This print-out should have 16 questions, check that it is complete. Multiple-choice questions may continue on the next column or page: find all choices before making your selection.

This is Test 1

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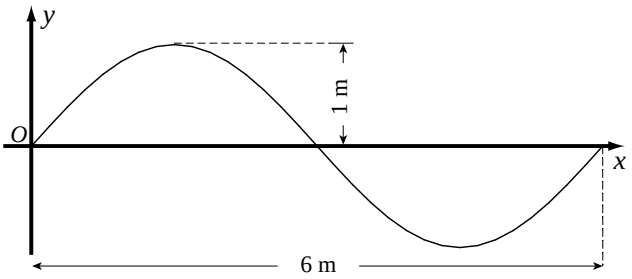
001 (part 1 of 1) 10 points

Consider the sinusoidal wave pictured in the figure.



Which of the following equations describes the wave.

1. $y = (1\text{ m})\cos(2\,\pi\,x\,(6\text{ m}))$

2. $y = (1\text{ m})\sin\left(\dfrac{x}{(6\text{ m})}\right)$

3. $y = (1\text{ m})\sin(x + (6\text{ m}))$

4. $y = (1\text{ m})\cos\left(\dfrac{2\,\pi\,x}{(6\text{ m})}\right)$

5. $y = (1\text{ m})\sin(2\,\pi\,x\,(6\text{ m}))$

6. $y = (1\text{ m})\cos(x + (6\text{ m}))$

7. $y = (1\text{ m})\sin\left(\dfrac{x}{(6\text{ m})} + \pi\right)$

8. $y = (1\text{ m})\sin(x - (6\text{ m}))$

9. $y = (1\text{ m})\cos(x - (6\text{ m}))$

10. $y = (1\text{ m})\sin\left(\dfrac{2\,\pi\,x}{(6\text{ m})}\right)$

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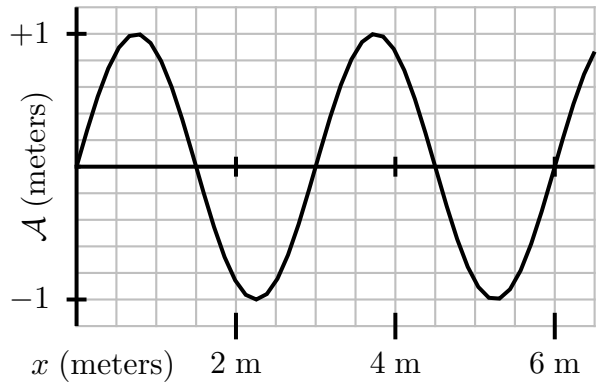
002 (part 1 of 1) 10 points

A harmonic wave

$$y = \mathcal{A}\sin[k\,x]\,,$$

where $\mathcal{A} = 1$ meter and k has units of m^{-1} is plotted in the diagram below.



Which wave function corresponds best to the diagram?

1. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{15\text{ m}}\right)x\right]$

2. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{11\text{ m}}\right)x\right]$

3. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{19\text{ m}}\right)x\right]$

4. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{21\text{ m}}\right)x\right]$

5. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{13\text{ m}}\right)x\right]$

6. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{9\text{ m}}\right)x\right]$

7. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{25\text{ m}}\right)x\right]$

8. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{7\text{ m}}\right)x\right]$

9. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{3\text{ m}}\right)x\right]$

10. $y = \mathcal{A}\sin\left[\left(\dfrac{2\,\pi}{5\text{ m}}\right)x\right]$

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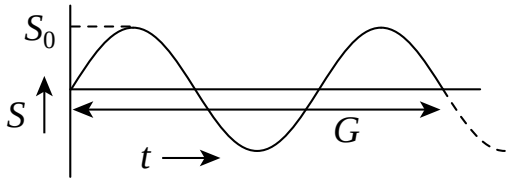
003 (part 1 of 2) 10 points

The time interval indicated on this diagram is G.



Which formula corresponds best to the diagram?

