10

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MATH 254H, Fall 2018 QUIZ #1

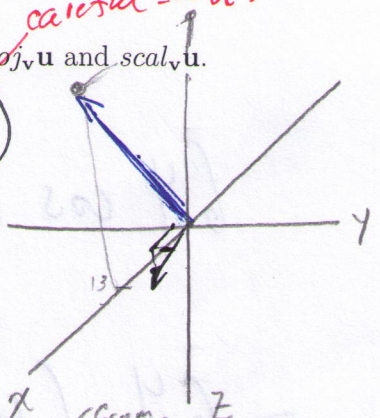
FOR EACH PROBLEM SHOW ALL ESSENTIAL STEPS.

6 1. For the vectors $\mathbf{u} = \langle 13, 0, 26 \rangle$ and $\mathbf{v} = \langle 4, -1, -3 \rangle$, calculate $proj_{\mathbf{v}}\mathbf{u}$ and $scal_{\mathbf{v}}\mathbf{u}$.

careful --- u, v ?

$$\text{Proj}_v u = \left(\frac{u \cdot v}{v \cdot v}\right) v \quad \therefore \quad \text{Proj}_v u = v\left(\frac{v \cdot u}{v \cdot v}\right)$$

$$\text{scal}_v u = \frac{u \cdot v}{|v|} \quad \therefore \quad \text{scal}_v u = \frac{v \cdot u}{|v|}$$



$u = \langle 13, 0, 26 \rangle \quad v = \langle 4, -1, -3 \rangle$

proj

$\langle 4, -1, -3 \rangle \left(\frac{52 + 0 - 78}{16 + 1 + 9}\right) = \frac{-26}{26} = -1$ (26 = 3 · 78)

$\therefore \text{proj}_v u = \langle -4, 1, 3 \rangle$ ✓

scal

$\text{scal}_v u = \frac{-26}{\sqrt{26}}$ (From proj calc ☺)

$\text{Scal}_v u = -\frac{26}{\sqrt{26}}$

4 2. Find the equation of the line through $< 0, 0, 0 >$ that is perpendicular to both $\underset{u}{< 1, 0, 2 >}$ and $\underset{v}{< 0, 1, 1 >}$.

DIRECTION will be $u \times v$

$$u \times v = \begin{vmatrix} i & -j & k \\ 1 & 0 & 2 \\ 0 & 1 & 1 \end{vmatrix} = i\begin{vmatrix} 0 & 2 \\ 1 & 1 \end{vmatrix} - j\begin{vmatrix} 1 & 2 \\ 0 & 1 \end{vmatrix} + k\begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$$

$$(0 - 2) - (1 - 0) + (1 - 0)$$

$$\langle -2, -1, 1 \rangle = u \times v$$

$$\vec{r}(t) = t\langle -2, -1, 1 \rangle$$