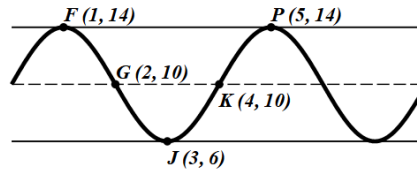


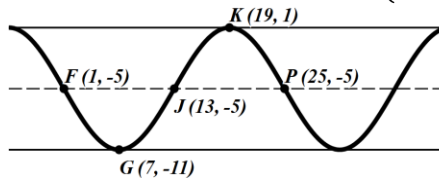
Sinusoidal Graphs (3.5, 3.6) Homework

1. Below two full cycles of the periodic function $h(x)$ are shown. Five points are labelled. No axes are presented. The function h can be written in the form $h(x) = a \sin(b(x + c)) + d$.



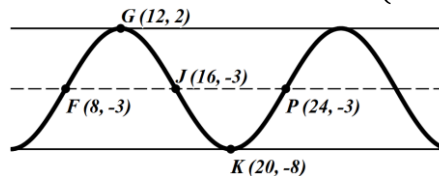
- Find values of constants a , b , c , and d .
 - Let t_1 be the x -coordinate of point F and t_2 be the x -coordinate of point G . On the interval (t_1, t_2) which of the following is true about h ?

(A) h is positive and increasing	(B) h is positive and decreasing
(C) h is negative and increasing	(D) h is negative and decreasing
 - On the interval (t_1, t_2) , describe the concavity of $h(x)$ and determine whether the rate of change of h is increasing or decreasing.
2. Below two full cycles of the periodic function $h(x)$ are shown. Five points are labelled. No axes are presented. The function h can be written in the form $h(x) = a \cos(b(x + c)) + d$.



- Find values of constants a , b , c , and d .
 - Let t_1 be the x -coordinate of point G and t_2 be the x -coordinate of point J . On the interval (t_1, t_2) which of the following is true about h ?

(A) h is positive and increasing	(B) h is positive and decreasing
(C) h is negative and increasing	(D) h is negative and decreasing
 - On the interval (t_1, t_2) , describe the concavity of $h(x)$ and determine whether the rate of change of h is increasing or decreasing.
3. Below two full cycles of the periodic function $h(x)$ are shown. Five points are labelled. No axes are presented. The function h can be written in the form $h(x) = a \sin(b(x + c)) + d$.



- Find values of constants a , b , c , and d .
- Let t_1 be the x -coordinate of point K and t_2 be the x -coordinate of point P . On the interval (t_1, t_2) which of the following is true about h ?

(A) h is positive and increasing	(B) h is positive and decreasing
(C) h is negative and increasing	(D) h is negative and decreasing
- On the interval (t_1, t_2) , describe the concavity of $h(x)$ and determine whether the rate of change of h is increasing or decreasing.

4. Find the period, amplitude, domain, and range of each of the following functions.

a. $f(x) = 2 - 5 \sin(3x)$

c. $h(x) = 3 \sin\left(4\left(x + \frac{\pi}{6}\right)\right) + 1$

b. $g(x) = 8 \cos\left(\frac{x}{2} - \pi\right) - 6$

d. $k(x) = -\frac{1}{2} \cos(\pi x) + 4$

5. Which of the following are NOT sinusoidal functions. Select all that apply.

(A) $\sin\left(\frac{x}{4}\right)$

(C) $\sin\left(x - \frac{1}{4}\right)$

(E) $\frac{\sin x}{4}$

(B) $\frac{1}{4} \cos(x)$

(D) $\sin\left(\frac{4}{x}\right)$

(F) $\frac{4}{\cos x}$

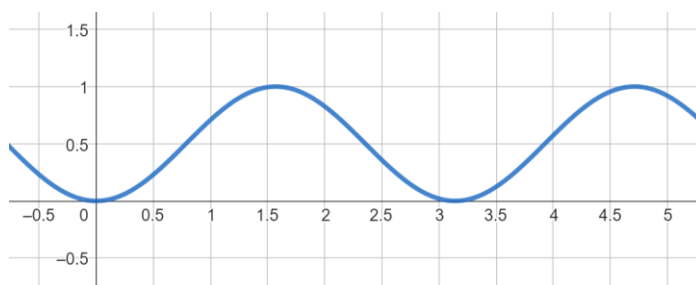
6. To the right is the graph of $y = f(x)$. Which of the following could be the function $f(x)$?

