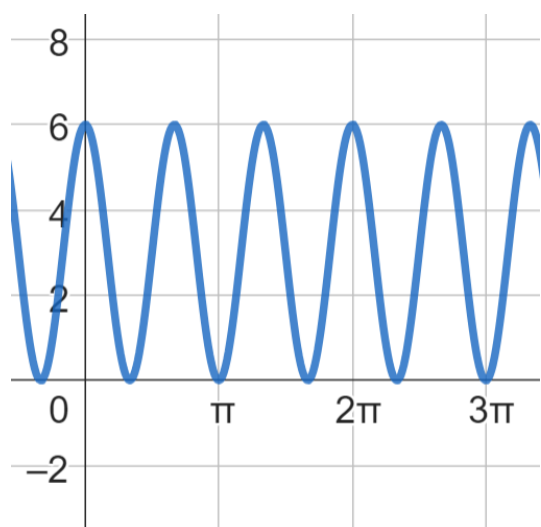
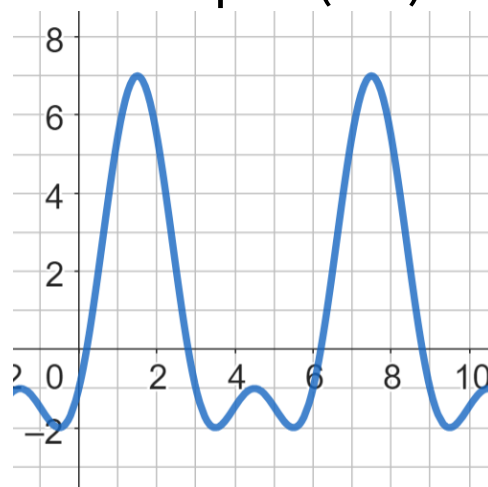


Transformations (1.12) and Intro to Periodic Graphs (3.1)

To the right is a graph of $f(x)$. Find the period and amplitude of each of the following functions.

1. $f(x)$
2. $2f\left(\frac{1}{3}x\right)$
3. $3f(x - 1)$
4. $\frac{1}{10}f(2x)$
5. $f(x) - 2$



To the left is a graph of the periodic function $g(x)$.

6. Find the amplitude of $g(x)$
7. Find the period of $g(x)$
8. Find $g(17\pi)$

9. If the amplitude of $f(x)$ is 5 pounds and the period of $f(x)$ is 2 days, write a function, in terms of $f(x)$, that has amplitude 15 pounds and period 1 day. (in terms of $f(x)$ means that your answer should look something like $\frac{1}{6}f(4x)$)
10. The asteroid Dimorphos orbits the larger parent asteroid Didymos. Its orbit could be described by a function with period of 11 hours and 55 minutes. In September of 2022, NASA intentionally collided a spacecraft with Dimorphos. This changed its orbit. Now the period of its orbit is shortened by 32 minutes. Does this decrease correspond with an increase or a decrease in the frequency of the function modelling the asteroid's orbit?
11. Suppose $g(x)$ has period $\frac{\pi}{2}$. Select all of the following functions that are identical to $g(x)$?

A) $g(x + \pi)$	B) $g(x - \pi)$	C) $g\left(x - \frac{\pi}{4}\right)$
D) $g(x - 2\pi)$	E) $g\left(x + \frac{3\pi}{2}\right)$	F) $g\left(x + \frac{3\pi}{4}\right)$

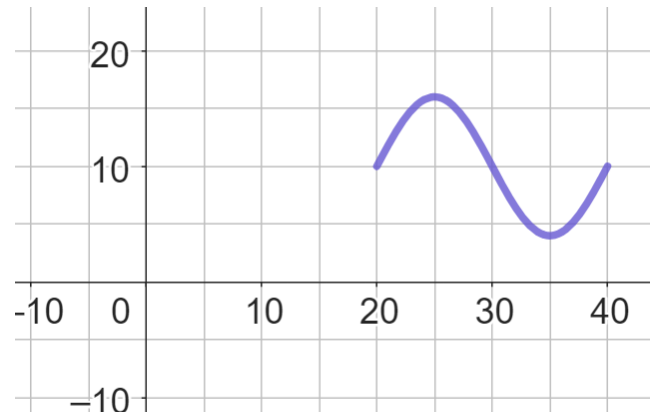
To the right is the graph of one period of the periodic function $h(x)$. Use it to answer questions #12-14

12. Over the interval $-5 < x < 0$, $h(x)$ is...

- A) Increasing and concave up
- B) Decreasing and concave up
- C) Increasing and concave down
- D) Decreasing and concave down

