your name(s)_____

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Physics 851 Exercise #4 - Monday, Oct 4th, 2021

Consider a particle of mass m under the influence of the potential,

$$V(x) = V_0 \theta(-x) - \frac{\hbar^2}{2m} \beta \delta(x - a), \quad V_0 \to \infty, \ \beta > 0.$$

A plane wave moving in the $-\hat{x}$ direction is reflected off the potential. For$(x > a)$ the plane wave will have the form

$$e^{-ikx} - e^{2i\delta} e^{ikx}.$$

Here, δ is referred to as the phase shift.

1. Find δ as a function of ka, and plot for $\beta a = 0.5$ and for $0 < ka < 10$. Because addition of $n\pi$ to the phase shift is arbitrary, translate all phase shifts to angles between zero and π.

2. Repeat for $\beta a = 0.99, 1.01, 1.5$.