Example 1

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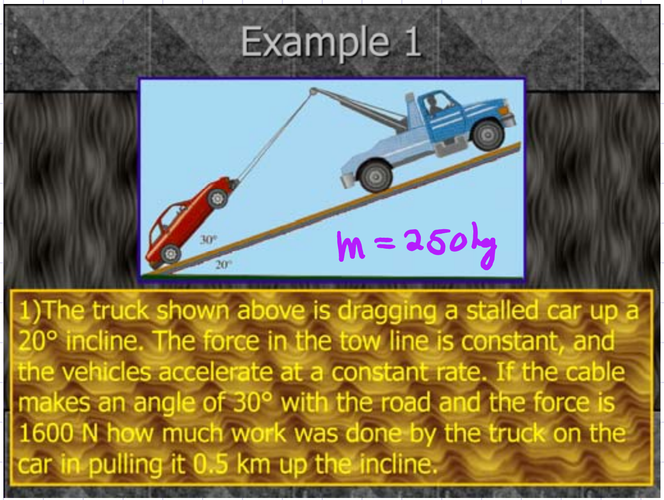
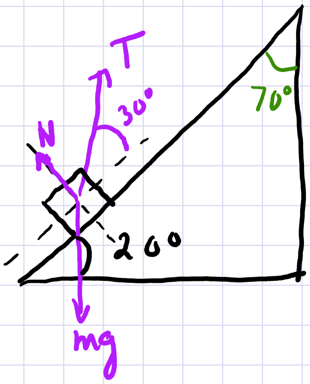
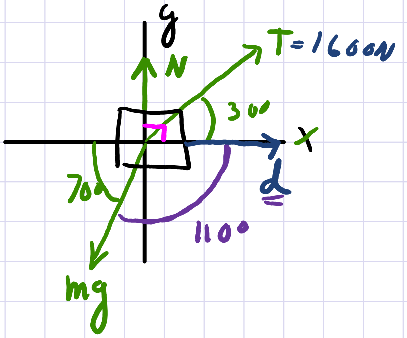


Example 1

1)The truck shown above is dragging a stalled car up a 20° incline. The force in the tow line is constant, and the vehicles accelerate at a constant rate. If the cable makes an angle of 30° with the road and the force is 1600 N how much work was done by the truck on the car in pulling it 0.5 km up the incline.





