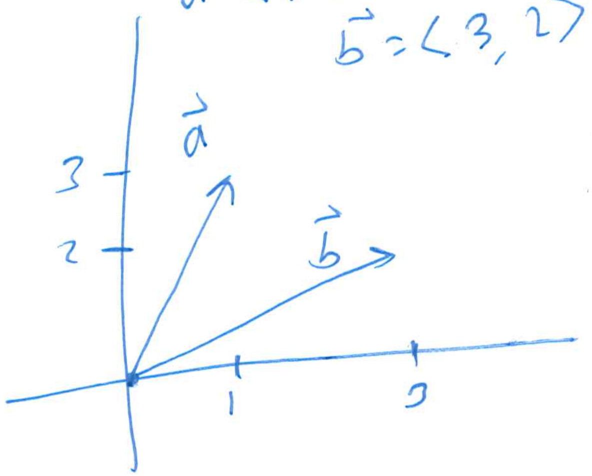
To add $\vec{a}$, $\vec{b}$: put the head of $\vec{a}$ at the tail of $\vec{b}$, then

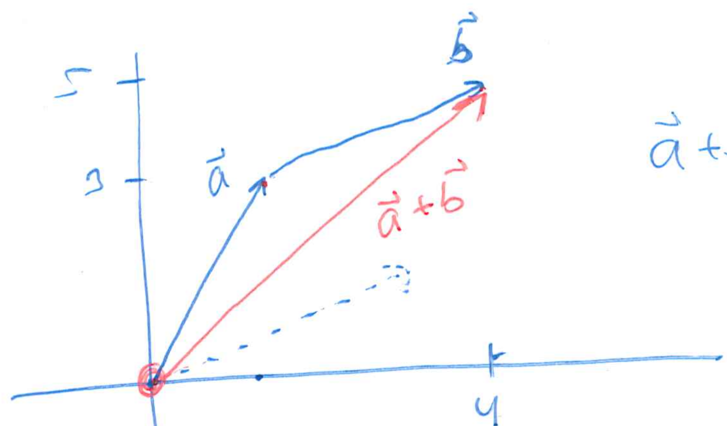
$\vec{a} + \vec{b}$: has tail @ tail of $\vec{a}$

