1. Integrate. \[ \int \frac{3x^2 + 8x}{\sqrt{x^2 + 4x^2 + 1}} \, dx \]

This is a straightforward substitution: The top of this fraction is the derivative of the function inside of the square root. Define:

\[ u = x^3 + 4x^2 + 1 \]
\[ \frac{du}{dx} = 3x^2 + 8x \]

Then rewrite the integral as

\[ \int \frac{du}{\sqrt{u}} = \int u^{-1/2} \, du = 2u^{1/2} + C = 2\sqrt{x^3 + 4x^2 + 1} + C \]

2. Calculate the value of the definite integral. \[ \int_0^{\pi/2} e^{2\cos(x)} \sin(x) \, dx \]

Again, a straightforward substitution. Define:

\[ u = 2\cos(x) \]
\[ \frac{du}{dx} = -2\sin(x), \text{ so } -\frac{1}{2} \frac{du}{dx} = \sin(x) \]

Rewrite the integral, including the limits of integration, as

\[ \int_{u(0)}^{u(\pi/2)} e^{u} \left( -\frac{1}{2} \right) \, du = -\frac{1}{2} \int_0^0 e^{u} \, du = -\frac{1}{2} e^0 \bigg|_0^0 = -\frac{1}{2} (1 - e^0), \text{ or } \frac{1}{2} (e^0 - 1) \]

3. Find the volume of the solid of revolution generated by revolving around the x-axis the area enclosed by the following curves.

\[ y = x + 5, \quad y = \sqrt{\sin(x)}, \quad x = 0, \quad x = \pi \]

Below is a basic sketch of the enclosed area, before revolving:

Using the method of washers, we get that the volume is:

\[ \pi \int_0^\pi (x+5)^2 - \left( \sqrt{\sin(x)} \right)^2 \, dx = \pi \int_0^\pi x^2 + 10x + 25 - \sin(x) \, dx = \left[ \frac{x^3}{3} + 5x^2 + 25x + \cos(x) \right]_0^\pi = \frac{\pi^4}{3} + 5\pi^3 + 25\pi^2 \]