1. Question Details SCalc8 5.4.001. [335

A 380-lb gorilla climbs a tree to a height of 26 ft. Find the work done if the gorilla reaches that height in the following times.

(a) 10 seconds

(b) 5 seconds

$W = F \cdot D = 380 \cdot 26$ ft-lbs; regardless of how quick he does it.

2. Question Details SCalc8 5.4.002. [3354033]

How much work is done when a hoist lifts a 260-kg rock to a height of 6 m? (Use 9.8 m/s^2 for the acceleration due to gravity.)

$F = ma = (260\ kg)\left(9.8\ \frac{m}{s^2}\right) = 2548\ N \left(\frac{kg-m}{s^2}\right)$

$W = F \cdot D = (2548\ N)(6\ m) = 15{,}288\ \frac{kg-m^2}{s^2} = 15{,}288\ J$

3. Question Details SCalc8 5.4.003. [3353617]

A variable force of $5x^{-2}$ pounds moves an object along a straight line when it is x feet from the origin. Calculate the work done in moving the object from $x = 1$ ft to $x = 14$ ft. (Round your answer to two decimal places.)

See Notes from 12/6/17

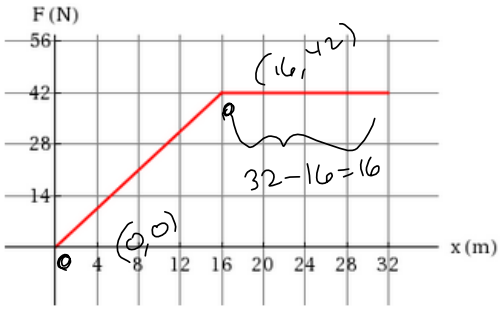
4. Question Details SCalc8 5.4.005. [3353793]

Shown is the graph of a force function (in newtons) that increases to its maximum value and then remains constant. How much work W is done by the force in moving an object a distance of 32 m?

$m = \frac{42}{16} = \frac{21}{8}$

$y = m(x - x_1) + y_1$

$y = \frac{21}{8}x$



$$\int_0^{16} \frac{21}{8}x \, dx + (42)(16)$$

5. Question Details SCalc8 5.4.007.MI. [3353856]

A force of 14 lb is required to hold a spring stretched 8 in. beyond its natural length. How much work W is done in stretching it from its natural length to 13 in. beyond its natural length?

Hooke's Law: $F = kx$

$14 = k \cdot 8$

$k = \frac{14}{8} = \frac{7}{4}$

$F = \frac{7}{4}x$

$$\int_0^{13} \left(\frac{7}{4}x\right) dx$$

6. Question Details SCalc8 5.4.009. [3354042]

Suppose that 4 J of work is needed to stretch a spring from its natural length of 36 cm to a length of 48 cm.

(a) How much work is needed to stretch the spring from 38 cm to 46 cm? (Round your answer to two decimal places.)

(b) How far beyond its natural length will a force of 10 N keep the spring stretched? (Round your answer one decimal place.)

(a)

$F = kx$

$$\int_0^{12} kx\,dx = 4$$

$$k\frac{x^2}{2}\Big]_0^{12} = 4$$

$72k = 4$

$k = \frac{4}{72} = \frac{2}{36} = \frac{1}{18} = k$

Let x = amt spring is stretched from its natural length of 36 cm.

$L = 36$

So, $L = 36$ to $L = 48$ is

$x = 0$ to $x = 12$

$L = 38$ to $L = 46$

$x = 2$ to $x = 10$

$$\text{Work} = \frac{1}{18}\int_2^{10} x\,dx = \frac{1}{36}x^2\Big]_2^{10}$$

$$= \frac{100}{36} - \frac{4}{36} = \frac{96}{36} = \frac{48}{18} = \frac{24}{9} = \frac{8}{3}\text{ J}$$

(b) $F = kx = 10$

$x = \frac{10}{k} = 18(10) = 180$ cm

7. Question Details SCalc8 5.4.010. [3354071]

If the work required to stretch a spring 3 ft beyond its natural length is 9 ft-lb, how much work is needed to stretch it 18 in. beyond its natural length?

$(18\text{ in})\left(\frac{1\text{ ft}}{12\text{ in}}\right) = 1.5\text{ ft}$

$$\int_0^3 kx\,dx = 9$$

$$k\left[\frac{x^2}{2}\right]_0^3 = k\left[\frac{9}{2} - 0\right] = \frac{9}{2}k = 9 \Rightarrow k = 2$$

$$\int_0^{1.5} 2x\,dx = \left[x^2\right]_0^{1.5} = \left[x^2\right]_0^{\frac{3}{2}} = \left(\frac{3}{2}\right)^2 = \frac{9}{4} = 2.25\text{ J}$$

8. Question Details SCalc8 5.4.012. [3353817]

If 24 J of work are needed to stretch a spring from 13 cm to 17 cm and 40 J are needed to stretch it from 17 cm to 21 cm, what is the natural length of the spring?

