**Math 251 Fall 2017**                                                          **Quiz #2, September 6**
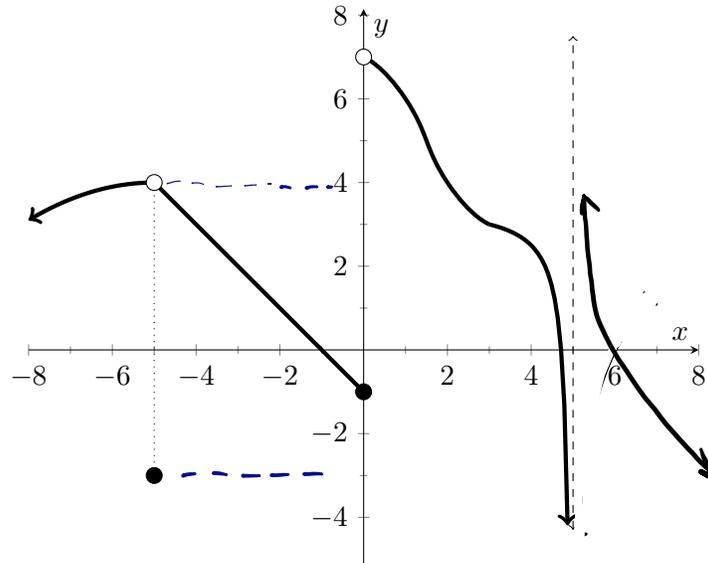
Name: _____ Solutions _____

There are 25 points possible on this quiz. This is a closed book quiz. Calculators and notes are not allowed. **Please show all of your work!** If you have any questions, please raise your hand.

*Exercise* 1. (9 pts.) Use the graph of the function of $f(x)$ to answer the following questions.



1. $\lim\limits_{x \to -5} f(x) =$ __**4**__

2. $\lim\limits_{x \to 0} f(x) =$ __**DNE**__

3. $\lim\limits_{x \to 6} f(x) =$ __**0**__

4. $f(-5) =$ __**-3**__

5. $f(0) =$ __**-1**__

6. $f(6) =$ __**0**__

7. $\lim\limits_{x \to 0^-} f(x) =$ __**-1**__

8. $\lim\limits_{x \to 0^+} f(x) =$ __**7**__

9. $\lim\limits_{x \to 5^-} f(x) =$ __**-∞**__

*Exercise* 2. (5 pts.) Evaluate the limit below and justify your answer. **Note:** The 5 points for this problem are distributed as: 1 point for the correct answer, 4 points for a clearly written justification using complete sentences.

$$\lim_{x \to 1^-} \frac{3 + x^2}{x - 1} = \boxed{-\infty}$$

As x approaches 1 from below, x-1 approaches zero but is negative. The numerator approaches $3+1^2 = 4$, a positive nonzero number. So the quotient is unbounded. Its sign is negative.

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*Exercise* 3. (6 pts.) The position of a car is given by values in the table below. Include units in your answers.

| t (seconds) | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| s (feet) | 0 | 11 | 32 | 70 | 119 | 179 |

(a.) Find the average velocity of the car over the time interval $[2, 3]$.

$$\frac{\text{average}}{\text{velocity}} = \frac{\Delta s}{\Delta t} = \frac{70 - 32}{3 - 2} = \frac{38}{1} = 38 \text{ ft/sec}$$

(b.) Find the average velocity of the car over the time interval $[3, 4]$.

$$\frac{\text{average}}{\text{velocity}} = \frac{\Delta s}{\Delta t} = \frac{119 - 70}{4 - 3} = \frac{49}{1} = 49 \text{ ft/sec}$$

(c.) Give a rough estimate of the instantaneous velocity at $t = 3$.

average the velocity on either side : instantaneous velocity at t=3 $\approx \frac{49 + 38}{2} = \frac{87}{2} = 43.5 \text{ ft/sec}$

*Exercise* 4. (5 pts.) On the axes below, sketch the graph of the function $f(x) = \begin{cases} |x + 2| & \text{if } x < 1 \\ (x - 2)^2 & \text{if } 1 \le x < 3 \\ 7 - 2x & \text{if } 3 \le x. \end{cases}$

Use the graph to determine the values of $a$ for which $\lim_{x \to a} f(x)$ does not exist and, for each $a$-value, justify your answer.
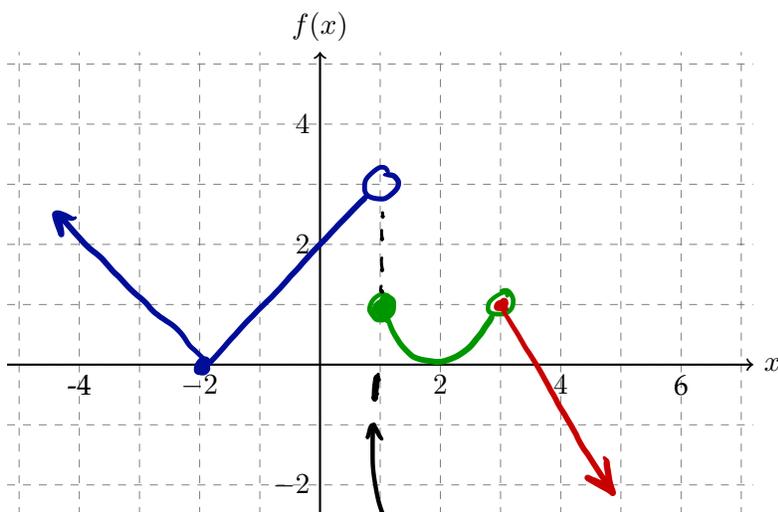


| $a$-value | justification |
|---|---|
| a = 1 | The left- and right-handed limits have different values. |

only place where limit fails to exist.