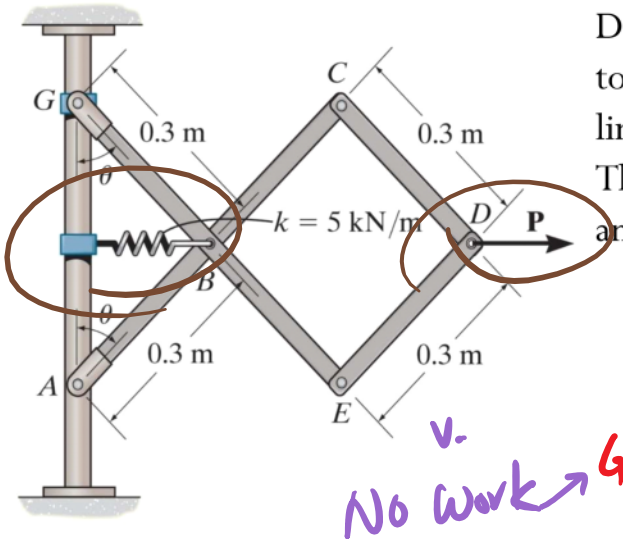
Announcements

- Last day of class: Monday, Dec. 9
- No discussion sections next week
- Last day of office hours and Piazza help: Wednesday, Dec. 12
- CBTF (last) Quiz 6 starts Thursday, Dec. ~~14~~ 13 (thanks Math)

❑ Upcoming deadlines:

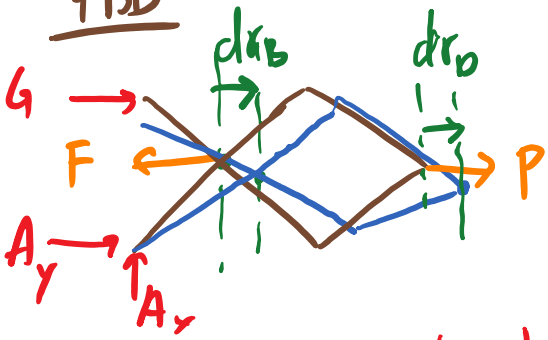
- Friday (12/7)
  - Written assignment 9
- Tuesday (12/11)
  - Last PL HW

Wednesday, December 5, 2018 12:09 PM



Determine the required force P needed to maintain equilibrium of the scissors linkage when the angle is 60 degrees. The spring is unstretched when the angle is 30 degrees.

FBD



v. No work

displacement from unstretched length

$F_{spring} = ks = k(l - l_0)$

$dU = 0 = dU_F + dU_P$

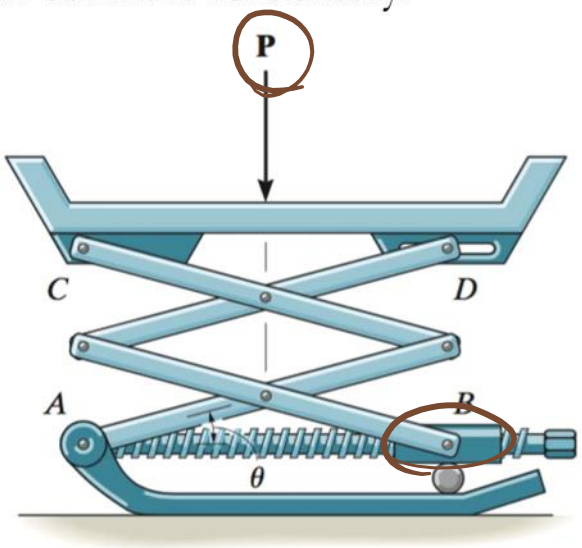
$dU_F = -F\,dr_B = -ks(0.3\cos\theta\,d\theta)$

$dU_P = +P\,dr_D = +P(0.9\cos\theta\,d\theta)$

$-0.3ks\cos\theta\,d\theta + 0.9P\cos\theta\,d\theta = 0$

$\rightarrow P = \frac{ks}{3}$

The scissors jack supports a load **P**. Determine the axial force in the screw necessary for equilibrium when the jack is in the position shown. Each of the four links has a length L and is pin-connected at its center. Points B and D can move horizontally.



