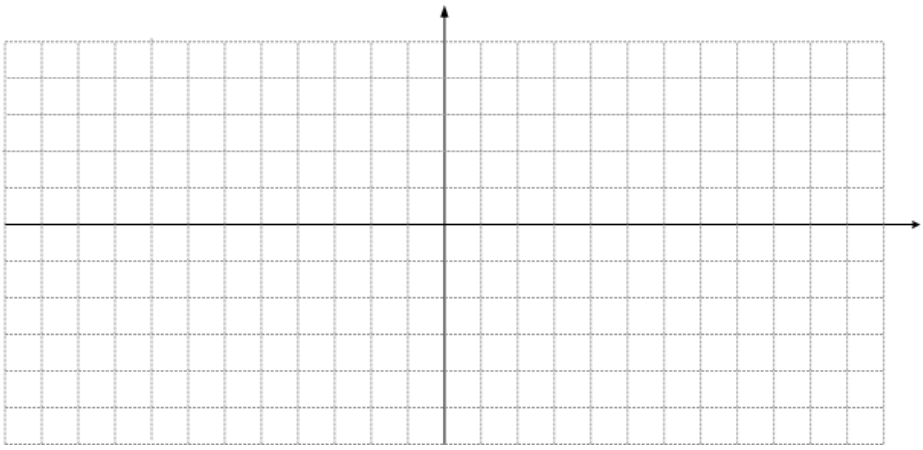
6.3 Seeing Music

Practice Tasks

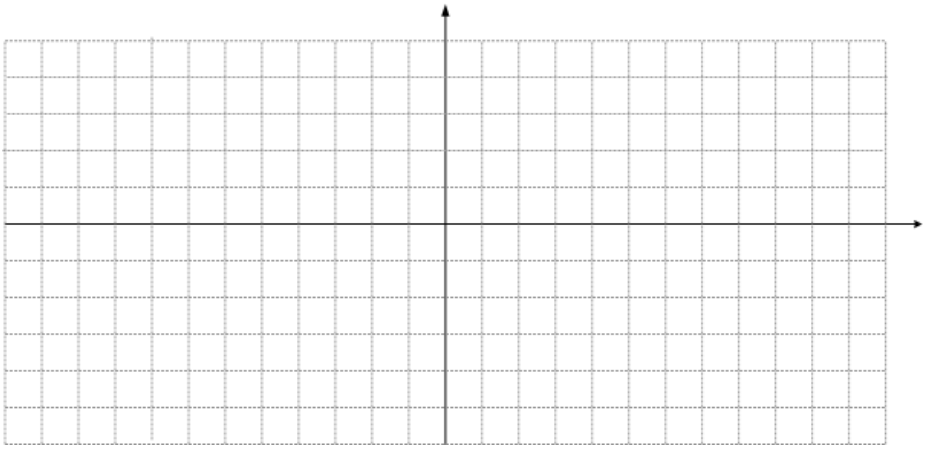
I. Concepts and Procedures

1. Graph the following functions. Then find the period, amplitude and phase shift of the function.

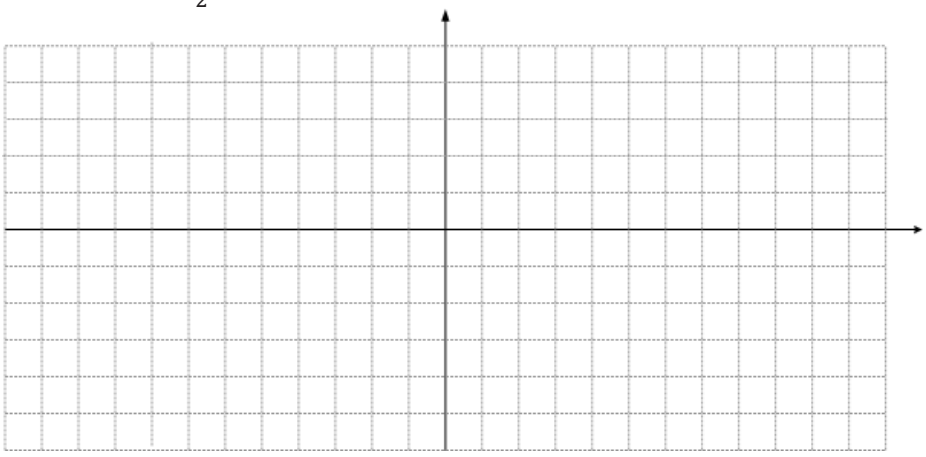
   a. $f(x) = \sin(2x + \pi)$



   b. $f(\theta) = 2 + \sin 2(\theta - \frac{\pi}{4})$



c. $y = 2\cos(x - \frac{\pi}{2}) + 2$



II. Problem Solving

The pitch (or note) of an instrument is determined by the **frequency** of the sound. The frequency is found by determining the reciprocal of period

