

## Linear Algebra Super-Dot Product

*The dot product is an operation that allows us to find characteristics of vectors like their magnitude, the angle between them, etc. We would like to define the equivalent of a “dot product” for linear spaces other than  $\mathbb{R}^n$ . This will be (temporarily) called a super-dot product.*

**Review** Using the dot product in  $\mathbb{R}^n$  :

(a) the norm of a vector is defined as :  $\|\vec{v}\| =$

(b) the angle between two vectors is:

(c) two vectors are perpendicular if:

(d) the distance between two vectors is:

**Properties** What are some important properties of the dot product in  $\mathbb{R}^n$  ? (You can do some research).

**Create** Invent a “super-dot product” for the linear space  $P_2$  that has (some of) the same properties as the usual dot product in  $\mathbb{R}^n$ . Show which properties apply to your super-dot product. Then write the “norm” of  $f(x) = x^2 + 2x + 1$  according to your super-dot product. Also, find two quadratic functions that are “perpendicular” according to your super-dot product.