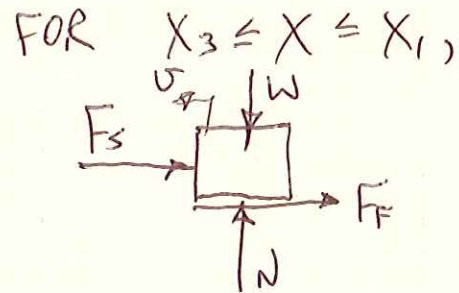
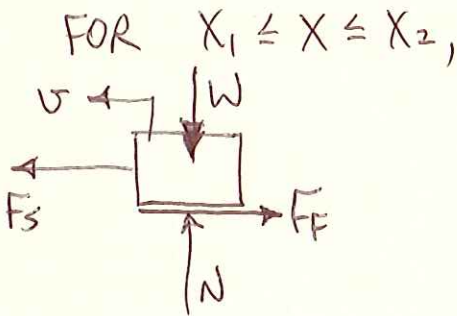
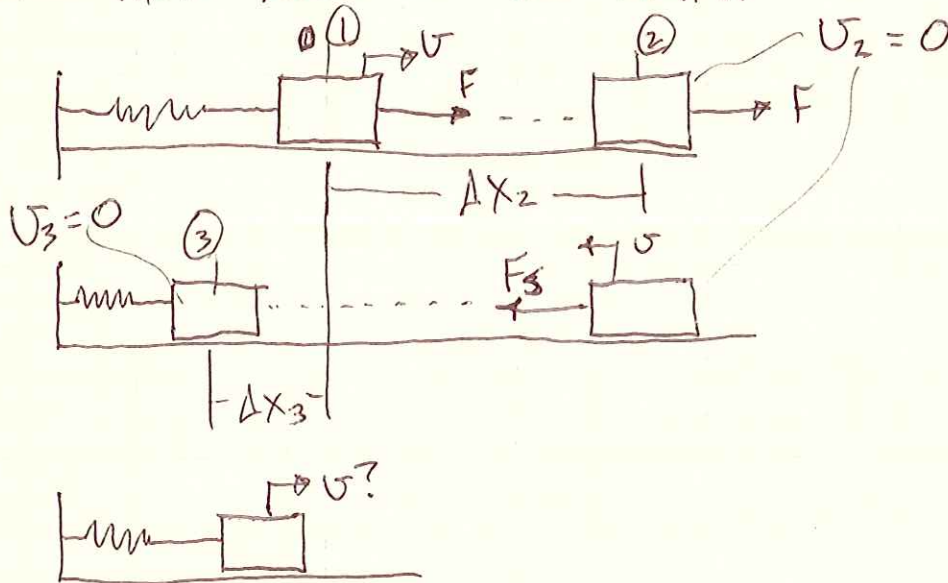


PROB. 13-27

$W = 10^{LB}$ ,  $K = 144 \frac{LB}{ft}$ ,  $\mu_s = 0.6$ ,  $\mu_k = 0.4$ ,  $F = 20^{LB}$ ,  
 FIND  $\Delta X$  TO THE LEFT, AND WHETHER THE BLOCK  
 WILL THEN MOVE TO THE RIGHT.



PRINCIPLE OF WORK AND ENERGY: BLOCK TRAVELS  
 FROM POINT 2 TO POINT 3:

$$T_2 + U_{2-3} = T_3$$

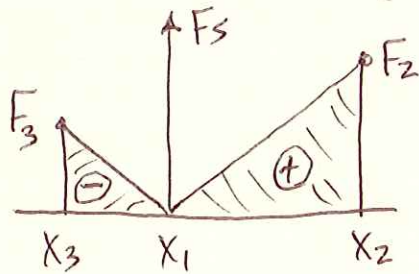
$$T_2 = 0 \text{ SINCE } v_2 = 0, \quad T_3 = 0 \text{ SINCE } v_3 = 0$$

$$U_{2-3} = 0$$

$$U_{2-3} = (U_{2-3})_s + (U_{2-3})_F$$

PROB. 13-27 CONT.

SPRING WORK:  $(U_{2-3})_s = (U_{2-1})_s + (U_{1-3})_s$



= AREA UNDER CURVE

$$(U_{2-1})_s = \frac{1}{2} F_2 (\Delta X)_2$$

$$(U_{1-3})_s = -\frac{1}{2} F_3 (\Delta X)_3$$

$$(U_{2-3})_s = \frac{1}{2} F_2 (\Delta X)_2 - \frac{1}{2} F_3 (\Delta X)_3$$

$$(U_{2-3})_s = \frac{1}{2} k (\Delta X)_2^2 - \frac{1}{2} k (\Delta X)_3^2$$

FRICITION WORK:

$$(U_{2-3})_F = (U_{2-1})_F + (U_{1-3})_F = -F_F (\Delta X)_2 - F_F (\Delta X)_3$$

$$(U_{2-3})_F = -\mu_k W (\Delta X)_2 - \mu_k W (\Delta X)_3$$

$$U_{2-3} = 0 = \frac{1}{2} k (\Delta X)_2^2 - \frac{1}{2} k (\Delta X)_3^2 - \mu_k W (\Delta X)_2 - \mu_k W (\Delta X)_3$$

$$\frac{1}{2} (144 \frac{\text{LB}}{\text{ft}}) (\Delta X)_3^2 + (0.4)(10^{\text{LB}}) (\Delta X)_3 + [(0.4)(10^{\text{LB}})(0.1389 \text{ft}) - \frac{1}{2} (144)(0.1389)^2] = 0$$

$$72 (\Delta X)_3^2 + 4 (\Delta X)_3 - 0.8335 = 0$$

$$\Delta X_3 = \frac{-4 \pm \sqrt{4^2 - 4(72)(-0.8335)}}{2(72)}$$

$$\Delta X_3 = -0.02778 \pm 0.1111 \text{ ft} \quad \text{TAKE POSITIVE ROOT:}$$

$$\Delta X_3 = 0.08334 \text{ ft}$$

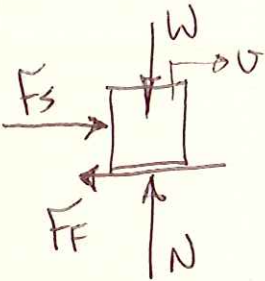
PROB. 13-27 CONT.

TOTAL DISTANCE TRAVELED TO THE LEFT:

$$d = \Delta X_2 + \Delta X_3 = (0.1389 \text{ ft}) + (0.08334 \text{ ft}) = 0.2222 \text{ ft}$$

WILL BLOCK MOVE BACK TO THE RIGHT?

FBD AT POINT 3: IMPENDING MOTION



$$F_s = k(\Delta X_3) = \left(144 \frac{\text{LB}}{\text{ft}}\right)(0.08334 \text{ ft}) = 12 \text{ LB}$$

$$F_{f, \text{MAX}} = \mu_s \cdot N = \mu_s \cdot W = (0.6)(10 \text{ LB}) = 6 \text{ LB}$$

SINCE  $F_s > F_{f, \text{MAX}}$ , BLOCK WILL MOVE TO THE RIGHT