

Please let me know if any of the problems are unclear or have typos.

Exercise 1.1. [Picture-hanger's problem.] We identify our living-room wall with the complex plane \mathbb{C} and hammer in a pair of nails at 0 and 1. It is straight-forward to hang a picture P from these nails so that, after removing just one of them, P does *not* fall to the ground. Find a way to hang the picture so that, after removing either nail, P *does* fall.

Challenge: Suppose that we in hammer nails at $0, 1, \dots, n$. Find a way to hang P so that removing any one nail causes P to fall.

Exercise 1.2. Find a winning strategy for the game of skill *fast-and-loose* (also called the *endless chain*) shown here: http://youtu.be/pw0_u9E3ihU?t=1m27s

Exercise 1.3. For each of the figures below, decide if the loop α is null-homotopic in the complement of the genus two handlebody V .

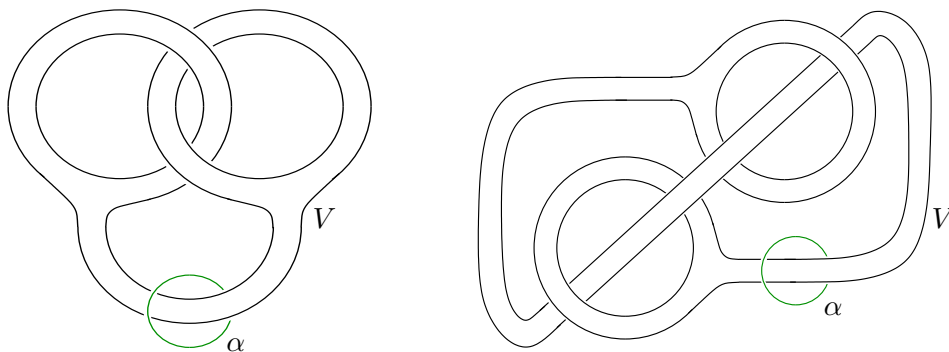


Figure 1.4: The figure on the left is inspired by artwork of Anatoly Fomenko, as found at the end of the book *Algorithmic and computer methods for three-manifolds*. The figure on the right is essentially the same as Stewart Coffin's *Figure Eight Puzzle*.