# Problem 5.60

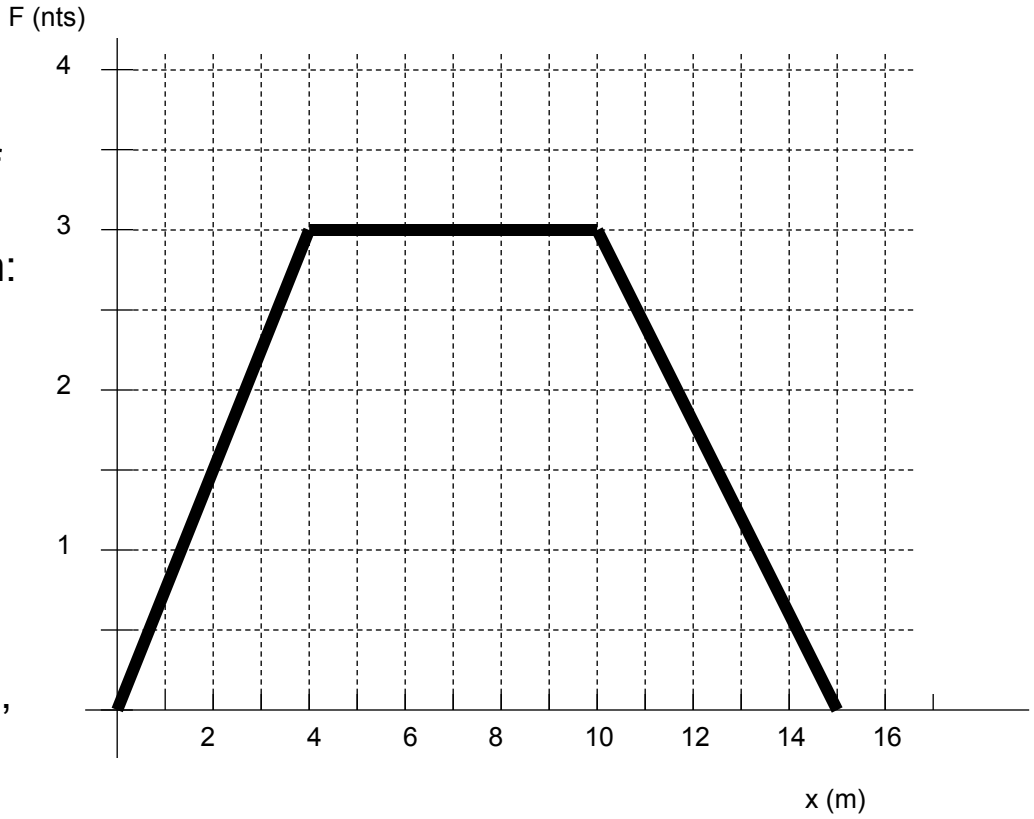
A 3 kg mass moves under the influence of the force graphed to the right. What work does the force do as the body moves from:

a.) x=0 to x=5?

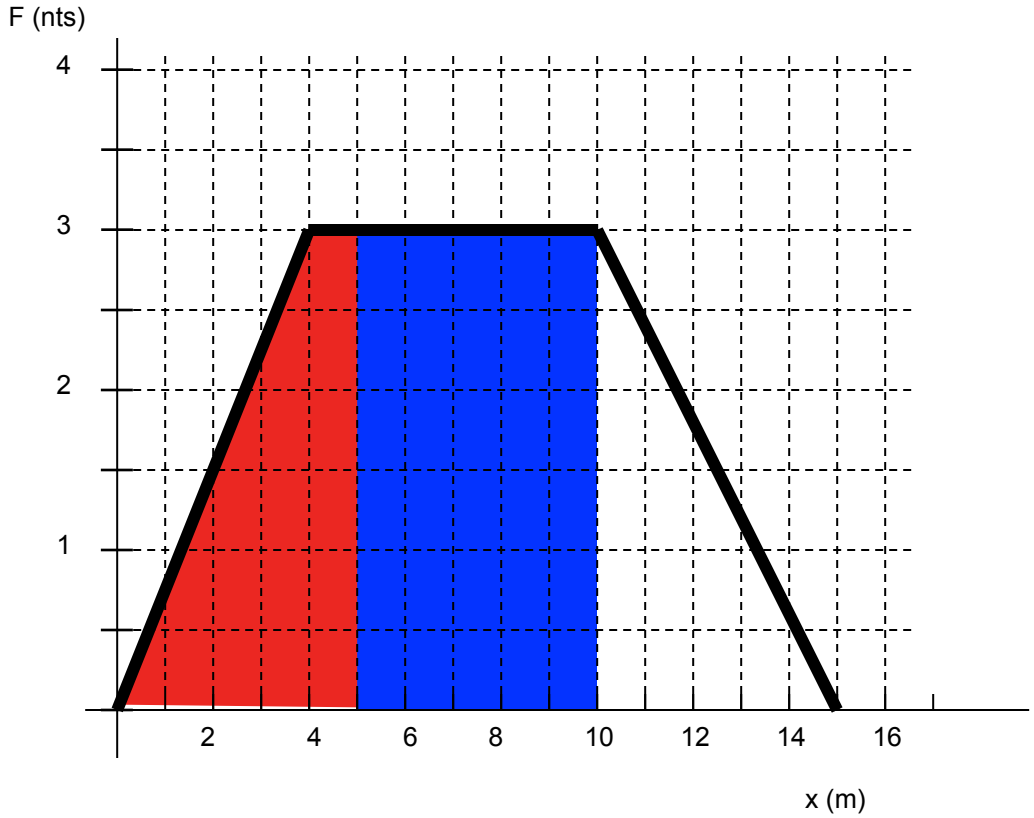
b.) x=5 to x=10?

c.) x=10 to x=15?

d.) If the body is moving at v=5 m/s at x=0, how fast is it moving at x=10 meters and x=15 meters?



m = 3 kg




a.) Work over x=0 to x=5?