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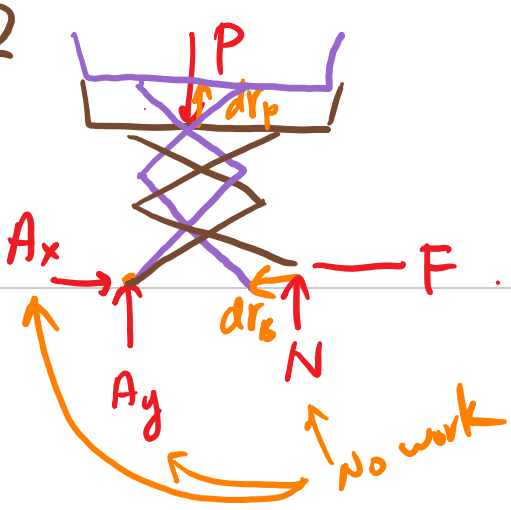


$dU = 0 = dU_p + dU_F$

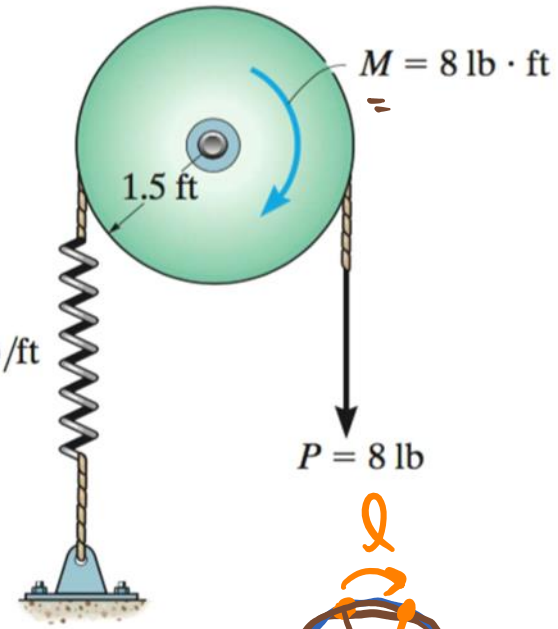
dr_B = horizontal

dr_p = vertical

$$dU = -P\,dr_p + F\,dr_B = -P\left(2L\cos\theta\,d\theta\right) + F\left(L\sin\theta\,d\theta\right) = 0$$

$$F = \frac{2P\cos\theta}{\sin\theta}$$

The disk has a weight of 10 lb and is subjected to a vertical force P = 8 lb and a couple moment M = 8 lb ft. Determine the disk's rotation θ if the end of the spring wraps around the periphery of the disk as the disk turns. The spring is originally unstretched.



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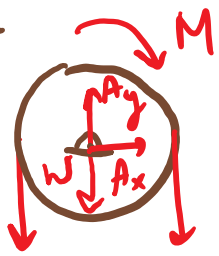


$F_{sp} = ks$ P

$dU_F = -F\,dr_C$

$dU_M = +M\,d\theta$

$dU_P = +P\,dr_B$

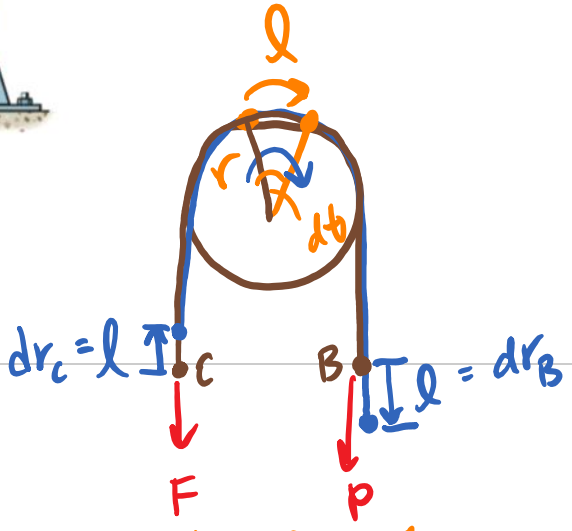
A_x & A_y won't do work.

$$dU = 0 = dU_F + dU_M + dU_P$$
$$= -F dr_C + M d\theta + P dr_B$$
$$= -F(1.5\,d\theta) + M d\theta + P(1.5\,d\theta)$$

$$F = \frac{M + 1.5P}{1.5} = ks$$

$$s = \frac{M + 1.5P}{1.5k} = l = r\theta.$$

$$\theta = \frac{M + 1.5P}{1.5kr}$$



arc length: $l = r\theta$

$dr_B = 1.5\,d\theta$ ft

$dr_C = 1.5\,d\theta$ ft