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Per: D

33/36

Analysis H – Deggeller / Hahn
Ch 5 – Vectors Quiz 1 (36 points)
Calculator OK

1. Given $\vec{u}=\langle 5,4\rangle$, $\vec{v}=\langle -1,6\rangle$, and $\vec{w}=\langle 2,-9\rangle$, find the following (a-d are 2 points, e-h are 3 points each):

a) $|\vec{u}| = \sqrt{41}$

b) $2\vec{u}+\vec{w} = \langle 12,-1\rangle$

c) $\vec{u}\cdot\vec{w}$ $5\cdot 2+4\cdot -9 = -26$

d) $\hat{v} = \left\langle \frac{-1}{\sqrt{37}}, \frac{6}{\sqrt{37}} \right\rangle$

e) the angle between $\vec{w}$ and $\vec{v}$ (in degrees)

$\cos\theta = \frac{w\cdot v}{|w||v|} = \frac{-2-54}{\sqrt{85}\sqrt{37}}$

$\theta = 176.93°$

f) a unit vector orthogonal to $\vec{w}$

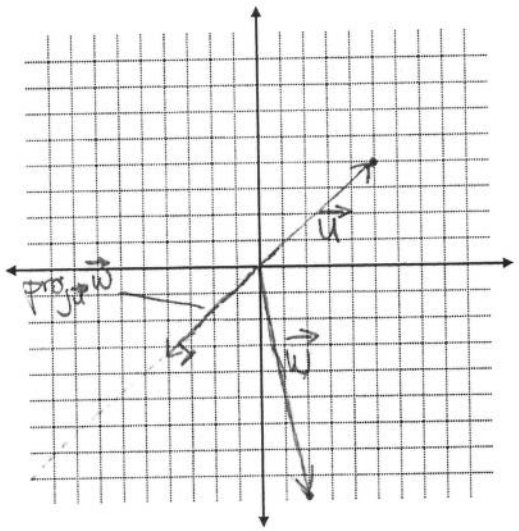
$\left\langle \frac{9}{\sqrt{85}}, \frac{2}{\sqrt{85}} \right\rangle$

g) vector $proj_{\vec{u}}\vec{w}$

$\text{proj}_{\vec{u}}\vec{w} = \frac{\vec{w}\cdot\vec{u}}{|\vec{u}|^2}\vec{u}$

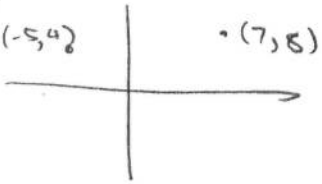
$\frac{2\cdot 5+4\cdot -9}{37}\langle 5,4\rangle = \left\langle -\frac{130}{37}, -\frac{104}{37} \right\rangle$

h) sketch $\vec{u}$, $\vec{w}$, and $proj_{\vec{u}}\vec{w}$ on the axis, and label each:



2. Write a vector equation for the line containing the points (-5, 4) and (7, 8). (2 points)

$y = \langle -5,4\rangle + t\langle 12,4\rangle$



3. Write your answer from #2 as a set of parametric equations. (2 points)

$x = 12t - 5$
$y = 4t + 4$

-1

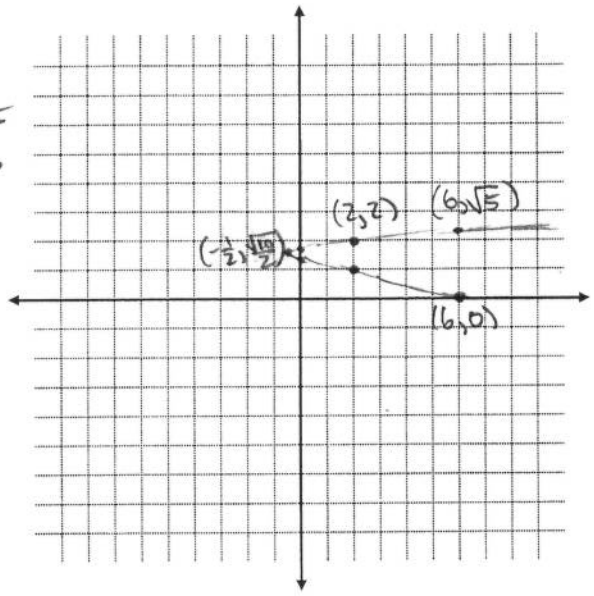
4. Examine the following set of parametric equations:

