# TEST: Quotient and Product Spaces
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MATH 3406

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In a field $F$ there are **products**

$$ab \in F$$

and **quotients**

$$\frac{a}{c} \in F, \qquad c \neq 0.$$

Also,

$$\frac{a}{c}\, c = a.$$

For vector spaces, i.e., in the "category" of all vector spaces over a field $F$, there are **products**

$$V \times W = \{(v, w) : v \in V,\ w \in W\}$$

and **quotients**

$$V/Z = \{v + Z : v \in V\} \qquad \text{where } Z \text{ is a nonzero subspace of } V.$$

**Problem 1** What happens in a quotient of vector spaces when you divide by zero $Z = \{\mathbf{0}\}$?

**Problem 2** How about

$$(V/Z) \times Z?$$