

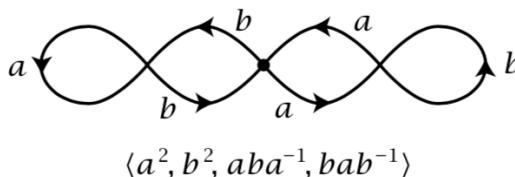
Name: _____

Score (Out of 6 points):

1. (6 points) Each of the following statements is either true or false. If it is true, write **True** and give a brief justification. If it is false, write **False** and give a brief justification or state a counterexample. You do not need to prove your counterexample. You may receive partial credit for correctly writing **True** or **False** with no justification.

(a) Every connected cover of the torus is regular.

- (b) Let \tilde{X} be the cover of $S^1 \vee S^1$ shown below. We adopt our usual convention of identifying the fundamental group of $S^1 \vee S^1$ based at the wedge point x_0 with the free group $F_{\{a,b\}}$ on a, b . We choose a basepoint \tilde{x}_0 for \tilde{X} (shown by a black dot) so that $H = p_*(\pi_1(\tilde{X}, \tilde{x}_0))$ is the subgroup of the free group on a, b freely generated by $a^2, b^2, aba^{-1}, bab^{-1}$.



Then the element $a \in F_{\{a,b\}}$ is in the normalizer of H .

- (c) Again consider the cover \tilde{X} of $S^1 \vee S^1$ shown above. Then the action of a on the preimage of x_0 is transitive.