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Math 102 — Lab 3

1. Each statement below is false. For each statement, highlight one error and explain why it is a mistake.

(a) For $\mathbf{x} = (1, -1, 2, 7)$ and $\mathbf{y} = (3, 13, -2, 8)$ we have [1]

$$\mathbf{x} \cdot \mathbf{y} = (1, -1, 2, 7) \cdot (3, 13, -2, 8) = (3, -13, -4, 56).$$

(b) For $\mathbf{x} = (-1, 0, -1, 0, 0)$ and $\mathbf{y} = (1, 0, -1)$ we have [1]

$$\mathbf{x} \cdot \mathbf{y} = -1(1) + 0(0) + (-1)(-1) = 0.$$

(c) Given $\mathbf{x} \in \mathbb{R}^n$ and $c < 0$ we have [1]

$$\|c\mathbf{x}\| = c\|\mathbf{x}\|$$

(d) For vectors $\mathbf{x}, \mathbf{y} \in \mathbb{R}^3$ we have [1]

$$(\mathbf{x} \cdot 2\mathbf{y}) + \mathbf{x} - \mathbf{y} = 2(\mathbf{y} \cdot \mathbf{x}) + \mathbf{x} - \mathbf{y} = (2\mathbf{x} \cdot \mathbf{y}) + \mathbf{x} - \mathbf{y}.$$

Clue: The dot product of two vectors is a number. Can you add numbers with vectors?

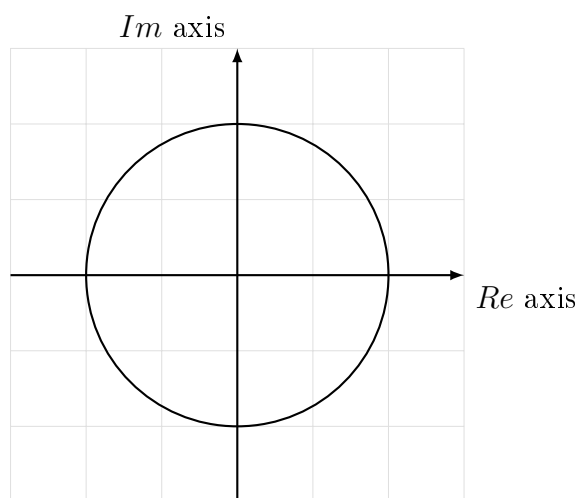
2. Consider the polynomial $p(z) = z^6 - 1$ where $z \in \mathbb{C}$.

- (a) Find a complete factorization of $p(z)$. That is, find numbers $\{\mu_i : 1 \leq i \leq 6\}$ such that [3]

$$p(z) = (z - \mu_1)(z - \mu_2) \cdots (z - \mu_6)$$

Clue: If the roots of $p(z)$ are μ_1, \dots, μ_6 , then we know $p(z) = (z - \mu_1) \cdots (z - \mu_6)$

- (b) Plot each of the numbers $\{\mu_i : 1 \leq i \leq 6\}$ you found in part (a) on the unit circle below. [2]



- (c) Compute $\sum_{i=1}^6 \mu_i$. [1]

Clue: Look at your plot in part (b).