## Problem Set 4
October 9, 2023

All numbered exercises are from the textbook *Calculus Vol. 3*, by OpenStax.

1. Exercises 3.3.103–111 (odd only).

2. Exercise 3.3.106.

3. Exercises 3.3.119–123 (odd only).

4. Exercise 3.3.130.

5. Exercises 3.3.131–139 (odd only).

6. Find an equation of a parabola that has curvature 4 at the origin.

7. At what point does the curve $y = \ln x$ have its maximum curvature? What happens to the curvature as $x \longrightarrow \infty$?

8. Find the curvature of $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$ at the point $(1, 1, 1)$.

9. Let $C$ be a smooth planar curve given by parametric equations $x = f(t)$, $y = g(t)$, where $f$ and $g$ are two times continuously differentiable functions. Show that the curvature of $C$ is given by the formula
$$\kappa = \frac{|f'g'' - f''g'|}{[(f')^2 + (g')^2]^{3/2}}.$$

   [Hint: Use the formula (3.16) from Theorem 3.6 in the text.]