MATH 202 Name :___________________________

Quiz 1 January 30, 2008

Instructions: All questions are worth 1 point. You get one point for taking this quiz.

1. An object is located at the point $P = (2, 0, 1)$, but is constrained so that it can only move in the straight-line direction toward the point $B = (1, 1, 1)$.

   (a) Give, in coordinate form, a vector $\mathbf{v}$ representing the direction in which the object can move.

   $$\vec{V} = \langle 1-2,\ 1-0,\ 1-1 \rangle = \langle -1,\ 1,\ 0 \rangle$$

   (b) Give, in coordinate form, a *unit* vector pointing in the direction that the object can move.

   $$\vec{u} = \frac{\vec{V}}{|\vec{V}|} = \frac{\langle -1, 1, 0 \rangle}{\sqrt{(-1)^2 + 1^2 + 0^2}} = \langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0 \rangle$$

2. (a) Determine if the vector $\mathbf{v}_1 = (-2, 0, 4)$ and $\mathbf{v}_2 = (1, 1, 1)$ are perpendicular.

   $$\vec{V}_1 \cdot \vec{V}_2 = (-2)\cdot 1 + 0\cdot 1 + 4\cdot 1 = 2 \neq 0$$

   Vectors are not perpendicular

   (b) Find the angle θ between the vectors $\mathbf{a} = (2, \sqrt{3}, 1)$ and $\mathbf{b} = (-1, \frac{-1}{2}, 2)$. Give your answer in radians.

   $$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|\,|\vec{b}|}$$

   $$\vec{a}\cdot\vec{b} = -2 - \frac{\sqrt{3}}{2} + 2 = -\frac{\sqrt{3}}{2}$$

   $$|\vec{a}| = \sqrt{2^2 + (\sqrt{3})^2 + 1^2} = \sqrt{8} = 2\sqrt{2}$$

   $$|\vec{b}| = \sqrt{(-1)^2 + (-\frac{1}{2})^2 + 2^2} = \sqrt{5\frac{1}{4}} = \sqrt{\frac{21}{4}}$$

   $$\cos\theta = \frac{-\frac{\sqrt{3}}{2}}{2\sqrt{2}\sqrt{\frac{21}{4}}} = -\frac{\sqrt{14}}{28} \qquad \theta = \cos^{-1}\left(-\frac{\sqrt{14}}{28}\right)$$