# MA104 - Differential Calculus
## Homework Assignment 1 - 35 points
## Due in class Monday, January 28, 2008

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Show all work to ensure full credit!

1. (a) Find the slope of the tangent line to the parabola $y = 7x + x^2$ at the point $(1, 8)$ in two different ways:
   i. Using Equation (2) on Page 145.
   ii. Using the Power Rule for derivatives.

   (b) Find an equation for the tangent line in part (a).

   (c) Using Mathematica, plot the parabola and its tangent line at $(1, 8)$ on the same set of axes. Include a printout of your code and the resulting plot.

2. Algebraically (i.e. by hand), compute $\lim_{n\to\infty} \dfrac{11n^3 + 2n + 5}{n + 4n^2 + 3n^3}$. Be sure to show your work!

3. Use the Intermediate Value Theorem to show that there is a root of the equation $2x^3 + x^2 + 2 = 0$ in the interval $(-2, -1)$.

4. Using the *definition of the derivative*, find the derivative of the function $g(x) = 3x^2 + x + 8$.
   (Note: Only use our derivative rules to *check* your work!)

5. A basketball is moving in a straight line, and its displacement (in feet) is given by the function $s(t) = 2t^2 - 11t$, where $t$ is in seconds.

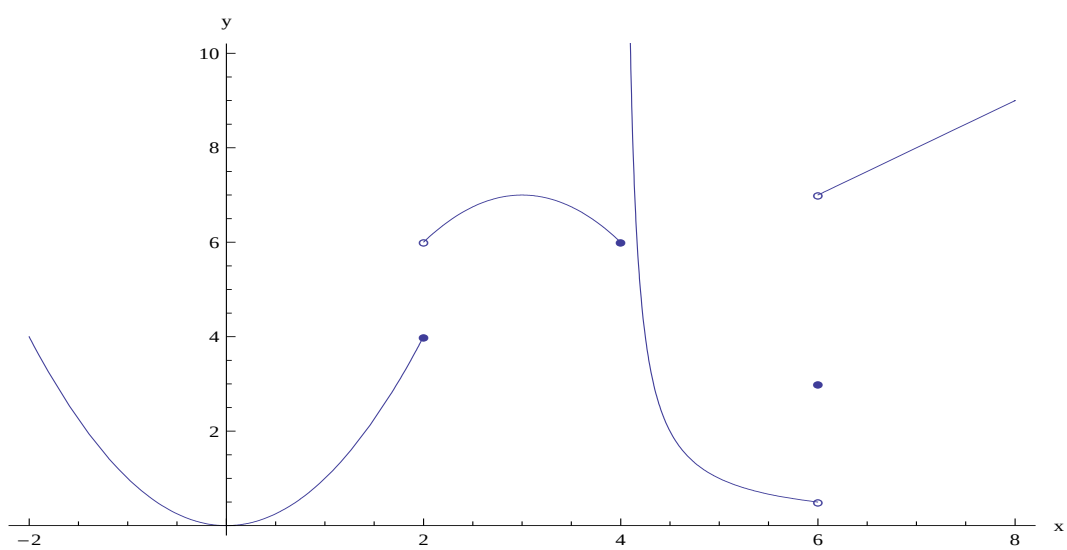
   (a) Find the average velocity of the ball over the time intervals $[2, 2.5]$ and $[2, 2.1]$.

   (b) Find the instantaneous velocity of the ball when $t = 2$. (Note: This should be exact, not an estimate.)

6. Compute $f'(t)$ if $f(t) = \ln t + t^{\frac{7}{2}} + 18 + e^t + 2t^\pi$.

7. Using the graph of the function $f$ given below, compute the following:

   (a) $\lim_{x\to 2^-} f(x)$ (b) $\lim_{x\to 2^+} f(x)$ (c) $\lim_{x\to 4^-} f(x)$
   (d) $\lim_{x\to 4^+} f(x)$ (e) $\lim_{x\to 6^-} f(x)$ (f) $\lim_{x\to 6^+} f(x)$
   (g) $\lim_{x\to 4} f(x)$ (h) $f(6)$ (i) $\lim_{x\to 6} f(x)$




8. Is the function $f$ given above continuous or discontinuous at the points $x = 1$ and $x = 2$? Why or why not? (Be specific!)