NAME: (1 pt)	NUMBER: (1 pt)

MAT 136, Dr. Carol J.V. Fisher
This exam is closed book, closed notes, closed neighbor, and open mind.
Only a basic, four-function calculator is allowed (but is ***not*** required).
Show work leading to answers to receive full credit. Good luck!

1. (32 pts) The graph of a function f is shown below.

Read the following information from the graph; if something does not exist, write DNE.
(1 pt each, unless otherwise specified)

$f(1)$	$f(2)$	$f(1.9)$	$f(6)$
$f'(0)$	$f'(\frac{1}{2})$	$f'(1.9)$	$f'(3)$
$\lim_{x\to 1^+} f(x)$	$\lim_{x\to 1^-} f(x)$	$\lim_{x\to 1} f(x)$	$\lim_{x\to 6^-} f(x)$
$\lim_{x\to 2^+} f(x)$	$\lim_{x\to 2^-} f(x)$	$\lim_{x\to 2} f(x)$	$\lim_{x\to 3} f(x)$
the domain of f (use interval notation)		the range of f (use interval notation)	
(2 pts) the average rate of change of f between $x = 0$ and $x = 2$			
the instantaneous rate of change of f at $x = 0.5$			
the slope of the tangent line to the graph of f at $x = 5$			
(2 pts) all value(s) of x where f is NOT continuous			
(2 pts) all value(s) of x where f is NOT differentiable			
(2 pts) the coordinates of a point (x, y) where f has a local maximum value (even if there is more than one, you only need to list one such point)			
(2 pts) the coordinates of a point (x, y) where f has a global minimum value (even if there is more than one, you only need to list one such point)			
(2 pts) the local linearization, $\ell_5(x)$, to the graph of f at $x = 5$			

2. (5 pts) Again refer to the graph at the top of the first page.
   Graph the function f' (the derivative of f) for $-1 < x < 2$ in the space provided below.

3. (7 pts) As we did in class, you will create a graph that matches the story below.
   You live on a long, straight, road (i.e., a number line). Your house is at position 0.
   You always leave your house and turn in the positive direction (i.e., towards $1, 2, \ldots$).
   Let $p(t)$ denote the position of the car at time t.
   Put $p(t)$ along the vertical axis, and t along the horizontal axis.

   - Leave your house at $t = 0$. Gradually speed up to 70 mph at $t = a$.
   - Travel at 70mph until $t = b$; at this time, you see a police car ahead of you on the road, and quickly step on the brakes.
   - By $t = c$, you manage to be down to 50mph.
   - Too late! You hear the sirens. You pull over to the side of the road, coming to a complete stop at $t = d$, and remain there for a while while the policewoman writes out a speeding ticket (sigh).

4. (12 pts) Compute the following limits. If a limit does not exist, state DNE.

   - $\lim_{x \to 1} (x^4 - 3x^2 + 5)$
   - $\lim_{x \to 2} \dfrac{x^2 - 4}{x - 2}$
   - $\lim_{x \to \infty} \dfrac{2x - 3x^4 + 5}{7x^4 - 6x + 1}$
   - $\lim_{x \to 0^+} \dfrac{|x|}{x}$

5. (2 pts) Start with the graph of $y = x^3$. Shift it to the right 4 units, and up 2 units. What is the equation of the resulting graph?

   (2 pts) Explain, in words, what is done to the graph of $y = f(x)$ to obtain the graph of $y = -3f(x + 5)$.

6. (8 pts) Use the definition of the derivative to find $f'(x)$ if $f(x) = x^2 + 2x - 3$.
   (2 pts) Then, use your derivative formula to find the slope of the tangent line to f at $x = 3$.

7. (6 pts) Determine the values of a and b if f is continuous:

$$f(x) = \begin{cases} x^2 & \text{if } x < -4 \\ ax + b & \text{if } -4 \leq x < 5 \\ \sqrt{x+31}, & \text{if } x \geq 5 \end{cases}$$

8. In each spaces below, sketch the graph of a function f satisfying the following requirements:

$f(x) > 0$ and $f'(x) > 0$ and $f''(x) < 0$	f is decreasing and f is concave up

9. (5 pts) Give a precise statement of the Squeeze Theorem.
Include a sketch that illustrates what the theorem is saying.