(A) $f(x) = -\frac{1}{2} \sin(2x) + \frac{1}{2}$

(B) $f(x) = \frac{1}{2} \sin(2x) + \frac{1}{2}$

(C) $f(x) = -\frac{1}{2} \cos(2x) + \frac{1}{2}$

(D) $f(x) = \frac{1}{2} \cos(2x) + \frac{1}{2}$



7. Let $g(x) = -2f(3x + 6) - 1$. The point $(3, -10)$ is on the graph of $f(x)$. Find the corresponding point on the graph of $g(x)$.

8. Consider the function $y = \sin(2x)$. Sketching this function is not necessary but nonetheless may be helpful in answering both parts of this question.

a. At which of the following x -values does this graph have points of inflection? Select all that apply.

$-\frac{\pi}{2}$

-3π

π

$\frac{9\pi}{2}$

$\frac{\pi}{2}$

$-\pi$

0

$\frac{3\pi}{4}$

$-\frac{\pi}{4}$

2π

b. Which one of the following represents ALL x -values at which this graph has points of inflection?

(A) $\frac{\pi}{2} + \frac{\pi}{4}k$ where k is any integer

(C) $\frac{\pi}{4}k$ where k is any integer

(B) $\frac{\pi}{4} + \frac{\pi}{2}k$ where k is any integer

(D) $\frac{\pi}{2}k$ where k is any integer

9. Select all of the following intervals over which the graph of $y = \cos(x)$ has a positive rate of change.
- (A) $\left(-\pi, -\frac{\pi}{2}\right)$ (C) $\left(\frac{\pi}{2}, \pi\right)$ (E) $\left(5\pi, \frac{11\pi}{2}\right)$
- (B) $\left(-\frac{\pi}{2}, 0\right)$ (D) $\left(2\pi, \frac{5\pi}{2}\right)$ (F) $\left(10\pi, \frac{21\pi}{2}\right)$
10. Three of the following statements are true. One is false. Select the false statement.
- (A) The period of a sinusoidal function can be found by analyzing the difference in x -values between two points with equal y -value.
- (B) The amplitude of a sinusoidal function can be determined by taking half the difference between the maximum and minimum values of the function.
- (C) The midline of a sinusoidal function can be found by averaging the maximum and minimum value of the function.
- (D) The frequency of a sinusoidal function can be found by taking the reciprocal of the period.
11. Two of the following functions are even. Two of the following functions are odd. Two are neither even nor odd. Classify each function as even, odd, or neither. You may want to do this by testing the result of plugging in a couple input values. Or, you may want to do this by sketching a graph. If you would like to roughly sketch each function, the last page of this file has some blank graphs that might be helpful.
- A) $f(x) = \sin(2x)$ B) $g(x) = \cos(x) - 1$ C) $h(x) = \sin\left(x + \frac{\pi}{4}\right)$
- D) $k(x) = \cos\left(x - \frac{\pi}{2}\right)$ E) $m(x) = \sin(x) + 1$ F) $p(x) = \cos(x - \pi)$
12. Let $g(x) = f(-2x + 6)$. Which of the following does NOT accurately describe the relationship between the graph of $f(x)$ and the graph of $g(x)$.
- (A) The graph of $g(x)$ is the image of the graph of $f(x)$ after a reflection over the y -axis followed by a horizontal translation by 6 units followed by a horizontal dilation by a factor of $\frac{1}{2}$
- (B) The graph of $g(x)$ is the image of the graph of $f(x)$ after a horizontal translation by 6 units followed by a horizontal dilation by a factor of $\frac{1}{2}$ followed by a reflection over the y -axis
- (C) The graph of $g(x)$ is the image of the graph of $f(x)$ after a reflection over the y -axis followed by a horizontal dilation by a factor of $\frac{1}{2}$ followed by a horizontal translation by 3 units
- (D) The graph of $g(x)$ is the image of the graph of $f(x)$ after a horizontal dilation by a factor of $\frac{1}{2}$ followed by a horizontal translation by a factor of -3 units followed by a reflection over the y -axis

Consider the graph of $y = f(x)$ shown to the right.