a) $W_T = Fd\cos\theta$

$W_T = (1600N)(500m)\cos(30°)$

$W_T = 692820$ J

$W_T = 6.9\times10^5$ J

b) $W_g = Fd\cos\theta$

$W_g = (250kg)(9.8m/s^2)(500m)\cos(110°)$

$W_g = -418,974\,J = -4.2\times10^5\,J$

c) $W_N = Fd\cos\theta$

$W_N = Nd\cos(90°)$

$W_N = 0$

$W_{tot} = W_T + W_g + W_N$

$W_{tot} = 6.9\times10^5 J - 4.2\times10^5 J + 0$

$W_{tot} = 2.7\times10^5 J$

Example 2

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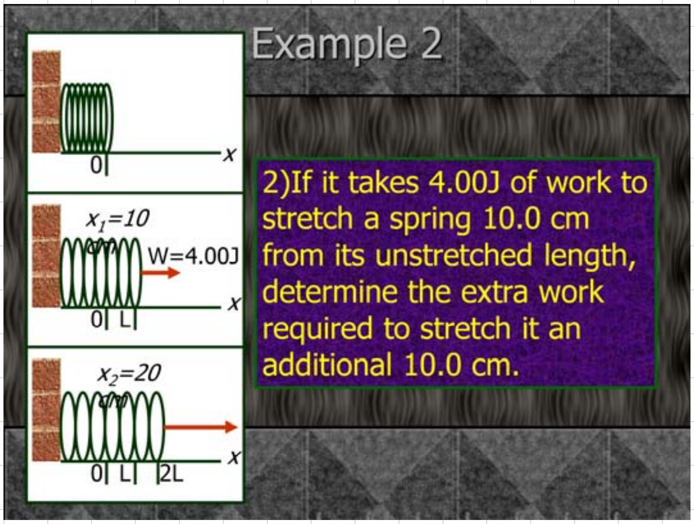
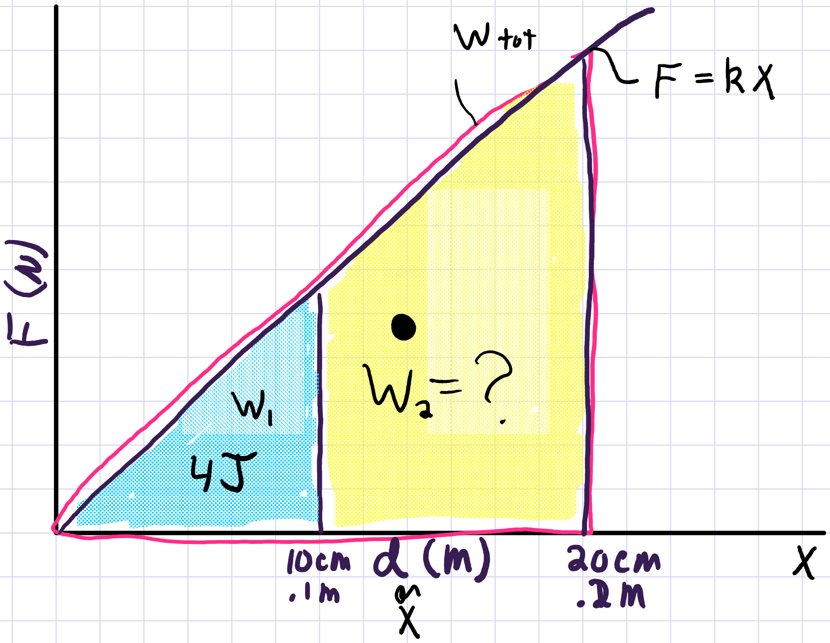
$F = -kX$

$\theta = 0$ $\cos\theta = 1$



Example 2

2)If it takes 4.00J of work to stretch a spring 10.0 cm from its unstretched length, determine the extra work required to stretch it an additional 10.0 cm.



$W_1 = \frac{1}{2} b h$

$W_1 = \frac{1}{2}(X)(kX)$

$W_1 = \boxed{\frac{1}{2} k X^2}$

$k = \frac{2W_1}{X^2} \rightarrow \frac{N \cdot m}{m^2} \rightarrow \frac{N}{m}$

$k = \frac{2(4J)}{(.1m)^2}$

$k = 800 \ N/m$

$W_{tot} = \frac{1}{2} k X^2$

$W_{tot} = \frac{1}{2}(800N/m)(.2m)^2$

$W_{tot} = 16J$

$W_2 = W_{tot} - W_1 = 16J - 4J$

$\boxed{W_2 = 12J}$

Example 3

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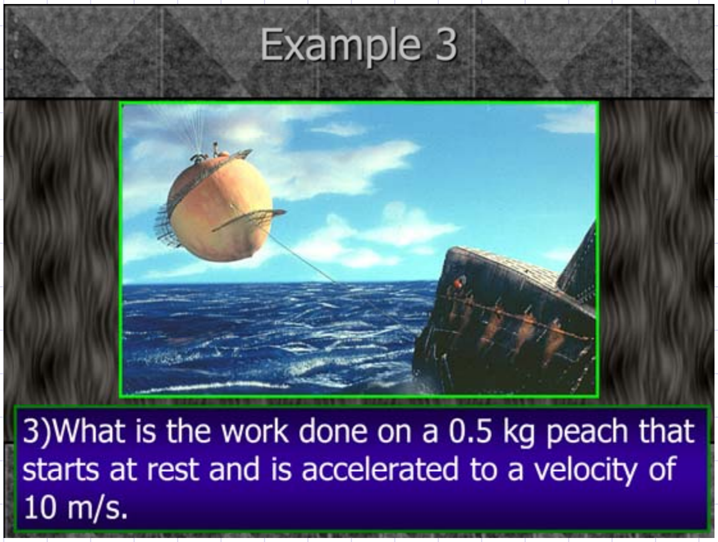
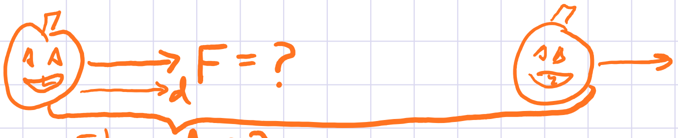


Example 3

3)What is the work done on a 0.5 kg peach that starts at rest and is accelerated to a velocity of 10 m/s.