13. Over the interval $10 < x < 15$, $h(x)$ is...

- A) Positive and increasing
- B) Positive and decreasing
- C) Negative and increasing
- D) Negative and decreasing



14. If $f(x)$ is a periodic function with amplitude 8, then which one of the following is NOT possible?

- A) $f(5) - f(0) = -2$
- B) $f(5) - f(0) = 6$
- C) $f(5) - f(0) = 14$
- D) $f(5) - f(0) = 22$

15. If $g(x)$ is a periodic function with amplitude 6, period 4, and $g(1) = 10$, find the average rate of change of $g(x)$ over the interval $1 \leq x \leq 5$.

16. $h(x)$ is a periodic function with range $[-2, 10]$.

- a. What is the amplitude of $h(x)$?
- b. What is the amplitude of $3h(x)$?
- c. What is the range of $3h(x)$?

17. After a short run, Jack's heart beats 120 times per minute. What is the corresponding period in seconds?

18. Jill is driving in circles. Literally. She's a racecar driver. Jill completes 10 laps in three minutes. If $g(x)$ models Jill's position on the track, find the period and frequency of $g(x)$.

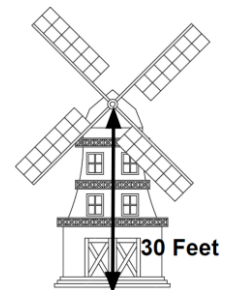
19. Diane is riding a merry-go-round. In one minute, the merry-go-round makes seven and a half revolutions. If $h(x)$ models Diane's position, find the period of $h(x)$.

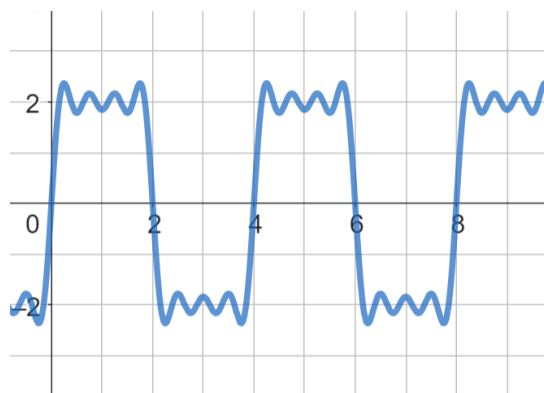
20. Sally is see-sawing. She starts 4 inches off the ground, travels up 3 feet (bringing her to a height of 40 inches off the ground), and then returns back to 4 inches off the ground. This takes 4 seconds. Let $h(t)$ be a function modelling Sally's height off the ground.

- a. Express the frequency of $h(t)$ in see-saws per minute.
- b. Express the amplitude of $h(t)$ in inches.

21. Rose is a bug on the edge of a windmill. Every minute, the windmill turns a quarter of a revolution. The middle of the windmill is 30 feet in the air. Let $k(t)$ be a function that models Rose's height above the ground. The amplitude of $k(t)$ is 12 feet.

- a. Find the frequency of $k(t)$
- b. Find the period of $k(t)$
- c. If $k(0) = 30$, find the first time $t > 0$ at which Rose returns to a height of 30.
- d. If the amplitude of $k(t)$ is 12 feet, find the minimum value of $k(t)$





Above is the graph of a couple periods of the periodic function $f(x)$. Match each of the numbered equations with the letter of the corresponding graph.

