1) The PE of the elevator is converted to KE by work done by gravity - When it hits to spring this KE is changed to PE_{spring}.

The elevator travels down the extra distance the spring compresses

1)

$$\Delta PE_{elev} \pm KE_{elev} = PE_{springs}$$

$$\Delta PE_{el} = PE_{spr}$$

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

$$mg(4(53)+x) = \tfrac{1}{2}(42500)x^2$$

$$20mg + mgx = 21250x^2$$

$$21250x^2 - (2500)(9.81)x - 20(2500)(9.81) = 0$$

$$21250x^2 - 24525x - 490500 = 0$$

$$\boxed{x = 5.42\text{ m}}$$

2) As Hanna does work on the bow it stores PE this PE is transfered to KE of the arrow.

2)

$$W = PE_B = KE_A$$

$$Fd = \tfrac{1}{2}mv^2$$

$$(350)(.65) = \tfrac{1}{2}(.110)v^2$$

$$\boxed{v = 64.3\text{ m/s}}$$

3) The KE you give the ball is changed to PE by work done by gravity.

3)

$$KE = PE$$

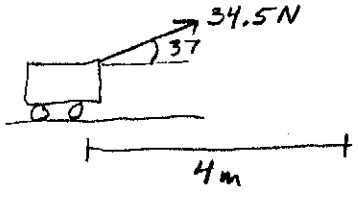
$$\tfrac{1}{2}mv^2 = mgh$$

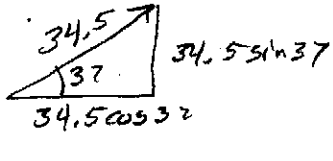
$$\tfrac{1}{2}(26)^2 = (9.81)h$$

$$\boxed{h = 34.4\text{ m}}$$

4) only the horizontal component of your force does work on the wagon

4)





$$W = Fd$$

$$W = 34.5\cos 37\,(4)$$

$$\boxed{W = 110\text{ J}}$$

5) Tarzan's KE is converted to PE as he swings on the vine.

5) $v = 17.4\ m/s$

$KE = PE$

$\frac{1}{2}mv^2 = mgh$

$\frac{1}{2}(17.4)^2 = 9.81h$

$\boxed{h = 15.4\ m}$

6) The PE of the spring is converted to the balls KE when launched.

6) $PE = KE$

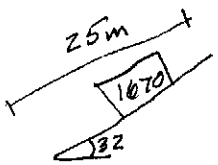
$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$k(.14)^2 = (.057)(4.92)^2$

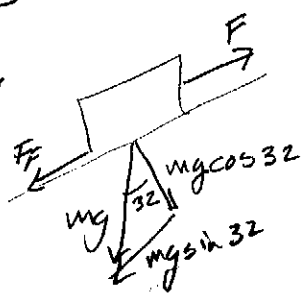
$\boxed{k = 70.4\ N/m}$

7) The strongman has to give the boat energy to add to its PE and the work it does against friction

7)



$\nu = .689$



$E = \Delta PE + W_{nc}$

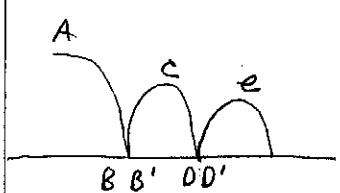
$E = mgh + F_f d$

$E = (1670)(9.81)(25\sin 32) + (.689)(1670)(9.81)\cos 32\,(25)$

$\boxed{E = 4.56 \times 10^5\ J}$

8) The ball loses the same % of energy each bounce

The PE at the top of each bounce converts to KE at bottom



$h_A = 2.25m$

$h_C = 1.95m$

8) $PE_A = KE_B$ $\quad (P)KE_B = KE_{B'}$

$KE_{B'} = PE_C = KE_D$ $\quad (P)KE_D = KE_{D'} = PE_e$

$(P)\,PE_A = PE_C$ $\quad (P)\,PE_C = PE_e$

$(P)mgh_A = mgh_C$ $\quad (P)mgh_C = mgh_e$

$P = \frac{1.95}{2.25}$ $\quad \left(\frac{1.95}{2.25}\right)(1.95) = h_e$

$\boxed{h_e = 1.69\ m}$