Name _____

HW L1.3

1. Consider the graph of $f(x) = (x-4)^3$.

   a. On which interval(s) is f concave up?

   b. On which interval(s) is f concave down?

2. The value of a car, in dollars, with respect to its age, in years, can be modeled by the function V. The table gives the value of V for selected values of t.

$t(\text{years})$	0	1	2	3	4
$V(t)(\$)$	$24,000$	$21,360$	$19,010$	$16,919$	$15,058$

   a. Is the value of the car increasing or decreasing?

   b. Is the graph of V concave up or concave down? How do you know?

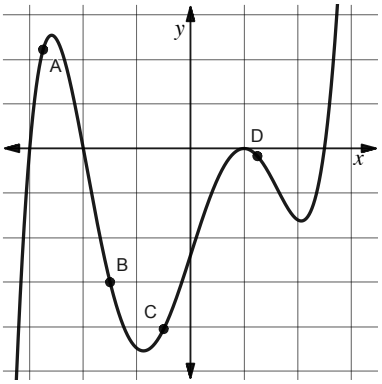
3. The graph of the function $y = g(x)$ is shown. At each of the given points, determine if g is increasing or decreasing, and whether the rate of change of g is increasing or decreasing.

   a. Point A

   b. Point B

   c. Point C

   d. Point D



4. Information about a continuous function L and its rate of change is given in the table.

x	$-\infty < x \leq -8$	$x = -8$	$-8 \leq x \leq 2$	$x = 2$	$2 \leq x \leq 5$	$x = 5$	$5 \leq x < \infty$
L	Decreasing	5	Increasing	10	Increasing	21	Decreasing
Rate of change of L	Increasing	0	Increasing	12	Decreasing	0	Decreasing

a. On which interval(s) is the slope of the graph of L positive?

b. On which interval(s) is the graph of L concave down?

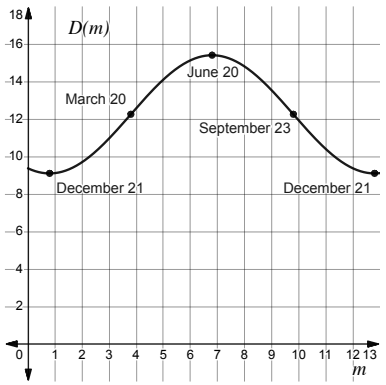
c. On which interval(s) are the slopes of L negative and getting flatter?

5. The graph of $y = D(m)$ shown models the number of daylight hours for a city in the Northern hemisphere, $D(m)$, on the 1^{st} day of the m^{th} month of the year. The four dates shown mark the winter solstice (December 21), the vernal equinox (March 20), the summer solstice (June 20), and the autumnal equinox (September 23).

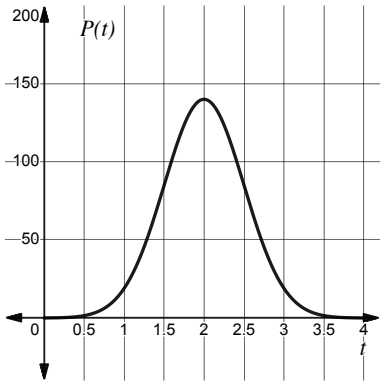
a. Estimate the number of daylight hours at each of these four dates.

b. Describe how the number of daylight hours is changing at each of these four dates.

c. Describe how the number of daylight hours is changing on the intervals between these four dates.



6. The number of people waiting in line to enter an auditorium for a musical production can be modeled by the function P. The graph of $y = P(t)$ is shown for $0 \leq t \leq 4$, where t is measured in hours. The doors to the auditorium open at $t = 2$.



a. Approximate the interval of t in which the number of people waiting in line is increasing, but at a decreasing rate.

b. Is the rate at which people leave the line to enter the auditorium speeding up or slowing down at $t = 3$? How do you know?

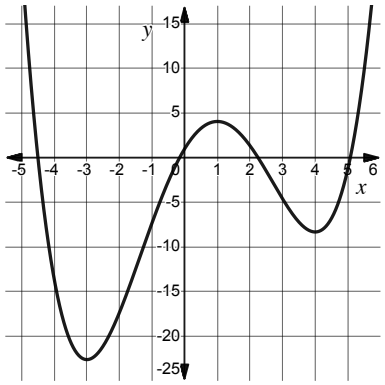
c. Approximate the time(s) t at which the number of people in line changes the fastest. How do you know?

7. Consider the graph of $g(x) = \sqrt{x + 5}$.

a. On which interval(s) is g concave up?

b. On which interval(s) is g concave down?

8. The graph of a function $y = g(x)$ is shown. On which of the following intervals of x is g increasing at a decreasing rate?



A) $(-3, 1) \cup (4, \infty)$

B) $(-1.4, 1)$ only

C) $(-1.4, 2.7)$

D) $(-1.4, 1) \cup (4, \infty)$

9. The graph of a smooth, continuous function f has a single inflection point at $x = 3$. Which of the following statements is true?

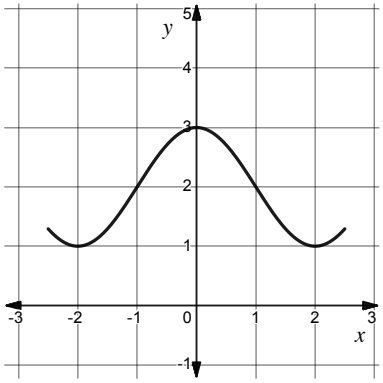
A) f is increasing at $x = 3$

B) The graph of f is concave down at $x = 3$

C) f has an absolute minimum value at $x = 3$

D) The rate of change of f changes from increasing to decreasing or decreasing to increasing at $x = 3$

10. The complete graph of a function f is shown. At which x-value(s) does the graph of f have a point of inflection?



A) $x = -1$ and $x = 1$

B) $x = -2, x = 0, x = 2$

C) $x = -1$ only

D) $x = 0$ only

11. The graph of a smooth, continuous function f has a single inflection point at $x = -6$. Which of the following statements is NOT true?

