

MATH 133 – Calculus with Fundamentals 1
First Applied Optimization Problems
November 29, 2017

Questions

Today, we'll work through solutions of the following optimization problems together.

1. Find the strictly positive numbers x, y such that $x + y = 100$ and xy^2 is a *maximum*.
2. What are the dimensions of the rectangle of maximum area that can be inscribed in a $3-4-5$ right triangle, with sides parallel to the legs of the triangle?
3. You have become a landlord with a large property management business in an old industrial city in central Massachusetts. All the units in one of your buildings, a large 100-unit apartment block, will be occupied (rented) when the rent is set at $r = \$900$ per month, but one tenant will leave and that unit becomes vacant for each \$10 increase in the rent. Each occupied unit generates \$80 in maintenance costs to you since the tenants will call you to repair anything that breaks or needs repair. Unoccupied units do not generate any such costs. What rent should you charge to maximize your monthly profit from this building?
4. The volume of a conical paper cup of radius r and height h is $V = \frac{\pi}{3}r^2h$. The surface area is $S = \pi r\sqrt{r^2 + h^2}$. Thinking of the surface area as a measure of the amount of paper needed to produce the cup, find the dimensions of the cup of maximum volume with $S = 1$.