Exercise 1 (5 points)
Find the area enclosed by the line $y = x - 1$ and the parabola $y^2 = 2x + 6$.

Solution
By solving the two equations, the two intersection points are $(-1, -2)$ and $(5, 4)$. As the parabola is given as a function of $y$ it is better to integrate on the Y-axis. The function are $x_R = y + 1$ and $x_L = \frac{1}{2}y^2 - 3$

Then $A = \int_{-4}^{2} (x_R - x_L) dy = \int_{-4}^{2} \left( (y + 1) - \left( \frac{1}{2}y^2 - 3 \right) \right) dy = 18$. 

Exercise 2 (5 points)
Use the integration by parts to calculate the integral
\[ \int_0^1 \tan^{-1}(x) \, dx. \]

Solution
Let \( u = \tan^{-1}(x) \) and \( dv = dx \), then \( du = \frac{dx}{1 + x^2} \) and \( v = x \).

\[ \int_0^1 \tan^{-1}(x) \, dx = [x \tan^{-1}(x)]_0^1 - \int_0^1 \frac{x \, dx}{1 + x^2} = \frac{\pi}{4} - \int_0^1 \frac{x \, dx}{1 + x^2} \]

\[ \int_0^1 \frac{x \, dx}{1 + x^2} = \frac{1}{2} \int_0^1 \frac{2x \, dx}{1 + x^2} = \left[ \frac{1}{2} \ln(1 + x^2) \right]_0^1 = \frac{\ln(2)}{2} \]

Then \( \int_0^1 \tan^{-1}(x) \, dx = \frac{\pi}{4} - \frac{\ln(2)}{2}. \)