Sections 5.5, 5.7, 6.1

Exercise 1. A parcel delivery service will deliver a package only if the length plus girth (distance around) does not exceed 108 inches.

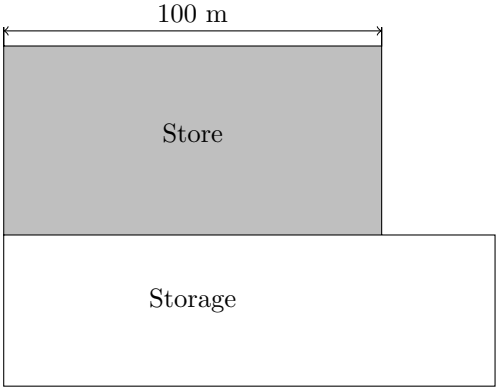
1. Find the dimensions of a rectangular box with square ends that satisfies the delivery service's restriction and has maximum volume. What is the maximum volume?

2. Find the dimensions (radius and height) of a cylindrical container that meets the delivery service's requirement and has maximum volume?

The owner of an irrigation supply store wants to construct a fence to enclose an outdoor storage area adjacent to the store, using all of the store as part of one side of the area. Find the dimensions that will enclose the largest area if

1. 240 feet of fencing material are used.

2. 400 feet of fencing material are used.



Exercise 2. A farmer want to fence an area of 20000 square meter in a rectangular field and ten divide it in 3 equal pens with the fences parallel to one of the slides of the rectangle. How can he do this so as to minimize the cost of the fence.

Exercise 3. A box with an open box is to be constructed from a square piece of cardboard, 2m wide, by cutting out a square from each of the four corner and bending up the sides. Find the largest volume that such a box can have.

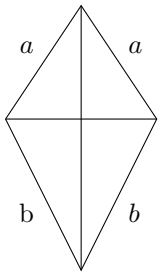
Exercise 4. A wire 30" long is cut into two pieces of possibly different lengths, with one piece bent into a circle and the other bent into a square. How long must each piece be to minimize the total area enclosed by the circle and square?

Exercise 5. A rectangular box with open top has height h, length l and width w. The length of the box is twice its width and the volume of the box is 12 ft^3. The material for the base cost \$8 per ft^2 and the material for the sides costs \$3 per ft^2. Find the dimension of the box that will minimize the cost of the material. What is the minimal cost? Show that your answer gives a minimum.

Exercise 6. Find the point on the parabola $x + 2y^2 = 0$ that is closest to the point $(0, -9)$

Exercise 7. A poster is to have an area of 180cm^3 with 2cm margins at the bottom and sides and 5 cm at the top. What is the dimension of the poster with the largest printed area.

Exercise 8. The frame of a kite is to be made from six piece of wood. The four exterior pieces have been cut with the lengths indicated in the figure. To maximize the area of the kite, how long should the diagonal pieces be?



Exercise 9. A steel pipe is being carried down a hallway 3m wide. At the end of the hall there is a right-angles turn into a narrower hallway 2m wide.What is the dimension of the longest pipe that can be carried horizontally around the corner?

Exercise 10. Find the most general antiderivative of the functions

$$f(x) = 2x^4 + \frac{3}{x^5} + \mathrm{e}^x$$

$$f(x) = \frac{x^2 + \sqrt{x} + 1}{x}$$

Exercise 11. Find the function f such that

$$f'(x) = \frac{1}{1+x^2} + \frac{1}{\sqrt{1-x^2}}, \qquad -1 < x < 1, \quad f(0) = 5$$

$$f''(x) = 2\cos x - 3\sin x, \quad f'(0) = 4, \quad f(0) = -2$$

Exercise 12. An object moves along the x axis so that its position at time $t = 1$ is $x = 0$ and its velocity is $x'(t) = 3t^2 - 10t + 7$. Find the position at time t.

Exercise 13. A car is traveling at 120km/h when the brakes are fully applied, producing a constant deceleration of 20km/s^2. What is the distance covered before the car comes to a stop.

Exercise 14. A projectile is fired with an initial speed of 500m/s and angle of elevation 30°. Find

1. The range of the projectile.

2. The maximum height reached,

3. The speed at the impact.

Exercise 15. Write the sum in expanded form

$$\sum_{i=0}^{7} \frac{(-1)^i(i-1)}{i+1}$$

Exercise 16. Write the sum using sigma notation

$$\frac{1}{1} + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \cdot + \frac{1}{n^2}$$

Exercise 17. Find the value of the sum

$$\sum_{k=0}^{n} (i+1)(i+2)$$

$$\sum_{j=0}^{9} \frac{(-1)^i}{3^i}$$

$$\sum_{j=2}^{n} \left(\frac{2}{3}\right)^n$$