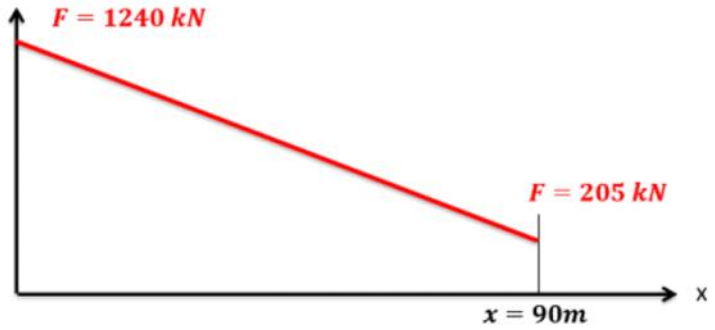
Problem 4

A 24,000 kilogram aircraft is launched from an aircraft carrier using the a hydraulic catapult. If the force the catapult exerts over the 90 meter runway is shown in the graph below.

- What is the work done by the catapult?
- What is the speed of the plane at the end of the runway?



$$\vec{F}(x) = -11.5x + 1240$$

$$W = \int_0^{90} -11.5x + 1240$$

$$W = \left[-5.75x^2 + 1240x \right]_0^{90}$$

$$\boxed{W = 65{,}025 \text{ kN m}}$$

$$W = \Delta KE + \cancel{\Delta PE}^{\,0}$$

$$65.025 \times 10^6 \text{ N m} = \frac{1}{2}(24{,}000 \text{ kg})(V_f)^2$$

$$\boxed{V_f = 73.6 \text{ m/s}}$$