Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: `http://math.hws.edu/~mitchell/Math130F16/index.html`.

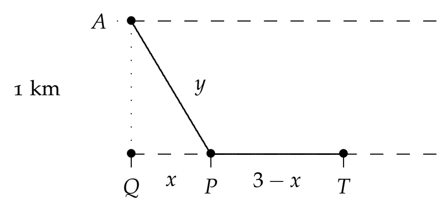
1. ☞ **CIT.** Let f be a continuous function on a closed interval $[a, b]$. Then the absolute extrema of f occur either at critical points of f on the open interval (a, b) or at the endpoints a and/or b.
2. ☞ **SCPT.** Assume that f is a continuous function on an interval (open, closed, or half-open) I. Assume that c is the only critical number of f.
   (*a*) If f has a relative maximum at c, then f has a absolute maximum at c.
   (*b*) If f has a relative minimum at c, then f has a absolute minimum at c.

Practice

Read section 4.4; concentrate on the examples. Practice using the homework and finish the classwork. Optimization problems require lots of practice and will be on the exam.

1. (*a*) These problems are straightforward. Make sure you can do them: Page 275ff #5, 9, 11, 15. A bit harder, but still very doable: #17, 21(a). Now try #29. **Extra Credit**: Page 262 #26.
2. ☞ **Graphing With Asymptotes.** Read Section 4.3. We have already done all of this except to take asymptotes (HAs and VAs) into account. We will do that in the next class. WeBWorK set Day 33, #4–12.

EXAMPLE 33.0.3 (From Last Class). A cable television company has its master antenna located at point A on the bank of a straight river 1 kilometer wise (Figure 1 above). It is going to run a cable from A to a point P on the opposite bank of the river and then straight along the bank to a town T situated 3 kilometers downstream from A. It costs \$15 per meter to run the cable under the water and \$9 per meter to run the cable along the bank. What should be the distance from P to T in order to minimize the total cost of the cable?



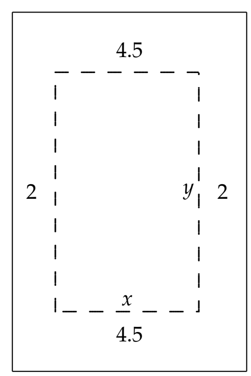
1. Minimize the cost $C = 15y + 9(3 - x)$ (in thousands of dollars, the distances are in kilometers).
2. Subject to $y^2 = x^2 + 1^2$
3. Eliminate y. Here, $y = \sqrt{x^2 + 1^2}$, where from the diagram $0 \le x \le 3$.
4. Substitute and rewrite C. $C(x) = 15\sqrt{x^2+1} + 9(3 - x)$ on $[0, 3]$.
5. Solve using CIT (or possibly SCPT). Find the critical numbers.

$C'(x) =$

EXAMPLE 33.0.4. Soda cans hold 113π cm^3 (355 ml). The tops and bottoms are made of aluminum that is double thick. Find radius of the can that minimizes the material used to make (sides, top, and bottom of) the can. **How does this compare to the radius of an actual soda can?**

1. Minimize surface area $A = \overbrace{2\pi rh + 2(2\pi r^2)}^{\text{side + 2(top + bottom)}}$.
2. Subject to the constraint is $V = 113\pi =$ ______________.
3. Eliminate (solve for) $h =$ ______________ on **domain**: ______________

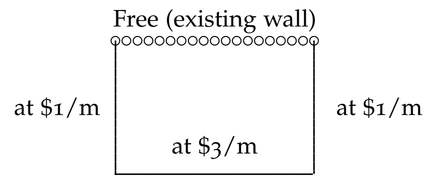
EXAMPLE 33.0.5. Advertising fliers are to be made from rectangular sheets of paper that contain 400 square centimeters of printed message. If the margins at the top and bottom are each 4.5 centimeters and the margins at the sides are each 2 centimeters, what should be the dimensions of the fliers if the total page area is to be a minimum?



Math 130, Day 33 Homework. Name: ________________________

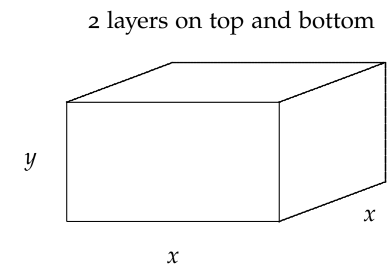
Carry out the procedure we used in class to solve these optimization problems. (Do WeBWorK set Day 33.)

1. President Gearan has $600 to spend to enclose his yard to keep out students. One side of the yard will use an existing rock wall while the other 3 sides will use electric fence to keep out students. The fence parallel to the wall costs $3 per meter while the other fence costs $1 per per meter. What dimensions of the yard *maximize* the enclosed area. WeBWorK set Day 33, #1.



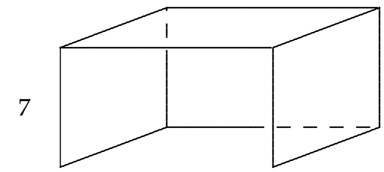
Did you determine a domain for your function? Have you justified your answer based on this domain?

2. Most shipping cartons are constructed with double layers of cardboard at the top and bottom (where the carton folds over on itself). If such a carton with a square base is to hold 16,000 cubic cm, what dimensions minimize the material used (surface area, include double top and bottom)? WeBWorK set Day 33, #2.



Did you determine a domain for your function? Have you justified your answer based on this domain?

3. President Gearan wants to build a rectangular open storage shed on the quad that will hold 686 cubic feet. It will be 7 feet tall, with a flat roof, no front and no floor (just three walls and a roof). What dimensions minimize the amount of materials used? Note: The base need NOT be square. WeBWorK set Day 33, #3.



No floor, no front

4. [Easy, be careful.] Find the two non-negative numbers x and y with $x + y = 4$ so that $x^2 + y^2$ is a maximum.

5. On Wednesday we will graph with HA's and VA's. Review limits at infinity and infinite limits. WeBWorK Day 33.

(*a*) $\displaystyle \lim_{x \to +\infty} \frac{3 - 2x^2}{3x^3 - 1}$

(*b*) $\displaystyle \lim_{x \to +\infty} \frac{3 - 2x}{3x - 1}$

(*c*) $\displaystyle \lim_{x \to -\infty} \frac{3 - 2x^2}{3x - 1}$

(*d*) $\displaystyle \lim_{x \to 0^-} \frac{x^2 + x - 2}{x^2}$

(*e*) $\displaystyle \lim_{x \to 1^-} \frac{x^2 + x}{x^2 - 1}$