$v_i = 0$ $\theta = 0$ $v_f = 10 m/s$



$m = .5 kg$ $d = ?$

$W = Fd \cancel{\cos\theta}^{1}$

$W = mad$

$W = m\left[\frac{v_f - v_i}{\cancel{t}}\right]\left[\frac{v_i + v_f}{2}\right]\cancel{t}$

$W = \frac{1}{2} m (v_f - v_i)(v_i + v_f)$

$W = \frac{1}{2} m (v_f^2 - v_i^2)$

$$\boxed{W = \underbrace{\boxed{\frac{1}{2} m v_f^2}}_{KE}} + \cancel{\frac{1}{2} m v_i^2}^{0}$$

$W = \frac{1}{2}(.5 kg)(10 m/s)^2$

$W = 25 J$

$a = \frac{\Delta v}{t} = \frac{v_f - v_i}{t}$

$\Delta x = d = \left[\frac{v_i + v_f}{2}\right] t$

$W = KE_f - KE_i$

Example 4

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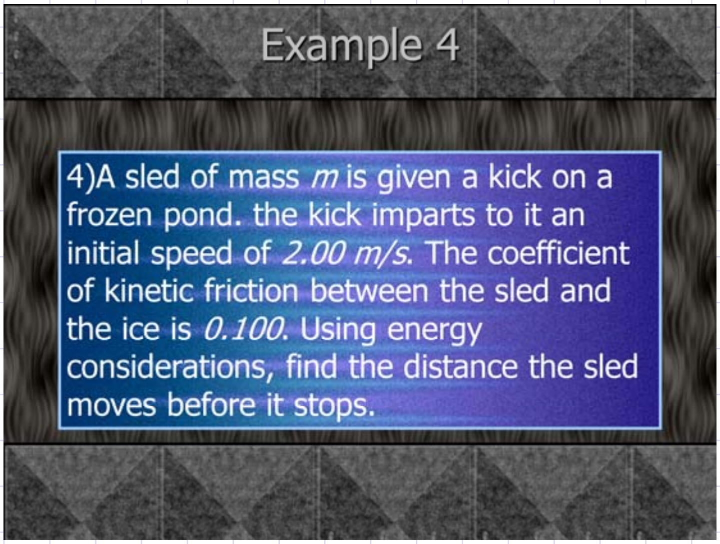
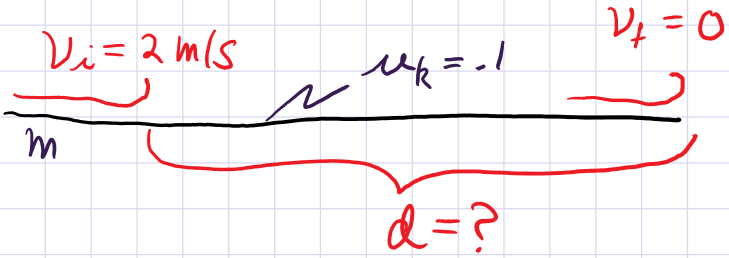


Example 4

4)A sled of mass *m* is given a kick on a frozen pond. the kick imparts to it an initial speed of *2.00 m/s*. The coefficient of kinetic friction between the sled and the ice is *0.100*. Using energy considerations, find the distance the sled moves before it stops.



