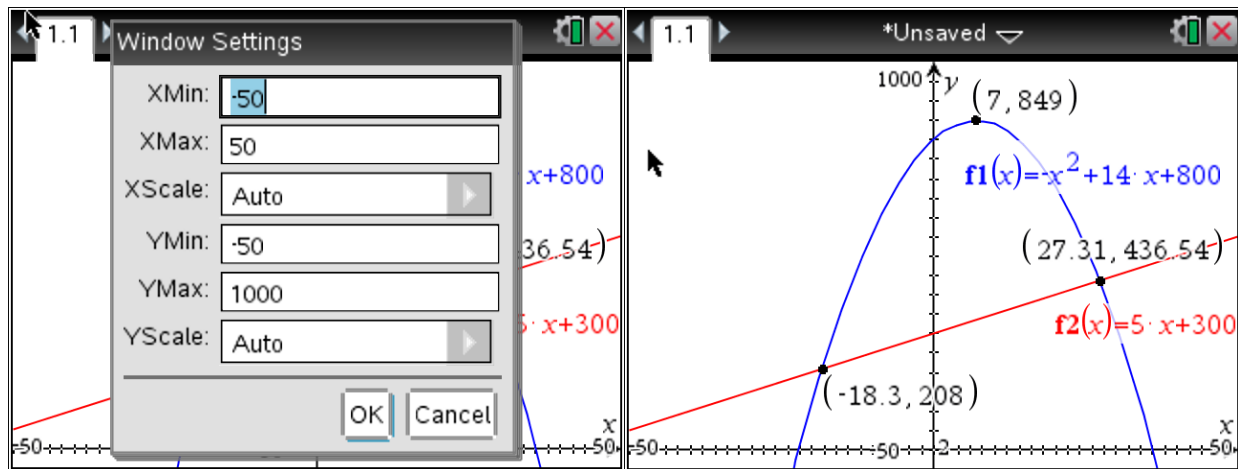


Application of Quadratic Systems

Example:

You work at a restaurant whose weekly profit is given by the formula $P = -c^2 + 14c + 800$, where c is the average price of the food, in dollars. The manager wants to add delivery service, which will cost the restaurant $D = 5c + 300$ per week.

- Use a graphing calculator to find the highest average price c the restaurant can sell its food at and still make a profit if they add delivery.
- What will the weekly profit P be if the restaurant sells its food at this average price and doesn't offer delivery?
- REASONING** Even though the system of equations has two solutions, why is only one solution useful?



Solution:

- Notice we adjusted the window to see the intersections. The highest average price c the restaurant can sell its food at and still make a profit if they add delivery is \$27.31. Notice this value is obtained from one of the intersections above. We can solve this algebraically to arrive at the same dollar value. Please note that according to the profit model, the highest profit margin occurs at the function's maximum, which is (7, 845). This means that if the restaurant sold its food at an average price of \$7, the weekly profit would be a maximum of \$849.
- If the restaurant sells its food at an average price of \$27.31 and doesn't offer delivery, its weekly profit will be \$436.54. In other words, the question is asking for the value of $P(27.31)$, the value of the function P (y -value) at x .
- The only useful solution is the one in the first quadrant. Negative price doesn't make sense. "It's like asking someone to give you money and food." -Alex Brock

Extension:

- What is the delivery cost if the average price of food is \$7? If you were a restaurant owner and the average price of food was \$7, would you offer delivery service? Please explain using mathematics.
- At what point, i.e., at what average price of food, is offering delivery not a wise business move? Please convince me with a careful explanation that uses accurate mathematics.