**0.** **(0 points)** /opt/webwork/webwork2/conf/snippets/ASimpleCombinedHeaderFile.pg

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**Assignment PHY141_WW2 due 09/16/2022 at 11:59pm EDT**

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**1.** **(1 point)** setPHY141_WW2/time_g.pg

**Gravity!**

A ball is tossed upward from near the groud at time $t = 0$. When it leaves the ground it has $z = 0$ and an upward velocity of $v_{0,z} =$ 5 m/s.

At what time does the ball reach its maximum height?

Enter time of maximum height: $t =$ _____ s.

What is the maximum height reached?

Enter maximum height: _____ m.

(Enter numbers good to 2 decimal place).

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**2.** **(1 point)** setPHY141_WW2/acc.pg

**On acceleration and integration.**

A particle moves along a line in one dimension with coordinate $x$.

Its acceleration $\frac{dx^2}{dt^2}$ is described by the function $f(t) = 3t^2 + 3t - 1$.

Its velocity $v = \frac{dx}{dt}$ .

How much the velocity change during the time interval $t = [0,2]$?

Enter $\Delta v$: _____

($\Delta v = v(2) - v(0)$ as a number accurate to 1 decimal place).

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**3.** **(1 point)** setPHY141_WW2/unitsG.pg

**On units of $G$.**

What are the MKS units for the Gravitational constant $G$?

Fill in the exponents:

$G = 6.67430(15) \times 10^{-11} \times$ m⟌kg⟌s⟌

$G = 6.67430(15) \times 10^{-11} \times$ ¡big¿ m ¡/big¿ ¡sup¿¡sup¿¡sup¿¡sup¿¡sup¿ ¡small¿ ⟌¡/small¿ ¡/sup¿¡/sup¿¡/sup¿¡/sup¿ ¡big¿ kg ¡/big¿ ¡sup¿¡sup¿¡sup¿¡sup¿¡sup¿ ¡small¿ ⟌¡/small¿ ¡/sup¿¡/sup¿ ¡/sup¿¡/sup¿ ¡big¿ s ¡/big¿ ¡sup¿¡sup¿¡sup¿¡sup¿¡sup¿ ¡small¿⟌¡/small¿ ¡/sup¿¡/sup¿ ¡/sup¿¡/sup¿

(Answers should be numbers)

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**4.** **(1 point)** setPHY141_WW2/Kepler.pg

**On scaling from things we know about.**

The period $P$ of an orbit about a star of mass $M_*$ depends on the orbit's semi-major axis $a$. Scaling from the Earth's orbit, Kepler's third law implies that

$$\left(\frac{P}{1 \text{ year}}\right) = \left(\frac{a}{1 \text{ AU}}\right)^{\frac{3}{2}} \left(\frac{M_*}{M_\odot}\right)^{-\frac{1}{2}}$$

The S02 star near the Galactic center has a period of 16 years and a semi-major axis of 970 AU. Here AU is the astronomical unit and the distance between Earth and Sun, and $M_\odot$ is a solar mass.

What is the mass in solar masses of the massive black hole that the S02 star orbits?

Enter $M_{blackhole}$: _____ $M_\odot$

(Enter a number to a precission of 1 decimal place in exponential notation. For example 1.5E5).

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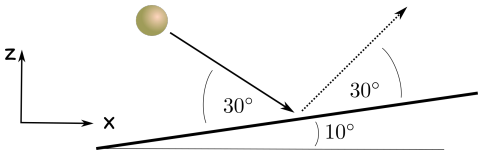
**5.** **(1 point)** setPHY141_WW2/vector1.pg

**On vector directions**




A pingpong ball impacts an inclined table top. The angle between the ball trajectory and the table is 30°. The table top is inclined by 10° from horizontal. The ball's velocity upon impact is $v$ = 2 m/s. The ball rebounds elastically.

After impact what is the vertical component of the ball's velocity?

Enter $v_z$: _____ m/s

(Enter a number accurate to 1 decimal place).

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**6.** **(1 point)** setPHY141_WW2/motor.pg

**On circular motion.**

A motor rotates at 300 rpm (rotations per minute).

What is the angular rotation rate $\dot{\theta}$ of the motor's axle?

Enter $\dot{\theta}$: _____ radians/s.

(Enter a number accurate to 1 decimal place).

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**7.** **(1 point)** setPHY141_WW2/circ2.pg

**On circular motion**

A motor turns at a frequency of $f = 100$ Hz. It turns a flywheel that has a radius of $R = 0.19$ meters.

What is the tangential velocity $v_\theta$ of the edge of the flywheel?

Enter $v_\theta$ : _____ m/s.

(Enter a number accurate to 2 decimal places).

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**8.** **(1 point)** setPHY141_WW2/circ3.pg

**On circular motion**

A mass is in a circular orbit with radius $R = 1$ m and tangential velocity $v_\theta = 1$ m/s.

What is the rotation period? $P =$ _____ s.

(Enter a number that is accurate to 1 decimal place).