22. $f(3x)$

23. $\frac{3}{2}f(2x)$

24. $\frac{1}{2}f(x) + 2$

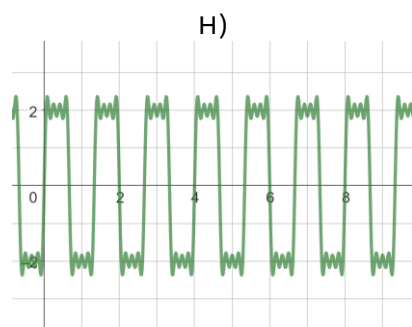
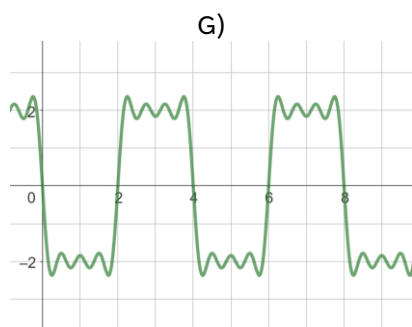
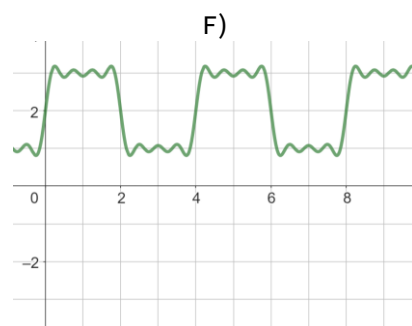
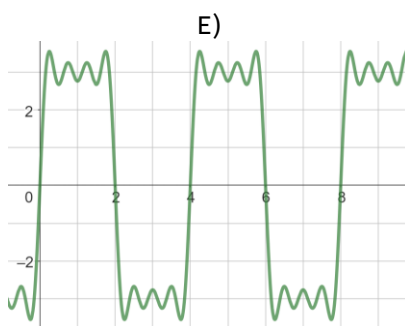
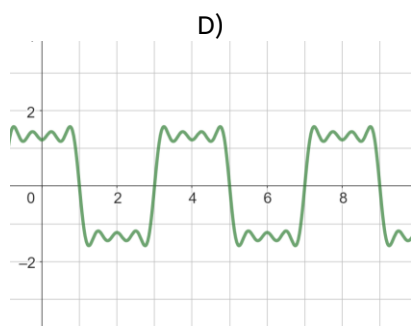
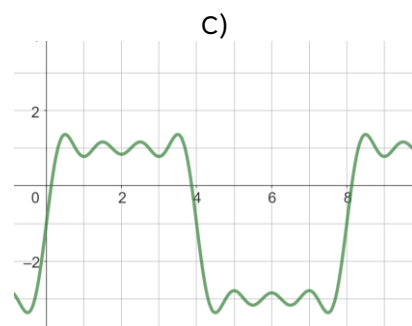
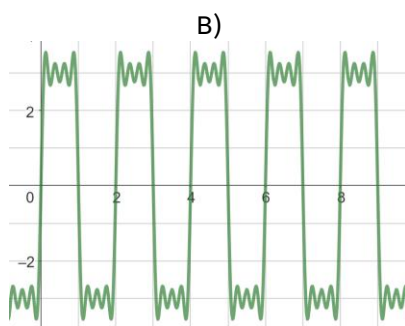
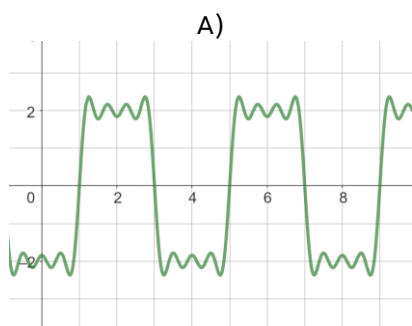
25. $f\left(\frac{1}{2}x\right) - 1$

26. $f(x - 1)$

27. $\frac{2}{3}f(x + 1)$

28. $f(x + 2)$

29. $\frac{3}{2}f(x - 4)$



Transformations and Periodic Graphs HW Answers

1. Period: 6 Amplitude: $\frac{9}{2}$
2. Period: 18 Amplitude: 9
3. Period: 6 Amplitude: $\frac{27}{2}$
4. Period: 3 Amplitude: $\frac{9}{20}$
5. Period: 6 Amplitude: $\frac{9}{2}$
6. 3
7. $\frac{2\pi}{3}$
8. $g(17\pi) = 0$
9. $3f(2x)$
10. Higher Frequency
11. A, B, D, E
12. A
13. B
14. D
15. 0

If $g(1) = 10$, then $g(5)$ also equals 10 since g has period 4.

$$\frac{g(5) - g(1)}{5 - 1} = \frac{10 - 10}{4} = 0$$

16.
 - a. 6
 - b. 18
 - c. $[-6, 30]$
17. Period: $\frac{1}{2}$ second
18. Period: 18 seconds Frequency: $\frac{10 \text{ lap}}{3 \text{ min}} = \frac{1 \text{ lap}}{18 \text{ sec}}$
19. Period: 8 seconds
20.
 - a. $15 \frac{\text{see saws}}{\text{min}}$
 - b. 1.5 feet or 18 inches
21.
 - a. $\frac{1 \text{ revolution}}{4 \text{ min}} = 15 \frac{\text{revolution}}{\text{hour}}$
 - b. 4 minutes
 - c. $t = 2$
 - d. 18 feet
22. H
23. B
24. F
25. C
26. A
27. D
28. G
29. E