Test 1 **MATH 125- Section 7** **September 12, 2017**

Name: _____ **Signature:** _____

Show all your work!

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1. [30 points]

   (a) Find the following limits:

   $\lim_{x\to\infty} \dfrac{3x^2-4x+1}{4x^2-7}$.

   $\lim_{x\to\infty} \dfrac{3x^2+1}{4x^5-70}$.

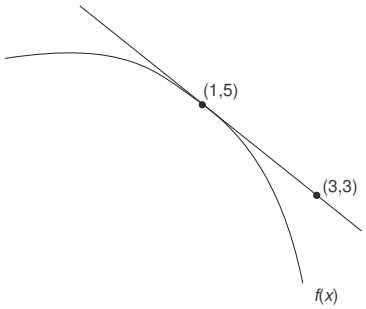
   $\lim_{x\to\infty} \dfrac{3^{-x}+7+\tan^{-1}x}{e^{-x}+4}$

   (b) Find a value of the constant k such that $\lim_{k\to 2} \dfrac{x^2-4x+k}{x-2}$ exists. Explain.

   (c) Sketch a graph of the function f with the following properties:

   $$\lim_{x\to 1^+} f(x)=\infty, \quad \lim_{x\to 1^-} f(x)=-\infty, \quad \lim_{x\to\infty} f(x)=0, \quad f \text{ is not continuous at } x=2.$$

2. [15 points] Given the graph of a function f and its tangent line at $x = 1$.



(a) Find $f'(1)$.

(b) Find the equation of the tangent line of f at $x = 1$.

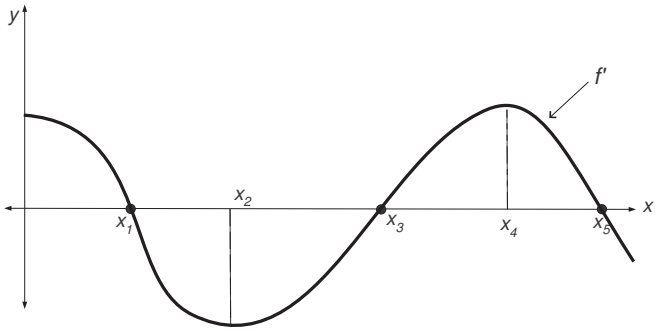
(c) Use the tangent line to approximate $f(1.01)$. Is it an underestimate or an overestimate? Explain

3. [15 points] Show that $f(x) = (x + |x|)^2 + 3$ is differentiable at $x = 0$ and find $f'(0)$.

4. [20 points] Find the value of k such that the following function is continuous at $x = 1$,

$$f(x) = \begin{cases} kx^2 + 2, & \text{if } x \geq 1 \\ x - 1 & \text{if } x < 1 \end{cases}$$

5. [20 points] Given the graph of the **first derivative function** of $f(x)$.



A- Find the intervals on which

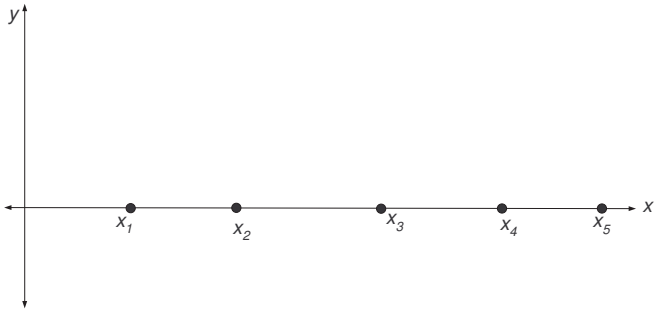
(a) f is increasing.

(b) f is decreasing.

(c) f is concave down.

(d) f is concave up.

B- Sketch $f''(x)$.



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