Name: ________________________ Class: ___________________ Date: __________ ID: A

Unit 2 Practice

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. What is the average rate of change for the function $f(x) = -x^2 + x - 5$ over the interval $1 \le x \le 4$?

a. -12
b. -4
c. -3
d. 4

____ 2. What is the average rate of change of the function $h(x) = 5x - 11$ over the interval $-22 \le x \le \frac{8}{5}$?

a. -11
b. -5
c. 5
d. 23.6

____ 3. Which expression represents the average rate of change of the function $f(x) = -x^2 - x + 1$ over the interval $-2 \le x \le 1$?

a. $\dfrac{-1-(-1)}{-2-1}$
b. $\dfrac{1-(-1)}{1-(-2)}$
c. $\dfrac{-1-1}{1-(-2)}$
d. $\dfrac{-1-(-1)}{1-(-2)}$

____ 4. Which function has a negative average rate of change on the interval $1 \le x \le 4$?

a. $f(x) = x^2 - x - 1$
b. $g(x) = 1.6x - 2$
c. $h(x) = -x^2 + 9$
d. $j(x) = -3$

____ 5. The students in a physics class are performing an experiment to determine the acceleration due to gravity. They drop water balloons from the top of a building and estimate the time at which the balloons hit the ground. After analyzing all of their data, the produce the model $h(t) = -5t^2 + 30$ to model the height of a balloon in metres t seconds after it has been dropped. What is the best estimate for the instantaneous rate of change in the height of a balloon 1 s after it has been dropped?

a. -20 m/s
b. -10 m/s
c. -5 m/s
d. 5 m/s

____ 6. Martin walks 5 m toward a motion sensor over the course of 10 s, at a constant speed. What would be the slope of the segment representing this walk on a distance versus time graph?

a. -2
b. $-\frac{1}{2}$
c. $\frac{1}{2}$
d. 2

____ 7. Andrea walks 5 m toward a motion sensor over the course of 10 s, at a constant speed. What would be the slope of the segment representing this walk on a speed versus time graph?

a. -2
b. $-\frac{1}{2}$
c. 0
d. $\frac{1}{2}$

Name: ________________________ **ID: A**

____ 8. Use a graphing calculator or algebraic techniques to determine the minimum or maximum point for $f(x) = -x^2 + 4x + 5$.

a. (−1, 0)
b. (5, 0)
c. (2, 9)
d. (2, −7)

____ 9. Which function does not have a maximum value?

a. $f(x) = x^2 + 9$
b. $g(x) = 9 - x - x^2$
c. $h(x) = -(x + 1)^2$
d. $k(x) = -4 + x - x^2$

____ 10. For the function $g(x) = -(x - a)^2 + b$, the point (a, b) is which of the following?

a. a maximum
b. a minimum
c. neither a maximum nor a minimum
d. It cannot be determined.

Short Answer

11. Which function has the greatest average rate of change on the interval $1 \le x \le 3$?

$f(x) = 2x^2$

$g(x) = 3x^2$

$h(x) = -x^2$

12. When using intervals to estimate the instantaneous rate of change, how can the best estimate be obtained?

13. Determine the zeros of $f(x) = x^2 - 3x - 4$ and estimate the instantaneous rate of change in $f(x)$ at the zeros.

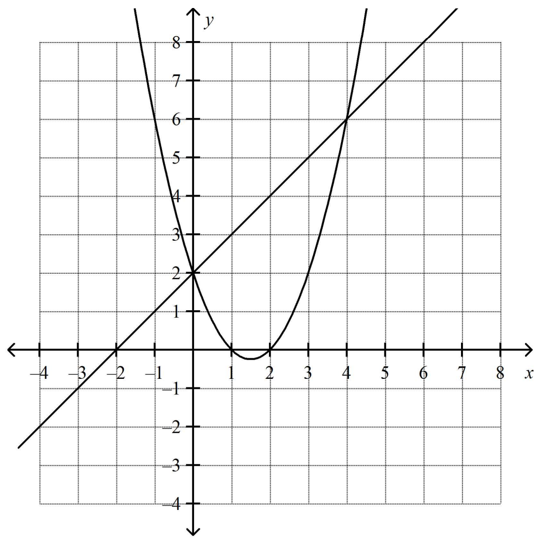
14. A student is walking in a straight line in front of a motion sensor. The student walks at a constant rate from a point 2 m from the motion sensor to a point 8 m from the sensor in 4 s. What is the student's speed during this walk?

