Bonus Lesson 2 - Work

I. W = Fd Work = Force * Distance

Transfer of Energy

Ex. Find the work done by a man pushing a 150lb box 20 feet.

$W = (150\text{lb})(20\text{ ft})$

$W = 3000\ \text{ft-lb}$

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Ex. A person is pushing a cart up a hill that experiences a force represented by 10x+4. lbs. How much work is done to push it 4 feet up the hill?

$\text{Work} = \int_a^b F \, dx$ (f(x))

$\int_0^4 10x+4\,dx$

$5x^2+4x\Big|_0^4$

$80+16 = 96\ \text{ft-lbs}$

Last ?

$\int_0^{20} 150\,dx$

$150x\Big|_0^{20}$

$150(20)-0$

3000

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Ex. A girl is roller blading up a π ft ramp experiences a force represented in lbs by sin x. How much work does she do to go up the ramp?

$\int_0^{\pi} \sin x\,dx$

$-\cos x\Big|_0^{\pi}$

$-\cos\pi + \cos 0$

$1+1 = 2\ \text{ft-lbs}$

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II. Spring Problems

Hooke's Law: The forced needed to keep a spring stretched (or compressed) x units beyond (or short of) its natural length is given by F(x) = kx
meaning the force needed is directly proportional to x, where k is called the spring constant.

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Ex. A spring has a natural length of 3 feet. A force of 10 lbs is required to keep it stretched to 3.5 feet.

a) Find the spring constant $F = kx$

$10 = k(1/2)$

$20 = k$

b) Find the work done to stretch the spring to 5 feet.

$F = 20x$

$\int_0^2 20x\,dx = 10x^2\Big|_0^2$

$40\ \text{ft-lbs}$

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c) Find the work done to stretch the spring from 4 feet to 5 feet.

$\int_1^2 20x\,dx = 10x^2\Big|_1^2 = 40-10 = 30$

d) How far beyond its natural length will a 15lb force stretch the spring?

$F = kx$

$15 = 20x$

$\frac{3}{4} = x$

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