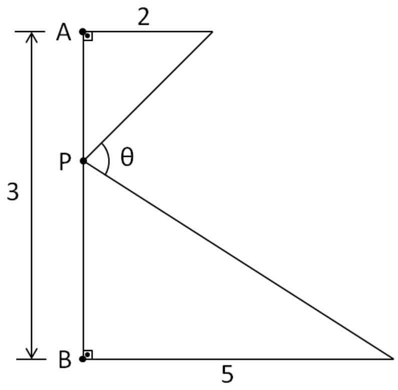
OPTIMIZATION PROBLEMS

1. 

Where should the point **P** be chosen on the line segment **AB** so as to maximize the angle θ? (Asked in last year's 2nd midterm examination)

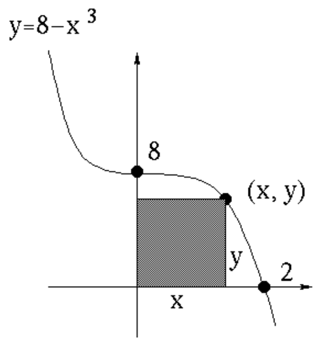
2. Consider all triangles formed by lines passing through the point $(8/9, 3)$ and both the x- and y-axes. Find the dimensions of the triangle with the shortest hypotenuse.

3. A sheet of cardboard 3 ft. by 4 ft. will be made into a box by cutting equal-sized squares from each corner and folding up the four edges. What will be the dimensions of the box with largest volume ?

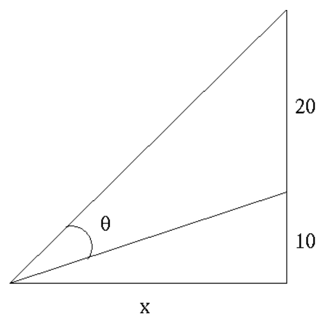
4. Construct a window in the shape of a semi-circle over a rectangle. If the distance around the outside of the window is 12 feet, what dimensions will result in the rectangle having largest possible area ?

5. There are 50 apple trees in an orchard. Each tree produces 800 apples. For each additional tree planted in the orchard, the output per tree drops by 10 apples. How many trees should be added to the existing orchard in order to maximize the total output of trees ?

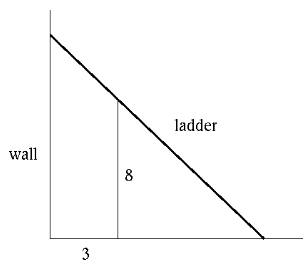
6. Find the dimensions of the rectangle of largest area which can be inscribed in the closed region bounded by the x-axis, y-axis, and graph of $y = 8 - x^3$. (See diagram.)



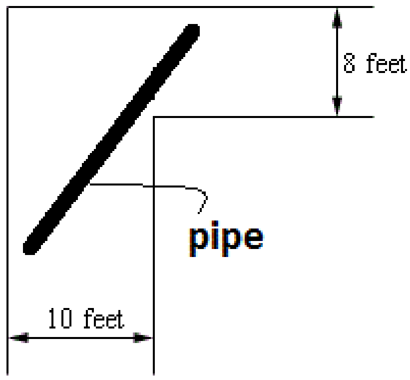
7. A movie screen on a wall is 20 feet high and 10 feet above the floor. At what distance x from the front of the room should you position yourself so that the viewing angle of the movie screen is as large as possible ? (See diagram.)



8. Find the length of the shortest ladder that will reach over an 8-ft. high fence to a wall which is 3 ft behind the fence. (See diagram.)



9. Consider a wire of length 1, cut into two pieces. Bend one piece into a square and the other into a equilateral triangle. We want to figure out where to cut the wire in order to enclose as much area in both the square and the triangle as possible.



10. A piece of pipe is being carried down a hallway that is 10 feet wide. At the end of the hallway the there is a right-angled turn and the hallway narrows down to 8 feet wide. What is the longest pipe that can be carried (always keeping it horizontal) around the turn in the hallway?

References

[1] http://www.math.ucdavis.edu/~kouba/CalcOneDIRECTORY/maxmindirectory/MaxMin.html

[2] http://ocw.mit.edu/courses/mathematics/18-01-single-variable-calculus-fall-2006/lecture-notes/lec11.pdf

[3] http://tutorial.math.lamar.edu/Classes/CalcI/MoreOptimization.aspx