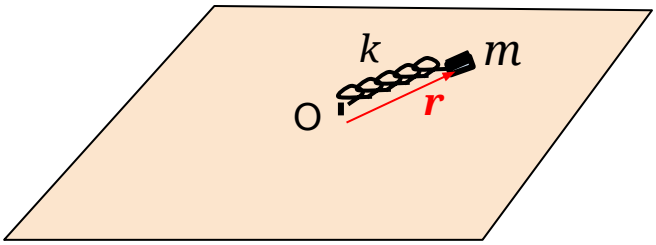
Quiz 10/28

Name _____grading key_____



In the figure, the mass m slides without friction on the horizontal plane, and the spring (Hooke's constant = k , equilibrium length = ℓ_0) is free to revolve around the point O.

(A) What is the potential energy U(r)? (Taylor states that the potential energy is not ½ k r^2.)

(B) Now assume the mass moves on a circle of radius R. Calculate the period of revolution.

(A) $U(r) = \frac{1}{2} k (r - l_0)^2$;

the force is $F_r = - k (r - l_0)$.

(B) For circular motion, $a_r = - v^2/r = - r \omega^2$.

Newton's second law, $a_r = F_r /m = - (k/m) (r - l_0)$.

So $\omega^2 = (k/m) (r - l_0)/r$

The period is

$$T = 2\pi / \omega = 2\pi \sqrt{\frac{m}{k}} \sqrt{\frac{r}{r - l_0}}$$

Homework Assignment #8 Name_____grading_____

due in class Friday, October 28

Cover sheet : Staple this page in front of your solutions.

Write the *answers* (without calculations) on this page;

write the detailed *solutions* on your own paper.

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[37] Problem 4.26.* *Answer: What is dE/dt?*

dE /dt = m y dg/dt **1 point**

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[38] Problem 4.28 and 4.29.***[computer]

For #4.29, hand in the computer program and any plots. Check plot.

Answer: What is the period for #4.29 part (d)?

3.708 time units **3 points**

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[39] Problem 4.33.**[computer]

Hand in the computer program and any plots.

Answer: Did you hand in the computer results?

Check the plots of U(θ) for b = 0.9 r and b = 1.1 r. **2 points**

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[40] Problem 4.34.**

Answer: What is the period if the length is 1 m?

2.007 seconds **2 points**

[40x] Problem 4.37.***[computer]

Hand in the computer program and any plots.

Answer: Did you hand in the computer results? Check the plots of U vs φ.

Answer: What is the critical ratio m/M ? 0.7426 **3 points**

[40xx] Problem 4.38.***[computer]

Hand in the computer program and any plots.

Answer: Did you hand in the computer results? Check the plot of τ vs Φ.

*Answer: **Explain** what becomes of τ as the amplitude of oscillation approaches π.*

The period approaches infinity because Φ = π is a point of (unstable) equilibrium.

3 points