Student: _____ **Date:** _____	**Instructor:** Joe Betters **Course:** Pre-Calculus Pre AP (Master Course)	**Assignment:** 8.5 Classwork Day 2

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

$d = 9 \sin(10t)$

(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?

_____ seconds

(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.)

2. An object of mass m = 30 grams attached to a coiled spring with damping factor b = 0.75 gram/second is pulled down a distance a = 19 centimeters from its rest position and then released. Assume that the positive direction of the motion is up and the period of the first oscillation is T = 5 seconds. Answer parts (a) and (b).

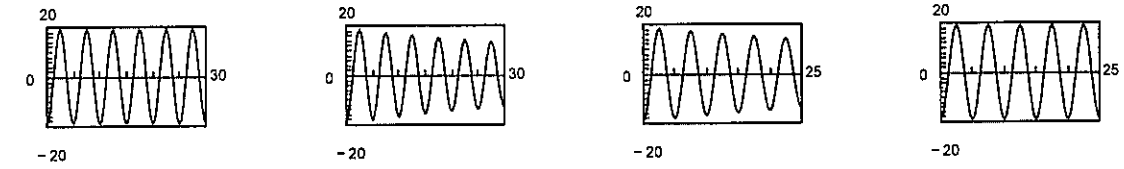
(a) Write an equation that relates the distance d of the object from its rest position after t seconds.

Which of the following is an equation for d?

- $d = -19\cos\left(\sqrt{\frac{4\pi^2}{25} - \frac{0.5625}{3600}} \cdot t\right)$
- $d = -19\cos\left(\sqrt{\frac{2\pi}{5} - \frac{0.75}{30}} \cdot t\right)$
- $d = -19e^{-0.75t/60}\cos\left(\sqrt{\frac{2\pi}{5} - \frac{0.75}{30}} \cdot t\right)$
- $d = -19e^{-0.75t/60}\cos\left(\sqrt{\frac{4\pi^2}{25} - \frac{0.5625}{3600}} \cdot t\right)$

(b) Graph the equation found in part (a) for 5 oscillations using a graphing utility.

Which of the following is the graph of d for 5 oscillations?



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.

$$d = -20\,e^{-0.6t/80}\cos\left(\sqrt{\left(\frac{2\pi}{7}\right)^2 - \frac{0.36}{6400}}\cdot t\right)$$

Answer parts (a) – (e).

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

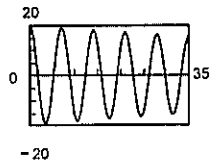
m = _____ kg

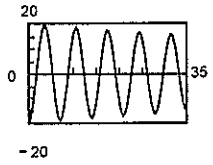
(b) What is the initial displacement of the bob? That is, what is the displacement at t = 0?

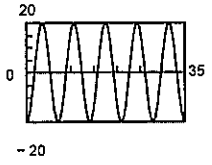
_____ m to the (1) _____

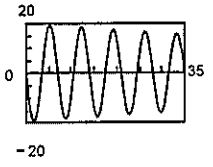
(c) Graph the motion using a graphing utility.

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?

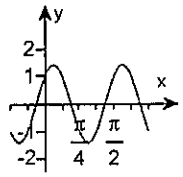
○ d oscillates between – 20 and 20
○ d approaches 0.
○ d increases without bound.
○ d approaches – 20.

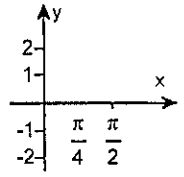
(1) ○ left ○ right (2) ○ left ○ right

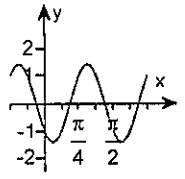
4. Use the method of adding y-coordinates to graph the function.

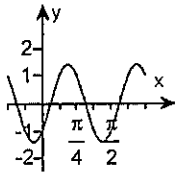
$f(x) = \sin(4x) - \cos(4x)$

Choose the correct graph of the function.

○ A. 

○ B. 

○ C. 

○ D. 

5. A loudspeaker diaphragm is oscillating in simple harmonic motion described by the equation $d = a\cos(\omega t)$ with a frequency of 654 hertz (cycles per second) and a maximum displacement of 1.10 millimeter. Find ω and then determine the equation that describes the movement of the diaphragm.

$\omega =$ _____
(Simplify your answer. Type an exact answer, using π as needed.)

Choose the correct equation that describes the movement of the diaphragm.

- ○ $d = 1.10\cos(654\pi t)$
- ○ $d = 0.55\cos\left(\frac{\pi}{654}t\right)$
- ○ $d = 1.10\cos\left(\frac{\pi}{654}t\right)$
- ○ $d = 0.55\cos(654\pi t)$
- ○ $d = 1.10\cos(1308\pi t)$
- ○ $d = 0.55\cos(1308\pi t)$

1. Yes

9

$\frac{\pi}{5}$

$\frac{5}{\pi}$

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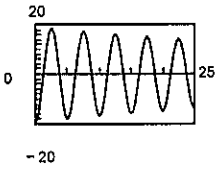
2. $d = -19e^{-0.75t/60}\cos\left(\sqrt{\frac{4\pi^2}{25} - \frac{0.5625}{3600}} \cdot t\right)$



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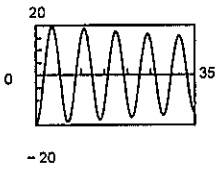
3. 40

20

(1) left



18.98

(2) left

d approaches 0.

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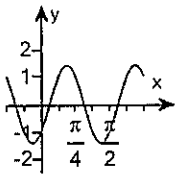
4. 

D.

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5. 1308π

$d = 1.10\cos(1308\pi t)$

8.5 classwork day 2

① $d = 9 \sin(10t)$

simple harmonic

max displacement amplitude $= \boxed{9}$

time required for one oscillation $= \frac{2\pi}{\omega} = \frac{2\pi}{10} = \boxed{\pi/5}$

$\text{frequency} = \frac{\omega}{2\pi} = \frac{10}{2\pi} = \boxed{\frac{5}{\pi}}$

8.5 cw day 2

② $m = 30 \rightarrow 2(30) = 60$

.75 g/s

-19 (pulled down)

1st oscillation is 5 seconds

$\text{oscillation} = \frac{2\pi}{\omega} \rightarrow 5 = \frac{2\pi}{\omega}$

$\omega = 2\pi/5$

$$-19e^{-.75t/60}\cos\left(\sqrt{\left(\frac{2\pi}{5}\right)^2 - \frac{.75^2}{60^2}}\ t\right)$$

Graph C

8.5 cw day 2

③ $\text{MASS} = \frac{80}{2} = \boxed{40}$

displacement = 20 to the left

Graph B

* use calculator *

$$-20e^{-.6t/80}\cos\left(\sqrt{\left(2\pi/7\right)^2 - \frac{.36}{6400}}\ t\right)$$

d approaches 0

18.98 to the left

8.5 cw day 2

④

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

$(-\frac{\pi}{2}, -1)$

$(0, -1)$

$(\pi/2, -1)$

$(\pi, -1)$

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

$(2\pi, -1)$

Graph D

8.4 cw day 2

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

$654 = \frac{\omega}{2\pi}$

$\omega = 1308\pi$

$\delta = 1.10\cos(1308\pi t)$