0. Introduce yourself to your colleague. Do they have any pets?

1. Show that homotopy is an equivalence relation on the set of continuous maps \( X \to Y \).

2. Suppose that \( f_0, f_1 : X \to Y \) and \( g_0, g_1 : Y \to Z \) are continuous maps. Show that if \( f_0 \simeq f_1 \) and \( g_0 \simeq g_1 \), then \( g_0 \circ f_0 \simeq g_1 \circ f_1 \).

3. In lecture I asserted that the maps \( f_0, f_1 : S^2 \to \mathbb{R}^3 \setminus 0 \) defined by
   \[
   f_0(x) = 2x + (1, 0, 0) \\
   f_1(x) = 3x + (0, 0, 1)
   \]
   are homotopic via the “straight-line homotopy”
   \[
   F(x, t) = (1 - t)f_0(x) + tf_1(x).
   \]
   (a) Convince yourself that if you fix \( x \in S^2 \) and let \( t \) vary, then \( F(x, t) \) traces out a straight line segment from \( f_0(x) \) to \( f_1(x) \).
   (b) Show that \( F \) takes values in \( \mathbb{R}^3 \setminus 0 \), so it’s really a homotopy between \( f_0 \) and \( f_1 \).