**Ex 1** Express the region contained by the graph of \( y = e^x \), the graph of \( y = \sqrt{x} \), and the lines \( x = 0 \) and \( x = 2 \) as a difference of integrals.

\[
\text{Answer: } \int_0^2 e^x \, dx - \int_0^2 \sqrt{x} \, dx
\]

**Thm** (Area Between Curves) The area contained between the graphs of functions \( f(x) \) and \( g(x) \) and the lines \( x = a \) and \( x = b \) is equal to

\[
\int_a^b [f(x) - g(x)] \, dx = \int_a^b f(x) \, dx - \int_a^b g(x) \, dx
\]

as long as \( f(x) \geq g(x) \) on the interval \([a, b]\).

**Ex 2** Find the exact area of the region indicated in Example 1.

\[
\int_0^2 (e^x - \sqrt{x}) \, dx = \int_0^2 (e^x - x^{1/2}) \, dx = \left[ e^x - \frac{2}{3} x^{3/2} \right]_0^2 = e^2 - \frac{2}{3} (2^{3/2})^2 = e^2 - \frac{2}{3} (2^{3/2} \cdot 2^{3/2}) = e^2 - \frac{2}{3} (2^3) = e^2 - \frac{2}{3} (8) = e^2 - \frac{16}{3}
\]

**Ex 3** Find the area contained between the graphs of \( f(x) = 2x + 3 \) and \( g(x) = x^2 \).
Need to solve the equation \( f(x) = g(x) \)
(There should be two solutions)

\[ 2x + 3 = x^2 \]

\[ x^2 - 2x - 3 = 0 \]

\[ (x - 3)(x + 1) = 0 \]
\[ x = 3 \quad \text{and} \quad x = -1 \]

\[
\int_{-1}^{3} [f(x) - g(x)]\,dx = \int_{-1}^{3} (2x + 3 - x^2)\,dx
\]

\[
= \left[ x^2 + 3x - \frac{1}{3}x^3 \right]_{-1}^{3}
\]

\[
= 3^2 + (3)(3) - \frac{1}{3}(3^3) - \left[ (-1)^2 + 3(-1) - \frac{1}{3}(-1)^3 \right]
\]

\[
= 9 + 9 - 9 - 1 - \frac{(-3) - 1}{3}
\]

\[
= 11
\]