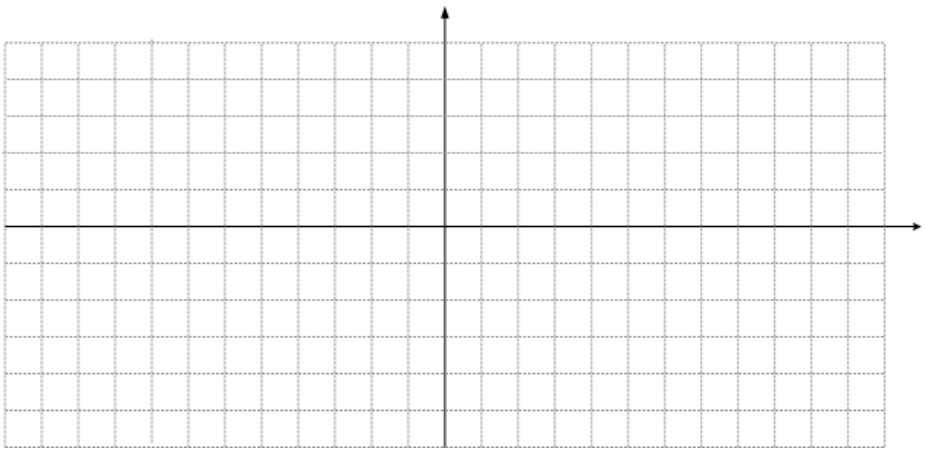
$$(frequency = \frac{1}{period}, \text{ or } period = \frac{1}{frequency}).$$

Apply this formula to the following problems.

1. A tuba player in a marching band plays the note E. For a pure E to be played, the variation in pressure from normal air pressure is given by the function $V(t) = 0.2 \sin 80\pi t$, where V is measured in pounds per square inch and t in seconds.

   a. What are the amplitude, period, and frequency of the function V?

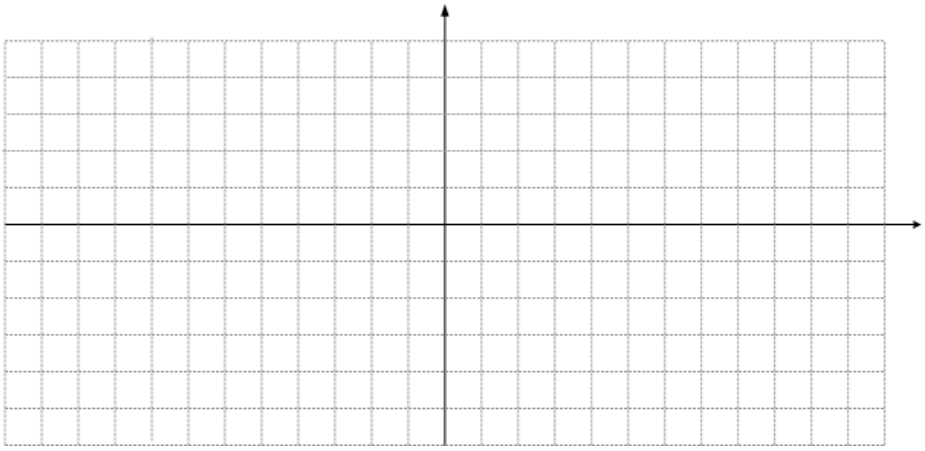
   b. Sketch a graph of the function V.



2. The tuba player in the marching band from the previous question is not playing a G note. A pure G note can be represented with the trigonometric equation $V(t) = 0.2\sin(49\pi t)$, where V is measured in pounds per square inch and t is in seconds.

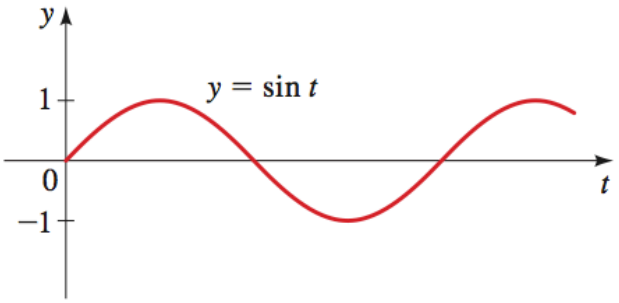
   a. What are the amplitude, period, and frequency of the function V

