Math 241 C8 **Name:** Key

Quiz # 2

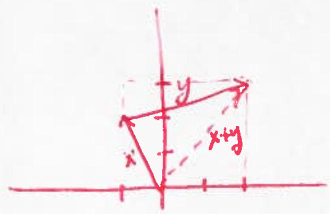
February 6, 2013

No electronic devices, notes, or interpersonal communication allowed.

Show work to get credit.

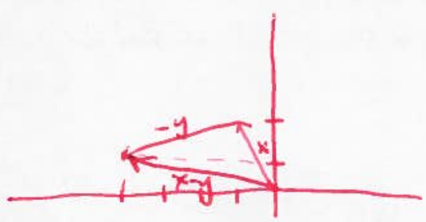
(1) Let $\vec{x} = \langle -1, 2\rangle$ and $\vec{y} = \langle 3, 1\rangle$.

(a) [3pts] Draw $\vec{x}$ and $\vec{y}$ in the plane with their tails placed so that you can easily draw in $\vec{x}+\vec{y}$. Compute $\vec{x}+\vec{y}$ and check that it matches your picture.



$x+y = \langle 2, 3\rangle$ ✓

(b) [3pts] Draw $\vec{x}$ and $\vec{y}$ in the plane with their tails placed so that you can easily draw in $\vec{x}-\vec{y}$. Compute $\vec{x}-\vec{y}$ and check that it matches your picture.



$x-y = \langle -4, 1\rangle$ ✓

(2) [6pts] Consider the lines with parametric formulas $\ell_1(t) = (3,0,1) + t(-2,1,1)$ and $\ell_2(t) = (5,4,1) + t(1,2,0)$. Are they parallel, perpendicular, or neither? Do they intersect, or not?

$d_1 = (-2,1,1)$ $\quad d_1 \cdot d_2 = -2+2+0 = 0$

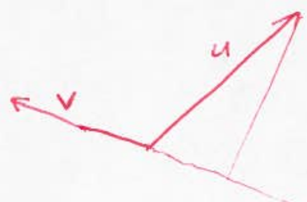
$d_2 = (1,2,0)$ $\quad \Rightarrow$ perpendicular

$$\begin{cases} 3-2t = 5+s & \text{True!} \\ t = 4+2s \longrightarrow s=-2 \\ 1+t = 1 \Rightarrow t=0 \end{cases}$$

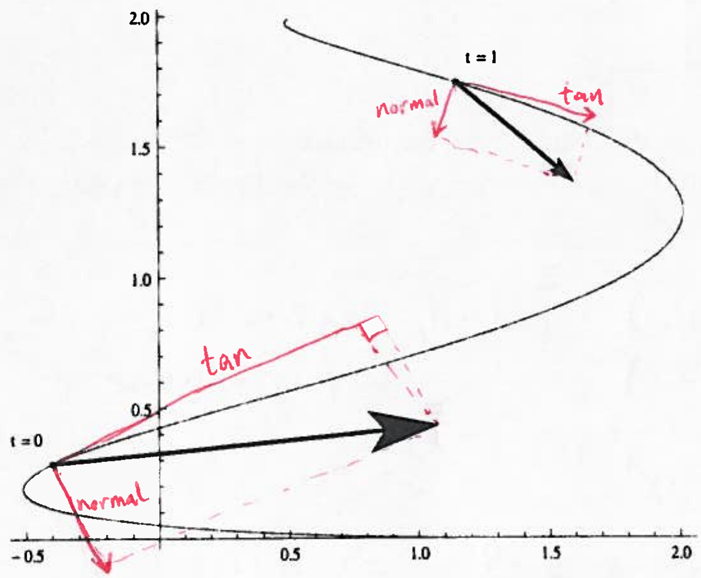
$\Rightarrow$ intersect, at $(3,0,1)$

(3) [4pts] Let $\vec{u} = (-2, 3, 5)$ and $\vec{v} = (1, -2, 1)$. Find the push (projection) of $\vec{u}$ in the direction of $\vec{v}$. Sketch a picture showing the situation (draw in the plane containing $\vec{u}$ and $\vec{v}$; don't mess with a 3D picture).

$$\text{proj}_v u = \frac{u \cdot v}{v \cdot v} v = \frac{-3}{6}(1,-2,1) = \left(-\tfrac{1}{2}, 1, -\tfrac{1}{2}\right)$$



(4) [4pts] Here's a plot of the motion of a particle in the plane, together with the acceleration vectors at $t = 0$ and $t = 1$ (plotted with tails at the position at those times). Add into the picture the tangential and normal components of acceleration at those times. What do these tell you about how the speed of the particle is changing at these two points?



Since at $t=0$, the tan. comp. of accel is in the direction of motion, the particle is speeding up.

At $t=1$, the reverse is true; the particle is slowing down.