13. What is the period of $f(x)$?

14. What is the amplitude of $f(x)$?

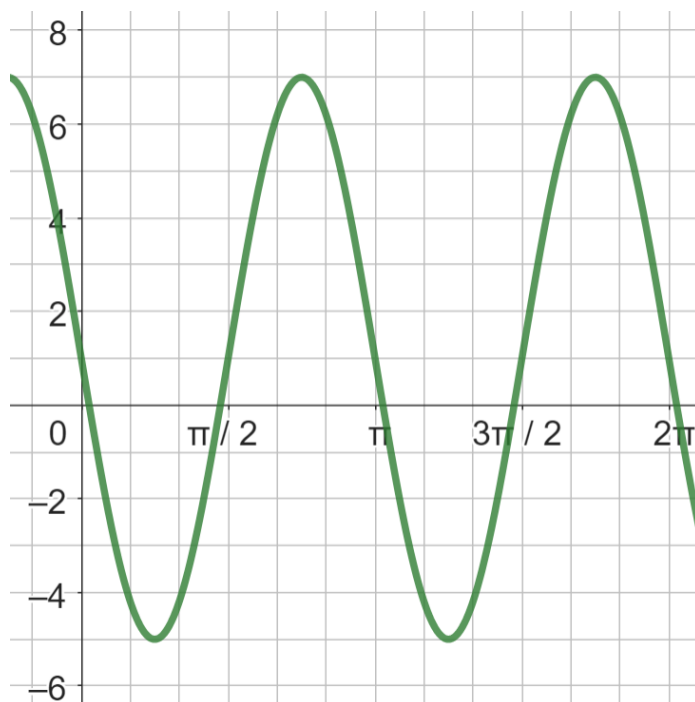
15. Which one of the following could be the equation of $f(x)$?

- (A) $f(x) = 6 \sin\left(\frac{x}{2}\right) + 1$
- (B) $f(x) = 6 \cos(2x) + 1$
- (C) $f(x) = -6 \sin(2x) + 1$
- (D) $f(x) = -6 \cos\left(\frac{x}{2}\right) + 1$

16. Over the interval $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$, $f(x)$ is....

- (A) Increasing with an increasing rate of change
- (B) Decreasing with an increasing rate of change
- (C) Increasing with a decreasing rate of change
- (D) Decreasing with a decreasing rate of change

17. What is the period of $f(2x)$?



Questions #1-3 are the most important questions on this assignment. Below are websites for extra practice of this type of question. These websites not only tell you the right answer, they give solutions.

Extra Practice for 1a, 2a, and 3a



Extra Practice for 1b, 2b, and 3b



Extra Practice for 1c, 2c, and 3c



Questions like #9 and #16 help us make sure we do not forget the vocab from the first unit. To the right is a link to a game from that unit, but this time it only will use sinusoidal functions.



Sinusoidal Graphs (3.5, 3.6) Homework Answers

1.
 - a. $a = 4, b = \frac{\pi}{2}, c = -4$, and $d = 10$ (note: there are other possible correct answers)
 - b. (B) h is positive and decreasing
 - c. On the interval (t_1, t_2) the graph of h is concave down. Therefore, the rate of change of h is decreasing on that interval.
2.
 - a. $a = 6, b = \frac{\pi}{12}, c = -19, d = -5$ (note: there are other possible correct answers)
 - b. (C) h is negative and increasing
 - c. On the interval (t_1, t_2) the graph of h is concave up. Therefore, the rate of change of h is increasing on that interval.
3.
 - a. $a = 5, b = \frac{\pi}{8}, c = -8, d = -3$ (note: there are other possible correct answers including $c = -24$)
 - b. (C) h is negative and increasing
 - c. On the interval (t_1, t_2) the graph of h is concave up. Therefore, the rate of change of h is increasing on that interval.
4.

d. Period: $\frac{2\pi}{3}$	Amplitude: 5	Domain: $(-\infty, \infty)$	Range: $[-3, 7]$
e. Period: 4π	Amplitude: 8	Domain: $(-\infty, \infty)$	Range: $[-14, 2]$
f. Period: $\frac{\pi}{2}$	Amplitude: 3	Domain: $(-\infty, \infty)$	Range: $[-2, 4]$
g. Period: 2	Amplitude: $\frac{1}{2}$	Domain: $(-\infty, \infty)$	Range: $\left[\frac{7}{2}, \frac{9}{2}\right]$
5. (D) and (F) are NOT sinusoidal
6. C
7. $(-1, 19)$
8.
 - a. $-\frac{\pi}{2}, -3\pi, \pi, \frac{9\pi}{2}, \frac{\pi}{2}, -\pi, 0, 2\pi$
(all of the options except $\frac{3\pi}{4}$ and $-\frac{\pi}{4}$)
 - b. D
9. A, B, and E
10. A
11.

A) $f(x)$ is odd	B) $g(x)$ is even	C) $h(x)$ is neither
D) $k(x)$ is odd	E) $m(x)$ is neither	F) $p(x)$ is even
12. B
13. π
14. 6
15. C
16. A
17. $\frac{\pi}{2}$

(some blank graphs in case they are helpful)