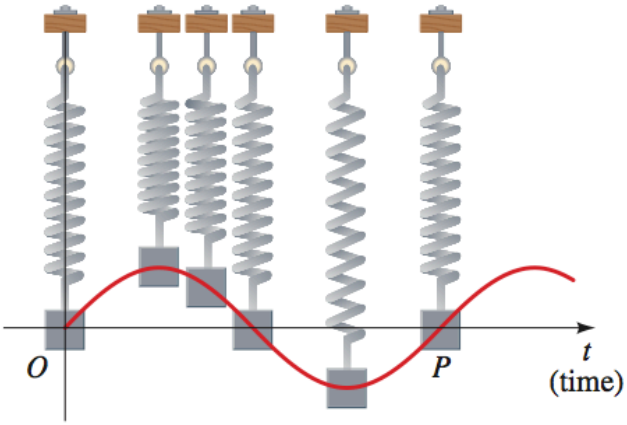
   b. Sketch a graph of the function V.



   c. If the tuba player increases the loudness of the note, how does the equation for V change?

   d. If the tuba player plays the note incorrectly and it is a little flat, how does the equation for V change? You may need to ask one of your musical classmates what it means for a note to be "flat."

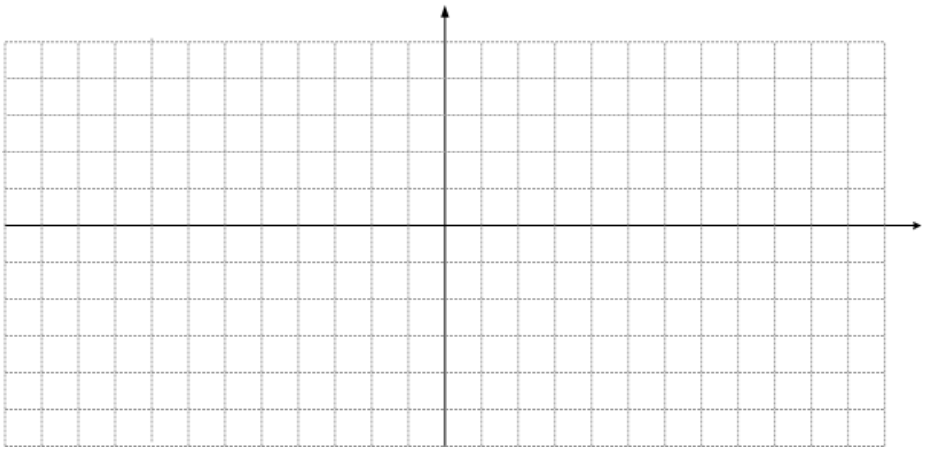




3. The displacement of a mass suspended by a spring is modeled by the function $y = 10\sin(4\pi t)$, where y is measured in inches and t in seconds. Assume that the mass is at its resting position at time $t = 0$.

   a. Find the amplitude, period, and frequency of the motion of the mass.

   b. Sketch the graph of the displacement of the mass.

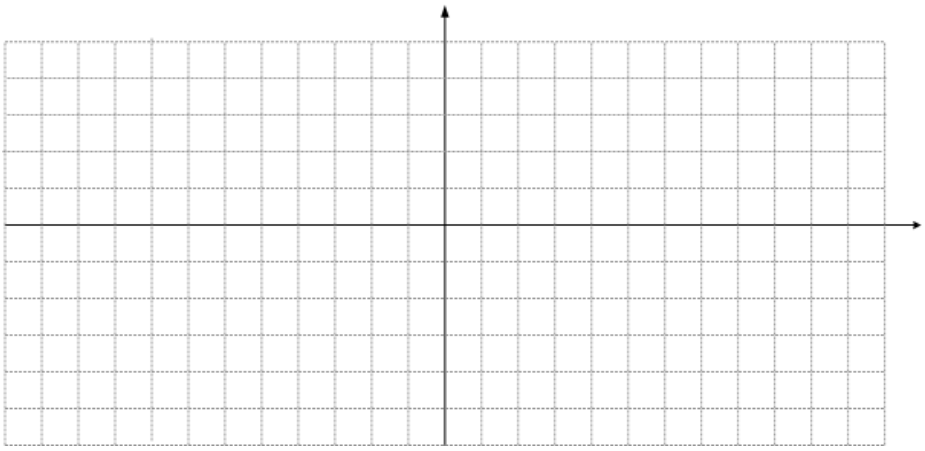


III. Modeling

1. A mass is suspended by a string. The string is compressed a distance of 4cm and then released. It is observed that the mass returns to the compressed position after $\frac{1}{3}$ s.

   a. Find a function that models the displacement of the mass.

   b. Sketch the graph of the displacement of the mass



2. Go online and find a table of frequencies for musical notes (try googling something like "frequency of a note"). Pick your favorite musical note and write it below.

   Note: _____ Frequency: _____ Hz

   Using the frequency of your note, create a trigonometric function that models the note. Use a sine function and assume that the amplitude is 1.