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:

$$
\begin{aligned}
L(5, 20) &= \int_5^{20} \sqrt{4x^2 + 1}\, dx \\
&= [\frac{1}{2}\sqrt{4x^2 + 1}x + \sinh^{-1} 2x]_5^{20} \\
&= 375.346
\end{aligned}
$$

\]