

Due Friday by 2:15pm

Points 50

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Two positive charges of magnitude  $Q$  are fixed at  $x = -a$  and  $a$ , respectively, on the  $x$  axis ( $a > 0$ ). A negative charge of magnitude  $q$  and mass  $m$  is free to move along the  $y$  axis only.

- (a) Find the electric potential energy of the negative charge as a function of  $y$ . Use this result to find the net force acting on it. (10 points)
- (b) By deriving a differential equation, show that for a small neighborhood around the equilibrium position, the negative charge executes simple harmonic oscillations. Specify the equilibrium position and the angular frequency of oscillations. (30 points)
- (c) What is the limit on the size of the small neighborhood in (b) and why? (10 points)