University of Toronto Scarborough Campus
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Problems

Q1. Sketch the vectors $-\mathbf{v}$, $\mathbf{v}+\mathbf{w}$, and $\mathbf{v}-\mathbf{w}$ where $\mathbf{v}=(2,3,-6)$ and $\mathbf{w}=(-1,1,1)$.
Note: Please do this without using 3D graphing software.
You won't have access to such tools during the term tests.

Q2. Consider the plane spanned by $\mathbf{v}_1=(2,7,0)$ and $\mathbf{v}_2=(7,2,0)$.

(a) Determine the plane spanned by $\mathbf{v}_1$ and $\mathbf{v}_2$.

(b) Write the plane as a set of points.

Q3. Find the points of intersection of the line $\ell(t)=(3+2t,7+8t,-2+t)$ with the coordinate planes. The coordinate planes are the planes: $x=0$, $y=0$, and $z=0$.

Q4. Compute $\|\mathbf{u}\|$, $\|\mathbf{v}\|$, and $\mathbf{u}\cdot\mathbf{v}$ for the vectors $\mathbf{u}=15\mathbf{i}-2\mathbf{j}+4\mathbf{k}$ and $\mathbf{v}=\pi\mathbf{i}+3\mathbf{j}-\mathbf{k}$.

Q5. Suppose that $\mathbf{u}$ and $\mathbf{v}$ are non-zero vectors in $\mathbb{R}^n$. What is the geometric relationship between the vectors $\mathbf{u}$ and $\mathbf{v}$ if $\mathbf{u}\cdot\mathbf{v}=-\|\mathbf{u}\|\,\|\mathbf{v}\|$?

Q6. Use the dot product to prove the converse of the Pythagorean theorem: Suppose that an arbitrary triangle has side lengths $a,b,c>0$. If the sides satisfy $a^2+b^2=c^2$ then the triangle is right angled.