Math 173 - Quiz 1
January 21, 2016

Name key

Score _____

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

1. (3 points) Find a unit vector that has the direction of the vector from $(3, 7)$ to $(-8, 1)$.

$$\frac{\vec{PQ}}{\|\vec{PQ}\|} = \frac{1}{\sqrt{157}}\left(-11\hat{i} - 6\hat{j}\right)$$

P Q

$$\vec{PQ} = (-8-3)\hat{i} + (1-7)\hat{j}$$

$$= -11\hat{i} - 6\hat{j}$$

$$\|\vec{PQ}\| = \sqrt{(-11)^2 + (-6)^2}$$

$$= \sqrt{157}$$

2. (4 points) Find a vector of magnitude 7 that is perpendicular to the graph of $y = \sqrt{x}$ at the point where $x = 4$.

$$\frac{dy}{dx} = \frac{1}{2}x^{-1/2}$$

$$\left.\frac{dy}{dx}\right|_{x=4} = \frac{1}{4}$$

$$m_\perp = -4$$

$$\vec{u} = \hat{i} - 4\hat{j} \qquad \|\vec{u}\| = \sqrt{1+16} = \sqrt{17}$$

$$\frac{7\vec{u}}{\|\vec{u}\|} = \frac{7\hat{i} - 28\hat{j}}{\sqrt{17}}$$

3. (3 points) Let $\vec{u} = 3\hat{i} - 5\hat{j} + \hat{k}$ and $\vec{v} = 6\hat{j} - 8\hat{k}$. Find a vector of magnitude 2 that has the direction of $2\vec{u} - \vec{v}$.

$$\vec{\omega} = 2\vec{u} - \vec{v} = \left[6\hat{i} - 10\hat{j} + 2\hat{k}\right] - \left[6\hat{j} - 8\hat{k}\right]$$

$$= 6\hat{i} - 16\hat{j} + 10\hat{k}$$

$$\|\vec{\omega}\| = \sqrt{36 + 256 + 100} = \sqrt{392}$$

$$\frac{2\vec{\omega}}{\|\vec{\omega}\|} = \frac{12}{\sqrt{392}}\hat{i} - \frac{32}{\sqrt{392}}\hat{j} + \frac{20}{\sqrt{392}}\hat{k}$$