

**Exam 1**  
**Calculus III**

**September 2024**  
**Prof. Nollet**

- 11.1 Sketching regions in three dimensions. distance between points, equation of sphere.
- 11.2 Vectors, operations addition and scalar multiple via algebra and geometry, vector length, unit vectors, decomposition into length and direction, standard unit vectors, combined force problems.
- 11.3 Dot product,  $\cos \theta$ , where  $\theta$  is angle between vectors, orthogonal vectors (same meaning as perpendicular or normal), Projection of a vector  $\mathbf{u}$  along a vector  $\mathbf{v}$ , the vector components of  $\mathbf{u}$  along  $\mathbf{v}$  and orthogonal to  $\mathbf{v}$ .
- 11.4  $2 \times 2$  and  $3 \times 3$  determinants, the cross product, computing cross product with determinants, geometric interpretation of cross product (right hand rule direction and length relating to area of parallelogram), the triple scalar product and geometric interpretation in terms of volume of parallelepiped.
- 11.5 Parametric equations for lines, normal vectors to planes, equation for a plane, intersections of two lines/line and plane/two planes, angles between lines and planes, distance from point to plane, (don't need distance from point to line).
- 11.6 Sketching surfaces in  $\mathbb{R}^3$ , planes and spheres, cylinders and their rulings, quadric surfaces and their traces: in general, drawing traces (2-dimensional pictures from setting one variable constant) is useful.

Suggestions: Look over homework, quizzes, and examples from class. The book has practice exercises at the end of the chapter that could help: if you know how to do one, then the review problem has already served its purpose.