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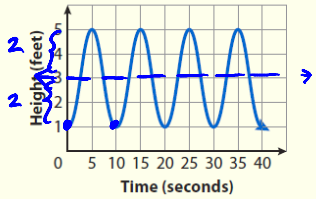
Chapter 13 Test Review

For Exercises 1–3, fill in the blank with a property of a periodic function.

1. The number of cycles per unit of time is called the frequency
2. Half of the difference between the maximum point and the minimum point is called the amplitude
3. The time for one complete cycle is called the period.

For Exercises 4–6, use the following situation.

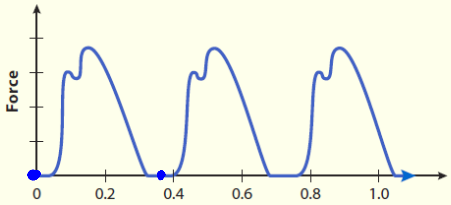
The height of a carousel horse's stirrup changes periodically over time as the carousel spins. The graph of this motion is shown below.



4. What is the period in seconds? 10 seconds
5. What are the maximum and minimum heights of the stirrup in feet? max = 5 feet, min = 1 foot
6. What is the amplitude in feet? 2 feet

For Exercises 7–8, use the following situation.

The graph below shows how the force of impact of a runner's shoes with the ground varies with time.



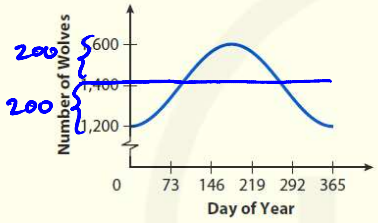
SOURCE: DANIEL LIEBERMAN/HARVARD UNIVERSITY VIA THE BOSTON GLOBE

7. What is the period of the graph in seconds? ≈ 0.38 sec (a little less than 0.4 sec)
8. What is the frequency of the runner's steps? $\frac{1}{0.38} \approx 2.6$ cycles/sec

} answers will vary slightly

For Exercises 9–11, use the following situation.

A population of gray wolves in Yellowstone Park varies periodically over a year (365 days). A graph of a function that models the relationship between wolf population and time is shown below.



9. State the graph's period and discuss what it means in this situation.
10. Give the graph's amplitude and discuss what it means in this situation.
11. When is the wolf population largest, and how many wolves are there at that time?

(9) The period is 365 days... the time it takes for the population of gray wolves to return to a low of 1200 (or a high of 1600)

(10) The amplitude is 200 wolves... the amount the population increases/decreases by from the midline (sinusoidal axis/oscillating line)

(11) There are 1600 wolves at about mid year (between day 182 and 183) or July 1st.

For Exercises 12–13, complete the statement.

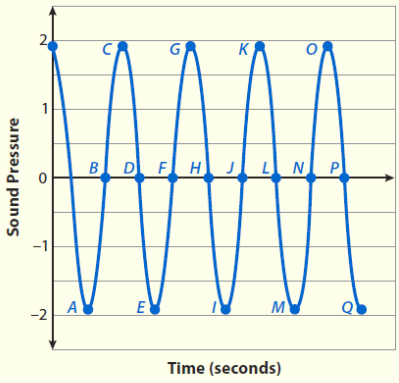
12. If the period of a sound pressure-vs-time graph decreases, the frequency increases.

13. If the period of a sound pressure-vs-time graph increases, the frequency decreases.

The period and frequency are reciprocals (inverses) of each other!

14. Would you add or remove water to decrease the frequency of the tone produced by blowing across the top of a bottle? remove

15. Find the period and frequency of the sound wave from the graph and data.

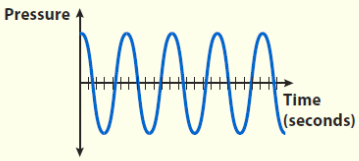


Point	Time (seconds)	Sound Pressure
A	0.0028	−1.917
B	0.0042	0
C	0.0056	1.917
D	0.0069	0
E	0.0081	−1.917
F	0.0095	0
G	0.0109	1.917
H	0.012	0
I	0.013	−1.917
J	0.0148	0
K	0.0159	1.917
L	0.0174	0
M	0.0187	−1.917
N	0.02	0
O	0.0212	1.917
P	0.0227	0
Q	0.0239	−1.917

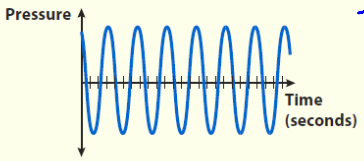
Period = .0081 − .0028 = .0053 sec

Frequency = $\frac{1}{.0053} \approx$ 189 cycles/sec or 189 Hz

16. The graphs below are of different tones. Which one represents the tone with the lower pitch? Justify your answer.



Graph A



Graph B

Graph A represents the tone with the lower pitch, b/c lower tones have longer periods. This causes there to be fewer cycles per second than higher pitched tones. Graph A has fewer cycles than Graph B.

17. Suppose the period of a tone is 0.0048 second. Find the frequency.

$\frac{1}{.0048} \approx$ 208 cycles/sec

18. Suppose the frequency of a tone is 154 cycles per second. Find the period.

$\frac{1}{154} \approx$ .0065 second

19. A group of students are trying to tune a bottle to a note that has a frequency of 311 Hz. They put water in the bottle and blow across it while collecting sound pressure data with a CBL. They estimate the period of the scatter plot to be 0.003 second. Should they add or remove water from their bottle?

$\frac{1}{.003} \approx$ 333 Hz The frequency is too high, so they should remove water.