

Math 141 Tutorial 8

Problem 1

Let $P(1, -1, 0)$, $Q(2, 1, -1)$ and $R(-1, 1, 3)$ be three points in the 3D-space.

- Find \overrightarrow{PQ} and \overrightarrow{PR} .
- Find the vector projection of \overrightarrow{PQ} onto \overrightarrow{PR} .
- Find the area of the triangle with vertices P, Q and R.

Problem 2

- If $\mathbf{u} = \langle 2, -3, 1 \rangle$ and $\mathbf{v} = \langle 3, 1, -1 \rangle$, then the vector $\text{proj}_{\mathbf{u}} \mathbf{v} =$

- Find a vector of magnitude 7 that is perpendicular to both

$$\vec{u} = \langle 3, -2, 1 \rangle \quad \text{and} \quad \vec{v} = \langle 1, -2, 2 \rangle.$$

- Let $\vec{u} = \langle 4, -2, 1 \rangle$, and $\vec{v} = \langle 5, 0, -3 \rangle$. If $\vec{w} = \text{proj}_{\vec{v}} \vec{u}$, calculate

$$\vec{w} \cdot [(2\vec{u} \times \vec{v}) - 3\vec{v}].$$

- Let \mathbf{u} and \mathbf{v} be two vectors such that $\|\mathbf{u}\| = 3$ and $\|\mathbf{v}\| = 2$. If $\theta = \frac{\pi}{3}$ is the angle between \mathbf{u} and \mathbf{v} , find

$$\|\mathbf{u} - \mathbf{v}\|.$$

Problem 3

- Find the parametric equations of line passing through $A(7, 6, 4)$ and $B(4, 6, 5)$
- Find the parametric equations of line passing through the point $P(1, -3, 2)$ and parallel to the line with symmetric equations

$$\frac{x+1}{5} = \frac{y-2}{3} = \frac{z-7}{2}$$

Problem 4

- Find an equation of the sphere centered at $(1, 1, 1)$ and containing the point $(2, 2, 2)$.
- Find the centre and radius of the sphere.

$$x^2 - 4x + y^2 + 4y + z^2 = 8.$$

$$x^2 + y^2 + z^2 - 4x - 6z - 3 = 0.$$

$$x^2 + y^2 + 2y + z^2 + 4z = 20.$$

Problem 5

Find parametric equations for the line L of intersection of the planes

$$x - 2y + z = 10 \quad \text{and} \quad 2x + y - z = 0.$$

Problem 6

Find the distance from a point $P(1, -2, 3)$ to the plane $2x - 2y + z = 5$

Problem 7

Find the distance between $Q(3, -1, 4)$ and the line given by $x = -2 + 3t$ $y = -2t$ $z = 1 + 4t$