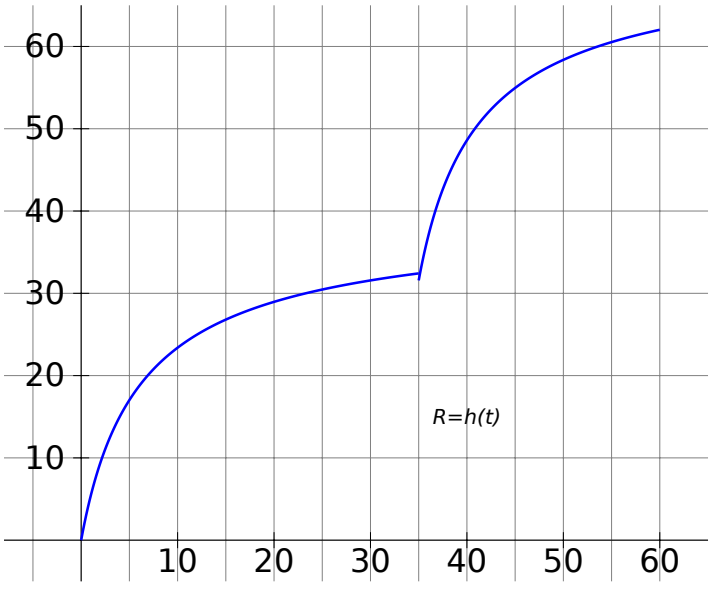
MAT 137
Tutorial #9– Applied optimization problems
November 26–27, 2018

1. You have the opportunity to enter a new business manufacturing luxury Anacleto boxes. An Anacleto box is a square open box: the bottom is a square, the four sides are identical rectangles, and there isn't anything on the top. The box should have a volume of 1000 cm^3. The material for the bottom costs \$2 per cm^2 and the material for each of the four sides costs \$3 per cm^2. You know you will be able to sell each box for \$1,250. Is this a profitable enterprise?

2. A farmer wants to hire workers to pick 1600 bags of beans. Each worker can pick 10 bags per hour and is paid \$1.00 per bag. The farmer must also pay a supervisor \$20 per hour while the picking is in progress. She has additional miscellaneous expenses of \$8 per worker (but not for the supersivor). How many workers should she hire to minimize the total cost? What will the cost per bag picked be?

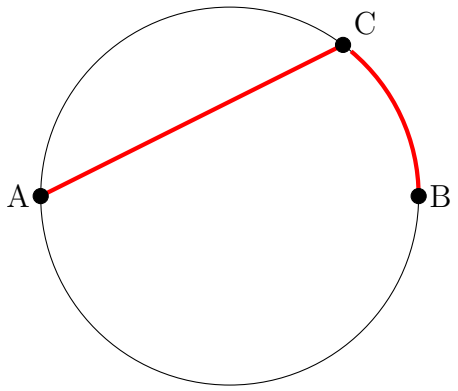
3. You are the CEO of a company that wants to run a commercial during the final of the Stanley Cup. The ad costs \$50,000 per second. Your market research team has produced the graph below. In it, $h(t)$ predicts the extra sales, in hundreds of thousands of dollars, that a commercial of length t seconds will produce. You can buy a commercial of any length between 0 and 60 seconds. Decide how long the commercial should be.



Harder question

4. You are at a point A in the shore of a circular lake with radius R. You want to get to the point B which is diametrically opposite from A. There is a boat at A. You could row in a straight line from A to B. You could also run around the lake all the way from A to B. Or you could row the boat from A to some point C in the coast somewhere in between A and B, abandon the boat, and then run to B. Assume that you can run with velocity v_1 and that you can row with velocity v_2. Assume $v_2 < v_1$ (otherwise, the problem is very easy, can you see why?) Where should the point C be located in order to get from A to B as fast as possible?

   Your answer will, of course, depend on the values of v_1 and v_2.



   Hint: The answer to this problem is surprising. If you solve it routinely and you do not notice anything unusual, chances are you are missing the point and your answer is wrong.