Vectors Quiz 1
Quiz 2021-22 No Calculators [31 pts]

$\frac{30.5}{31}$

Vector Inspector Chris Lee
Period 3

1. Given $\vec{u} = \langle -1,4 \rangle$ and $\vec{v} = \langle 7,5 \rangle$, find the following [2 points each]: Give all your answers in exact form.

a) $|\vec{v}|$ $\sqrt{49+25} = \boxed{\sqrt{74}}$

b) $2\vec{u}+\vec{v}$ $2\langle -1,4\rangle + \langle 7,5\rangle =$
$\langle -2,8\rangle + \langle 7,5\rangle = \boxed{\langle 5,13\rangle}$

c) $\vec{u}\bullet\vec{v}$ $-1\cdot 7 + 4\cdot 5 = -7+20 =$
$\boxed{13}$

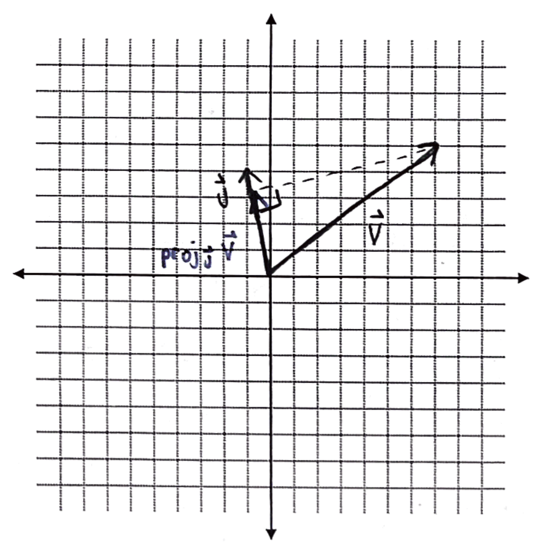
d) scalar $proj_{\vec{u}}\vec{v}$
$comp_{\vec{u}}\vec{v} = \frac{\vec{u}\cdot\vec{v}}{|\vec{u}|} = \boxed{\frac{13}{\sqrt{17}}}$

1+16

e) the angle between $\vec{u}$ and $\vec{v}$ (in degrees)
$\cos\theta = \frac{\vec{u}\cdot\vec{v}}{|\vec{u}||\vec{v}|} = \frac{13}{\sqrt{17}\cdot\sqrt{74}}$
$\theta = \cos^{-1}\left(\frac{13}{\sqrt{1258}}\right)^{\circ}$

f) vector $proj_{\vec{u}}\vec{v}$
$proj_{\vec{u}}\vec{v} = \frac{\vec{u}\cdot\vec{v}}{|\vec{u}|^2}\cdot\vec{u} = \boxed{\frac{13}{17}\langle -1,4\rangle}$
$\left\langle \frac{-13}{17}, \frac{52}{17} \right\rangle$

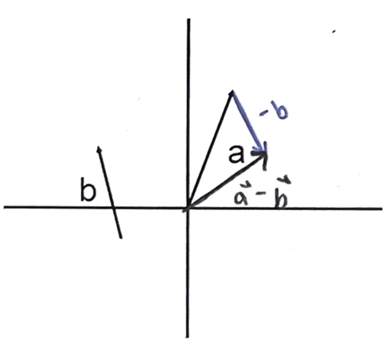
g) sketch $\vec{u}$, $\vec{v}$, and vector $proj_{\vec{u}}\vec{v}$ on the axes, to the right and label each



---

2. On the axes below sketch and label the vector $\vec{a}-\vec{b}$. [2]

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



3. The following pair of parametric equations represents a line segment. [4]

$x = a - \sin t \quad y = b + 2\sin t \quad for \quad t:(-\infty, \infty)$ where a, and b are constants.

a) Convert the equation to rectangular form, and solve for y in terms of the other variables.

