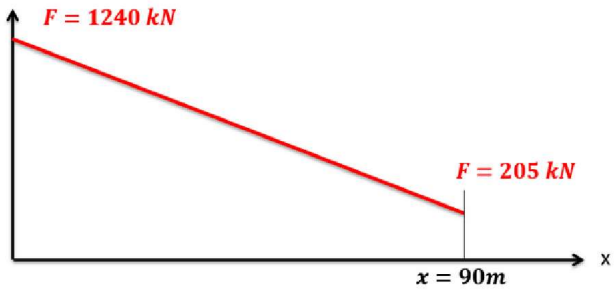
- A 24,000 kg aircraft is launched from an aircraft carrier using the a hydraulic catapult. If the force the catapult exerts over the 90m runway is shown below...
  - What is the work done by the catapult?
  - What is the speed of the plane at the end of the runway?



$$F(x) = 1240 + \frac{205-1240}{90-0}x$$

$$= -11.5x + 1240$$

$$W = \int_0^{90} (-11.5x + 1240)\,dx$$

$$= \frac{1}{2}(-11.5x^2) + 1240x \Big|_0^{90}$$

$$W = 65025 \text{ kN}\cdot\text{m}$$

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

$$65.025 \times 10^6 \text{ N}\cdot\text{m} = \frac{1}{2}(24000)v_f^2$$

$$v_f = 73.6 \text{ m/s}$$