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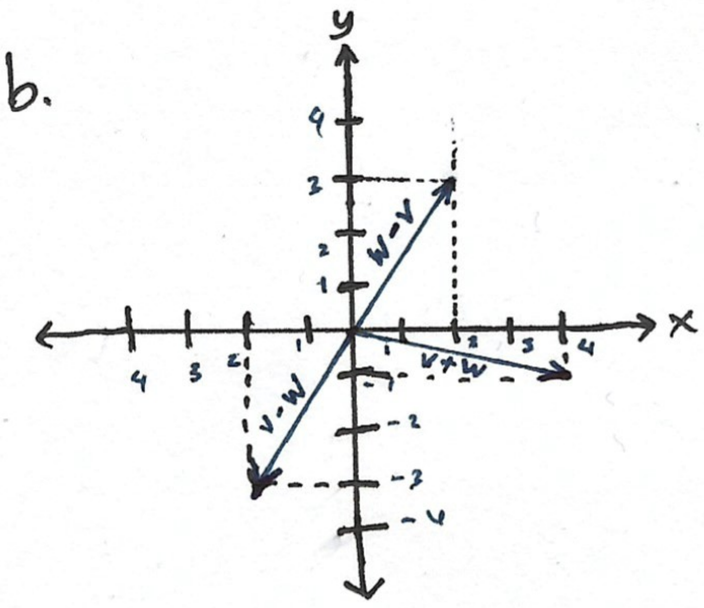
1. a. - $v+w = (1+3, -2+1) = (4, -1)$
   - $v-w = (1-3, -2-1) = (-2, -3)$
   - $w-v = (3-1, 1-(-2)) = (2, 3)$

b.



2. a. $P(3,2,0)$ $Q(5,-2,0)$

$\overrightarrow{PQ} = (5-3, -2-2, 0-0)$

$v = (2, -4, 0)$

b. $P(1,1,1)$ $Q(-4,-4,-4)$

$\overrightarrow{PQ} = (-4-1, -4-1, -4-1)$

$v = (-5, -5, -5)$

c. $P(1, 0, 1.2)$ $Q(0, 0, 6.2)$

$\overrightarrow{PQ} = (0-1, 0-0, 6.2-1.2)$

$v = (-1, 0, 5)$

3. a. $\|v\| = \sqrt{(2)^2 + (-4)^2 + (0)^2}$
$= \sqrt{4+16} = \sqrt{20} = 2\sqrt{5}$

b. $\|v\| = \sqrt{(-5)^2 + (-5)^2 + (-5)^2}$
$= \sqrt{25+25+25}$
$= \sqrt{75} = 5\sqrt{3}$

c. $\|v\| = \sqrt{(-1)^2 + (0)^2 + (5)^2}$
$= \sqrt{1+25} = \sqrt{26}$

4. a. $\hat{u} = \left(\frac{2}{2\sqrt{5}}, \frac{-4}{2\sqrt{5}}, \frac{0}{2\sqrt{5}}\right)$
$= \left(\frac{\sqrt{5}}{5}, \frac{-2}{\sqrt{5}}, 0\right)$

b. $\hat{u} = \left(\frac{-5}{5\sqrt{3}}, \frac{-5}{5\sqrt{3}}, \frac{-5}{5\sqrt{3}}\right)$
$= \left(\frac{-\sqrt{3}}{3}, \frac{-\sqrt{3}}{3}, \frac{-\sqrt{3}}{3}\right)$

c. $\hat{u} = \left(\frac{-1}{\sqrt{26}}, \frac{0}{\sqrt{26}}, \frac{5}{\sqrt{26}}\right)$
$= \left(\frac{-\sqrt{26}}{26}, 0, \frac{5\sqrt{26}}{26}\right)$

5. $u(1,1,1)$, $v(2,3,1)$, $w(-1,1,0)$

a. angle between u, v

$\cos\theta = \frac{u \cdot v}{\|u\|\|v\|}$ → $(1\cdot 2 + 1\cdot 3 + 1\cdot 1) = (2+3+1) = 6$

$\|u\|\|v\|$ → $\sqrt{(2)^2+(3)^2+(1)^2} = \sqrt{4+9+1} = \sqrt{14}$

→ $\sqrt{1+1+1} = \sqrt{3}$

$\cos\theta = \frac{6}{\sqrt{3}\sqrt{14}} = \frac{6}{\sqrt{42}} = \frac{6\sqrt{42}}{42} = \frac{\sqrt{42}}{7} \rightarrow \approx 0.93$

$\theta = \cos^{-1} 0.9$

b. angle between u, w

$\cos\theta = \frac{u \cdot w}{\|u\|\|w\|}$ → $(1\cdot(-1) + 1\cdot 1 + 1\cdot 0) = -1+1+0 = 0$

$\|u\|\|w\|$ → $\sqrt{(-1)^2+1^2+0^2} = \sqrt{2}$

→ $\sqrt{3}$

$\cos\theta = \frac{0}{\sqrt{2}\cdot\sqrt{3}} = \frac{0}{\sqrt{6}} = 0$

$\cos\theta = 0 \rightarrow \theta = 90°$

c. angle between v, w

$\cos\theta = \frac{v \cdot w}{\|v\|\|w\|}$ → $(2\cdot(-1) + 3\cdot 1 + 1\cdot 0) = -2+3+0 = 1$

$\|v\|\|w\|$ → $\sqrt{2}$

→ $\sqrt{14}$

$\cos\theta = \frac{1}{\sqrt{14}\cdot\sqrt{2}} = \frac{1}{\sqrt{28}} = \frac{\sqrt{28}}{28} = \frac{2\sqrt{7}}{28} = \frac{\sqrt{7}}{14} \rightarrow \approx 0,18$

$\theta = \cos^{-1} 0.2$

6. a. $(2,3)$ & $(1,-1)$ (x_0, x_1)

$x = (1-t)x_0 + tx_1$
$= (1-t)2 + t$
$x = 2-t$

$y = (1-t)y_0 + ty_1$
$y = (1-t)3 + (-t)$
$y = 3-4t$

b. $(2,1)$ & $v = (-1,1)$

$x = x_0 + tv$
$x = 2 + (-1)t = 2-t$
$y = y_0 + tv$
$= 1+t$

7. $P_0(1,-2,1)$, $P_1(-1,2,0)$, $P_2(0,4,1)$

$a(x-x_0) + b(y-y_0) + c(z-z_0) = 0$

$\overrightarrow{v_1} = \overrightarrow{P_0P_1} = \langle(-1-1), (2+2), (0-1)\rangle$
$= \langle -2, 4, -1\rangle$

$\overrightarrow{v_2} = \overrightarrow{P_1P_2} = \langle(0+1), (4-2), (1-0)\rangle$
$= \langle 1, 2, 1\rangle$

$\begin{vmatrix} i & j & k \\ -2 & 4 & -1 \\ 1 & 2 & 1 \end{vmatrix} \rightarrow \begin{vmatrix} 4 & -1 \\ 1 & 1 \end{vmatrix} i - \begin{vmatrix} -2 & -1 \\ 1 & 1 \end{vmatrix} j + \begin{vmatrix} -2 & 4 \\ 1 & 2 \end{vmatrix} k$
$= (4-(-1))i - (-2-(-1))j + (-4-4)k = 5i+1j-8k$

$\langle a,b,c\rangle = \langle 5,1,-8\rangle$

$5(x-1) + 1(y+2) - 8(z-1)$

$5x-5+y+2-8z+8 = 0$