

Name: _____

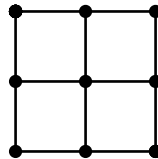
Score (Out of 4 points):

1. For each of the following spaces X ,

- determine a presentation for the fundamental group
- describe loops in the space representing the generators, either by written description or by a picture. Please describe loops in (a space homeomorphic to) X , not just in a homotopy-equivalent space.

You do not need to give rigorous proofs, but briefly explain the steps in your reasoning.

(a) (2 points) X is the graph below.



- (b) (2 points) X is obtained by gluing a Mobius band by its boundary homeomorphically onto a longitudinal loop of a torus (shown below).

