Physics 121MA/Math 122PH
Fall 2001 Project 4 Name _____

Instructions: We encourage you to work with others on this project. You should write your solution neatly using complete sentences that incorporate all symbolic mathematical expressions into the grammatical structure. Include enough detail to allow a fellow student to reconstruct your work, but you need not show every algebraic or arithmetic step. It is important that you do your own writing, even if you have worked out the details with other people. All graphs should be done carefully on graph paper or drawn by a computer. This project is due at the beginning of class on Friday, September 28.

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1. (a) Edgar Martínez is attempting to hit a baseball over a wall that stands 6.50 m tall and is 115 m (horizontally) from where he stands. Assume that Edgar strikes the ball when it is exactly one meter above the ground and that it leaves his bat with a speed of 37.0 m/s. Ignore air resistance. For what range of launch angles will the ball clear the wall? Measure your launch angles in the usual way, in degrees, with zero degrees horizontal and 90 degrees vertical.

   (b) The center field wall at Cheney Stadium is 128.0 m from home plate and is 9.76 m high. What is the minimum speed with which a baseball could be hit from a height of 1.00 m above the ground and just clear the wall? What is the launch angle θ_0 under these conditions?

2. The *error function* is defined by $\operatorname{erf}(x) = \dfrac{2}{\sqrt{\pi}} \displaystyle\int_0^x e^{-t^2}\, dt$.

   (a) Use the definition to make an accurate plot of the error function for the interval $[-4, 4]$ (without using any aspect of a computer application that "knows" about the error function).

   (b) Make a conjecture on why the factor of $\frac{2}{\sqrt{\pi}}$ is included in the definition of the error function.

   (c) Find the first and second derivatives of the error function.