Math 208H, Section 1

Quiz number 2 solutions

Show all work. How you get your answer is just as important, if not more important, than the answer itself. If you think it, write it!

2. For the vectors $\vec{v} = (1, 2, 2)$ and $\vec{w} = (1, 0, 1)$,

   (a) Find the cosine of the angle between $\vec{v}$ and $\vec{w}$

   Using the dot product:

   $\vec{v} \circ \vec{w} = (1)(1) + (2)(0) + (2)(1) = 1 + 0 + 2 = 3$, and
   $||\vec{v}|| = \sqrt{1^2 + 2^2 + 2^2} = \sqrt{9} = 3$, $||\vec{w}|| = \sqrt{1^2 + 0^2 + 1^2} = \sqrt{2}$, so
   $\cos(\theta) = \dfrac{\vec{v} \circ \vec{w}}{||\vec{v}|| \cdot ||\vec{w}||} = \dfrac{3}{3\sqrt{2}} = \dfrac{1}{\sqrt{2}}$

   [This means that $\theta = \dfrac{\pi}{4}$ (!)]

   (b) Find a (non-$\vec{0}$) vector perpendicular to $\vec{v}$. [Note: there are many correct answers...]

   We want a vector (a, b, c) with $(a, b, c) \circ (1, 2, 2) = a + 2b + 2c = 0$.
   Picking <u>any</u> a and b, we can solve for c !, That is, $c = \dfrac{1}{2}(-a - 2b)$. So, e.g.,

   $(2, 1, -2)$, and $(0, 1, -1)$, and $(12, 5, -11)$, and $(322, -411, 250)$,

   are all perpendicular to $\vec{v}$.