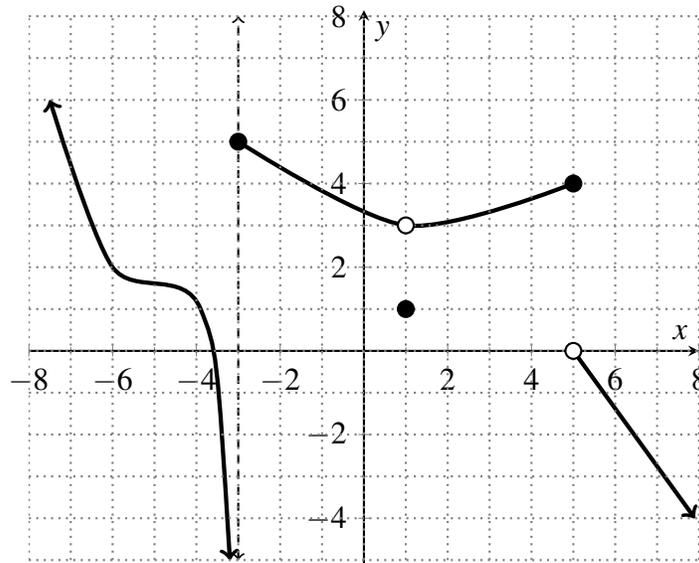**Name:** _____   _____ / 20

There are 20 points possible on this quiz. No aids (book, calculator, etc.) are permitted. **Show all work for full credit.**

1. **[8 points]** Use the graph of the function of $f(x)$ to answer the following questions. If a value does not exist, write DNE.

a. $f(-3) = $ __5__   b. $f(1) = $ __1__

c. $\lim\limits_{x \to -3^-} f(x) = $ __$-\infty$__   d. $\lim\limits_{x \to -3^+} f(x) = $ __5__   e. $\lim\limits_{x \to -3} f(x) = $ __DNE__

f. $\lim\limits_{x \to 1} f(x) = $ __3__   g. $\lim\limits_{x \to -6} f(x) = $ __2__   h. $\lim\limits_{x \to 5^+} f(x) = $ __0__

2. **[2 points]** The table below shows total active COVID cases in the Fairbanks North Star Borough over the 8 weeks ending 8/31/2020 (number of active cases measured on Mondays).

date	7/13	7/20	7/27	8/3	8/10	8/17	8/24	8/31
t (week)	0	1	2	3	4	5	6	7
C (# of cases)	146	167	192	215	238	275	332	409

a. What was the average rate of change in the number of cases over the 8 ~~8~~ **7** weeks? Show your work.

$$\text{average rate of change} = \frac{\Delta C}{\Delta t} = \frac{C(t_7) - C(t_0)}{t_7 - t_0}$$

$$\frac{\Delta C}{\Delta t} = \frac{409 - 146}{7} \approx 37.57 \ (\text{# of cases/week})$$

b. What was the average rate of change in the number of cases between weeks 2 and 5? Show your work.
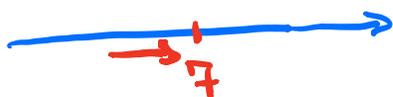
$$\text{average rate of change} = \frac{C(t_5) - C(t_2)}{t_5 - t_2} = \frac{275 - 192}{3}$$

$$\frac{\Delta C}{\Delta t} \approx 27.7 \ (\text{# of cases/week})$$

3. [6 points] Compute the following infinite limits. For each limit, |justify your answer| with a sentence or two, perhaps with a rough sketch. An answer with no justification will not receive full credit.

(handwritten) $43 > 0$

a. $\displaystyle\lim_{x\to 7^-} \frac{x^2-6}{x-7} = \boxed{-\infty}$

(handwritten) -0 , $x \to 7^-$

(handwritten)
$x_0 = 7$
$x_1 = 6.9 \;\Rightarrow\; x_1 - x_0 = -0.1$
$x_2 = 6.99 \;\Rightarrow\; x_2 - x_0 = -0.01$
$x_3 = 6.999 \;\Rightarrow\; x_3 - x_0 = -0.001$
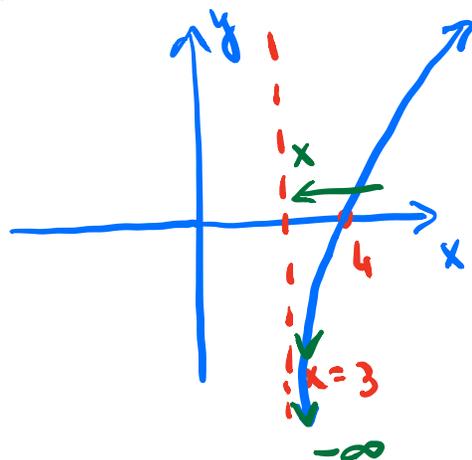$x_4 = 6.9999 \;\Rightarrow\; x_4 - x_0 = -0.0001$

b. $\displaystyle\lim_{x\to 3^+} 18\ln(x-3) = \boxed{-\infty}$

(handwritten) $\displaystyle\lim_{x\to 3^+} 18\ln(x-3) = 18\lim_{x\to 3^+}\ln(x-3) \to -\infty$
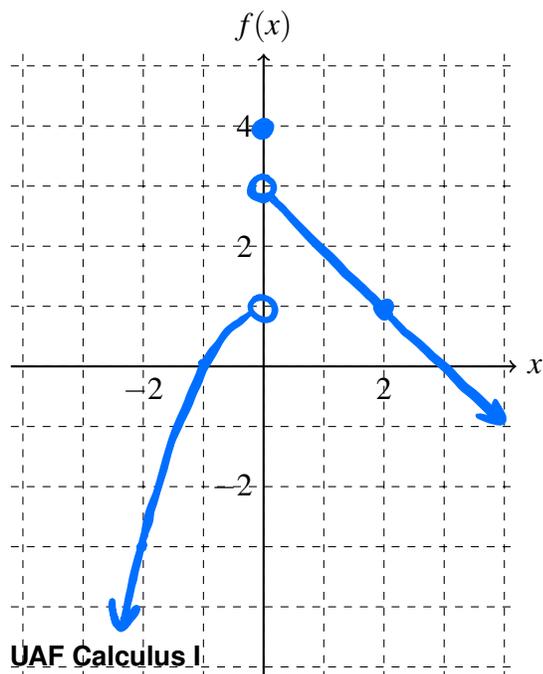
(handwritten) $x = 3$, $-\infty$

4. [4 points] On the axes below, sketch the graph of the function

$$f(x) = \begin{cases} 1-x^2 & x < 0 \\ 4 & x = 0 \\ 3-x & x > 0. \end{cases}$$

Then compute, with brief justification, the requested values in the table. An answer with no justification will not receive full credit.

$f(x)$

Value	Justification
$f(0) =$ **4**	Based on the definition of $f(x)$, this function is defined at $x=0$ and $f(0)=4$
$\displaystyle\lim_{x\to 0^-} f(x) =$ **1**	One-sided limit exists. As x is approaching 0 from the left, the value of f is getting closer to 1.
$\displaystyle\lim_{x\to 0} f(x) =$ **DNE**	$\displaystyle\lim_{x\to 0} f(x)$ DNE since $\displaystyle\lim_{x\to 0^+} f(x) \neq \lim_{x\to 0^-} f(x)$

(handwritten at bottom) 3 , 1