Problem 5.9

2500 kg car at rest is pushed to velocity v over a 25 meter distance dumping 5000 joules of energy into the system in the process.

a.) Determine v:

b.) Determine horizontal force required:

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a.) Determine v: (if you are just starting out, the work/energy theorem is the way to go; if you're fairly far into this section, then conservation of energy is the way to go—both are shown!)

work/energy

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

$$5000 = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$\Rightarrow \quad v_2 = \sqrt{\frac{2(5000\ \text{J})}{(2500\ \text{kg})}}$$

$$\Rightarrow \quad v_2 = 2\ \text{m/s}$$

conservation of energy

$$\sum KE_1 + \sum U_1 + \sum W_{extraneous} = \sum KE_2 + \sum U_2$$

$$(0) + (0) \quad (5000\ \text{J}) = \frac{1}{2}mv_2^2 + (0)$$

$$\Rightarrow \quad v_C = \left[\frac{2(5000)}{2500}\right]^{1/2}$$

$$\Rightarrow \quad v_C = 2\ \text{m/s}$$

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b.) Determine horizontal force required:

$$W_{man} = \left|\vec{F}_{man}\right| \left|\vec{d}\right| \cos 0^o$$

$$5000\ \text{J} = \left|\vec{F}_{man}\right| (25\ \text{m})$$

$$\Rightarrow \quad \left|\vec{F}_{man}\right| = 200\ \text{nt}$$