

## MA3402 HOMEWORK

Homeworks are intended as quick exercises to help solidify key ideas from the previous week. If you are spending a long time on them, stop and talk it over with someone.

### 1. HOMEWORK 10

- (1) If  $[\omega], [\tau] \in H^*(M)$ , show that  $\omega \wedge \tau$  is closed and that  $[\omega \wedge \tau]$  is independent of the choice of representative  $\omega$  or  $\tau$ .
- (2) Calculate the cohomology of  $T^3 = \mathbb{R}^3/\mathbb{Z}^3$  in the same way we calculated  $T^2$  in lectures: that is, see Tu Proposition 28.2 where  $\pi: \mathbb{R}^2 \rightarrow \mathbb{R}^2/\mathbb{Z}^2$  and  $\alpha, \beta$  are forms such that  $dx = \pi^*(\alpha)$ ,  $dy = \pi^*(\beta)$ . We checked whether  $\alpha, \beta$  are closed and exact. You can argue they are linearly independent, but showing they're a basis takes more time (e.g. via Mayer-Vietoris).
- (3) Compute the cohomology of  $S^n$ . (Hint: Mayer-Vietoris)
- (4) Revision and Exam Prep exercise: **Create and *submit* your own exam question.** Can be either from this week or any point in the course. **Submit by Tues 20 Nov** preferably in latex.