$x = t^2 + t \longrightarrow t(t+1)$

$y = \sqrt{t+3}$

for $t : [-3, \infty)$

	-3	-2	-1	0	1	2	3
x	6	2	0	0	2	6	12
y	0	1	$\sqrt{2}$	$\sqrt{3}$	2	$\sqrt{5}$	$\sqrt{6}$



a) Sketch the set of parametric equations on the grid to the right. Label at least 3 points. (3 points)

b) Eliminate the parameter and write x as a function of y. (2 pts)

$x + \frac{1}{4} = (t + \frac{1}{2})^2$

$\sqrt{x+\frac{1}{4}} = t + \frac{1}{2}$

$t = \sqrt{x+\frac{1}{4}} - \frac{1}{2}$

$y = \pm\sqrt{\sqrt{x+\frac{1}{4}} - \frac{1}{2}}$ (-1)

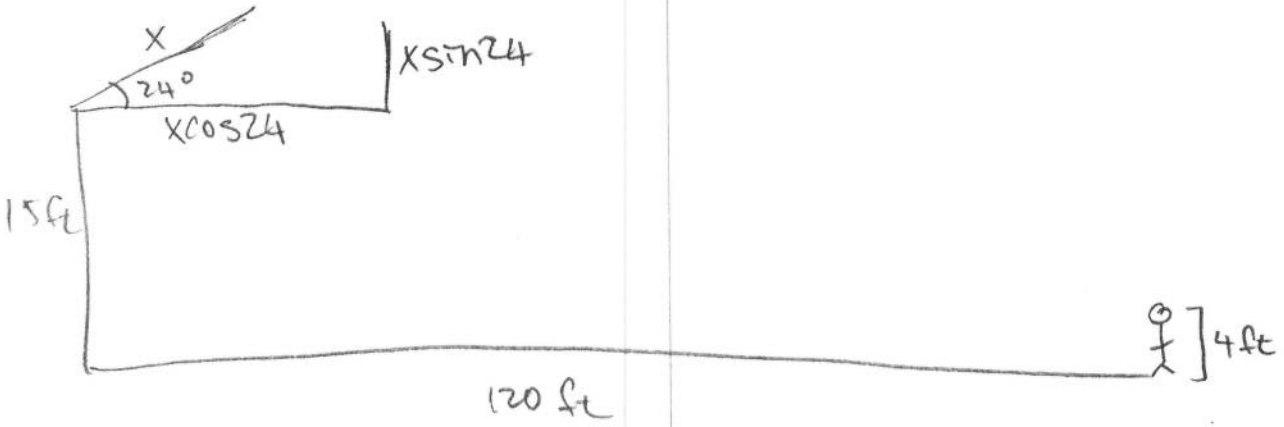
$x = (y^2-3)^2 + y^2 - 3$

c) What is the domain of the function (possible x values)? (2 pt)

$x \geq -\frac{1}{4}$ (-1)

5. Calvin is on the roof of his house (15 feet tall) with a pile of water balloons and a giant slingshot. The slingshot is fixed to launch water balloons at 24 degrees above horizontal, but he can change the velocity of the balloons by how much he pulls the rubber band back. He sees Susie Derkins (who is 4 feet tall), standing across the street, 120 feet away. (vertical motion formula: $h(t) = -16t^2 + v_0 t + h_0$)

How fast does a water balloon need to leave the slingshot in order to hit Suzie on top of her head? Your answer must be accurate to 2 decimal places. (5 pts)



$= \frac{120}{x\cos 24}$ $\quad -16\left(\frac{120}{x\cos 24}\right)^2 + (x\sin 24)\left(\frac{120}{x\cos 24}\right) + 15 = 4$

$-16\left(\frac{120}{x\cos 24}\right)^2 = -11 - \left(\frac{120}{\cos 24}\right)\sin 24$

$x = 65.46 \text{ ft/sec}$

-2