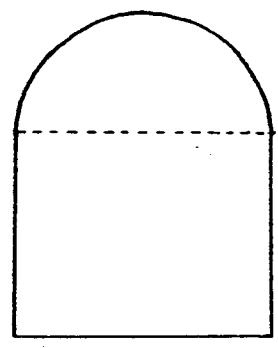


ESP  
Kouba  
Worksheet 13

1. For what values of  $x$  is  $f'(x) = 0$  if  $f(x) = 3 + \sec 2x$  ?

2. An eagle egg is accidentally bumped from its nest on a high cliff, and falls through the air toward the ground. If it strikes the ground traveling at a speed of 60 miles per hour, from how high did the egg fall ?

3. Construct a window in the shape of a semi-circle atop a rectangle. If the total distance around the edge of the window is ten feet, what dimensions of the rectangle maximize the total area of the window ?

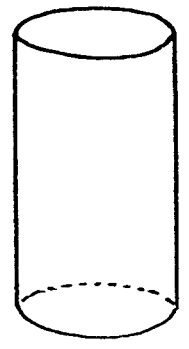


4. Determine the point  $(x, y)$  on the graph of  $y = 2x$  which is nearest the point  $(3, 0)$ .

5. Determine the point  $(x, y)$  on the graph of  $y = 2/x$  (in the first quadrant) which is nearest the point  $(0, 0)$ .

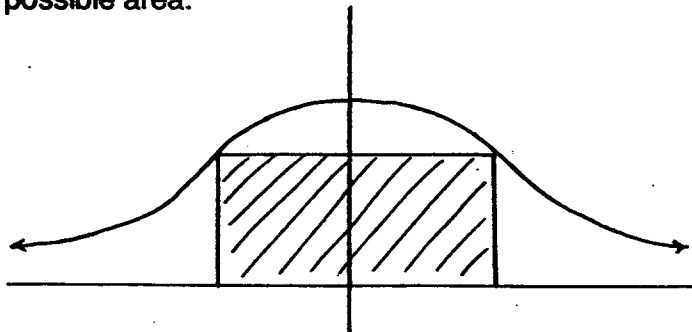
6. An open rectangular box with square bottom is to have a volume of 4 cubic feet. What box dimensions will minimize the surface area of the box ?

7.



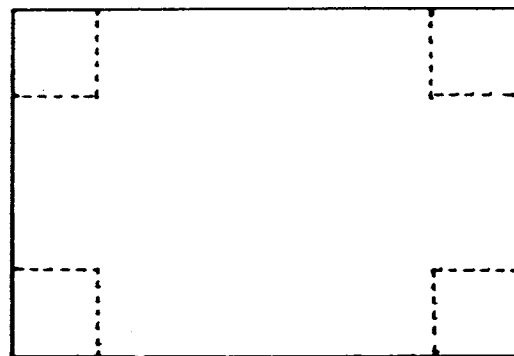
A garbage can in the shape of a right circular cylinder with no top is to be constructed from all of  $3\pi$  square meters of material. What height  $h$  and base radius  $r$  will result in the largest possible volume ?

8. A rectangle is to be inscribed below the graph of  $y = \frac{4}{x^2 + 1}$  and above the x-axis. Find the dimensions of the rectangle of largest possible area.



9. Consider the functions  $y = 1/x$  (in the first quadrant) and  $y = -1/2 x - 3$ .
- Sketch the graph of each function on the same set of axes.
  - Determine the shortest distance between the graphs of the two functions.

10. A piece of cardboard six feet wide by ten feet long is to be made into an open box by cutting out equal-sized squares from each corner and folding up the remaining edges. What size of squares will result in a box with maximum volume ?



11. An open rain gutter is to be made from a long sheet of metal, which is two feet wide, by folding it down the middle in such a way that an angle of measure  $\theta$  is formed. Determine that angle measure which results in the maximum flow of water through the rain gutter.