15. What does the slope of a secant line through two points on the graph of a distance versus time graph represent?

Problem

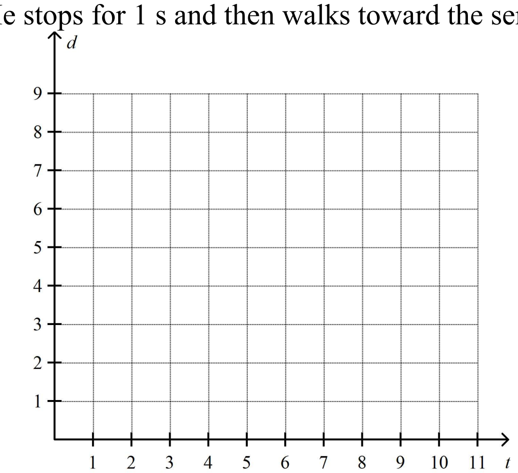
16. Consider several linear functions: horizontal, vertical, and those that are neither vertical nor horizontal. Discuss the average rates of change for each type of linear function.

17. Compare the average rate of change on the interval $0 \le x \le 4$ for the two functions whose graphs are shown below.

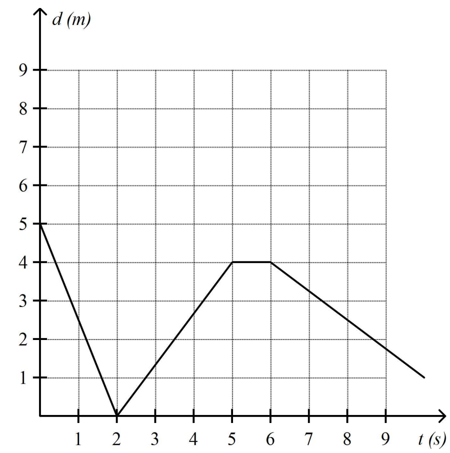


18. Draw a distance versus time graph that corresponds to the walk described below.

Adam starts 8 m away from the motion sensor and walks in a straight line toward the sensor at a constant rate of 0.5 m/s for 3 s. He immediately begins walking away from the sensor at a constant rate of 0.25 m/s for 4 s. He stops for 1 s and then walks toward the sensor at a constant rate of 0.5 m/s for 2 s.



19. Explain how to calculate the average speed for the entire 10 s walk illustrated by the following distance versus time graph, then calculate the average speed.



20. Explain how to determine the value of x that gives a maximum for a transformed cosine function in the form $y = a\cos(k(x-d))+c$, $a > 0$, if the maximum for $y = \cos x$ occurs at (0°, 1).

Unit 2 Practice
Answer Section

MULTIPLE CHOICE

1. ANS: B PTS: 1 REF: Knowledge and Understanding
OBJ: 2.1 - Determining Average Rate of Change
2. ANS: C PTS: 1 REF: Knowledge and Understanding
OBJ: 2.1 - Determining Average Rate of Change
3. ANS: D PTS: 1 REF: Knowledge and Understanding
OBJ: 2.1 - Determining Average Rate of Change
4. ANS: C PTS: 1 REF: Thinking
OBJ: 2.1 - Determining Average Rate of Change
5. ANS: B PTS: 1 REF: Application
OBJ: 2.2 - Estimating Instantaneous Rates of Change from Tables of Values and Equations
6. ANS: B PTS: 1 REF: Knowledge and Understanding
OBJ: 2.4 - Using Rates of Change to Create a Graphical Model
7. ANS: C PTS: 1 REF: Knowledge and Understanding
OBJ: 2.4 - Using Rates of Change to Create a Graphical Model
8. ANS: C PTS: 1 REF: Knowledge and Understanding
OBJ: 2.5 - Solving Problems Involving Rates of Change
9. ANS: A PTS: 1 REF: Thinking
OBJ: 2.5 - Solving Problems Involving Rates of Change
10. ANS: A PTS: 1 REF: Thinking
OBJ: 2.5 - Solving Problems Involving Rates of Change

