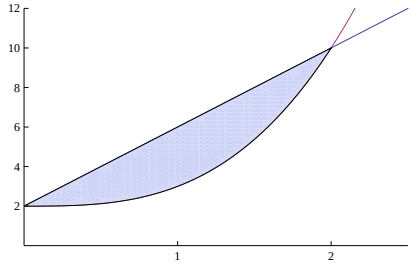
1. **(8 points)** Find the center of mass of the region bounded by the curves $y = x^3 + 2$ and $y = 4x + 2$. Expressions need not be arithmetically reduced.



2. **(8 points)** Let $f(x) = \begin{cases} 0 \text{ for } x < 1 \\ \dfrac{2}{x^3} \text{ for } x \geq 1 \end{cases}$

   (a) **(4 points)** Verify that $f(x)$ is a probability distribution function.

   (b) **(4 points)** For a random variable X described by the above probability distribution function, find $P(X \geq 10)$.

3. **(8 points)** Answer the following questions about the differential equation $\frac{dy}{dx} = y^2$.

   (a) **(4 points)** Verify that $y = \frac{1}{5-x}$ is a solution to this differential equation.

   (b) **(4 points)** Using Euler's method, if $y = 2$ when $x = 1$, estimate the value of y when $x = 1.2$, using a step size of 0.1.

4. **(2 point bonus)** Find the average value of the random variable described by the probability distribution function $f(x) = \begin{cases} 0 \text{ for } x < 0 \\ xe^{-x} \text{ for } x \geq 0 \end{cases}$