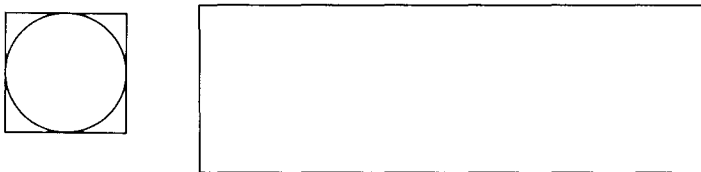


Use proper notation and show all work for full credit. Label all sketches with appropriate values and/or symbols. Use algebra whenever possible to find maximums and minimums. If you use your calculator to sketch a graph, you must include an accurate sketch. Neatness and completeness of answers/solutions are important.

1. You are asked to build an open cylindrical can with volume 172 cubic inches. You will cut its bottom from a square of metal and form its curved side by bending a rectangular sheet of metal (as shown below). Express the total amount of material needed to build this can as a function of the radius.



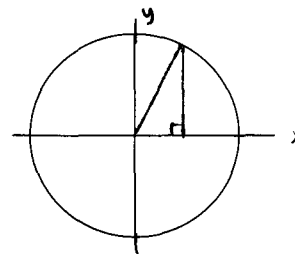
2. A person of height 6 feet casts a shadow while standing near a lamppost that is 19 feet tall. Express the length of the shadow as a function of the distance the person is standing from the lamppost. Include a clear sketch.

3. The product of two numbers is 28. Express the sum of the squares of the two numbers as a function of a single variable.

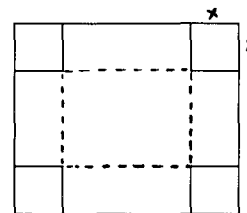
4. Express the volume of a sphere as a function of its surface area.

5. Consider the right triangle drawn in the circle of radius 5 shown at the right.

- A. Express the area of the triangle as a function of  $x$ .
- B. Express the perimeter of the triangle as a function of  $y$ .



6. You will build an open box out of a sheet of cardboard by cutting out squares in each corner then fold up the sides. The cardboard is  $A$  inches wide and  $B$  inches long. Express the volume of the resulting box as a function of  $x$ . Note: your answer will also have  $A$  and  $B$  in it, but these are constants.



7. Suppose the function  $p = 160 - \frac{1}{5}q$  relates the selling price of an item in dollars to the quantity  $q$  that is sold.

A. Express the revenue as a function of  $q$ .

B. Find the quantity sold that would maximize revenue. What is the selling price?

8. A wire of length 30 inches will be cut into two pieces. One piece will be bent into a square and the other into a rectangle. The longer side of the rectangle will be 1 inch longer than the short side.

A. Express the total area of the two figures as a function of the position of the cut. Include sketches.

B. Where should we cut the wire so that the total area of the figures is a minimum? A maximum?

9. The operating cost of a truck is  $12 + \frac{x}{6}$  cents per mile when the truck travels  $x$  miles per hour along a 400 mile turnpike. The driver earns \$6 per hour.

A. Express the total cost of the trip in dollars as a function of the speed of the truck.

B. If the truck can only travel between 35 and 60 miles per hour, find the speed that would minimize the total cost. What is the total cost?

10. A. Express the distance between the point  $(-1, 2)$  and any point on the graph of  $y = 2 + \sqrt{5 - x}$  as a function of  $x$ .

B. Find the exact coordinates of the point on the graph that is closest to  $(-1, 2)$ .