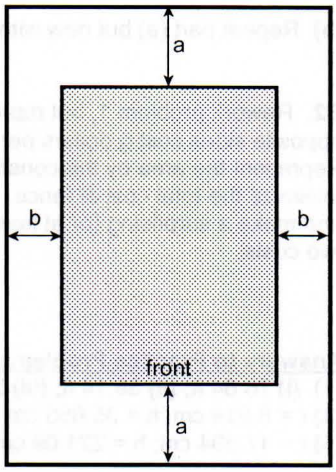
Assignment 6

Applied Optimization

You must submit solutions for problems 2, 4, and 6 (5 marks each question). Problems 1, 3, and 5 are provided as practice problems (answers given on the back of this sheet). To get any marks for any of the bonus questions, your solution must be substantially complete and correct.

1. A rectangular workyard of area 3,000 square feet is to be enclosed. Because of different exposures, the fence along two opposite sides of this rectangular region will cost $20.88 per foot, whereas the fence along the other two opposite sides will cost $40.88 per foot. Determine the dimensions of this yard which will minimize the cost of the fencing and compute the total cost of fencing (before tax) for this optimal design. State your answer as three numerical values in order:
(i) length of yard along the sides that require $20.88 per foot fencing,
(ii) length of yard along the sides that require $40.88 per foot fencing, and finally
(iii) total dollar cost of fencing for the yard.
Round all of your answers to two decimal places.

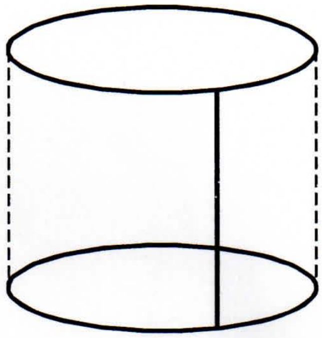
2. A large rectangular warehouse (the shaded region in the diagram) is to be built to satisfy the following conditions. The warehouse must have a total area of 10600 square meters. At the front and the back of the warehouse, there must be at least 24 meters of land to the property line to allow for loading vehicles (the borders labelled 'a' in the diagram to the right). On the sides of the building, there must be at least 14 meters of land to the property line (the borders labelled 'b' in the diagram). Determine the width (distance across the front) and length (distance front to back) of the warehouse so that the total land area required is as small as possible. Also calculate that minimum land area required. Your answer must be three numbers in order:
(i) the width of the warehouse in meters,
(ii) the length of the warehouse in meters, and
(iii) the total land area required in square meters.



3. A closed top cylindrical container is to be made to hold 8.9 litres. The cost of materials for the circular top and bottom are twice as much as the cost of materials for the cylindrical tube forming the sides. Determine the dimensions of this container (r and h) to result in the smallest possible cost of materials.

4. A closed top cylindrical container is to be fashioned to have a surface area no larger than 14500 square centimetres. Determine the dimensions of the container satisfying this condition which will have the largest possible internal volume.

5. A company must fabricate cylindrical steel containers with a volume of 215 litres for shipping their product. Because of the nature of their product, the welds required to form the closed container (the heavy lines in the diagram) are particularly costly, and so the goal is to determine dimensions for this container which will result in the smallest possible total cost of producing these welds. The weld around the bottom of the container is three times as costly as the other welds per centimetre. Determine what the radius and height of the container must be.
Your answer will consist of two numbers, in order:
(i) the radius of the circular cross-section of the container, and
(ii) the height of the container,
both in centimetres.



6. A piece of wire 320 cm long can be formed into a circle, or a square, or it can be cut into two pieces to form both a circle and a square. Determine the dimensions of the shape or shapes formed which will result in **(a)** a maximum combined area being enclosed, and **(b)** a minimum combined area being enclosed by the two shapes.

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