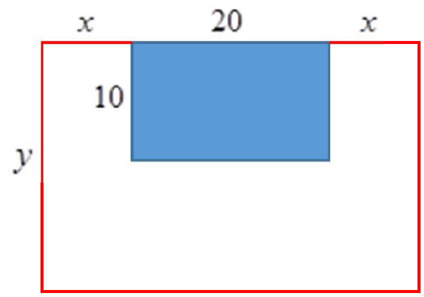
MPM1D9 – More Optimization Problems

Solve each of the following problems using both a numeric/graphical model and an algebraic/graphical model. A spreadsheet program such as Microsoft Excel is very helpful for the numeric/graphical model. A graphing calculator program such as Desmos is very helpful for the algebraic/graphical model.

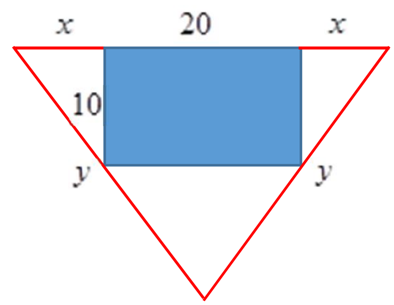
1. A fence is to be built around a cottage as shown in the diagram at the right. Determine the largest possible area enclosed by the fence if 200 m of fencing is to be used. (All lengths are in metres. Exclude the area of the cottage.)

[**Answer:** $x = 17.5$ m, $y = 55$ m, $A = 2825$ m^2]



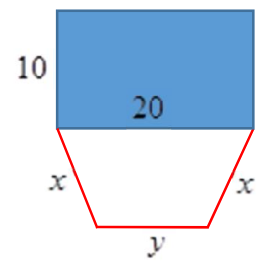
2. After a long and heated discussion with her friend Grishma, Foram (aka Pho Rum) insisted that the fence from question 1 should be built in the shape of an isosceles triangle (see the diagram at the right). What is the largest possible area enclosed by the fence if this configuration is used? (All lengths are in metres. Exclude the area of the cottage.)

[**Answer:** $x \doteq 23.3$ m, $y \doteq 66.7$ m, $A \doteq 1724.5$ m^2]



3. To settle the matter, Shivani came along, loudly told Foram and Grishma to stop arguing and made an executive decision to fence off an area in the shape of an isosceles trapezoid (see the diagram at the right). What is the largest possible area enclosed by the fence in this case? Why must the value of x be greater than 45 and less than 110? What restrictions are there on the value of y? (All lengths are in metres.)

[**Answer:** $x \doteq 66.7$ m, $y \doteq 66.7$ m, $A = 2706$ m^2]



4. Create an optimization question of your own in which the area of a rectangle of fixed perimeter is maximized but the answer does not turn out to be a square.

5. Create an optimization question of your own in which the perimeter of a rectangle of fixed area is minimized but the answer does not turn out to be a square.

Review Questions

For the following, assume that no additional restrictions are imposed on the shape. That is, assume that all dimensions of the shape are allowed to vary freely.

If the area of a rectangle of fixed perimeter is maximized, the rectangle turns out to be a ___________________.

If the volume of a square prism of fixed surface area is maximized, the square prism turns out to be a _______.

If the volume of a cylinder of fixed surface area is maximized, the cylinder's __________ equals its ________.

If the perimeter of a rectangle of fixed area is minimized, the rectangle turns out to be a ___________________.

If the surface area of a square prism of fixed volume is minimized, the square prism turns out to be a ________.

If the surface area of a cylinder of fixed volume is minimized, the cylinder's __________ equals its _________.