Math 124 K - Autumn 2007
Mid-Term Exam Number One
October 23, 2007

Name: _____

Student ID number: _____   Section: _____

1	12	
2	10	
3	10	
4	5	
5	10	
6	9	
7	9	
Total	65	

- Complete all questions.

- You may use a scientific calculator during this examination; graphing calculators and other electronic devices are not allowed and should be turned off for the duration of the exam.

- If you use trial-and-error, a guess-and-check method, or numerical approximation when an exact method is available, you will not receive full credit.

- You may use one double-sided, hand-written, 8.5 by 11 inch page of notes.

- Show all work for full credit.

- You have 80 minutes to complete the exam.

.

1. Determine the values of the following limits or state that the limit does not exist. If it is correct to say that the limit equals ∞ or $-\infty$, then you should do so.

(a) $\lim\limits_{x \to -3} \dfrac{x^2 - 9}{x^2 + 7x + 12}$

(b) $\lim\limits_{x \to 0^-} \dfrac{|x| - 3x}{|x| - 2x}$

(c) $\lim\limits_{x \to \infty} \dfrac{(x + 1)(3x + 1)}{(2x + 1)(x - 1)}$

(d) $\lim\limits_{x \to 2^+} \dfrac{6}{(x - 2)^3}$

2. Evaluate the following limits.

(a) $\displaystyle\lim_{h\to 0} \frac{\sqrt{h^2 + 3h} - h}{\sqrt{h}}$

(b) $\displaystyle\lim_{t\to\infty} \left(2\sin\left(\frac{\pi}{2} + \frac{1}{t}\right) + \frac{\cos(t^2 + 3)}{t^2 + 3} \right)$
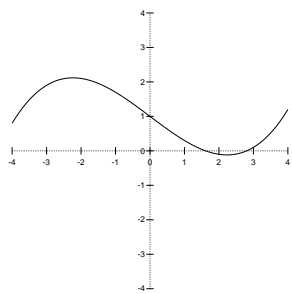
3. Find the tangent lines to the unit circle that pass through the point $(2, 1)$.

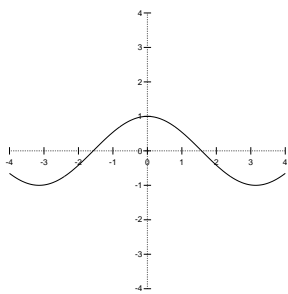4. Explain why the following function is discontinuous at $x = 3$.

$$f(x) = \begin{cases} x - 3 & \text{if } x \leq 3, \\ \dfrac{x^2 - 9}{x - 3} & \text{if } x > 3. \end{cases}$$

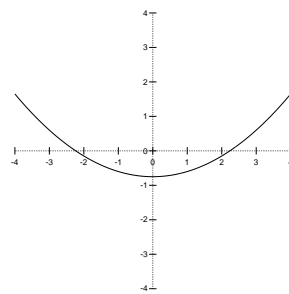5. Find the equation of the tangent line to the curve $y = \frac{1}{x}$ at the point $\left(2, \frac{1}{2}\right)$.

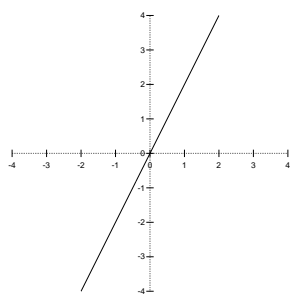6. In this problem, you are to match the graph of a function with the graph of its derivative.
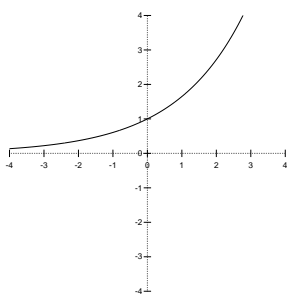

(a)

(b)
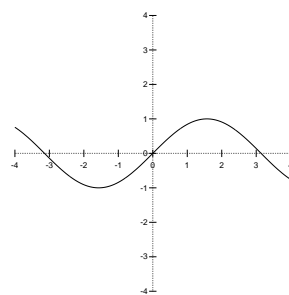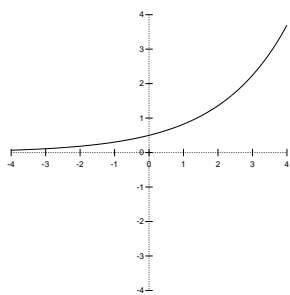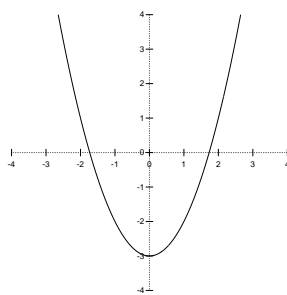

(c)

(d)

(e)

(f)

(g)

(h)

Fill in the blank with the appropriate graph's letter.

(a) Graph ____ shows the derivative of the function in graph (h).

(b) Graph ____ shows the derivative of the function in graph (e).

(c) Graph ____ shows the derivative of the function in graph (f).

7. A snail is roaming around the xy-plane. Its position t seconds after it starts moving is given by the equations

$$x = t^2 + 3t + 1, y = \frac{1}{2}t^2 - t$$

(a) Where is the snail when it starts moving?

(b) The snail starts on the x-axis, leaves and then returns some time later. What is the snail's horizontal velocity when it returns to the x-axis?