SHORT ANSWER

11. ANS:
$g(x) = 3x^2$

PTS: 1 REF: Thinking OBJ: 2.1 - Determining Average Rate of Change
12. ANS:
by making the interval used to calculate the average rate of change as small as possible

PTS: 1 REF: Communication
OBJ: 2.2 - Estimating Instantaneous Rates of Change from Tables of Values and Equations
13. ANS:
Instantaneous rate of change at $x = -1$: about -5
Instantaneous rate of change at $x = 4$: about 5

PTS: 1 REF: Knowledge and Understanding
OBJ: 2.2 - Estimating Instantaneous Rates of Change from Tables of Values and Equations

14. ANS:
1.5 m/s

PTS: 1 REF: Knowledge and Understanding
OBJ: 2.4 - Using Rates of Change to Create a Graphical Model

15. ANS:
The slope of the secant represents the average speed on the interval corresponding to the t-coordinates of the two points.

PTS: 1 REF: Communication
OBJ: 2.4 - Using Rates of Change to Create a Graphical Model

PROBLEM

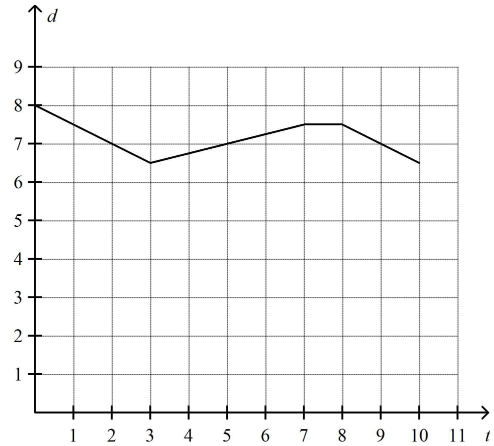
16. ANS:
For vertical linear functions, the average rate of change is undefined, since there is no change in the independent variable.
For horizontal functions, the average rate of change over the entire domain is 0, since there is no change in the dependent variable.
For linear functions that are neither horizontal nor vertical, the average rate of change is constant over the entire domain and can be any positive or negative real number.

PTS: 1 REF: Communication
OBJ: 2.1 - Determining Average Rate of Change

17. ANS:
The graphs intersect at points with x-coordinates of 0 and 4, the endpoints of the given interval. Since the same two points would be used in calculating the average rate of change over the interval for each function, the average rate of change over this interval must be the same for the two functions, even though one function decreases and then increases on the interval and the other function increases over the entire interval.

PTS: 1 REF: Communication
OBJ: 2.1 - Determining Average Rate of Change

18. ANS:



PTS: 1 REF: Knowledge and Understanding
OBJ: 2.4 - Using Rates of Change to Create a Graphical Model

19. ANS:
Determine the magnitude of the change in distance for each segment of the walk. Add these values to determine the total distance travelled over the course of the 10 s walk. Finally, divide the total distance by the total time, 10 s.

$|-5| + |4| + |0| + |-3| = 12$ m

$$\text{average speed} = \frac{12}{10}$$
$$= 1.2 \text{ m/s}$$

PTS: 1 REF: Communication
OBJ: 2.4 - Using Rates of Change to Create a Graphical Model

20. ANS:
Since the maximum for $y = \cos x$ occurs when $x = 0$, the maximum for $y = a\cos(k(x-d)) + c$ must occur when $(k(x - d)) = 0$.

$$k(x-d) = 0$$
$$x - d = 0$$
$$x = d$$

So, the maximum occurs when $x = d$.
Or, since $y = a\cos(k(x-d)) + c$ is a translation of $y = \cos x$ d units to the right, the maximum will also be translated d units to the right of 0, or to $x = d$.

PTS: 1 REF: Thinking OBJ: 2.5 - Solving Problems Involving Rates of Change