# HW 23: Section 4.5 and 4.6

Due: Monday, December 9th in SQRC by 9pm

Learning Goals:

- Compute anti-derivatives.
- Sketch the graph of a function from the graph of its derivative.
- Use the Fundamental Theorem of Calculus, Part I, to compute the integral of a function.
- Use the Fundamental Theorem of Calculus, Part II, to compute the derivative of an area function.
- Use u-substitutions to compute indefinite integrals.

Questions:

1. Problem 4.1.49.b. The graph of $y = f'(x)$ is given below. Assume that $f(0) = 0$. Sketch a graph of the function $f(x)$.
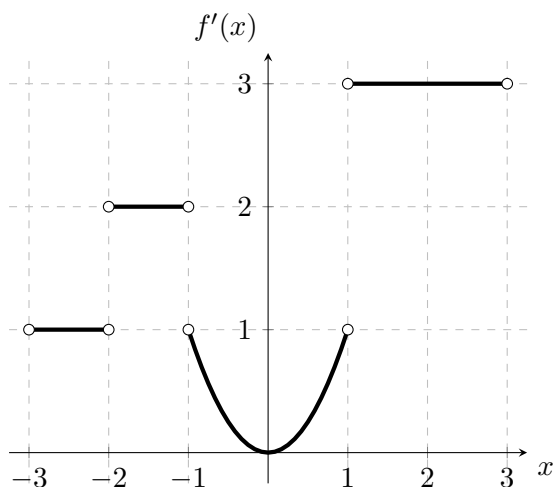
2. Problem 4.5.4. Use the Fundamental Theorem of Calculus to compute

$$\int_0^2 x^3 + 3x - 1 \, dx.$$

3. (a) Find the derivative $f'(x)$ where $f(x) = \int_3^x e^{2t} \, dt$.

   (b) Find the derivative $f'(x)$ where $f(x) = \int_3^{x^2} e^{2t} \, dt$. (hint: need chain rule)

   (c) Problem 4.5.30. Find the derivative $f'(x)$ where $f(x) = \int_{2-x}^{xe^x} e^{2t} \, dt$. (hint: break into two integrals)

4. Use a u-substitution to compute the following indefinite integral

$$\int \sin(x) \cos(x) \, dx$$

5. Use a u-substitution to compute the following indefinite integral

$$\int xe^{x^2}\,dx$$