head @ head of $\vec{b}$

$\vec{a} = \langle 1, 3 \rangle$

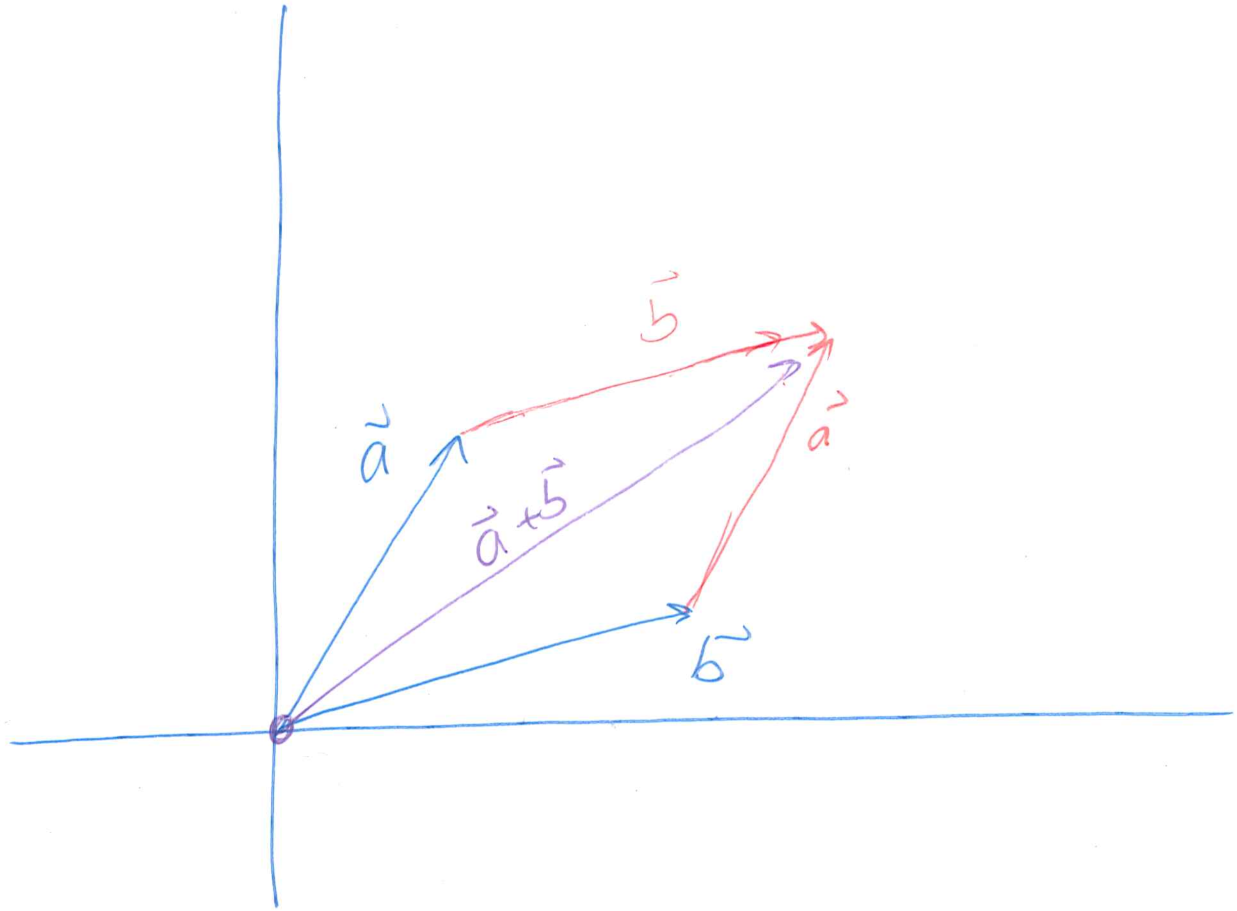
$\vec{b} = \langle 3, 2 \rangle$





$\vec{a} + \vec{b} = \langle 4, 5 \rangle$

$$\begin{array}{r} \langle 1, 2, 3 \rangle \\ + \; \langle 4, 8, -7 \rangle \\ \hline \langle 5, 10, -4 \rangle \end{array}$$



Dot Product

$\langle a, b \rangle \circ \langle x, y \rangle = ax + by$

$\langle a, b, c \rangle \circ \langle x, y, z \rangle = ax + by + cz$

If $\vec{u}$ and $\vec{v}$ are perpendicular, their dot product is 0.

ex

$\vec{a} = \langle 1, 0, 3 \rangle$

$\vec{b} = \langle 3, 0, -1 \rangle$

$\vec{c} = \langle -2, 0, -6 \rangle$

Which are parallel?

$\vec{a}, \vec{c}$

Which are perpendicular?

a, b perpendicular

b, c perpendicular

$\vec{a} \cdot \vec{b} = 3 + 0 + (-3) = 0$

$\vec{b} \cdot \vec{c} = -6 + 0 + 6 = 0$

$-2\vec{a} = \langle -2, 0, -6 \rangle = \vec{c}$

Properties of Dot Product

1. $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$

2. $s(\vec{a} \cdot \vec{b}) = (s\vec{a}) \cdot \vec{b}$

number (scalar)

$s(\vec{a} \cdot \vec{b}) = s(\vec{b} \cdot \vec{a}) = (s\vec{b}) \cdot \vec{a} = \vec{a} \cdot (s\vec{b})$

3. $\vec{a} \cdot (\vec{b} + \vec{c}) = \vec{a} \cdot \vec{b} + \vec{a} \cdot \vec{c}$

Ch. 12.1 Planes & Surfaces

Define a plane P with:

the vector $\vec{n}$ sticks straight out

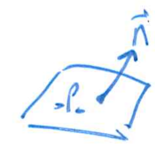
& point P_0 is on P

P consists of all points in $\mathbb{R}^3$ (xyz)

such that:

$\vec{n}$ is perpendicular (orthogonal)

to the vector from P_0 to our point.

A plane in $\mathbb{R}^3$ with 

normal vector (straight-out vector)

$$\vec{n} = \langle n_1, n_2, n_3 \rangle$$

and point $P_0 = (p_1, p_2, p_3)$

has equation:

$$n_1 x + n_2 y + n_3 z = n_1 p_1 + n_2 p_2 + n_3 p_3$$

ex Plane P has normal vector $\vec{n} = \langle 1, 2, 3 \rangle$
and passes through $(4, 0, 4)$:

equation of P:

$$x + 2y + 3z = 4 + 0 + 12 = 16$$

$$\boxed{x + 2y + 3z = 16}$$