Neeraj Gummalam committing crimes with both direction and magnitude 33 Period: 3

AH 24/25: Friedland / Hlasek /Tantod, Unit 5 (Vectors and Parametrics) Quiz

35 points

No Calculators

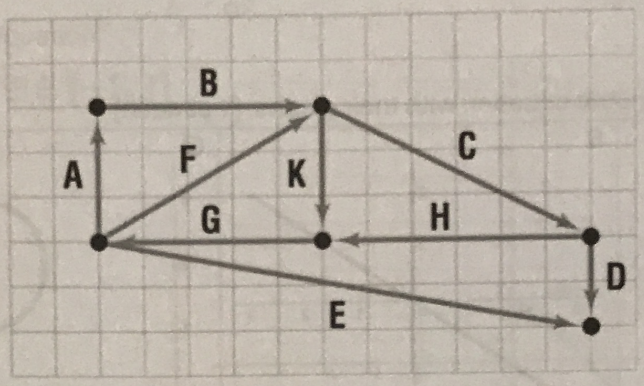
MULTIPLE CHOICE: Questions 1-5 are multiple choice. Circle one best answer for each question. [2pts each]

Helpful Physics formulas:

$x(t) = (v_0 \cos\theta)t$

$y(t) = (v_0 \sin\theta)t - 16t^2 + h_0$

Diagram for questions 1 and 2:



1. Express vector **E** in terms of vectors **G**, **H**, and **D**. $-G-H+D$

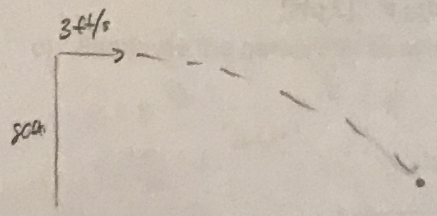
a) **E = G + H + D** b) **E = −G − H + D** ✓ c) **E = G − H + D** d) **E = −G − H − D**

2. Which of the statements about a dot product is true?

a) **A · K = 0** b) **A · F < 0** c) **A · B > 0** d) **A · E < 0** ✓

3. You throw a stone horizontally at a speed of 3 ft/s from the top of a cliff that is 80 ft high. At what horizontal distance from the base of the cliff does the stone hit the ground?

a) $3\sqrt{5}$ ft ✓ b) $5\sqrt{3}$ ft c) 15 ft d) $\sqrt{15}$ ft



$0 = -16t^2 + 80$

$\frac{-80}{-16} = t^2$ $\quad t = \sqrt{5}$

$d = (3\text{ ft/s})(\sqrt{5}\text{ s}) = 3\sqrt{5}$

4. Which parametric equation below does **NOT** match the rectangular curve $y = x^2 + 1$?

a) $x = t^3,\ y = t^6 + 1$ ✓ b) $x = t^2,\ y = t^4 + 1$ c) $x = -t,\ y = t^2 + 1$ d) $x = \frac{1}{t}, y = \frac{1}{t^2} + 1$

✓ ✗ can't be negative horizontal flip is same maybe

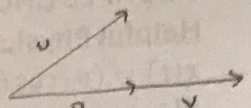
-0

$1^2+5^2+2^2 = 30$ $\quad -4-6=-10$

5. Given the vectors $\vec{p} = \langle -4,0,3\rangle$ and $\vec{q} = \langle 1,-5,-2\rangle$, find $proj_{\vec{q}}\vec{p}$.