1. $S(t) = S_0 \sin\left(\dfrac{3\,t}{2\,G}\right)$

2. $S(t) = S_0 \sin\left(\dfrac{2\,t}{3\,\pi\,G}\right)$

3. $S(t) = S_0 \sin\left(\dfrac{2\,\pi\,t}{3\,G}\right)$

4. $S(t) = S_0 \sin\left(\dfrac{3\,t}{2\,\pi\,G}\right)$

5. $S(t) = S_0 \sin\left(\dfrac{2\,t}{3\,G}\right)$

6. $S(t) = S_0 \sin\left(\dfrac{t}{2\,\pi\,G}\right)$

7. $S(t) = S_0 \sin\left(\dfrac{3\,\pi\,t}{2\,G}\right)$

8. $S(t) = S_0 \sin\left(\dfrac{3\,\pi\,t}{G}\right)$

9. $S(t) = S_0 \sin\left(\dfrac{t}{3\,\pi\,G}\right)$

10. $S(t) = S_0 \sin\left(\dfrac{2\,\pi\,t}{G}\right)$

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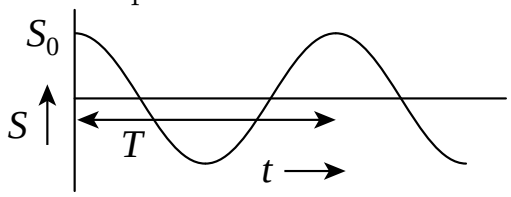
004 (part 2 of 2) 10 points

This wave has period T.



Which formula corresponds best to the diagram?

1. $S(t) = S_0 \sin\left(\dfrac{2\,\pi\,t}{T} - \dfrac{\pi}{2}\right)$

2. $S(t) = S_0 \sin\left(\dfrac{\pi\,t}{T}\right)$

3. $S(t) = S_0 \sin\left(-\dfrac{\pi}{2} - \dfrac{2\,\pi\,t}{T}\right)$

4. $S(t) = S_0 \sin\left(\dfrac{2\,\pi\,t}{T}\right)$

5. $S(t) = S_0 \sin\left(\dfrac{2\,\pi\,t}{T} + \dfrac{\pi}{2}\right)$

6. $S(t) = S_0 \sin\left(\dfrac{\pi\,t}{T} - \dfrac{\pi}{2}\right)$

7. $S(t) = S_0 \sin\left(\dfrac{\pi}{2} - \dfrac{\pi\,t}{T}\right)$

8. $S(t) = S_0 \sin\left(-\dfrac{\pi\,t}{T}\right)$

9. $S(t) = S_0 \sin\left(\dfrac{\pi\,t}{T} + \dfrac{\pi}{2}\right)$

10. $S(t) = S_0 \sin\left(-\dfrac{2\,\pi\,t}{T}\right)$

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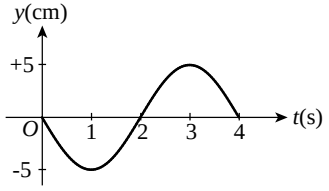
005 (part 1 of 1) 10 points

A particle oscillates up and down in simple harmonic motion. Its height y as a function of time t is shown in the diagram.



At what time t in the period shown does the particle achieve its maximum positive acceleration?

1. $t = 4$ s

2. $t = 1$ s

3. $t = 3$ s

4. None of the above, because the acceleration is constant

5. $t = 2$ s

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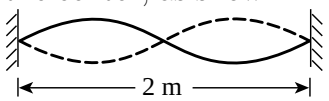
006 (part 1 of 2) 10 points

A standing wave of frequency 5 hertz is set up on a string 2 meters long with nodes at both ends and in the center, as shown.



Find the speed $|\vec{v}|$ at which waves propagate on the string.

1. $|\vec{v}| = 10$ m/s

2. $|\vec{v}| = 5$ m/s

3. $|\vec{v}| = 0.4$ m/s

4. $|\vec{v}| = 20$ m/s

5. $|\vec{v}| = 2.5$ m/s

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007 (part 2 of 2) 10 points
Find the fundamental frequency of vibration of the string.

1. $f = 1$ Hz

2. $f = 2.5$ Hz

3. $f = 5$ Hz

4. $f = 7.5$ Hz

5. $f = 10$ Hz

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008 (part 1 of 1) 10 points
An object moves up and down the y-axis with an acceleration given as a function of time t by the expression $a = A \sin \omega t$, where A and ω are constants.

What is the period of this motion?

1. $T = 2 \pi \omega$

2. $T = \omega^2 A$

3. $T = \omega$

4. $T = \dfrac{\omega}{2 \pi}$

5. $T = \dfrac{2 \pi}{\omega}$

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009 (part 1 of 1) 10 points
For a transverse wave on a string the string displacement is described by $y(x, t) = f(x - a t)$ where f is a given function and a is a positive constant.

Which of the following does **NOT** necessarily follow from this statement?

