Calculus   Name: Date:

Unit 3 Test Review

For each problem, support your solutions with sufficient evidence using the 1st and 2nd derivatives as appropriate.

1. Find the key features for the function $f(x) = \frac{1}{3}x^3 + x^2 - 8x$

    a. Critical Points:

    b. Extrema:

    c. Interval(s) of increasing:

    d. Intervals(s) of decreasing:

    e. Inflection points:

    f. Interval(s) of concave up:

    g. Interval(s) of concave down:

2. Find the key features for the function $f(x) = \frac{2x-4}{x^2-1}$

    a. Critical Points:

    b. Extrema:

    c. Interval(s) of increasing:

    d. Intervals(s) of decreasing:

    e. Inflection points:

    f. Interval(s) of concave up:

3. Interval(s) of concave down:Find the key features for the function $f(x) = -2x^2\sqrt{5 - x^2}$

   a. Critical Points:

   b. Extrema:

   c. Interval(s) of increasing:

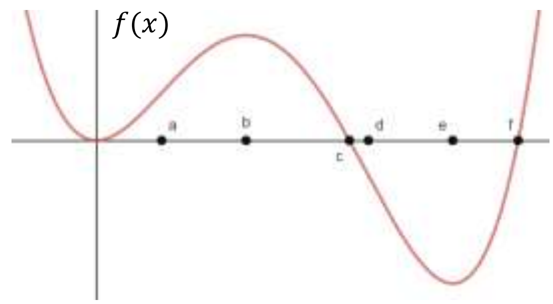
   d. Intervals(s) of decreasing:

   e. Inflection points:

   f. Interval(s) of concave up:

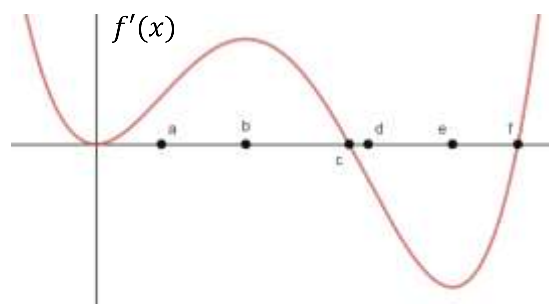
   g. Interval(s) of concave down:

4. Use the graph to find the location of the following:



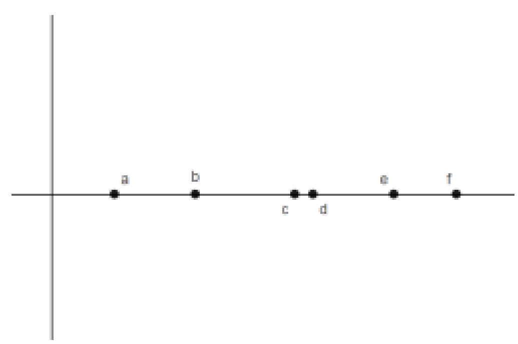
   a. Critical Points:
   b. Extrema:
   c. Interval(s) of increasing:
   d. Intervals(s) of decreasing:
   e. Inflection points:
   f. Interval(s) of concave up:
   g. Interval(s) of concave down:

5. Use the graph to find the location of the following:



   a. Critical Points:
   b. Extrema:
   c. Interval(s) of increasing:
   d. Intervals(s) of decreasing:
   e. Inflection points:
   f. Interval(s) of concave up:
   g. Interval(s) of concave down:

   h. Sketch a graph of $f(x)$ using these key features.



6. If $p(t)$ represents the population of fruit flies in a container at time t, describe in words what the following represent:
   a. $f'(t) > 0,$ and $f''(t) > 0$
   b. $f'(t) < 0,$ and $f''(t) > 0$
   c. $f'(t) > 0,$ and $f''(t) < 0$
   d. $f'(t) < 0,$ and $f''(t) < 0$

7. For each of the following functions:
   (i) determine if the function satisfies the two hypothesis of MVT on the indicated interval, and
   (ii)If it does, find the value of $f'(c)$ guaranteed by the theorem in the indicated interval.
   a. $f(x) = \frac{x^2}{x+3}$ on $[-5,-2]$
   b. $f(x) = \frac{1}{x-1}$ on $[2,4]$
   c. $f(x) = x^{\frac{1}{3}}$ on $[-1,1]$
   d. $f(x) = |x+4|$ on $[-5,-3]$

8. Determine if L'Hopital's rule applies, then find the limits using L'Hopital's rule if it does apply.
   a. $\lim_{x \to 2} \frac{e^{x-2}-1}{x^2-4}$
   b. $\lim_{x \to \infty} \frac{x^2+2x}{e^x}$

9. Construct a graph with the following characteristics:
   a. $f(x)$ is continuous
   b. $f(0) = f(3) = 0$
   c.

	$x < 1$	1	$1 < x < 2$	2	$2 < x < 3$	3	$x > 3$
$f'(x)$	+	0	+	0	-	DNE	-
$f''(x)$	-	0	+	0	-	DNE	+

10. Complete the table such that $f'(x) > 0$ and $f''(x) < 0$

x	y
1	
2	
3	
4	