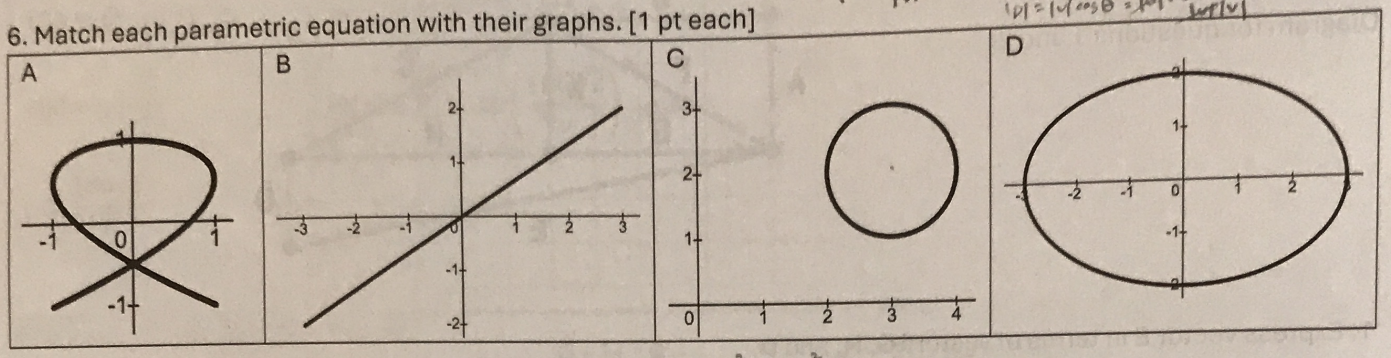
a) $\frac{-10}{30}\langle -4,0,3\rangle$ b) $\frac{-10}{25}\langle -4,0,3\rangle$ c) $\frac{-10}{30}\langle 1,-5,-2\rangle$ ✓ d) $\frac{-10}{25}\langle 1,-5,-2\rangle$

$q \cdot \frac{p \cdot q}{|q|^2} = \langle 1,-5,2\rangle \cdot \frac{-10}{30}$



$P = \frac{v}{|v|} \cdot |p| = v \cdot \frac{u \cdot v}{|v|^2}$ $\quad |p| = |u|\cos\theta = |u| \cdot \frac{u \cdot v}{|u||v|}$

6. Match each parametric equation with their graphs. [1 pt each]



(i) $x = 3\sin t, y = 2\cos t$ D $\quad \frac{x^2}{9} + \frac{y^2}{2} = 1$

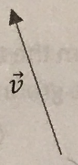
(ii) $x = 3 + \sin t, y = 2 + \cos t$ C ✓ $\quad (x-3)^2 + (y-2)^2 = 1$

(iii) $x = 3\sin t, y = 2\sin t$ B $\quad \frac{x}{3} = \frac{y}{2}$ $\quad y = \frac{2}{3}x$

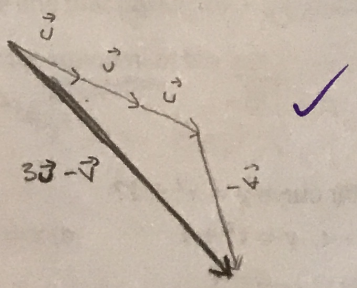
(iv) $x = \sin 3t, y = \cancel{\sin} \cos 2t$ A

OPEN RESPONSE: Show all work. Give your answers in exact form (use radicals if necessary). You should simplify your answers but you are *not* required to rationalize any denominators.

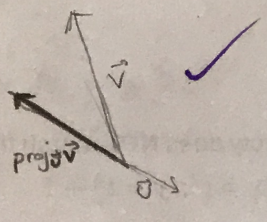
7. Given the vectors below, draw a diagram for each question below. In each diagram label each vector to make it **clear** which vector is your answer.



a) Draw $3\vec{u} - \vec{v}$ [2 pts]



b) Draw $proj_{\vec{u}}\vec{v}$ [2 pts]



/10

$\sqrt{4^2+3^2+2^2} = \sqrt{29}$

8. Given the vectors $\vec{a} = \langle -4,3,-2 \rangle$ and $\vec{b} = \langle 5,-2,-6 \rangle$, find $\text{comp}_{\vec{a}}\vec{b}$. [2 pts]

$|b|\cos\theta = |b| \frac{a \cdot b}{|a||b|} = \frac{a \cdot b}{|a|} = \frac{-20-6+12}{\sqrt{29}} = \frac{-14\sqrt{29}}{29}$ ✓

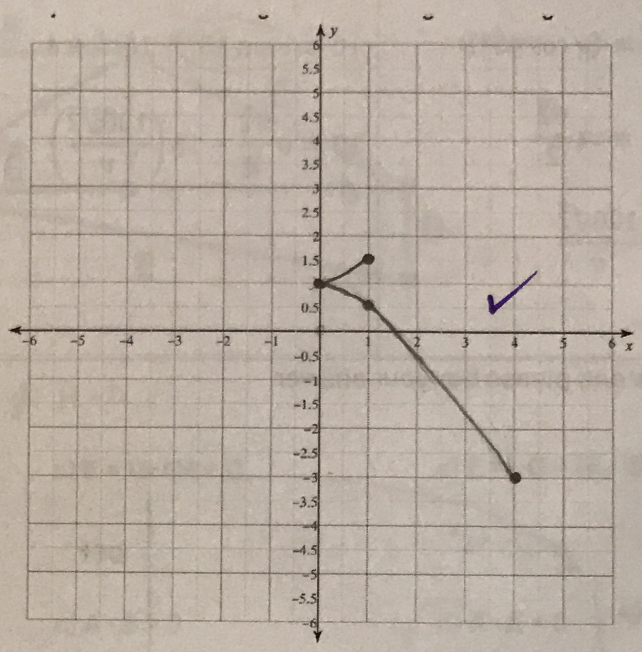
9. Consider the parametrically defined equation:

