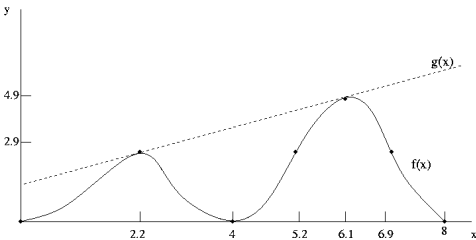


This assignment examines "average rate-of-change" in several contexts; these problems are adapted from section 1.2 of **Functions Modeling Change**.

- 1) interpret graph (pretend labelling of y-axis matches marked points)
- 2) determine sign of average rate-of-change for graphed function
- 3) compare average rate-of-change for 2 functions in a graph
- 4) average rate-of-change for straight line, interpret
- 5) functions presented via a table
- 6) interpret difference quotient as average rate-of-change and slope
- 7) average rate-of-change for  $f(x) = ax - b$
- 8) average rate(s)-of-change for  $f(x) = x^2 + b$
- 9) average rate(s)-of-change for a tabulated function

1. (1 pt) Questions 3 and 5:

Based on the graphs of  $f(x)$  and  $g(x)$  below, answer the following questions. You should not approximate any of your answers.



- a) What is the average rate of change of  $f(x)$  over the interval  $2.2 \leq x \leq 4$  ? \_\_\_\_\_
- b) What is the average rate of change of  $g(x)$  over the interval  $2.2 \leq x \leq 6.1$  ? \_\_\_\_\_

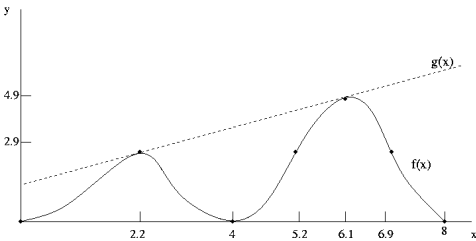
Answer(s) submitted:

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(incorrect)

2. (1 pt) Question 6:

Consider the graphs of  $f(x)$  and  $g(x)$  below:



For each interval given below, decide whether the average rate

of change of  $f(x)$  is POSITIVE, NEGATIVE, or ZERO over that particular interval. In the space next to each interval, indicate your answer by entering either POSITIVE, NEGATIVE, or ZERO.

| Interval              | Sign of Average Rate of Change of $f(x)$ |
|-----------------------|--|
| $0 \leq x \leq 4$     | _____                                    |
| $5.2 \leq x \leq 6.1$ | _____                                    |
| $2.2 \leq x \leq 6.9$ | _____                                    |
| $5.2 \leq x \leq 6.9$ | _____                                    |
| $0 \leq x \leq 2.2$   | _____                                    |

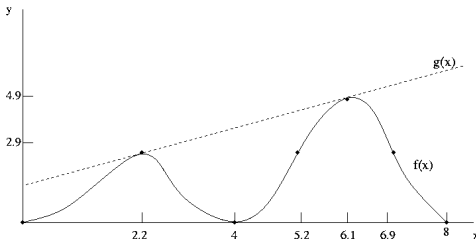
Answer(s) submitted:

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(incorrect)

3. (1 pt) Question 7:

Consider the graphs of  $f(x)$  and  $g(x)$  below:



For each interval given below, decide whether the average rate of change of  $f(x)$  or  $g(x)$  is greater over that particular interval. In the space next to each interval, enter f, g, or EQUAL to indicate which average rate of change is GREATER.

| Interval              | Which function has GREATER average rate of change? |
|-----------------------|--|
| $0 \leq x \leq 8$     | _____  |
| $2.2 \leq x \leq 4$   | _____  |
| $5.2 \leq x \leq 8$   | _____  |
| $0 \leq x \leq 2.2$   | _____  |
| $2.2 \leq x \leq 6.9$ | _____  |

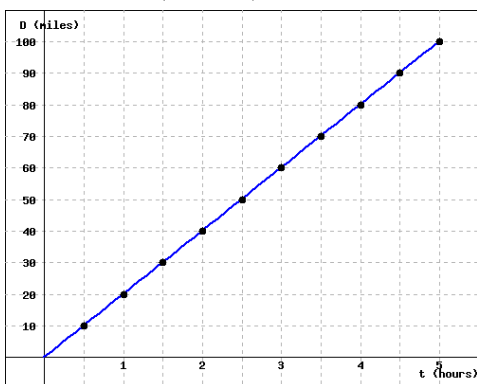
Answer(s) submitted:

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(incorrect)

4. (1 pt) Question 10:

The graph below shows the distance traveled,  $D$  (in miles) as a function of time,  $t$  (in hours).



(Click on the graph to get a larger version.)

a) For each of the intervals, find the values of  $\Delta D$  and  $\Delta t$  between the indicated start and end times. Enter your answers in their respective columns in the table below.

| Time Interval        | $\Delta D$ | $\Delta t$ |
|----------------------|------------|------------|
| $t = 2$ to $t = 4$   | _____      | _____      |
| $t = 1$ to $t = 4$   | _____      | _____      |
| $t = 0.5$ to $t = 2$ | _____      | _____      |

b) Based on your results from (a) it follows that the average rate of change of  $D$  is constant, it does not depend over which interval of time you choose. What is the constant rate of change of  $D$ ?  $\frac{\Delta D}{\Delta t} =$  \_\_\_\_\_

c) Which of the statements below CORRECTLY explains the significance of your answer to part (b)? Select ALL that apply (more than one may apply).

