All problems are to be written up clearly and thoroughly, using complete sentences. This assignment is due in discussion at 2pm on Thursday, May 9th.

For all T/F problems on the homework, provide a brief justification for your answer. That may be citing an appropriate theorem or providing a counterexample.

1. Section 2.3 problems 1, 3, 4, 9, 11, 12, 16, 17

2. Section 2.4 problems 1, 2a, c, e, 3, 7, 14, 15, 17, 24

3. Let V be a finite-dimensional vector space and let W be a subspace. Show that V and $W \times V/W$ are isomorphic by constructing an explicit isomorphism (rather than simply computing the dimensions).

   For HW 5 problem 3, I probably should have said that the product of vector spaces is just the underlying Cartesian product of sets with pointwise addition and scalar multiplication. If I take vector spaces over the same field U and V, then U x V has elements of the form (u, v) where u is in U and v is in V. We add coordinatewise so (u, v) + (u', v') = (u+u', v+v') and scalar multiply a(u,v) = (au, av). For number 3 in the homework, we read W x V/W as W x (V/W) so elements of W x V/W are of the form (w, v+W), since elements of V/W are cosets of the form v+W.

4. Let V be a finite-dimensional vector space over $\mathbb{F}$ and let $V^* = \text{Hom}(V, \mathbb{F})$ be its dual vector space. For W a subset of V, we define the **annihilator** of W to be the set
$$W^0 = \{f \in V^* \mid f(x) = 0 \text{ for all } x \in W\}.$$
   (a) Show that W^0 is a subspace of V^*.

   (b) For subspaces $W_1, W_2 \subseteq V$, show that $(W_1 + W_2)^0 = W_1^0 \cap W_2^0$.