$$W = \Delta KE$$

$$Fd\,\overset{-1}{\cancel{\cos\theta}} = \overset{0}{\cancel{KE_f}} - KE_i$$

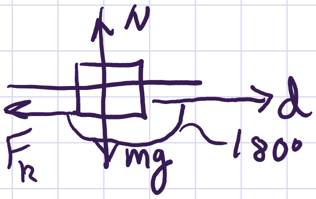
$$+Fd = +\tfrac{1}{2} m v_i^2$$

$$\mu_k \cancel{m} g d = \tfrac{1}{2} \cancel{m} v_i^2$$

$$d = \frac{v_i^2}{2\mu_k g}$$

$$d = \frac{(2\ \text{m/s})^2}{2(.1)(9.8\ \text{m/s}^2)}$$

$$\boxed{d = 2.04\ \text{m}}$$



$$F_k = \mu_k N$$

$$N = mg$$

Example 5

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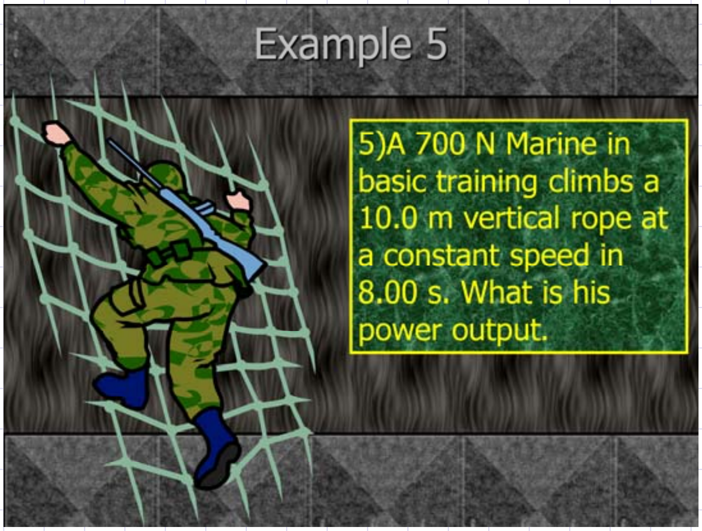

Example 5

5)A 700 N Marine in basic training climbs a 10.0 m vertical rope at a constant speed in 8.00 s. What is his power output.

$d = 10m$

$t = 8S$

$$p = \frac{W}{t}$$

$$p = \frac{F\,d\,\overset{1}{\cancel{\cos\theta}}}{t} = F\,v\cos\theta$$

$$p = \frac{Fd}{t}$$

$$p = \frac{(700N)(10m)}{8S}$$

$$P = 875\ W$$

$$W_m = mgd$$

$$W_g = -mgd$$

$$W_{tot} = 0$$

$$\Delta KE = 0$$

Example 6

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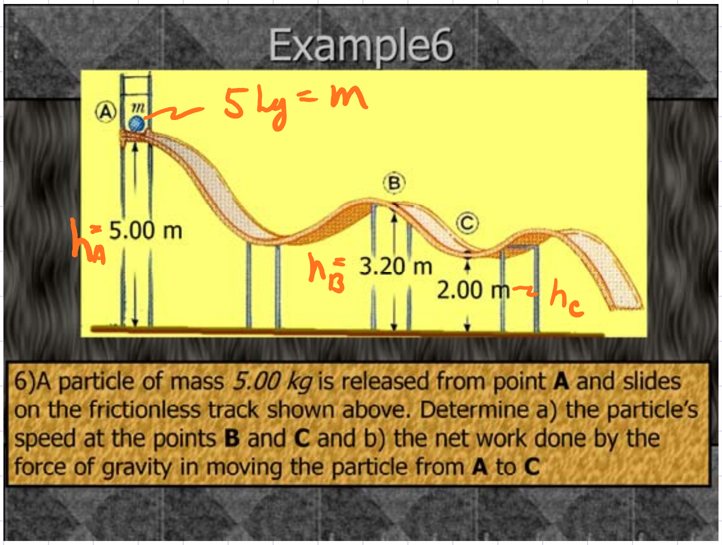


Example6

6)A particle of mass *5.00 kg* is released from point **A** and slides on the frictionless track shown above. Determine a) the particle's speed at the points **B** and **C** and b) the net work done by the force of gravity in moving the particle from **A** to **C**

