

Math 173 - Quiz 1

January 31, 2013

Name key

Score _____

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

1. (2 points) Find the vector of magnitude 4 that has the direction of
- $\vec{u} = 4\hat{i} - 2\hat{j} - 3\hat{k}$
- .

$$\|\vec{u}\| = \sqrt{4^2 + (-2)^2 + (-3)^2} = \sqrt{29}$$

$$\frac{4}{\|\vec{u}\|} \vec{u} = \frac{4}{\sqrt{29}} (4\hat{i} - 2\hat{j} - 3\hat{k})$$

2. (4 points) Let
- $\vec{u} = \hat{i} - 2\hat{j} + 5\hat{k}$
- and let
- \vec{w}
- be the vector of length 2 in the
- xy
- plane that makes a
- 60°
- with the positive
- x
- axis. Find the angle between
- \vec{u}
- and
- \vec{w}
- .

$$\vec{u} = \hat{i} - 2\hat{j} + 5\hat{k}$$

$$\begin{aligned} \vec{w} &= 2 \cos 60^\circ \hat{i} + 2 \sin 60^\circ \hat{j} \\ &= \hat{i} + \sqrt{3} \hat{j} \end{aligned}$$

$$\vec{u} \cdot \vec{w} = 1 - 2\sqrt{3}$$

$$\|\vec{u}\| = \sqrt{1 + 4 + 25} = \sqrt{30}$$

$$\|\vec{w}\| = 2$$

$$\cos \theta = \frac{1 - 2\sqrt{3}}{2 \cdot \sqrt{30}} \Rightarrow \theta \approx 102.999^\circ$$

3. (3 points) Let
- P
- ,
- Q
- , and
- R
- be the points
- $(1, 2, -3)$
- ,
- $(5, 0, -1)$
- , and
- $(4, -2, 1)$
- , respectively. Compute
- $\vec{PQ} \times \vec{PR}$
- .

$$\vec{PQ} = 4\hat{i} - 2\hat{j} + 2\hat{k}$$

$$\vec{PR} = 3\hat{i} - 4\hat{j} + 4\hat{k}$$

$$\begin{aligned} \vec{PQ} \times \vec{PR} &= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & -2 & 2 \\ 3 & -4 & 4 \end{vmatrix} = \hat{i}(0) - \hat{j}(10) + \hat{k}(-10) \\ &= -10\hat{j} - 10\hat{k} \end{aligned}$$

4. (1 point) Find a nonzero vector orthogonal to
- $\vec{w} = -9\hat{i} + \hat{j} + 8\hat{k}$
- .

$$\vec{u} = \hat{i} + 9\hat{j} \Rightarrow \vec{u} \cdot \vec{w} = (1)(-9) + (9)(1) + (0)(8) = 0$$

THERE ARE INFINITELY MANY
POSSIBLE ANSWERS.