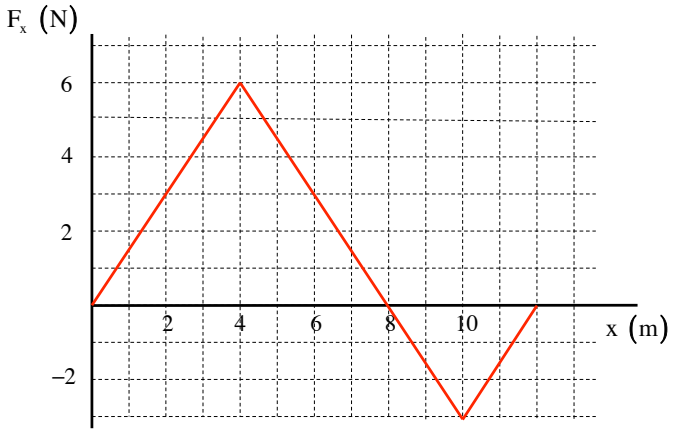
Problem 7.14

The quantity $W_F = \vec{F} \bullet \vec{d}$ or, in it's most general form, $W_F = \int \vec{F} \bullet d\vec{r}$, suggests that the work a force does as it moves some distance is equal to the area under its *Force versus Displacement* curve. Below is such a curve for a body's motion.



1.)

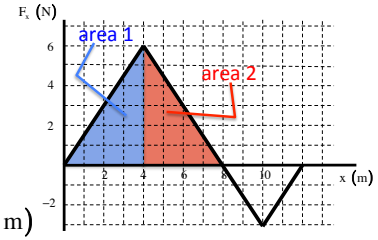
a.) How much work is done as the body traveled from x = 0 to x = 8.00 meters?

The area under the curve for that traverse is:

$$W = A_{triangle1} + A_{triangle2}$$

$$= \frac{1}{2}(6.00\ \text{N})(4.00\ \text{m}) + \frac{1}{2}(6.00\ \text{N})(4.00\ \text{m})$$

$$= 24.0\ \text{J}$$



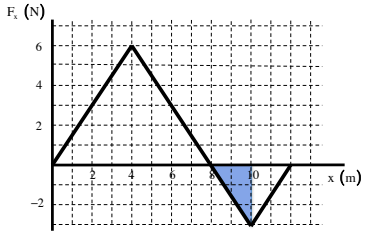
b.) How much work is done as the body traveled from x = 8.00 meters to x = 10.00 meters?

The area under the curve for that traverse is shown:

$$W = A_{blue}$$

$$= \frac{1}{2}(-3.00\ \text{N})(2.00\ \text{m})$$

$$= -3.00\ \text{J}$$



2.)

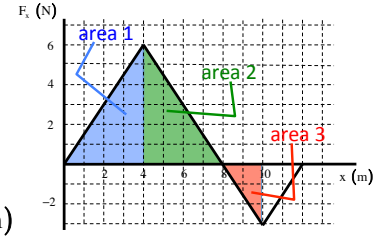
c.) How much work is done as the body traveled from x = 0 to x = 10.00 meters?

The area under the curve for that traverse is:

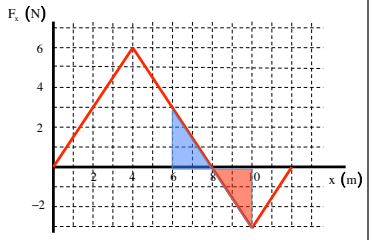
$$W = A_{triangle1} + A_{triangle2} - A_{triangle2}$$

$$= \frac{1}{2}(6.00\ \text{N})(4.00\ \text{m}) + \frac{1}{2}(6.00\ \text{N})(4.00\ \text{m}) - \frac{1}{2}(3.00\ \text{N})(2.00\ \text{m})$$

$$= 21.0\ \text{J}$$



NOTE: The area under the curve where the force is "backwards" and the *work is negative*, subtracts from the work being done when the force is "forward" and the work is positive. With that in mind, the statement, "The total, net work done as the body moved from x = 6 meters to x = 10 meters is ZERO," shouldn't bother you!



3.)