1. Solve the following initial value problems.

   (a) $\dfrac{dN}{dt} = \dfrac{t+2}{t}$ for $t \geq 1$ with $N(1) = 2$.

   (b) $\dfrac{dy}{dx} = \dfrac{e^{-x} + e^x}{2}$ for $x \geq 0$ with $y(0) = 0$.

2. Approximate the area under the parabola $y = x^2$ from 0 to 1 using four equal subintervals.

3. Use Leibniz's Rule to solve $y = \dfrac{d}{dx} \displaystyle\int_x^{2x} (1 + t^2)dt$.

4. Find the average value of $f(x) = -x^2 - 2x + 5$ over the interval $[-4, 0]$.

5. Find the area of the region bounded by $y = x^2 + 1$ and $y = x + 1$.

6. Find the volume of the solid bounded by $y = -x^2 + 1$, $y = 0$, and rotated about the x-axis

7. Imagine stacking squares whos sides are the length between $f(x) = 2x^2 - 1$ and $g(x) = 7$. This would create a shape over the area between $f(x)$ and $g(x)$. What is the volume of this solid?

8. Solve the indefinite integral $\int x^3 e^{x^2} dx$.