L = natural length (cm)

$$\int_{13-L}^{17-L} kx\,dx = 24$$

fixes itself w/ squares.

$$\frac{k}{2}x^2\Big]_{L-13}^{L-17} = \frac{k}{2}\left[(L-17)^2 - (L-13)^2\right] = 24$$

$$= \frac{k}{2}\left[L^2-34L+289 - \left[L^2-26L+169\right]\right] = 24$$

$$\Rightarrow \frac{k}{2}\left[-34L+289+26L-169\right] = 24$$

$$\Rightarrow \frac{k}{2}\left[-8L+120\right] = 24$$

$$\int_{17-L}^{21-L} kx\,dx = 40$$

$$\frac{k}{2}x^2\Big]_{L-17}^{L-21} = \frac{k}{2}\left[(L-21)^2 - (L-17)^2\right] = 40$$

same as $(21-L)^2 - (17-L)^2$

$$= \frac{k}{2}\left[L^2-42L+441 - (L^2-34L+289)\right]$$

$$= \frac{k}{2}\left[-42L+441+34L-289\right] = \frac{k}{2}\left[-8L+152\right] = 40$$

$$k\left[-8L+152\right] = 80$$

$$k\left[-8L+120\right] = 48$$

$$\Rightarrow -8kL + 152k = 80$$

$$-\left(-8kL + 120k = 48\right)$$

$$32k = 32$$

$$k = 1$$

$$-8L+152 = 80$$

$$-8L = -72$$

$$L = 9 \text{ cm}$$

$k = 1$

$-8L+120 = 48$

$-8L = -72$

$L = 9$

$$\begin{array}{r} {}^{1}\cancel{1}20 \\ -\ 48 \\ \hline -72 \end{array}$$

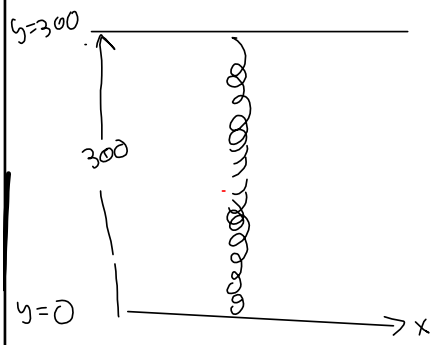
9. Question Details SCalc8 5.4.015. [3353974]

A cable that weighs 8 lb/ft is used to lift 600 lb of coal up a mine shaft 300 ft deep. Find the work done.

Show how to approximate the required work by a Riemann sum. (~~Let x be the distance in~~ feet below the top of the shaft. Enter x_i^* as x_i.)

#15 in Text.

Express the work as an integral. Evaluate the integral.



Force = weight of chain + weight of coal.

Weight of chain:

$y=0$: $(8 lb/ft)(300 ft) = 2400$ lbs

$(y, w) = (0, 2400)$

$y=300$:

$(y, w) = (300, 0)$

$m = \frac{2400-0}{0-300} = -8$

$w = m(y-y_1) + w_1$

$= -8(y-0) + 2400$

$= -8y + 2400 = wt = Force$

TOTAL FORCE:

$(-8y + 2400) + 600 = -8y + 3000$

chain + coal

$$\int_0^{300} (-8y + 3000)\, dy = 54000 \text{ ft-lbs}$$

$$\int_0^{300} (8x + 600)\, dx = 54000 \text{ ft-lbs}$$

10. Question Details SCalc8 5.4.017. [3353600]

A leaky 10-kg bucket is lifted from the ground to a height of 14 m at a constant speed with a rope that weighs 0.7 kg/m. Initially the bucket contains 42 kg of water, but the water leaks at a constant rate and finishes draining just as the bucket reaches the 14-m level. Find the work done. (Use 9.8 m/s^2 for g.)

Show how to approximate the required work by a Riemann sum. (Let x be the height in meters above the ground. Enter x_i^* as x_i.)

$$\lim_{n\to\infty}\sum_{i=1}^{n}(\quad)\,\Delta x$$

This exercise was set up in class, December 7th, 2017.

See Notes on harryzaims.com.

Express the work as an integral.

Evaluate the integral. (Round your answer to the nearest integer.)

Forces: Bucket, Rope, Water

Bucket: $(10\,kg)(9.8\,\frac{m}{s^2}) = 98\,\frac{kg\text{-}m}{s^2} = 98\,N.$

Work done on it is $(98\,N)(14\,m) = 1372\,N\text{-}m =$ 1372 J

Add @ end.

Rope: $(.7\,kg/m)($

Top: ON $\longrightarrow$ $(14, 0)$

Bottom: $(.7\,\frac{kg}{m})(14\,m)(9.8\,\frac{m}{s^2}) = 96.04\,N$

$(0, 96.04\,N)$

$m = \frac{96.04}{14}$