

Analyzing Quadratic Equations

Name: _____

Date: _____

Solve each equation using the best method.

1. $x^2 - x - 6 = 0$

2. $10x^2 + 9x = 3x + 2$

Solve the following problems.

1. Sarai has decided to take a risk. She's been saving money and now she's ready to invest in stocks. Most of her stocks give her a great return, but one—Bambi's Beach Bonnets—is a mixed story. The value of her shares in Bambi's Beach Bonnets over time is modeled by the function $v(t) = -2x^2 + 22x + 280$, where v represents the value of her investment and t represents time in weeks.
 - (a) What key feature of the function tells us when her investment was worth the most?

 - (b) When should she have sold her shares to maximize her profit? How much money would her investment have been worth?

 - (c) What key feature of the function tells us when she lost all of her money?

 - (d) After how many weeks did she lose all of her money?

 - (e) How much did Sarai initially invest in Bambi's Beach Bonnets? How do you know?

 - (f) Let's say Sarai's goal was to earn a profit of at least 10% on her investment. When could she have sold her shares to meet her goal?

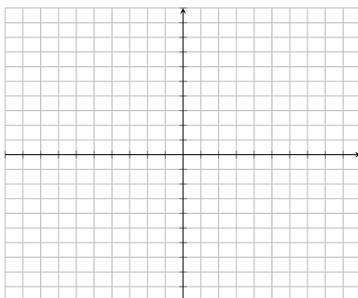
2. We depend on farmers to eat, but farming is a tough business. It's hard to make enough food to earn a living. However, farmers have been growing food for a long time and they've gotten smart about how to do it well.

For example, they know that an acre of apple trees can produce up to *five times* more depending on how well they take care of the trees. To take care of the trees well, many farmers use fertilizer. But fertilizer is dangerous. If you use some, it helps. If you use too much, it ends up killing your plants.

Over time, farmers have figured out how to calculate the right amount of fertilizer. When it comes to apple trees, there's a strong relationship between how many apples they produce and how much fertilizer they use. That relationship is modeled by the equation below, where $f(x)$ represents apple production (in tons per acre) and x represents fertilizer use (in pounds per acre):

$$f(x) = -0.00026x^2 + 0.14x + 6.86$$

(a) Graph $f(x)$.



x	y
0.0	
100.0	
200.0	
300.0	
400.0	

- (b) A long time ago, farmers didn't know how helpful fertilizer was. Based on the equation, about how many apples did farmers produce per acre before they started using fertilizer?
- (c) Farming has come a long way since then. How much fertilizer should farmers use to produce as many apples as possible? If they use that much fertilizer, how many tons of apples would they produce?
- (d) If farmers use more fertilizer than they need, it will literally start poisoning their apple trees. Too much fertilizer can even kill the trees. Based on the equation, how much fertilizer would it take to reduce farmers' apple production to zero?
- (e) **Extension question.** Fertilizer is expensive. Because it's so expensive, it doesn't actually make sense for farmers to use so much fertilizer that they produce as many apples as possible. In fact, for many farmers it's only worth using fertilizer when they produce at least 0.16 tons of apples per pound of fertilizer used. How much fertilizer should those farmers use? How many apples will they produce per acre?