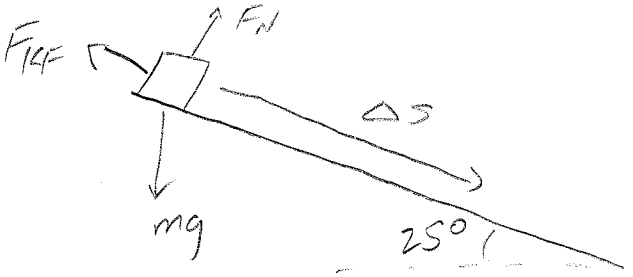
Physics 10154 - Exam #5B

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. A block is initially at rest at the top of a 2.0-meter plane inclined at 25° with respect to the horizontal. By the time the block slides down to the bottom of the plane, it is moving with a speed of 2.9 m/s. What is the coefficient of kinetic friction between the block and the inclined plane?



$W_N = 0$

$W_{grav} = (mg)(\Delta s)\cos 65°$

$= 8.28m$

$W_{KF} = (\mu_K F_N)(\Delta s)\cos 180°$

$= -\mu_K(mg\cos 25°)(\Delta s)$

$= -17.7\mu_K m$

$0 + 8.28m - 17.7\mu_K m = \frac{1}{2}m(2.9)^2 - 0$

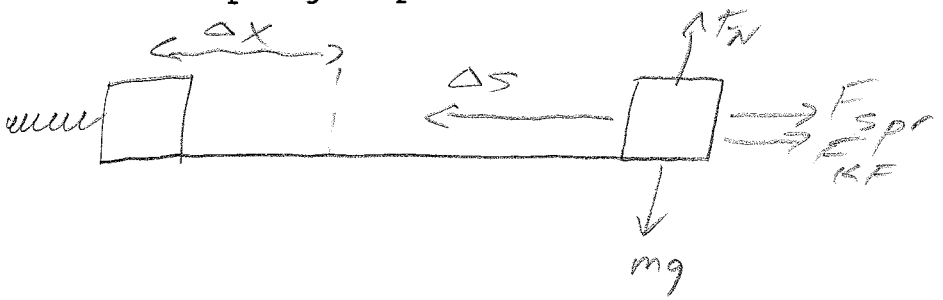
$8.28 - 17.7\mu_K = 4.21$

$-17.7\mu_K = -4.08$

$\boxed{\mu_K = 0.23}$

2. A 3.0-kg wooden block is given an initial speed of 7.5 m/s along a rough table with a coefficient of kinetic friction of 0.22 between the table and the block. After moving 2.2 meters along the horizontal surface, the block encounters a relaxed horizontal spring with a spring constant of 35 N/m.

Keeping in mind that friction continues to act on the block even while the spring is slowing the block down, to what maximum value of x is the spring compressed?



$W_N = 0$

$W_{grav} = 0$

$W_{spr} = -\frac{1}{2} k \Delta x^2 = -17.5 x^2$

$W_{KF} = (\mu_K F_N)(\Delta s + \Delta x)\cos 180°$

$= -\mu_K mg(\Delta s + x)$

$= -(.22)(3.0)(9.8)(2.2 + x)$

$= -14.23 - 6.47x$

$0 + 0 - 17.5x^2 - 14.23 - 6.47x = 0 - \frac{1}{2}(3)(7.5)^2$

$17.5x^2 + 6.47x + 14.23 = 84.4$

$17.5x^2 + 6.47x - 70.15 = 0$

$x = \frac{-6.47 \pm \sqrt{(6.47)^2 + 4(17.5)(70.15)}}{35} = -0.18 \pm 2.01$

$\boxed{x = 1.8\ m}$