

MATH 104: WORKSHEET 2

1. Concepts

- (1) Length
- (2) Dot products

Definition 1.1. The length of a vector \vec{v} in \mathbb{R}^n is

$$|\vec{v}| = \sqrt{v_1^2 + \cdots + v_n^2}.$$

Definition 1.2. The dot product between two vectors \vec{v} and \vec{w} in \mathbb{R}^n is

$$\vec{v} \cdot \vec{w} = v_1 w_1 + \cdots + v_n w_n.$$

Theorem 1.3 (Law of cosine).

$$\vec{v} \cdot \vec{w} = |\vec{v}| |\vec{w}| \cos \theta$$

where θ is the angle between the two vectors.

2. Discussions

Question 1. Given two points $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$. How do you construct a vector \vec{AB} with the beginning at A and the end at B ?

Question 2. Prove the law of cosine.

Question 3. Interpret the equation of a plane going through the origin in R^3 : $ax + by + cz = 0$.

Question 4. What is the value of c so that the planes $2cx - y + c^2 = 15$ and $x + 5cy - 3z = 4$ are orthogonal?

Question 5. What is the angle between the planes $x - 2y + 3z = 6$ and $2x + 3y - z = 11$?