The Work Done by a Variable, One-Dimensional Force

Suppose that \( F(x) \) is a variable force in the \( x \)-direction and that a body moves under the influence of that force as a net force. It follows that

\[
W = \int_{x_1}^{x_2} F \, dx,
\]

and, by the work-kinetic energy theorem,

\[
W_{\text{net}} = \int_{x_1}^{x_2} F_{\text{net}} \, dx = K - K_0 = \frac{1}{2} m v^2 - \frac{1}{2} v_0^2.
\]

In the plot below \( W_{\text{net}} \) is the area between the \( x \)-axis and the curve \( F(x) \). The red-shaded area represents negative work.