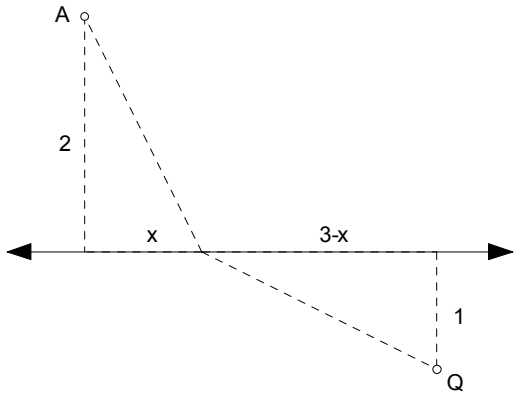
Optimization problems

1. A farmer constructs a chicken coop using P yards of wire. What dimensions should she use in order to create the coop with the maximum area?

2. A rectangle is bounded by the x-axis and the parabola $y = -x^2 + 9$. What length and width should the rectangle have so that its area is maximized?

3. Determine the dimensions of a box of maximum volume that can be made from a piece of material 16 cm X 20 cm. The box is to be made by cutting square pieces from the corners and folding up the sides. The box will not have a top.

4. Find the point on the curve $y = x^3$ that is a minimum distance from the point (-10, 9).

5. . A man is in a boat (at point A) 2 miles from the nearest point on the coast. He is to go to a point Q, 3 miles down the coast and 1 mile inland. If he can row at 2 miles per hour and walk at 4 miles per hour, toward what point on the coast should he row in order to reach point Q in the least time?