- A. It is the average velocity of the car over the first two hours.
- B. It is the acceleration of the car over the five hour time interval.
- C. It represents the car's velocity.
- D. It is how far the car will travel in a half-hour.
- E. It is the slope of the line.
- F. It is the total distance the car travels in five hours.
- G. None of the above

Answer(s) submitted:

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(incorrect)

5. (1 pt) Question 14:

The table below shows the number of calories used per minute as a function of an individual's body weight for three sports:

| Activity  | 100 lb | 120 lb | 150 lb | 170 lb | 200 lb | 220 lb |
|-----------|--------|--------|--------|--------|--------|--------|
| Walking   | 2.7    | 3.2    | 4      | 4.6    | 5.4    | 5.9    |
| Bicycling | 5.4    | 6.5    | 8.1    | 9.2    | 10.8   | 11.9   |
| Swimming  | 5.8    | 6.9    | 8.7    | 9.8    | 11.6   | 12.7   |

a) Determine the number of calories that a 170 lb person uses in one half-hour of walking . \_\_\_\_\_ calories

b) Who uses more calories, a 150 lb person swimming for one hour, or a 200 lb person bicycling for a half-hour?

- A. The 150 lb person swimming for one hour
- B. The 200 lb person bicycling for a half-hour
- C. They both use the same amount of calories

c) Does the number of calories of a person bicycling increase or decrease as weight increases?

- A. Increase
- B. Decrease

Answer(s) submitted:

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(incorrect)

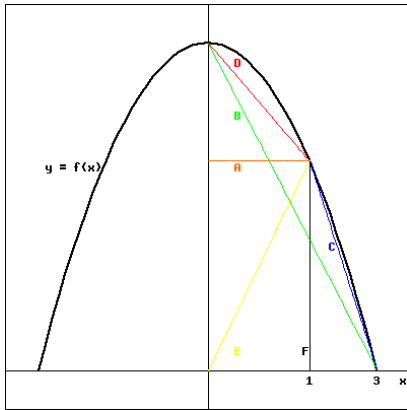
6. (1 pt) Question 16:

Let  $f(x) = 9 - x^2$ .

a) Compute each of the following expressions and interpret each as an average rate of change:

- (i)  $\frac{f(1)-f(0)}{1-0} =$  \_\_\_\_\_
- (ii)  $\frac{f(3)-f(1)}{3-1} =$  \_\_\_\_\_
- (iii)  $\frac{f(3)-f(0)}{3-0} =$  \_\_\_\_\_

b) Based on the graph sketched below, match each of your answers in (i) - (iii) with one of the lines labeled A - F. Type the corresponding letter of the line segment next to the appropriate formula. Clearly not all letters will be used.



(click on image to enlarge)

|   |                         |
|---|-------------------------|
| — | $\frac{f(1)-f(0)}{1-0}$ |
| — | $\frac{f(3)-f(1)}{3-1}$ |
| — | $\frac{f(3)-f(0)}{3-0}$ |

Answer(s) submitted:

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(incorrect)

#### 7. (1 pt) Question 18:

Consider the function  $f(x) = 3x - 6$  and find the following:

a) The average rate of change between the points  $(-1, f(-1))$  and  $(2, f(2))$ .

b) The average rate of change between the points  $(a, f(a))$  and  $(b, f(b))$ .

c) The average rate of change between the points  $(x, f(x))$  and  $(x+h, f(x+h))$ .

Answer(s) submitted:

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(incorrect)

#### 8. (1 pt) Question 20:

Consider the function  $f(x) = x^2 + 7$  and find the following:

a) The average rate of change between the points  $(-1, f(-1))$  and  $(1, f(1))$ .

b) The average rate of change between the points  $(a, f(a))$  and  $(b, f(b))$ .

c) The average rate of change between the points  $(x, f(x))$  and  $(x+h, f(x+h))$ .

Answer(s) submitted:

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(incorrect)

#### 9. (1 pt) Question 25:

The table below gives the average temperature,  $T$ , at a depth  $d$ , in a borehole in Belletierre, Quebec.

| $d$ , depth (m) | $T$ , temp ( $^{\circ}\text{C}$ ) |
|-----------------|-----------------------------------|
| 25              | 5.50                              |
| 50              | 5.20                              |
| 75              | 5.10                              |
| 100             | 5.10                              |
| 125             | 5.30                              |
| 150             | 5.50                              |
| 175             | 5.75                              |
| 200             | 6.00                              |
| 225             | 6.25                              |
| 250             | 6.50                              |
| 275             | 6.75                              |
| 300             | 7.00                              |

Evaluate  $\Delta T / \Delta d$  on the following intervals

a)  $25 \leq d \leq 100$   $\Delta T / \Delta d =$  \_\_\_\_\_

b)  $125 \leq d \leq 250$   $\Delta T / \Delta d =$  \_\_\_\_\_

c)  $75 \leq d \leq 175$   $\Delta T / \Delta d =$  \_\_\_\_\_

d) Which of the statements below CORRECTLY explains the significance of your answer to part (c)? Select ALL that apply (more than one may apply).

- A. The temperature is changing at a rate of 0.0065 degrees Celsius per minute when the depth is 75 meters.
- B. 0.0065 is the slope of the graph of at  $d = 75$ .
- C. Over the interval from 75 meters to 175 meters, the temperature changes on average at a rate of 0.0065 degrees Celsius per meter.
- D. On average, the temperature is changing at a rate of 0.0065 degrees Celsius per minute over the interval  $75 \leq d \leq 175$ .

- E. The temperature changes by a total of 0.0065 degrees Celsius when moving from a depth 75 meters to 175 meters.
- F. None of the above

Answer(s) submitted:

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(incorrect)