**Example 1.** You have exactly 24 hours to study for a final exam worth 1000 points, and without preparation you will get 200 points. You wasted all your time earlier to determine that your exam score will improve x(38 - x) points if you read lecture notes for x hours and y(51 - y) points if you solve review problems for y hours, but due to fatigue from your last minute cramming, you will lose  $(x + y)^2$  points. What is the maximum score you can obtain?

**Example 2.** You place a termite on a circular heated plate whose temperature is modeled by

$$f(x,y) = y^2 - x^2 + 5$$

degrees Celsius, where x and y are in meters from the center of the plate. The termite walks along just the outer edge of the plate, which has a radius of 7 meters. (It's an obscenely large plate). What is the warmest the termite could get traveling along this path?

**Example 3.** A fruit stand exclusively sells dragon fruit and guava. If the owner puts x pieces of dragon fruit and y guavas on the stand at the beginning of a day, it is estimated that he will make a profit of

$$P(x,y) = 5x^{3/2}y^{1/2}$$

dollars that day. If he can only put 130 total pieces of fruit on the stand per day, what is the maximum profit that the owner can make that day?

**Example 4.** You're at it again making rectangular boxes in your spare time. This time it has a square base, the material for the bottom costs \$7/sq. ft., the top costs \$4/sq. ft., and the sides cost \$3/sq. ft. Find the box of greatest volume that you can make for \$167. Note that buying a cheaper box on Amazon is not an option.

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