Math 173 - Quiz 2

February 4, 2010

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (3 points) Let $\vec{u} = -4\hat{\imath} + 7\hat{\jmath}$ and let $\vec{v}$ be the 2D vector that has magnitude 3 and makes a 30° angle with the positive x-axis. Find $3\vec{u} - 2\vec{v}$.

$\vec{u} = -4\hat{\imath} + 7\hat{\jmath}$

$\vec{v} = 3\cos 30^\circ \hat{\imath} + 3\sin 30^\circ \hat{\jmath}$

$= \frac{3\sqrt{3}}{2}\hat{\imath} + \frac{3}{2}\hat{\jmath}$

$3\vec{u} - 2\vec{v} = -12\hat{\imath} + 21\hat{\jmath} - \left(3\sqrt{3}\,\hat{\imath} + 3\hat{\jmath}\right)$

$= \boxed{\left(-12 - 3\sqrt{3}\right)\hat{\imath} + 18\hat{\jmath}}$

2. (3 points) Find the vector of magnitude 5 whose direction is opposite that of $\vec{w} = \hat{\imath} - 3\hat{\jmath} + 5\hat{k}$.

$|\vec{w}| = \sqrt{1^2 + (-3)^2 + 5^2} = \sqrt{35}$

$\frac{-5}{|\vec{w}|}\vec{w} = \boxed{\frac{-5}{\sqrt{35}}\hat{\imath} + \frac{15}{\sqrt{35}}\hat{\jmath} - \frac{25}{\sqrt{35}}\hat{k}} \approx -0.845\hat{\imath} + 2.535\hat{\jmath} - 4.226\hat{k}$

3. (3 points) Find the vector that has a second component of 3 and is parallel to the vector from $P(-2, 3, 9)$ to $Q(-3, -7, 5)$.

$\vec{PQ} = (-3+2)\hat{\imath} + (-7-3)\hat{\jmath} + (5-9)\hat{k}$

$\vec{PQ} = -\hat{\imath} - 10\hat{\jmath} - 4\hat{k}$

$t\vec{PQ} = \square\,\hat{\imath} + 3\hat{\jmath} + \square\,\hat{k} \Rightarrow -10t = 3$

$t = -\frac{3}{10}$

$-\frac{3}{10}\vec{PQ} = \boxed{\frac{3}{10}\hat{\imath} + 3\hat{\jmath} + \frac{12}{10}\hat{k}}$

4. (1 point) Find a 2D vector that is perpendicular to $\vec{r} = -9\hat{\imath} + 5\hat{\jmath}$.

$\vec{r}$ HAS SLOPE $-\frac{5}{9}$.

WE NEED A VECTOR WITH SLOPE $+\frac{9}{5}$.

$\vec{r}_\perp = \boxed{5\hat{\imath} + 9\hat{\jmath}}$