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8.5 Making Connections: Modelling with Combined Functions

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For question 1 and 2, refer to Example 1 on page 463.

1. There are lots of major triad chords. One is the D-major triad, consisting of D, F# and A.

a) Graph the combined function formed by this triad.

b) Compare the waveform to the one for the C-major triad.

2. When two sounds occur in the same area that have almost the same frequency, a special phenomenon called 'beats' occurs.

a) Graph the combined function formed when a sound with frequency of 10 Hz combines with a sound of frequency 9 Hz over the domain $-1 \le x \le 1$.

b) Describe the pattern of the waveform (called an *interference pattern*).

c) How far apart, in seconds, are the maximums of the pattern?

d) Since the intensity of a sound depends on its amplitude, what do beats sound like?

3. As time goes on, the amplitude of the vibrations of a vibrating object, such as a pendulum, gradually decreases, even though the frequency remains the same. The position of the object from its rest position is given by the combined function $x(t) = A(2)^{-\frac{t}{H}}\sin(2\pi ft)$, where

• A is the original amplitude of the vibration, in metres

• H is the time it takes for the amplitude to decrease to half its original value

• f is the frequency of the vibration

• t is time, in seconds

Suppose a pendulum has a frequency of 0.0125 Hz, an original amplitude of 3 m and takes 30 s for its amplitude to be cut in half.

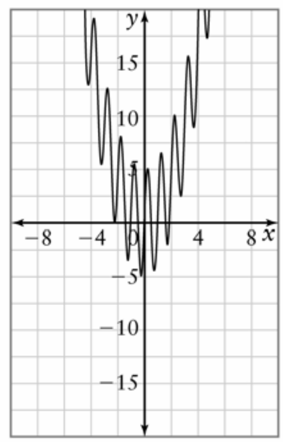
a) Use technology to graph $y = x(t)$.

b) On the same set of axes, graph $y = A(2)^{-\frac{t}{H}}$, using the same values for A and H.

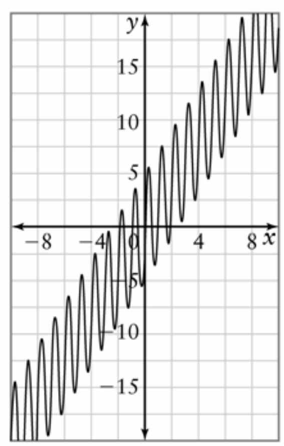
c) What does the graph of $y = A(2)^{-\frac{t}{H}}$ appear to do to the vibrations?

4. The following graphs are formed by the sum of $y = 5\sin(2\pi x)$ and one other function. Develop an algebraic model for each graph.

a)



b)



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c)