By now you have hopefully watched the video at the end of the link on the course webpage (if you haven’t, go do so now...I’ll wait). This assignment combines that video with material that we have covered in class. If you notice in the video, all of the fruit fly in parabolic trajectories. But, because multiple fruit can be hit in one swipe, it is easy to get a 2+ fruit combo. Suppose we make the following alteration to the game: instead of swiping, you slice fruit by touching them on the screen (this clearly does not work on the Wii or Xbox Kinect). Furthermore, suppose that we treat the bottom of the screen as the x-axis and the left side of the screen as the y-axis—making the lower-left corner the origin. With these assumptions, please answer the following questions.

(1) Given that any of the trajectories can be described with a function of the form $ax^2 + bx + x$ (with $a \neq 0$), must $a$ always be greater than or less than 0?

(2) Suppose there are only two fruit currently on screen. For definiteness, suppose Fruit A has function $f_A(x) = a_1 x^2 + b_1 x + c_1$ and Fruit B has function $f_B(x) = a_2 x^2 + b_2 x + c_2$. Write an equation (which uses the functions for Fruit A and Fruit B) that would allow you to determine if the two fruit could be sliced with one touch of the screen.

(3) Discuss the three possible outcomes with respect to the discriminant when there are two fruits on screen and your goal is to hit both fruit at the same time. For full credit you should list the cases, explain the conditions on the coefficients of the functions $f_A$ and $f_B$ for these cases, and supply example figures.