1 | **Arc length**

$$\begin{aligned} dr &= \sqrt{dx^2 + dy^2} \\ &= \sqrt{dx^2 + dy^2} \cdot \frac{dx}{dx} \\ &= \sqrt{\frac{dx^2 + dy^2}{dx^2}} \cdot dx \\ &= \sqrt{1 + \frac{dy^2}{dx^2}} dx \\ &= \sqrt{(\frac{dy}{dx})^2 + 1} dx \end{aligned}$$

Next, we will integrate to find the arc length as a whole. $L(x_0, x_1) = \int_{x_0}^{x_1} dr$

$$= \int_{x_0}^{x_1} \sqrt{(\frac{dy}{dx})^2 + 1}\, dx$$

Given that the arc length is of function f:

$$= \int_{x_0}^{x_1} \sqrt{f'x^2 + 1}\, dx$$

In the case of the arc length of $f(x) = x^2$ from 5 to 20:

$$L(5, 20) = \int_5^{20} \sqrt{4x^2 + 1}\, dx$$

$$= [\frac{1}{2}\sqrt{4x^2 + 1}x + \sinh^{-1} 2x]_5^{20}$$

$$= 375.346$$