

Math 173 - Test 1
February 20, 2014

Name _____

Score _____

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

1. (6 points) Find the component form of the vector of magnitude 3 that has the direction from $P(5, 2, -1)$ to $Q(3, -3, 4)$.

2. (8 points) Find the angle between the planes described by the following equations.

$$2x - y + 2z = 7$$

$$-5x + 3z = 12$$

3. (6 points) What does it mean for two vectors to be orthogonal? Find a nonzero vector orthogonal to $\vec{u} = \sqrt{2}\hat{i} - 5\hat{j} + \frac{3}{2}\hat{k}$.

4. (8 points) The vector \vec{u} lies in the xy -plane, has magnitude 4, and makes an angle of 120° with the positive x -axis. The vector \vec{w} is given by $\vec{w} = \hat{i} + \hat{j}$. Compute $\|\vec{u} + \vec{w}\|$.

5. (8 points) Find the midpoint of the line segment connecting the points $(1, 4, -7)$ and $(5, 2, -3)$. Using that point as your initial point, find a set of parametric equations for the line through the points.

6. (10 points) Consider the surface described by the equation $2x^2 + 2y^2 - z^2 = 4$.

(a) Describe (or sketch) in detail the level curve obtained by fixing $z = 0$.

(b) Describe (or sketch) in detail the level curve obtained by fixing $y = 0$.

(c) Identify the surface.

(d) Sketch a rough graph of the surface.

7. (8 points) Find a unit vector in the xy -plane normal to the graph of $x^3 + y^3 + xy = 5$ at the point where $(x, y) = (2, -1)$.

8. (6 points) Find numbers a and b so that $\vec{u} = 5\hat{i} - 3\hat{j} + a\hat{k}$ and $\vec{v} = b\hat{i} + 6\hat{j} - 4\hat{k}$ are parallel. Do the resulting vectors point in the same direction or opposite directions?

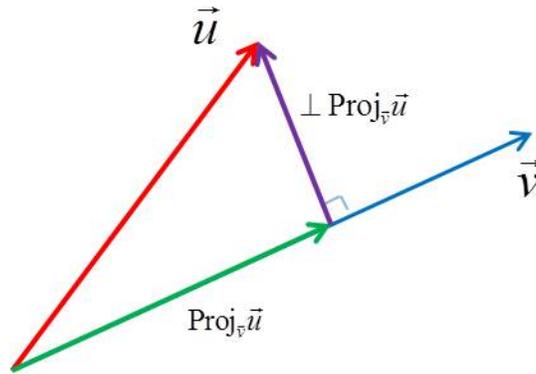
9. (8 points) The following vectors are orthogonal:

$$\vec{v} = \hat{i} + 3\hat{j} - 2\hat{k} \qquad \vec{w} = -5\hat{i} + \hat{j} - \hat{k}$$

Compute $\|\vec{v} \times \vec{w}\|$.

10. (6 points) Describe (or sketch) the 3D surface whose equation is given by $y = e^x$.
11. (8 points) Find the area of the triangle with vertices $(9, 1, -2)$, $(1, 1, 1)$, and $(-3, 4, 2)$.
12. (8 points) Find an equation of the plane parallel to $x - 8y + 7z = 15$ but passing through the point $(1, 2, 3)$.

13. (10 points) In the figure below, $\vec{u} = \hat{i} - \hat{j} - \hat{k}$ and $\vec{v} = 2\hat{i} + \hat{j} - 4\hat{k}$. Determine the projection, $\text{Proj}_{\vec{v}}\vec{u}$, and the vector labeled $\perp \text{Proj}_{\vec{v}}\vec{u}$.



14. (5 points ex credit) A line segment connects the points $P(2, 3, 1)$ and $Q(5, -4, 2)$. Find the coordinates of the point on the line segment that lies two-thirds of the way along the segment in the direction of \vec{PQ} .