

65 68
 18.2 21
 94 100(x3)

Name _____

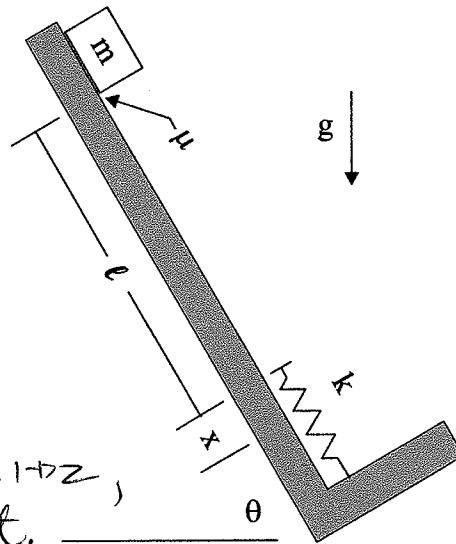
Section (circle one): 0910 1010

ME 212
Quiz 2
 Summer 2009

Solve the problems below on separate sheets of paper. In your solutions you need to show not only the answers but the steps or rationale you used to arrive at the answer. If you perform special actions on your calculator (like a SOLVE or a cross product), write out the steps you used and precisely what you entered into the calculator. Your answers need to be complete enough to make your work *checkable*. If the question has multiple parts, make sure that in your work, it is very clear which part of your work belongs to each sub-question. Box your final answers.

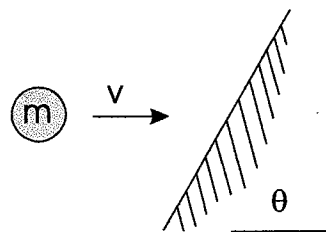
1. A mass m is let loose from rest at a length ℓ along an incline plane above a spring. It slides along the non-smooth plane, encounters the spring and compresses a distance x it before coming to a stop. Consider all the variables shown in the drawing at right known.

Assess the energy state of the mass at the beginning, when it's released, and at the end, when it comes to a stop with the spring compressed. Write the general energy equation for the system. You do not have to solve the equation, simply write it. Do not include in it any variables not shown in the drawing.



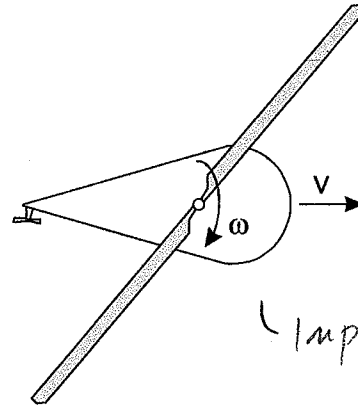
Lots left off distance in U_{1-2} ,
 so units don't work out.

2. In the picture at right, the 1 kg mass is impacting the 60° sloped surface at 20 m/sec. The coefficient of restitution (e) for the ball is 0.8. Determine v_n , v_t , v_n' , v_t' , θ , and θ' .



$v_n \neq 0$
 Don't use signs here.
 Directions are obvious.

3. The helicopter at right is proceeding to the right with a forward speed of 100 ft/sec. Its main rotor is rotating once per second, so 2π rad/sec. Where is the instantaneous center of the helicopter rotor?



Improve drawing

755 1. Let the height of the unstretched
802 spring be the zero V_g level.

17 min

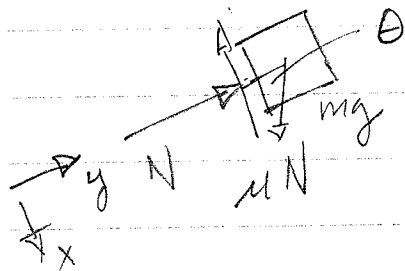
3 $E_1: V_{g1} = mgh = mg l \sin \theta$

3 $E_2: V_{e2} = \frac{1}{2} kx^2, V_{g2} = -mgh = -mgx \sin \theta$

3 $U_{1-2}: -\mu N (l+x)$

Need N :

FBD:



$$\sum F_y = 0 = N - mg \cos \theta$$

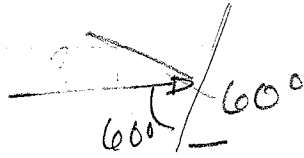
$$N = mg \cos \theta$$

$U_{1-2}: -\mu mg \cos \theta (l+x)$

3 $E_1 + U_{1-2} = E_2$

$$mg l \sin \theta - \mu mg \cos \theta (l+x) = \frac{1}{2} kx^2 - mgx \sin \theta$$

802 2.
808



3

$$\theta = 60^\circ$$

$$v_n = v \cos \theta = 20 \text{ m/sec} \cos 30$$

3

$$v_n = 17.3 \text{ m/sec}$$

$$v_t = v \sin \theta = 20 \text{ m/sec} \sin 30$$

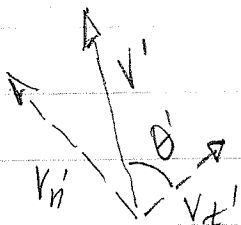
3

$$v_t = 10 \text{ m/sec} = v_t' \quad 3$$

$$v_n' = e v_n = 0.8 (17.3 \text{ m/sec})$$

3

$$v_n' = 13.8 \text{ m/sec}$$



3

$$\theta' = \arctan \left(\frac{v_n'}{v_t'} \right) = \arctan \frac{13.8}{10}$$

$$\theta' = 54.1^\circ$$

809 3.

$$v = \omega R$$

812

$$R = \frac{v}{\omega} = \frac{100 \text{ ft} \frac{\text{sec}}{\text{rad}}}{2\pi \frac{\text{sec}}{\text{rad}}} = 15.9 \text{ ft}$$

So ac lies 15.9 ft to the right of the direction of travel.