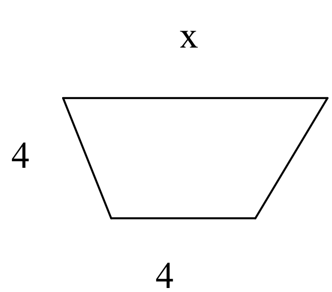
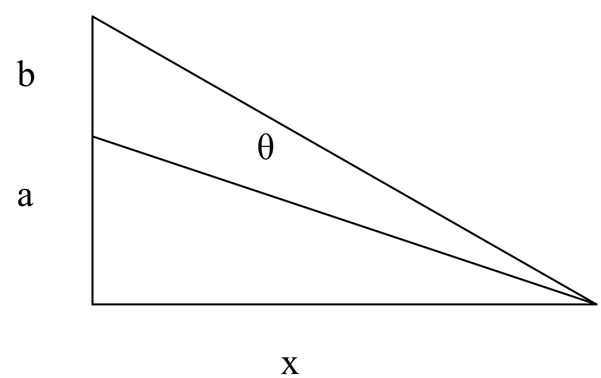
Name ________________________________ Calculus 1 Group Work Mike Huff

1. You are watering the lawn and aiming the hose upward at an angle of inclination θ. Let r be the range of the hose, that is, the distance from the hose to the point of impact of the water. Then r is given by
$$r = \frac{2v^2}{g}\sin\theta\cos\theta,$$
where v, g are constants. For what angle is the range a maximum?
2. Let $a_1, a_2, \ldots, a_n$ be numbers. Show that there is a single number x such that
$$(x-a_1)^2 + (x-a_2)^2 + \cdots + (x-a_n)^2$$
is a minimum and find this number.
3. A piece of wire of length L is cut into two parts, one of which is bent into the shape of an equilateral triangle and the other into the shape of a circle. How should the wire be cut so that the sum of the enclosed areas is:
    a) a minimum?
    b) a maximum?
4. A 400 meter track is to be constructed with two parallel straightaways of length *s* joining two semi-circular curves of radius *r*. What are the dimensions of the track that will enclose the largest area?
5. If we cut four congruent squares out of the corners of a square piece of cardboard 12 inches on each side, we can fold up the four remaining flaps to obtain a tray without a top. What size squares should be cut out in order to maximize the volume of the tray?
6. An irrigation channel made of concrete is to have a cross section in the form of an isosceles trapezoid, three of whose sides are 4 feet long. How should the trapezoid be shaped if it is to have the maximum possible area? (Consider the area as a function of *x* and solve.)
7. The base of a painting on a wall is *a* feet above the eye of an observer. The vertical side of the painting is *b* feet long. How far from the wall should the observer stand to maximize the angle that the painting subtends?





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Project: Hyperbolic Functions
Calculus 1 MATH 2413
Mike Huff
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