1. (a) Show that \( \langle (a, b), (c, d) \rangle = ac + \frac{1}{2}(ad + bc) + bd \) is an inner product on \( \mathbb{R}^2 \).

(b) Show that \( B = \{ x_1 = (1, 0), x_2 = (1, -2) \} \) is an orthogonal basis for \( \mathbb{R}^2 \) with this inner product.

(c) Use this inner product to find the coordinates of the vector \( (2, 2) \) with respect to the basis \( B \). (You can probably do it just by looking at it, but humor me and use the inner product.)

2. Let \( \mathbb{P}_2 \) be the vector space of all real polynomials of degree less than or equal to two. For \( p \) and \( q \) in \( \mathbb{P}_2 \), define

\[ \langle p, q \rangle := p(0)q(0) + p(1)q(1) + p(5)q(5). \]

Show that this defines an inner product on \( \mathbb{P}_2 \). What is the “length” of the polynomial \( 2x^2 + x \) with this inner product?