1. The waveform moves in the positive x direction.

2. The speed of the waveform is $\dfrac{x}{t}$.

3. The shape of the string at time $t = 0$ is given by $f(x)$.

4. The speed of the waveform is a.

5. The shape of the waveform does not change as it moves along the string.

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010 (part 1 of 1) 10 points
The displacement in simple harmonic motion is a maximum when the

1. linear momentum is a maximum.

2. acceleration is zero.

3. kinetic energy is a maximum.

4. velocity is a maximum.

5. velocity is zero.

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011 (part 1 of 4) 10 points
The motion of an object is described by the equation

$$x = (0.4 \text{ m}) \cos \left(\frac{\pi t}{6} \right)$$

What is the position of the object at 0.4 s?

1. 0.0951057 m

2. 0.109504 m

3. 0.141421 m

4. 0.380423 m

5. 0.391259 m

6. 0.42632 m

7. 0.511584 m

8. 0.542896 m

9. 0.560148 m

10. 0.746864 m

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012 (part 2 of 4) 10 points
What is the amplitude of the motion?

1. 0.1 m

2. 0.2 m

3. 0.3 m

4. 0.4 m

5. 0.5 m

6. 0.6 m

7. 0.7 m

8. 0.8 m

9. 0.9 m

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013 (part 3 of 4) 10 points
What is the frequency of the motion?

1. 0.0555556 Hz

2. 0.0625 Hz

3. 0.0714286 Hz

4. 0.0833333 Hz

5. 0.1 Hz

6. 0.125 Hz

7. 0.166667 Hz

8. 0.25 Hz

9. 0.5 Hz

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014 (part 4 of 4) 10 points
What is the period of the motion?

1. 2 s

2. 4 s

3. 6 s

4. 8 s

5. 10 s

6. 12 s

7. 14 s

8. 16 s

9. 18 s

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015 (part 1 of 1) 10 points
A string of length L is clamped at both ends. When it is plucked, it oscillates with a wavelength that is 2L/3. Consider the following statements:

A) There are three points on the string, excluding the ends, which remain motionless at all times.

B) There are two points on the string, excluding the ends, which remain motionless at all times.

C) The waves that form are standing waves.

D) The waves that form are traveling waves.

E) Energy is transferred from the string to each end clamp.

Which is correct?

1. B and D

2. A and C

3. A, C, and E

4. B and C

5. A, D, and E

6. B, D, and E

7. B, C, and E

8. A and D

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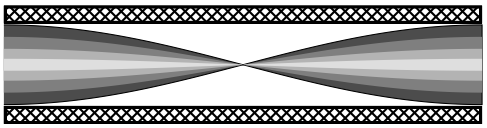
016 (part 1 of 1) 10 points
The length of a hollow pipe is 30.8 cm. The

pipe is closed on one end and open at the other end. There is a standing wave in the pipe with wavelength 8.8 cm.

Which figure schematically represents this standing wave?

1.



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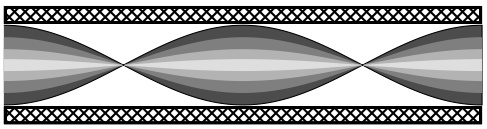

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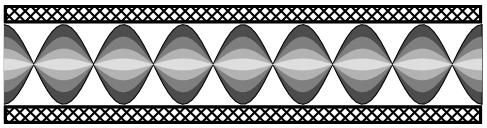

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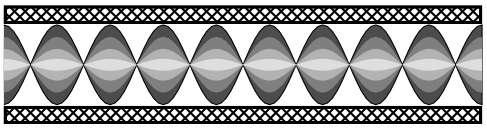

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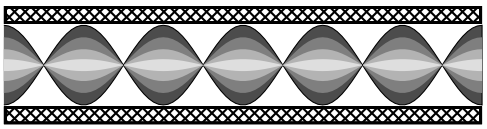

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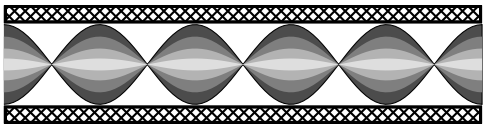

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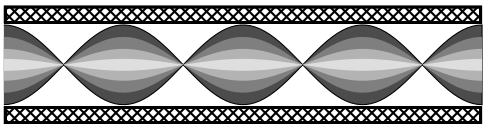

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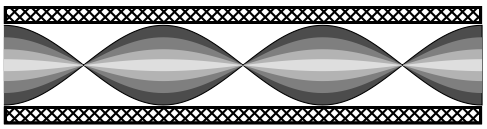

9.