

Do not turn this page over until instructed.

MAT 1301 Algebraic Topology

Term Test

University of Toronto, February 6, 2025

Respond to all 3 tasks on the other side of this page.

The tasks are of equal weight.

You have an hour and fifty minutes to write this test.

Notes

- No outside material allowed other than stationery, minimal hydration and snacks, and stuffed animals.
- Do not write on this form.
- Two of the three tasks on this form are not-fully-specified “write an essay” tasks. This is a graduate class, and one of the greatest challenges you will be facing later on will be to free-style write rather than demonstrate to a TA that you’ve memorized some material. So the essay tasks do not specify precisely what you need to do – it is up to you to decide what is important and what isn’t, which figures to draw and when are they superior to formulas, which formulas to write and when are they superior to figures, etc. Think that you really are writing a paper and you really are trying to transmit information that will be read and understood.
- **Neatness counts! Language counts!** You may want to write “draft essays” and only then write the final versions of your solutions. Messy essays cannot be read.

Good Luck!

Task 1. Write an essay on “ π_1 is a functor and therefore there does not exist a retract $r: D^2 \rightarrow S^1$ ”.

Task 2. Write an essay on “van Kampen’s Theorem”.

Task 3. If X is path-connected, prove that the set of homotopy classes of maps $S^1 \rightarrow X$ can be put in a bijection with the set of conjugacy classes in the fundamental group of X .

Good Luck!