HW UNIT OSCILLATION & SIMPLE HARMONIC MOTION

1. **Question:**

A simple pendulum has a period T on the earth. What is the period T' of this same pendulum on the moon, where the acceleration due to gravity is 1/6 that of the earth?

a. $\frac{T}{\sqrt{6}}$

b. $\frac{T}{6}$

c. $\sqrt{6}\ T$

d. $6T$

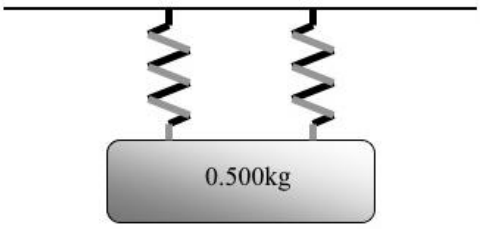
e. $36T$

2. **Question:**

A particle moves in a circular motion according to the functions $x = A\cos(\omega t)$ and $y = A\sin(\omega t)$, where A=2.0 meters and ω=3.0 rad/second. What is the magnitude of the particle's centripetal acceleration?

a. 2 m/s^2
b. 18 m/s^2
c. 24 m/s^2
d. 0
e. Cannot be determined without further information

3. **Question:**



A mass of 0.500 kg is hung from two identical springs, of negligible mass. The mass causes each spring to stretch by 0.10 m. What is the approximate spring constant of each spring?

a. 2.5 N/m
b. 5.0 N/m
c. 25 N/m
d. 50 N/m
e. 100 N/m

4. **Question:**

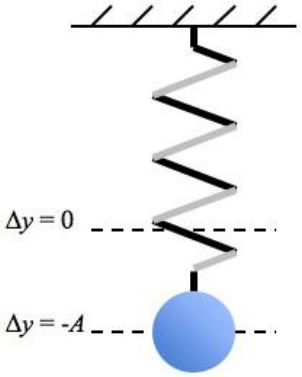
A simple pendulum is constructed by attaching a mass m to a thin rod of length ℓ. The pendulum is pulled back to some angle $\emptyset > 30°$ from the vertical and released. Which of the following techniques could be used to change the frequency f of this pendulum?

I. Changing the mass m on the end of the pendulum.
II. Changing the length ℓ of the pendulum.
III. Changing the angle $\emptyset$ from which the pendulum is released.

a. I only
b. I and II only
c. II only
d. II and III only
e. I, II, and III

5. **Question:**

A simple harmonic oscillator is created by suspending a mass from an ideal spring attached to a support. The mass is pulled from its equilibrium position a distance A in the negative-y direction as shown, and released from rest at time $t = 0$. The mass oscillates up and down with a period T. Which are the correct *displacement-time* and *velocity-time* graphs for this oscillator?



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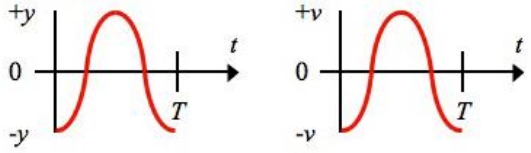

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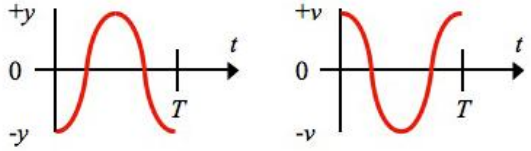

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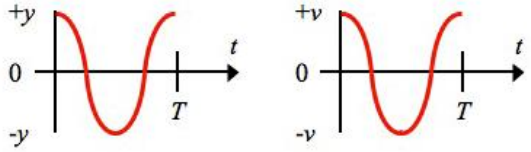

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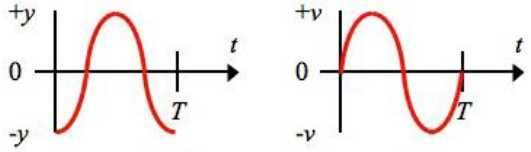

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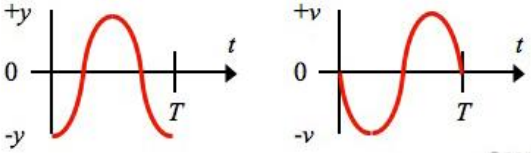


6. Question:

A particle moves constantly in a circle centered at the origin with a period of 4.0 seconds. If its position at time $t = 0$ seconds is (2,0) meters, two possible equations describing the particle's x- and y-components are:

a. $x = 2\cos\left(\frac{\pi}{2}t\right)$ $\quad y = 2\sin\left(\frac{\pi}{2}t\right)$

b. $x = 2\cos\left(\frac{2}{\pi}t\right)$ $\quad y = 2\sin\left(\frac{2}{\pi}t\right)$

c. $x = 2\sin\left(\frac{\pi}{2}t\right)$ $\quad y = 2\cos\left(\frac{\pi}{2}t\right)$

d. $x = 2\sin\left(\frac{\pi}{2}\right)$ $\quad y = 2\cos\left(\frac{\pi}{2}\right)$

e. $x = 2\pi\cos(2t)$ $\quad y = 2\pi\sin(2t)$

7. Question:

An enormous pendulum-driven clock, located on the earth, is set into motion by releasing its 10-meter long simple pendulum from a maximum angle of less than 10° relative to the vertical. At what approximate time t will the pendulum have fallen to a perfectly vertical orientation?

a. $\frac{\pi}{10}$ seconds

b. $\frac{\pi}{5}$ seconds

c. $\frac{\pi}{4}$ seconds

d. $\frac{\pi}{2}$ seconds

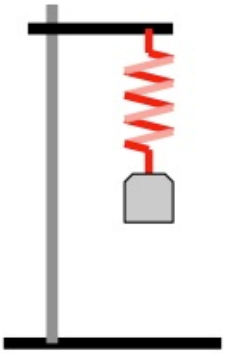
e. π seconds

8. Question:

A mass m is attached to the bottom of a string of negligible mass and length L to form a simple pendulum. The mass is pulled back a small angle Ø and released so that the pendulum swings back and forth with simple harmonic motion. Which of the following statements is true of this pendulum?

a. The acceleration of m is a minimum when displacement Ø is a minimum.
b. The period of the pendulum varies as a function of m.
c. The kinetic energy of the pendulum is a maximum when its displacement is a maximum.
d. The frequency of the pendulum varies with angle Ø.
e. The length of the string L has no effect on the period of the pendulum.

9. Question:



One end of a light spring with spring constant 10 N/m is attached to a vertical support, while a mass is attached to the other end, as shown. The mass is pulled down and released, and exhibits simple harmonic motion with a period of 0.2π. The mass is

a. 0.1 kg
b. 0.25 kg
c. 0.4 kg
d. 0.04 kg
e. 0.025 kg