$x = a - \sin t \qquad y = b + 2\sin t$

$x - a = -\sin t \qquad y - b = 2\sin t$

$\sin t = a - x$

$y - b = 2(a - x)$

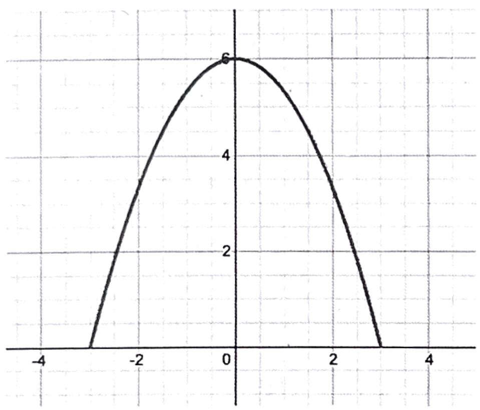
$y - b = 2a - 2x$

$\boxed{y = -2x + 2a + b}$

b) This graph makes a line segment. Name the two endpoints (in terms of a and b).

$(a-1, b+2) \quad (a+1, b-2)$

4. The parametric relation $x = 3\cos t$ and $y = 6\sin^2 t$ is graphed below over the interval $[0,2\pi]$



a) Name a t value that will generate the vertex point.

t= $\frac{\pi}{2}$ [2]

b) Eliminate the parameter to form a relationship in x, and y without trig functions. [2]

$x^2 = 9\cos^2 t \qquad y = 6\sin^2 t$

$\frac{x^2}{9} = \cos^2 t \qquad \frac{y}{6} = \sin^2 t$

$\cos^2 t + \sin^2 t = \frac{x^2}{9} + \frac{y}{6}$

$\frac{x^2}{9} + \frac{y}{6} = 1$ ✓

$\frac{y}{6} = -\frac{x^2}{9}$

$\boxed{y = -\frac{2}{3}x^2}$

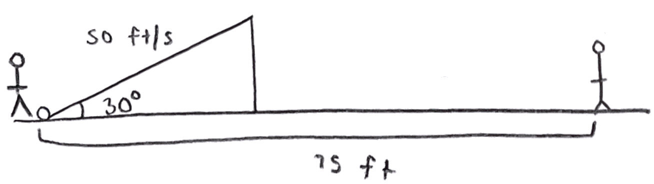
$-\frac{1}{2}$

5. Consider the points A= (-3, 3) and B = (3,6) find the point 2/3 of the way from A to B. $\langle 1, 5 \rangle$. [2]

$\langle -3, 3\rangle + t\langle 6, 3\rangle = \langle x, y\rangle$

$\langle -3, 3\rangle + \frac{2}{3}\langle 6, 3\rangle = \langle -3, 3\rangle + \langle 4, 2\rangle = \boxed{\langle 1, 5\rangle}$

6. Patricia kicks a soccer ball off the ground with initial velocity of 50 f/s at an angle of 30 degrees. Her friend, Leonardo, is standing 75 feet away. Will the ball make it to Leonardo before hitting the ground? Clearly show the equations you used to algebraically solve the problem, as well as a justification of your "yes" or "no" answer.[5]



$\frac{50\sqrt{3}}{2}$

$V_x = 50\cos 30 \qquad V_y = 50\sin 30$

$V_x = 25\sqrt{3} \qquad V_y = 25$

$d = rt$

$75 = 25\sqrt{3}\ t$

$t = \frac{75}{25\sqrt{3}} = \sqrt{3}$

$\frac{3\sqrt{3}}{\sqrt{3}}$

$h(t) = -16t^2 + 25t$

$h(t) = -16(\sqrt{3})^2 + 25(\sqrt{3})$

$= -16(3) + 25\sqrt{3}$

$h(t) = -48 + 25\sqrt{3}$ ✓

$(-48 + 25\sqrt{3}) < 0$

Since answer to height equation is neg, the ball will not make it to Leonardo before hitting the ground.

$-\frac{1}{2}$