1. (20 points) Find a Gaussian release for the pulse equation: 

\[ f'(t) = \begin{cases} 
\frac{\alpha}{2} & \text{if } t > 0 \\
0 & \text{otherwise} 
\end{cases} \]

\[ f(t) = \frac{1}{C \sqrt{\pi \tau}} e^{-\frac{t^2}{4\tau}} \]

2. (20 points) Find a Gaussian release for the pulse equation: 

\[ f'(t) = \begin{cases} 
\frac{\alpha}{2} & \text{if } t > 0 \\
0 & \text{otherwise} 
\end{cases} \]

\[ f(t) = \frac{1}{C \sqrt{\pi \tau}} e^{-\frac{t^2}{4\tau}} \]
3. Find the polar equation for the Cartesian equation $y = x^2$.

$$y = 2x + 1$$

$$\sqrt{1 + 4(2x+1)^2}$$

$$1 = 2\cos \theta + \cos \phi$$

$$\theta = \left\{ \begin{array}{ll}
\frac{\theta}{2} & \text{for } \phi > 0 \\
\pi - \frac{\theta}{2} & \text{for } \phi < 0
\end{array} \right.$$
(6) Find the points on the curve where the tangent line is vertical (if any):

\[ y = \ln(x) \]

\[ \frac{dy}{dx} = \frac{1}{x} \]

Vertical tangent occurs when \( \frac{dy}{dx} = 0 \):

\[ \frac{1}{x} = 0 \]

No vertical tangent points because the denominator cannot be zero.

(7) Find the points on the curve where the tangent line is horizontal (if any):

\[ y = \ln(x) \]

\[ \frac{dy}{dx} = \frac{1}{x} \]

Horizontal tangent occurs when \( \frac{dy}{dx} = \) constant:

\[ \frac{1}{x} = \text{constant} \]

No horizontal tangent points because the function is always increasing.

(8) Find the points on the curve where the tangent line is neither horizontal nor vertical (if any):

\[ y = \ln(x) \]

\[ \frac{dy}{dx} = \frac{1}{x} \]

This function has no points where the tangent line is neither horizontal nor vertical.
1. **Find the arc length of the curve.**

\[ L = \int_a^b \sqrt{\left( \frac{dx}{dt} \right)^2 + \left( \frac{dy}{dt} \right)^2} \, dt \]

where \( t \) is the parameter of the curve. For this curve, the arc length is:

\[ L = \int_0^1 \sqrt{\left( \frac{dx}{dt} \right)^2 + \left( \frac{dy}{dt} \right)^2} \, dt \]

2. **Find the area enclosed by the curve.**

The area enclosed by the curve is given by:

\[ A = \frac{1}{2} \int \left( y(x) - x(y) \right) \, dx \]

For this curve, the area is:

\[ A = \frac{1}{2} \int \left( \frac{1}{2} - x^2 \right) \, dx \]

\[ A = \left[ \frac{1}{2} \left( \frac{x^2}{2} \right) \right]_{-1}^{1} \]

\[ A = \frac{1}{2} \left( \frac{1}{2} - \frac{1}{2} \right) = 0 \]