Surface Area

The area of the surface obtained by rotating \( y = f(x), \ a \leq x \leq b \) about the \( x \)-axis is

\[
S = 2\pi \int_{a}^{b} f(x) \sqrt{1 + (f'(x))^2} \, dx
\]

This formula works when \( f(x) \) is positive and has a continuous derivative.

Example 1

Write out the integral that represents the area of the surface obtained by rotating the curve 
\( y = \ln x, \ 1 \leq x \leq 3 \), about the \( x \)-axis.
**Example 2**

Write out the integral of the surface obtained by rotating the curve \( y = e^x, 1 \leq y \leq 2 \), about the \( y \)-axis.
Example 3
Find the area of the surface obtained by rotating the curve \( y = 3x^3, 0 \leq x \leq 7 \), about the \( x \)-axis.
Example 4
Find the area of the surface obtained by rotating the curve $x = 1 + 2y^2$, $1 \leq y \leq 2$, about the $x$-axis.