# MATH1231 Assignment (Applied Mathematics Flavour)

**Q1.**

The function is defined by

Show that is linear.

**Answer:**

A transformation in the function from vector space to is only a linear transformation if it satisfies the vector addition condition

and the vector scalar multiplication condition

To show that is linear, we will show that it satisfies both the vector addition and scalar multiplication conditions.

To show that preserves vector addition, let where and

For the function we can substitute the according vectors , leaving us with,

For we substitute the vectors to get

and

Then

Hence, showing that T satisfies the vector addition condition.

To show that preserves vector scalar multiplication, let be any arbitrary scalar value where . By also using the vector defined earlier we can multiply it with the scalar giving us

Multiplying the scalar with the entire function gives us,

Therefore,

Thus, we can show that is linear as preserves the vector addition condition and preserves the scalar multiplication condition.

**Q2.**

Show that

is a subspace of

**Answer:**

To show that is a subspace of , we must first show that is a vector space of its own.

To do this, we must prove that satisfies the axiom of the existence of a zero vector, the axiom of closure under scalar multiplication, and the axiom of closure under addition.

**I)** To test if satisfies the **axiom of the existence of a zero vector**, consider the zero vector

Then,

Since

satisfies the axiom of the existence of a zero vector.

**II)** To test if satisfies the axiom of closure under scalar multiplication, let and where:

To test if is closed under addition, let where and

Additionally, and .