1) $\vec{v} = [1, 2, 3]$

normalize $\Rightarrow \frac{\vec{v}}{\|\vec{v}\|} =$

$\|\vec{v}\| = \sqrt{1^2+2^2+3^2} = \sqrt{14}$

$\frac{\vec{v}}{\|\vec{v}\|} = [\frac{1}{\sqrt{14}}, \frac{1}{\sqrt{7}}, \frac{3}{\sqrt{14}})$

2.

$3[1,1] + 2[-1,1]$

$= [3,3] + [-2,2]$

$= [1, 5]$

a) $\|[1,5]\| = \sqrt{1^2+25^2}$

b) $= \sqrt{26}$

3.

a) $[0,1,1] \times [1,1,0]$

$= [0\cdot1 - 1\cdot1, 1\cdot1 - 0\cdot0, 0\cdot1 - 1\cdot1]$

$= [-1, 1, -1]$

b) $[2,3,4] \times [1,0,0]$

$= [3\cdot0 - 4\cdot0, 4\cdot1 - 2\cdot0, 2\cdot0 - 3\cdot1]$

$= [0, 4, -3]$

c) $[0,3,4] \times [2,2,2]$

$= [3\cdot2 - 4\cdot2, 4\cdot2 - 0\cdot2, 0\cdot2 - 3\cdot2]$

$= [-2, 8, -6]$

4. a) $[1,0,1] \cdot [0,1,1]$

$= 1\cdot0 + 0\cdot1 + 1\cdot1$

$= 1$

b) $[0,3,4] \cdot [1,0,0]$

$= 0\cdot1 + 3\cdot0 + 4\cdot0$

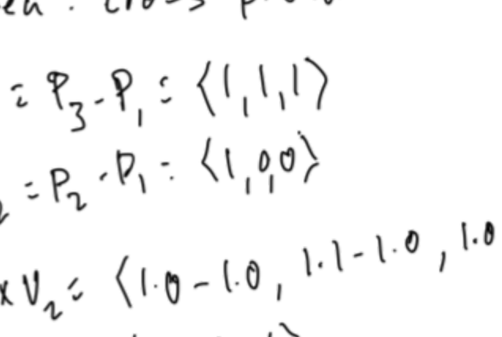
$= 0$

c) $[2,3,4] \cdot [6,4,3]$

$= 2\cdot6 + 3\cdot4 + 4\cdot3$

$= 36$

5)



the triangle is into the screen

a) Area = cross product of the long sides

$v_1 = P_3 - P_1 = \langle 1,1,1 \rangle$

$v_2 = P_2 - P_1 = \langle 1,0,0 \rangle$

$v_1 \times v_2 = \langle 1\cdot0 - 1\cdot0, 1\cdot1 - 1\cdot0, 1\cdot0 - 1\cdot1 \rangle$

$= \langle 0, 1, -1 \rangle$

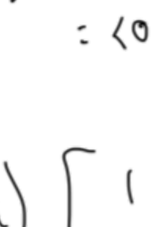
$\|v_1 \times v_2\| = \sqrt{1^2 + (-1)^2} = \sqrt{2}$

length of the 3rd side

Area of triangle $= \frac{1}{2} b \cdot h$

$= \frac{1}{2} \cdot 1 \cdot \sqrt{2} = \frac{\sqrt{2}}{2}$

b)



← we want this vector

← not this one

$v_1 \times v_2 = \langle 0, 1, -1 \rangle$ ← negative z

$v_2 \times v_1 = -(v_1 \times v_2)$

$= \langle 0, -1, 1 \rangle$ ← positive z

6 a) $\begin{bmatrix} 1 & 2 & 5 \\ -1 & -1 & 1 \\ 4 & 4 & -2 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$

$\begin{bmatrix} 1\cdot1 + 2\cdot2 + 5\cdot3 \\ -1\cdot1 + (-1\cdot2) + 1\cdot3 \\ 4\cdot1 + 4\cdot2 + (-2\cdot3) \end{bmatrix} = \begin{bmatrix} 20 \\ 0 \\ 6 \end{bmatrix}$

b) $\begin{bmatrix} 2 & 0 & 3 \\ 0 & -1 & 2 \\ 3 & 2 & -2 \end{bmatrix} \cdot \begin{bmatrix} -1 & -4 & 1 \\ 1 & -1 & 4 \\ 0 & 0 & 5 \end{bmatrix}$

$= \begin{bmatrix} 2\cdot(-1) + 0\cdot1 + 3\cdot0 & (2\cdot-4) + 0\cdot-1 + 3\cdot0 & 2\cdot1 + 0\cdot4 + 3\cdot5 \\ 0\cdot-1 + -1\cdot1 + 2\cdot0 & 0\cdot-4 + (-1\cdot-1) + 2\cdot0 & 0\cdot1 + (-1\cdot4) + 2\cdot5 \\ 3(-1) + 2\cdot1 + -2\cdot0 & 3(-4) + 2(-1) + -2(0) & 3\cdot1 + 2\cdot4 + (-2)5 \end{bmatrix}$

$= \begin{bmatrix} -2 & -8 & 17 \\ -1 & 1 & 6 \\ -1 & -14 & 1 \end{bmatrix}$

7) $y = \frac{4}{3}x - 1$

$y = 0$

intersection is

$0 = \frac{4}{3}x - 1$

$1 = \frac{4}{3}x$

$x = \frac{3}{4}$

$(\frac{3}{4}, 0)$ is the intersection

b) they are not perpendicular because the slopes are not negative reciprocals