Motivational Problems on Optimization

Using the maximum and minimum features on your graphing calculator, write an equation that represents the phenomenon in each problem. Then find the extreme value (max or min) requested in each problem.

1. A farmer wants to build an enclosure to keep his sheep safe. He needs to fence three sides of th e rectangular area as the fourth side is bounded by a river. The amount of fencing available is 100 m. Determine the dimensions that will maximize the area of the enclosed.

2. What is the shortest path from point D to point E to point C in the diagram below?
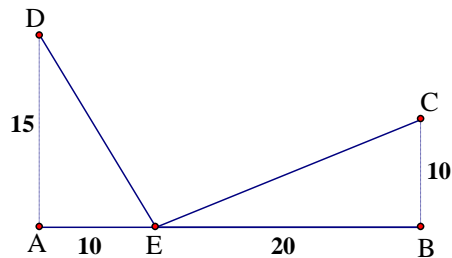
3. A landscape architect is creating a rectangular rose garden to be located in a local park. The rose garden is to have an area of 60 square meters and be surrounded by a lawn. The surrounding lawn is to be 10 meters wide on the north and south sides and 3 meters wide on the east and west sides. Find the dimensions of the rose garden if the total area of the garden and lawn together is to be a minimum. ($3\sqrt{2}x10\sqrt{2}$)

4. The dimensions of rectangular piece of paper ABCD are AB = 10 and BC = 9. It is folded so that corner D is matched with a point F on edge BC. Find the value of x that maximizes the area of triangle EFC.

5. Cut out a square from the corners of a regular 8.5 x 11 inch piece of paper. Fold up the sides to form a box. Find the dimensions of the cut-out square that maximizes the volume of the box.
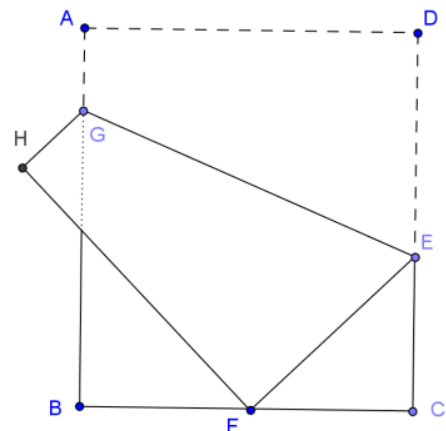
6. A farmer has 2400 ft of fencing and wants to fence off a rectangular field that borders a straight river. He needs no fence along the river. What are the dimensions of the field that has the largest area?

7. Alex the geologist is in the desert, 10 km from a long, straight road. On the road, Alex's jeep can do 50 kph, but in the desert sands, it can manage only 30 kph. Alex is very thirsty, and knows that there is a gas station 25 km down the road (from the nearest point N on the road) that has ice-cold Pepsi.
(a) How many minutes will it take for Alex to drive to P through the desert?
(b) Would it be faster if Alex first drove to N and then used the road to P?
(c) What is the fastest time in which Alex could get a Pepsi?
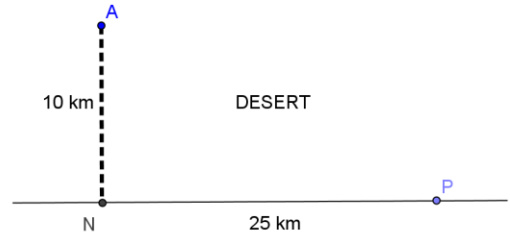
8. What are the dimensions of the rectangle with the largest area that can be graphed in the circle with the equation $x^2 + y^2 = 25$? Don't just guess – prove your conjecture with a function for the area.