Math 49B (8:30am – 9:20am)
Group Quiz 9
Wed Dec 3, 2008

Group Members' Names: ______________________

SCORE: ___ / 10 POINTS

NO CALCULATORS ALLOWED

Find a unit vector perpendicular to both $2\mathbf{i} + 4\mathbf{j} - 3\mathbf{k}$ and $2\mathbf{k} - \mathbf{i}$. **SCORE: ___ / 2 POINTS**

$\frac{1}{2}$ $\boxed{\langle 2,4,-3\rangle \times \langle -1,0,2\rangle} = \boxed{\langle 8,-1,4\rangle}$ $\frac{1}{2}$

$\frac{1}{2}$ $\boxed{\frac{1}{\|\langle 8,-1,4\rangle\|}\langle 8,-1,4\rangle} = \frac{1}{9}\langle 8,-1,4\rangle = \boxed{\left\langle \frac{8}{9}, -\frac{1}{9}, \frac{4}{9}\right\rangle}$ $\frac{1}{2}$

Find the area of the triangle with vertices (2, 3, 1), (1, –1, 2) and (–1, 1, 3). **SCORE: ___ / 3 POINTS**

$\vec{u} = \langle 1-2, -1-3, 2-1\rangle = \boxed{\langle -1,-4,1\rangle}$ $\frac{1}{2}$ OR $\langle 1,4,-1\rangle$ OR $\langle 3,2,-2\rangle$

$\vec{v} = \langle -1-2, 1-3, 3-1\rangle = \boxed{\langle -3,-2,2\rangle}$ $\frac{1}{2}$ $\langle -2,2,1\rangle$ $\langle 2,-2,-1\rangle$

$\boxed{\vec{u}\times\vec{v}} = \boxed{\langle -6,-1,-10\rangle}$ $\boxed{\frac{1}{2}\|\vec{u}\times\vec{v}\|} = \boxed{\frac{\sqrt{137}}{2}}$

$\frac{1}{2}$ $\frac{1}{2}$ ↳ or $\langle 6,1,10\rangle$ $\frac{1}{2}$ $\frac{1}{2}$

Let $u = -2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$, and $v = 3\mathbf{i} - 2\mathbf{j} - \mathbf{k}$, and $w = -\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$. **SCORE: ___ / 5 POINTS**

[a] Determine if $\mathbf{u} \times \mathbf{v}$ and $\mathbf{v} \times \mathbf{w}$ are orthogonal.

$\vec{u}\times\vec{v} = \boxed{\langle 5,10,-5\rangle}$ 1

$\vec{v}\times\vec{w} = \boxed{\langle 0,-5,10\rangle}$ 1

$\frac{1}{2}$ 1

$\langle 5,10,-5\rangle \cdot \langle 0,-5,10\rangle = \boxed{-100} \boxed{\neq 0 \quad \underline{\text{NO}}}$

[b] Find $(\mathbf{w} \times \mathbf{u}) \cdot \mathbf{v}$.

$\vec{w}\times\vec{u} = \boxed{\langle 10,0,5\rangle}$ 1

$\frac{1}{2}$

$\langle 10,0,5\rangle \cdot \langle 3,-2,-1\rangle = \boxed{25}$

BONUS: Use the algebraic properties of the dot and cross products to prove that $\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w}) = (\mathbf{w} \times \mathbf{u}) \cdot \mathbf{v}$ for all vectors $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$. **SCORE: ___ / 2 POINTS**