a) $\Delta KE + \Delta PE = 0$

$KE_f - \cancel{KE_i}^{0} + PE_f - PE_i = 0$

$\frac{1}{2}\cancel{m}v_B^2 + \cancel{m}gh_B - \cancel{m}gh_A = 0$

$\frac{1}{2}v_B^2 = gh_A - gh_B$

$v_B = \sqrt{2g(h_A - h_B)}$

$v_B = \sqrt{2(9.8\,m/s^2)(5m - 3.2m)}$

$v_B = 5.94\,m/s$

$v_c = \sqrt{2g(h_A - h_c)}$

$v_c = \sqrt{2(9.8\,m/s^2)(5m - 2m)}$

$v_c = 7.67\,m/s$

b) $W_{a\to c}$

$W = \Delta PE$

$W = PE_f - PE_i$

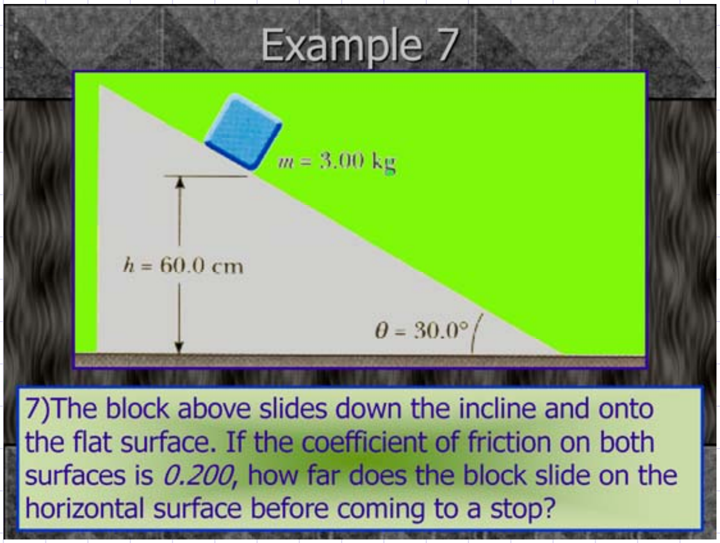
$W_{a\to c} = mgh_c - mgh_A$

$W_{a\to c} = mg(h_c - h_A)$

$W_{a\to c} = (5kg)(9.8\,m/s^2)(-3m)$

$W_{a\to c} = -147\,J$

$\underline{W = \Delta KE = +147\,J}$



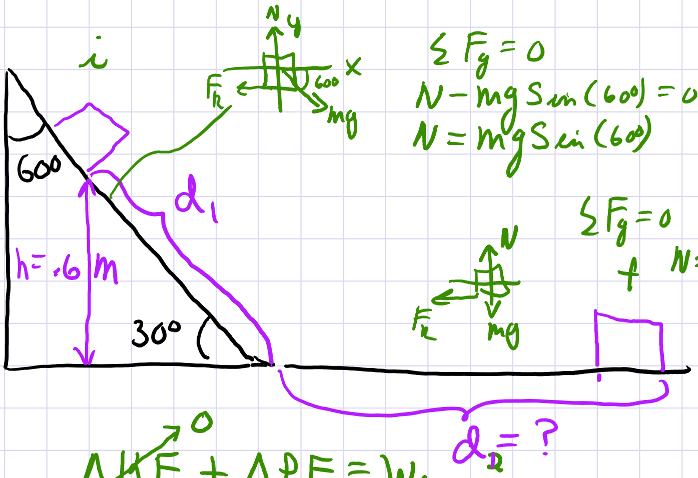
Example 7

7)The block above slides down the incline and onto the flat surface. If the coefficient of friction on both surfaces is *0.200*, how far does the block slide on the horizontal surface before coming to a stop?

$$\sin(30^\circ) = \frac{h}{d_1}$$

$$d_1 = \frac{h}{\sin(30^\circ)} = \frac{.6m}{\sin(30^\circ)}$$

$$d_1 = 1.2m$$



$$\Sigma F_y = 0$$

$$N - mg\sin(60^\circ) = 0$$

$$N = mg\sin(60^\circ)$$

$$\Sigma F_y = 0$$

$$N = mg$$

$$\overset{0}{\cancel{\Delta KE}} + \Delta PE = W_f$$

$$\overset{0}{\cancel{PE_f}} - PE_i = W_{f_1} + W_{f_2}$$

$$-mgh = F_{k_1} d_1 \overset{-1}{\cancel{\cos\theta}} + F_{k_2} d_2 \overset{-1}{\cancel{\cos\theta}}$$