What's important to note here is that work is a force times distance. This is the AREA under a "force versus distance" graph. Determining that area yields:

$$A_{triangle} = \frac{1}{2}bh + b_2h_2$$
$$= .5(3\text{ nt})(4\text{ m}) + (3\text{ nt})(1\text{ m})$$
$$= 9\text{ J}$$

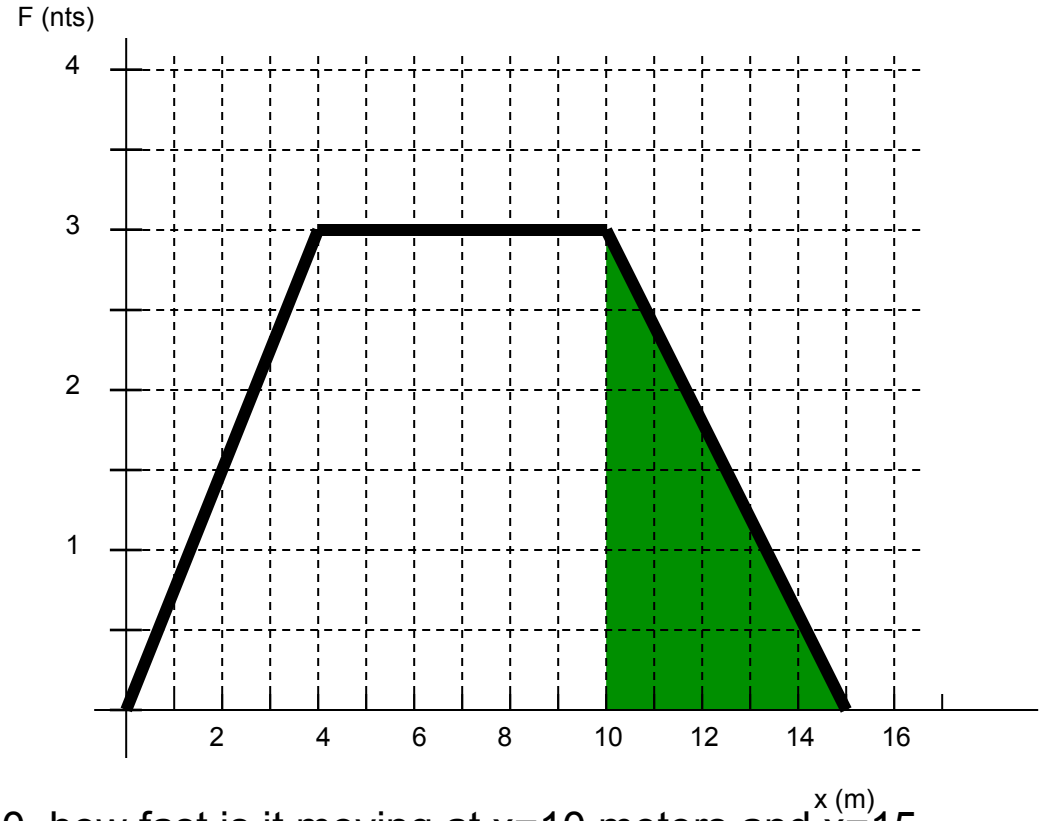
b.) Work over x=5 to x=10?

$$A_{triangle} = bh$$
$$= (3\text{ nt})(5\text{ m})$$
$$= 15\text{ J}$$

m = 3 kg

c.) Work over x=10 to x=15?

$$A_{triangle} = \frac{1}{2}bh$$
$$= .5(3\text{ nt})(5\text{ m})$$
$$= 7.5\text{ J}$$




d.) If the body is moving at v=5 m/s at x=0, how fast is it moving at x=10 meters and x=15 meters? For x = 10 meters:

$$W_{net} = \Delta KE$$
$$\Rightarrow \quad \sum F \bullet d = \frac{1}{2}mv_{10}^{\,2} - \frac{1}{2}mv_0^{\,2}$$
$$\Rightarrow \quad (6\text{ J}) + (18\text{ J}) = \frac{1}{2}(3\text{ kg})v_{10}^{\,2} - \frac{1}{2}(3\text{ kg})(5\text{ m/s})^2$$
$$\Rightarrow \quad v_{10} = 6.4\text{ m/s}$$

m = 3 kg

d.) (con't.) If the body is moving at v=5 m/s at x=0, how fast is it moving at x=10 meters and x=15 meters?

For x=10 meters:

$$W_{\text{netfromzeroto10}} = \Delta KE$$

$$\Rightarrow \quad \sum F \bullet d = \frac{1}{2}mv_5^2 - \frac{1}{2}mv_0^2$$

$$\Rightarrow \quad (9\text{ J}) + (15\text{ J}) = \frac{1}{2}(3\text{ kg})v_{10}^2 - \frac{1}{2}(3\text{ kg})(5\text{ m/s})^2$$

$$\Rightarrow \quad v_{10} = 6.4\text{ m/s}$$

For x=15 meters:

$$W_{\text{net}} = \Delta KE$$

$$\Rightarrow \quad \sum F \bullet d = \frac{1}{2}mv_{10}^2 - \frac{1}{2}mv_0^2$$

$$\Rightarrow \quad (9\text{ J}) + (15\text{ J}) + (7.5\text{ J}) = \frac{1}{2}(3\text{ kg})v_{15}^2 - \frac{1}{2}(3\text{ kg})(5\text{ m/s})^2$$

$$\Rightarrow \quad v_{15} = 6.78\text{ m/s}$$