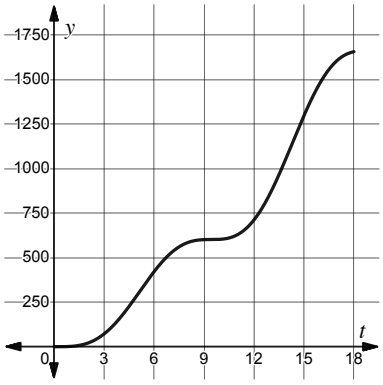
A) The rate of change of f changes from increasing to decreasing or decreasing to increasing at $x = -6$.

B) The rate of change of f changes the fastest at $x = -6$.

C) At $x = -6$, f changes its concavity from concave up to concave down or concave down to concave up.

D) f is decreasing at $x = -6$.

12. Traffic engineers study traffic patterns to be able to create conditions that optimize the flow of traffic. The total number of cars using a particular highway ramp was studied for an 18-hour period and can be modeled by the graph of $y = C(t)$, where $C(t)$ represents the total number of cars using the ramp over the time interval $0 \leq t \leq 18$ hours. Which of the following statements is true?



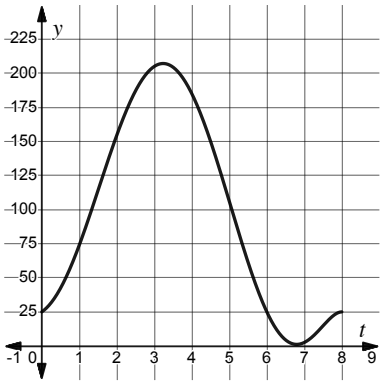
A) More cars take the ramp between $t = 6$ and $t = 9$ than between $t = 3$ and $t = 6$.

B) Between $t = 9$ and $t = 10$ there are about 600 cars using the ramp.

C) The rate at which cars enter the ramp is increasing or constant during the whole time period.

D) The total number of cars that have used the ramp is increasing more quickly at $t = 15$ than at $t = 17$.

13. An amusement park ride takes passengers to various heights. The height of the passengers was recorded for an 8 -minute ride and is modeled by the graph of $y = R(t)$, where $R(t)$ represents the height of the passengers in feet over the time interval $0 \leq t \leq 8$ minutes. Which of the following statements is true?



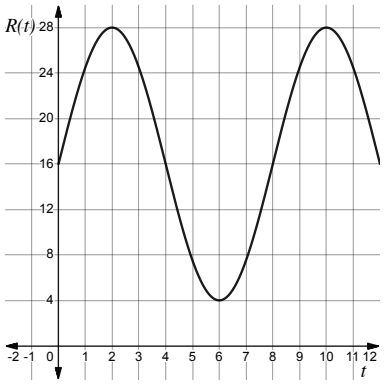
A) The rate at which the height of passengers is increasing is greater at $t = 3$ than at $t = 1$.

B) Between $t = 6$ to $t = 7$, the rate of change of the height of the passengers is increasing.

C) The rate at which the height of the passengers increases reaches its maximum value at $t = 3.25$.

D) Between $t = 5$ and $t = 6.75$, the height of passengers decreases at a decreasing rate.

14. The number of tables filled at a restaurant can be modeled by the function R . The graph $y = R(t)$ is shown for $0 \leq t \leq 12$, where t is measured in hours and $t = 0$ represents 10:00 AM when the restaurant opens. The lunch and dinner menus begin at 10:00 AM and 5:00 PM.

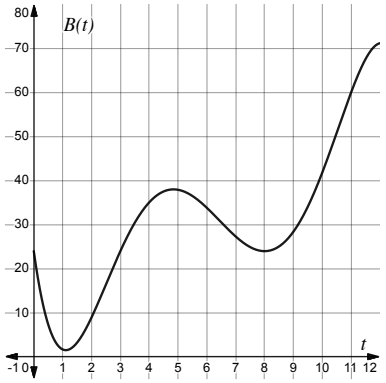


a. Approximate the interval of t in which the number of tables filled at the restaurant is decreasing, but at an increasing rate.

b. Is the rate at which tables are being filled speeding up or slowing down at $t = 7$? How do you know?

c. Approximate the time(s) t at which the number of tables filled changes the fastest. How do you know?

15. The number of bicycles sold at a store can be modeled by the function B. The graph $y = B(t)$ is shown for $0 \leq t \leq 12$, where t is measured in months.

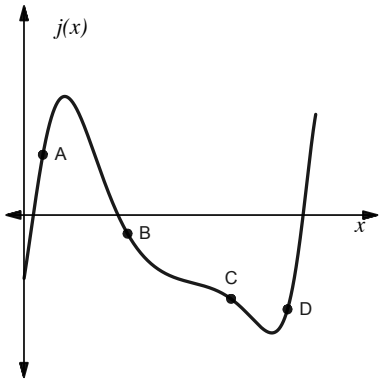


a. Approximate the interval(s) of t in which the number of bicycles sold is increasing, but at an increasing rate.

b. Is the rate at which bicycles being sold speeding up or slowing down at $t = 4$? How do you know?

c. Approximate the month(s) t at which the number of bicycles sold changes the fastest. How do you know?

16. The graph of j is shown. At which point on the graph is j decreasing at an increasing rate?



A) Point A

B) Point B

C) Point C

D) Point D