$$-mgh = -\mu_k N_1 d_1 - \mu_k N_2 d_2$$

$$\cancel{mg}h = \mu_k \cancel{mg}\sin(60^\circ) d_1 + \mu_k \cancel{mg} d_2$$

$$h = \mu_k \sin(60^\circ) d_1 + \mu_k d_2$$

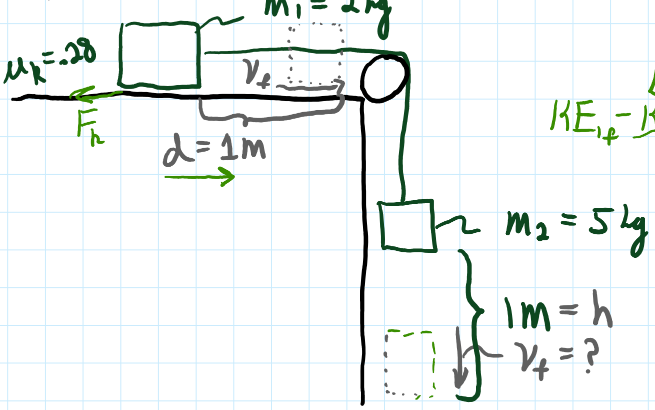
$$d_2 = \frac{h - \mu_k \sin(60^\circ) d_1}{\mu_k}$$

$$d_2 = \frac{.6m - (.2)\sin(60^\circ)(1.2m)}{.2}$$

$$\boxed{d_2 = 1.96m}$$

Extra 1

Monday, November 9, 2015 8:29 AM



$$\Delta KE + \Delta PE = W_f$$

$$\Delta KE_1 + \Delta KE_2 + \cancelto{0}{\Delta PE_1} + \Delta PE_2 = W_f$$

$$KE_{1f} - \cancelto{0}{KE_{1i}} + KE_{2f} - \cancelto{0}{KE_{2i}} + \cancelto{0}{PE_{2f}} - PE_{2i} = W_f$$

$$KE_{1f} + KE_{2f} - PE_{2i} = W_f$$

$$\tfrac{1}{2}m_1 v_f^2 + \tfrac{1}{2}m_2 v_f^2 - m_2 gh = F_k d \cancelto{-1}{\cos}\theta$$

$$\tfrac{1}{2}v_f^2(m_1+m_2) - m_2 gh = -\mu_k N d$$

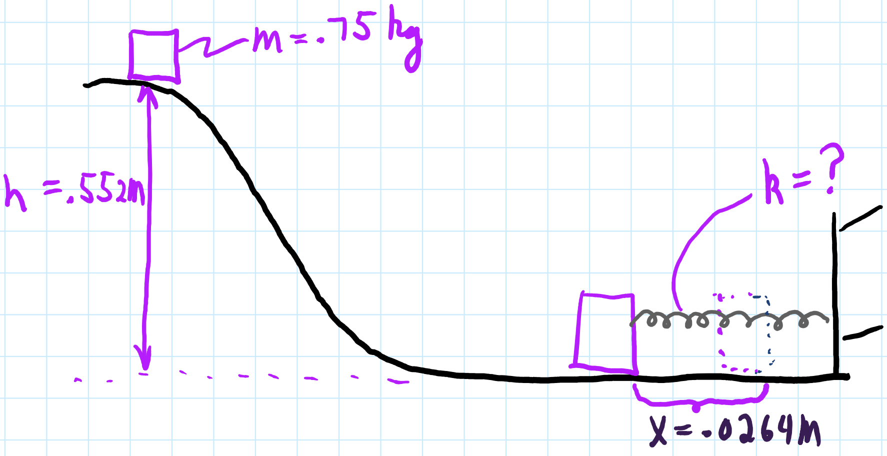
$$\tfrac{1}{2}v_f^2(m_1+m_2) - m_2 gh = -\mu_k m_1 g d$$

$$v_f = \sqrt{\frac{2(m_2 gh - \mu_k m_1 g d)}{(m_1 + m_2)}}$$

$$v_f = \sqrt{\frac{2(5kg)(9.8m/s^2)(1m) - (.28)(2kg)(9.8m/s^2)(1m)}{7kg}}$$

$$v_f = 3.53\ m/s$$

Extra 2



$$F = kX$$

$$\Delta \cancelto{0}{KE} + \underbrace{\Delta PE} = 0$$

$$\Delta PE_g + \Delta PE_s = 0$$

$$\cancelto{0}{PE_{g_f}} - PE_{g_i} + PE_{s_f} - \cancelto{0}{PE_{s_i}} = 0$$

$$-mgh + \tfrac{1}{2}kX^2 = 0$$

$$\tfrac{1}{2}kX^2 = mgh$$

$$k = \frac{2mgh}{X^2}$$

$$k = \frac{2(.75kg)(9.8m/s^2)(.552m)}{(.0264m)^2}$$

$$\boxed{k = 11{,}642.6\ N/m}$$