Optimization and Rectilinear Motion Practice

1. A farmer with 750 ft of fencing wants to enclose a rectangular area and then divide it into four pens with fencing parallel to one side of the rectangle. What is the largest possible total area of the four pens?
2. A box with an open top is to be constructed from a square piece of cardboard, 3 ft wide, by cutting out a square from each of the four corners and bending up the sides. Find the largest volume of the box.
3. A rectangular storage container with an open top is to have a volume of 10 m3. The length of its base is twice the width. Material for the base costs $10 per square meter. Material for the sides costs $6 per square meter. Find the cost of materials for the cheapest such container.
4. Find the point on the line y = 2x-3 that is closest to the origin.
5. Find the area of the largest rectangle that can be inscribed in a right triangle with legs of lengths 3 cm and 4 cm if two sides of the rectangle lie along the legs.
6. Find the positive number with the property that the sum of the number and twice the square of its reciprocal is a minimum.
7. A closed rectangular box with a square base is constructed with a top costing twice as much as the sides and bottom. The box is to contain 96 in3. What should be the dimensions in order to minimize the building cost?
8. Find the dimensions of the right circular cylinder of greatest volume that can be placed inside a right circular cone with a radius of 6 in and height of 12 in.
9. Two trees 21 ft apart are to be reinforced by a nylon rope connected to the trunks and tied at ground level to a stake in the ground between the trees. If the rope is tied 15 ft above the ground on one tree and 20 ft above the ground on the other, find the location of the stake that will minimize the amount of rope used.
10. You are designing a rectangular poster to contain 50 in2 of printing with a 4 in. margin at the top and bottom and a 2 in. margin at each side. What overall dimensions will minimize the amount of paper used?
11. A rectangle is to be inscribed under the arch of the curve y = 4 cos (0.5x) from x=- to x = . What are the dimensions of the rectangle with the largest area and what is the largest area?
12. Describe the motion of s(t) = -2t3 + 15t2 – 24t – 6 on the interval [0,5].
13. Describe the motion of s(t) = 5cos(/4t) on the interval [0,8].
14. A projectile is fired directly upward so that its height (in ft) above the ground at any time t (in sec) is given by s(t) = -16t2 + 64t + 30. a) Find the velocity and acceleration at any time t b) Find the maximum height of the projectile c) Find the duration of the flight d) Find the velocity when the projectile strikes the ground.

ANS. 1. 14062.5 ft2 2. V = 2 ft3 with 0.5 ft cut 3. w = 1.651m C = $163.54 4. (1.2, -0.6) 5. 3 cm2

6. 1.5874 7. 4 in x 4 in x 6 in 8. r = 4in, h = 4in 9. 9 ft from the 15 ft high rope 10. 18in x 9in

11. w=3.44, h =2.61, A= 8.98