$x(t) = t^{2/3} \quad y(t) = \frac{t}{2} + 1 \quad t \in [-8,1]$

t	x	y
-8	4	-3
-7		
-6		
-5		
-4		
-3		
-2	$\sqrt[3]{4}$	0
-1	1	0.5
0	0	1
1	1	1.5

decreasing

increasing



✓

a) State the domain and range of the graph. [2 pts each]

Domain: $[0,4]$ ✓ Range: $y \in [-3, 1.5]$ ✓

b) Carefully create the graph on the *xy* plane above. [3 pts]

c) Eliminate the parameter to express y **in terms of** x and box your final answer. [2 pts]

$x = t^{\frac{2}{3}} \qquad x^{\frac{3}{2}} = t$

$y = \frac{t}{2} + 1$

$y = \frac{x^{\frac{3}{2}}}{2} + 1$

-1

-1

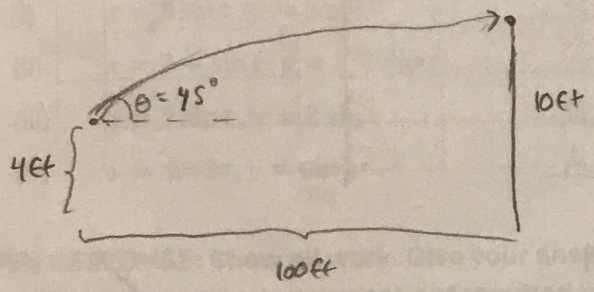
10. Beth is trying to solve the following math problem:

"A baseball just clears a 10 ft wall 100 ft from home plate. If it leaves the bat at 45° and 4 ft above the ground, what must its initial velocity be?"

Beth's work is shown below. Unfortunately, she made a mistake and got stuck. **Circle her mistake**, correct it, and finish solving for the initial velocity v. Leave your answer as a numerical expression. [3 pts]

$x = (v\cos\theta)t$	$y = (v\sin\theta)t - 16t^2 + h_0$	**Corrected mistake:**
$100 = (v\cos 45°)t$	$10 = (v\sin 45°) - 16t^2 + 4$	$v\sin 45° t$
$100 = vt\frac{\sqrt{2}}{2}$	~~10~~ $6 = v\frac{\sqrt{2}}{2} - 16\left(\frac{100\sqrt{2}}{v}\right)^2$ ~~$+4$~~	she omitted the t
$t = \frac{100\sqrt{2}}{v}$		

Find ***v*** and please box your answer.



$6 - 100 = -94$

$x = v\cos\theta \cdot t$

$y = v\sin\theta \cdot t - 16t^2 + h_0$

$6 = \left(\frac{\sqrt{2}}{2}\right)\left(\frac{100\sqrt{2}}{v}\right) - 16\left(\frac{100\sqrt{2}}{v}\right)^2$

$-94 = -16\left(\frac{100\sqrt{2}}{v}\right)^2$

$\frac{94}{16} = \frac{10000 \cdot 2}{v^2}$

$v = \sqrt{\frac{10000 \cdot 2 \cdot 16}{94}} = 100\sqrt{\frac{16}{47}} = \frac{400}{\sqrt{47}}$

$= \frac{400\sqrt{47}}{47}$ ft/s ✓

11. Consider the line that passes through these points: A(2, 6, 7) and B(-2, 9, -3).

(a) Write the vector equation of the line. [2 pts]

-1

$\langle 2, 6, 7\rangle + t\langle -4, 3, -10\rangle = \langle x, y, z\rangle$

(b) Write the parametric form of the line. [1 pt]

$x(t) = 2 - 4t$

$y(t) = 6 + 3t$ ✓

$z(t) = 7 - 10t$

-1