Student: _____ **Date:** _____	**Instructor:** Joe Betters **Course:** Pre-Calculus Pre AP (Master Course)	**Assignment:** 8.5 Classwork Day 1

1. An object attached to a coiled spring is pulled down a distance of 10 centimeters from its rest position and then released. Assuming that the motion is simple harmonic with a period of 2π seconds, write an equation that relates the displacement d of the object from its rest position after t seconds. Also assume that the positive direction of the motion is up. At time $t = 0$ the object is at its resting position and moving down.

Choose the correct equation for the distance of the object from the spring at t seconds.

- ○ **A.** $d = 10\cos\frac{1}{2}t$
- ○ **B.** $d = -10\cos t$
- ○ **C.** $d = 10\cos t$
- ○ **D.** $d = 10\sin t$
- ○ **E.** $d = -10\sin t$
- ○ **F.** $d = -10\sin\frac{1}{2}t$

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2. The displacement d (in meters) of an object at time t (in seconds) is given by the following equation.

$$d = 5 + 10\cos\left(\frac{5\pi}{2}t\right)$$

(a) Describe the motion of the object.

Is the motion simple harmonic?

- ○ Yes
- ○ No

(b) What is the maximum displacement from its resting position?

_____ meters

(c) What is the time required for one oscillation?

_____ second

(Simplify your answer. Type an exact answer, using π as needed. Use integers or fractions for any numbers in the expression.)

(d) What is the frequency?

_____ oscillations per second

(Simplify your answer. Type an exact answer, using π as needed. Use integers or fractions for any numbers in the expression.)

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3. The distance d (in meters) of the bob of a pendulum of mass m (in kilograms) from its rest position at time t (in seconds) is given. Assume that the release position is to the left of the rest position and represents a negative direction.

$$d = -20\,e^{-0.6t/50}\cos\left(\sqrt{\left(\frac{2\pi}{3}\right)^2 - \frac{0.36}{2500}}\cdot t\right)$$

Answer parts (a) – (e).

(a) If the damping factor is 0.6 kg / sec, give the mass.

m = _____ kg

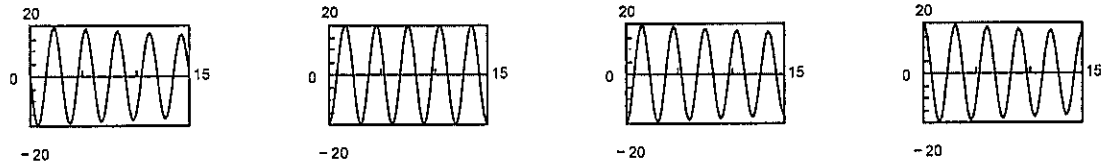
(b) What is the initial displacement of the bob? That is, what is the displacement at t = 0?

_____ m to the (1) _____

(c) Graph the motion using a graphing utility.

Which of the following is the graph of d?

○ ○ ○ ○



(d) What is the displacement of the bob at the start of the second oscillation?

_____ m to the (2) _____

(Do not round until the final answer. Then round to two decimal places as needed.)

(e) What happens to the displacement of the bob as time increases without bound?

- ○ d approaches 0.
- ○ d increases without bound.
- ○ d oscillates between −20 and 20
- ○ d approaches −20.

(1) ○ left ○ right (2) ○ left ○ right

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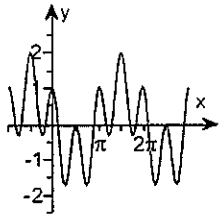
4. Use the method of adding y-coordinates to graph the function.

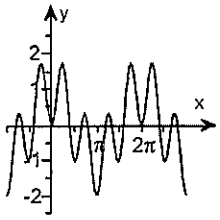
$f(x) = \cos(x) - \cos(4x)$

Choose the correct graph of the function.

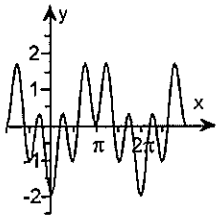
○ A.



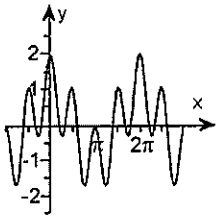
○ B.



○ C.



○ D.



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5. The end of a tuning fork moves in simple harmonic motion described by the equation $d = a \sin(\omega t)$. If a tuning fork for the note E^b above middle C on an even-tempered scale has a frequency of 311.13 hertz (cycles per second), find ω. If the maximum displacement of the end of the tuning fork is 0.02 millimeter, determine the equation that describes the movement of the tuning fork.

$\omega =$ _____

(Simplify your answer. Type an exact answer, using π as needed.)

Choose the equation that describes the movement of the tuning fork.

○ $d = 0.01 \sin\left(\frac{\pi}{311.13}t\right)$

○ $d = 0.01 \sin(311.13\pi t)$

○ $d = 0.02 \sin(311.13\pi t)$

○ $d = 0.02 \sin(622.26\pi t)$

○ $d = 0.01 \sin(622.26\pi t)$

○ $d = 0.02 \sin\left(\frac{\pi}{311.13}t\right)$

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1. E. $d = -10 \sin t$

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2. Yes

   10

   $\frac{4}{5}$

   $\frac{5}{4}$

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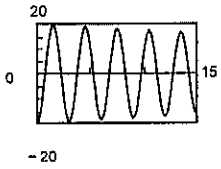
3. 25

   20

   (1) left

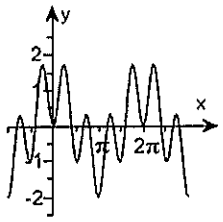


   19.29

   (2) left

   d approaches 0.

4.



   B.

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5. 622.26π

   $d = 0.02 \sin (622.26\pi t)$

8.5 cw day 1

① pulled down 10, $t=0$ rest position

simple harmonic

e. $\boxed{d = -10\sin t}$ $t=0$, $d=-10$

② $d = 5 + 10\cos\left(\frac{5\pi}{2}t\right)$

simple harmonic

max displacement at rest is amplitude $\boxed{10}$

$$\text{oscillation} = \frac{2\pi}{\omega} = \frac{2\pi}{5\pi/2} = \boxed{\frac{4}{5}}$$

$$\text{frequency} = \frac{\omega}{2\pi} = \frac{5\pi/2}{2\pi} = \boxed{\frac{5}{4}}$$

8.5 cw day 1

③ $d = -20e^{-.6t/50}\cos\left(\sqrt{\left(\frac{2\pi}{3}\right)^2 - \frac{.36}{2500}}\ t\right)$

$\text{mass} = \frac{50}{2} = \boxed{25}$

Initial displacement $\boxed{20 \text{ to left}}$

$\boxed{\text{Graph C}}$

* use calculator (Be in radians)

$\boxed{19.29 \text{ to left}}$

$\boxed{d \text{ approaches } 0}$

8.5 cw day 1

④ $f(x) = \cos x - \cos 4x$

	$-\pi/2$	0	$\pi/2$	π	$3\pi/2$	2π
$\cos x$	0	1	0	−1	0	1
$\cos 4x$	1	1	1	1	1	1
$\cos x - \cos 4x$	−1	0	−1	−2	−1	0

$(-\pi/2, -1)$

$(0, 0)$

$(\pi/2, -1)$

$(\pi, -2)$

$(3\pi/2, -1)$

$(2\pi, 0)$

Graph B

8.5 cw day 1

⑤ $\text{frequency} = \frac{\omega}{2\pi}$

$311.13 = \frac{\omega}{2\pi}$

$\omega = 622.26\pi$

$d = .02 \sin(622.26\pi t)$