Math 124 - Winter 2013
Exam 1
February 5, 2013

Name: _____

Section: _____

Student ID Number: _____

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- There are 5 pages of questions. Make sure your exam contains all these questions.
- You are allowed to use a scientific calculator (**no graphing calculators and no calculators that have calculus capabilities**) and one **hand-written** 8.5 by 11 inch page of notes.
- Check that your exam contains all the problems listed above.
- You must show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.** Give exact answers wherever possible.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- Any student found engaging in academic misconduct will receive a score of 0 on this exam.
- You have 80 minutes to complete the exam. Budget your time wisely.
  SPEND NO MORE THAN 15 MINUTES PER PAGE!

GOOD LUCK!

1. (12 pts) 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. **In all cases, show your work/reasoning. You must use algebraic methods where available. And explain in words your reasoning if an algebraic method is not available.**

   (a) $\lim_{x\to 2} \dfrac{\dfrac{1}{x^2+1} - \dfrac{1}{5}}{x-2}$

   (b) $\lim_{t\to 7} \dfrac{|10-t| + \cos(\pi t) - 30}{(t-7)^2}$

   (c) $\lim_{x\to\infty} \dfrac{\sqrt{x^2+1}}{3x-2} - \dfrac{4x}{6x-4}$

2. (12 pts) Find the indicated derivatives of the following functions. (You do not have to simplify your final answer).

(a) $y = \dfrac{4}{x^2} + \dfrac{x^3}{6} + \dfrac{3}{e^x} + \dfrac{e^x}{2}$, find y'

(b) $y = \sqrt{9x^3}\sec(x) - 16$, find $\dfrac{dy}{dx}$.

(c) $f(x) = \left(3 - 5\sqrt[3]{x}\right)^2$, find $f'(x)$.

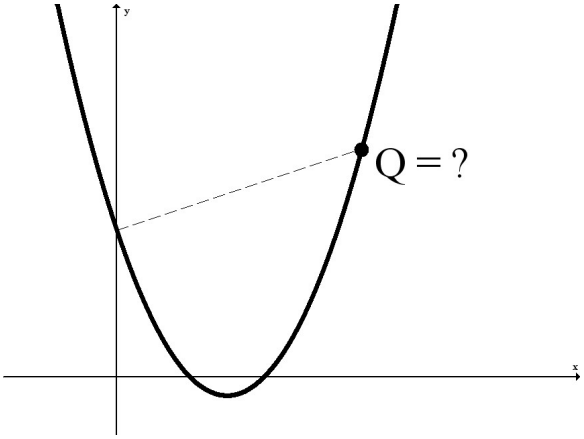
3. Assume the height, in feet, of a particular particle is given by $f(t) = \sqrt{2t+1}$ where t is in seconds.

(a) (5 pts) Find and *completely simplify* the expression $\dfrac{f(t+h)-f(t)}{h}$.
(Simplify until the h in the denominator cancels)

(b) (3 pts) Find the average speed of the particle over the interval from $t = 1$ to $t = 4$ seconds.
(Include units in your answer)

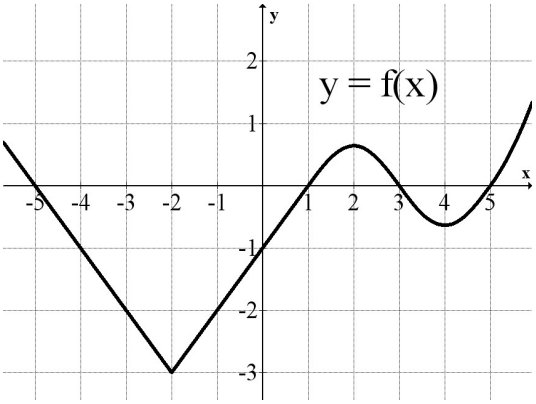
(c) (2 pts) Find the instantaneous speed of the particle at $t = 1$ seconds.
(Include units in your answer)

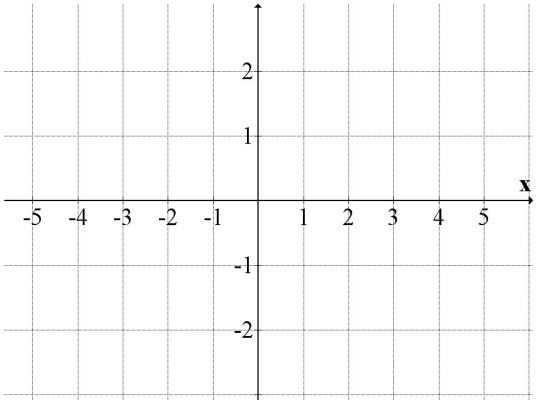
4. (a) (7 pts) Viewed from above, you are walking from left to right along the curve $y = x^2 - 3x + 2$ in the xy-plane. When you get to the point $(0, 2)$, you leave the path and follow the normal line for a shortcut. Find the x and y coordinates of the point, Q, where you meet up with the path again.



(b) (7 pts) Find the x and y coordinates of a point P on the curve $y = x^3$ at which the tangent line at the point P has a y-intercept of 10.

5. (a) (4 pts) The graph of a function $y = f(x)$ is shown. Sketch a rough graph of the derivative $y' = f'(x)$.





(b) For a constant c, consider the function $g(x) = \begin{cases} \dfrac{x^2-9}{x-3} & , \text{ if } x < 3; \\ cx^2 + 10 & , \text{ if } x \geq 3. \end{cases}$

i. (5 pts) Find the value c that will make this function continuous at $x = 3$.

ii. (3 pts) For the value of c you found in the previous part is the function $f(x)$ differentiable at $x = 3$? (Explain)