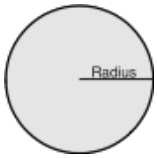
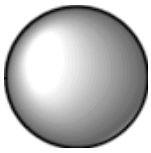
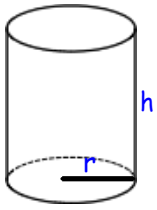
Formula Recall

Circle: 

$C = 2\pi r$ $A = \pi r^2$

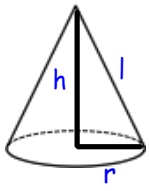
Sphere: 

$SA = 4\pi r^2$ $V = \frac{4}{3}\pi r^3$

Cylinder: 

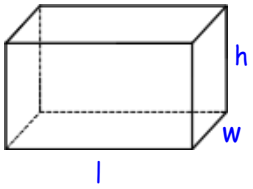
$V = \pi r^2 h$ $lat.\ SA = 2\pi rh$

$Tot.\ SA = 2\pi rh + 2\pi r^2$

Cone: 

$$V = \frac{1}{3}\pi r^2 h \qquad lat.\ SA = \pi rl$$

$$Tot.\ SA = \pi rl + \pi r^2 \quad where\ \ l = \sqrt{r^2 + h^2}$$

Prism: 

$$V = lwh$$

Other Areas

$$A_{triangle} = \frac{1}{2}bh$$

$$A_{trapezoid} = \frac{1}{2}h(b_1 + b_2)$$

Coordinate Geometry

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) \qquad m = \frac{y_2 - y_1}{x_2 - x_1}$$

General Rules for Solving Optimization Problems

1. Identify and assign Variables. If possible, draw a picture.

2. Express the quantity to be maximized or minimized in terms of these variables.

3. Identify the relations among the variables so that you can express all the variables in terms of ONE variable.

4. Calculate f',set f'(x)=0, find the Max and/or Mins with number line analysis. Max (+ → -) and Min (- → +)

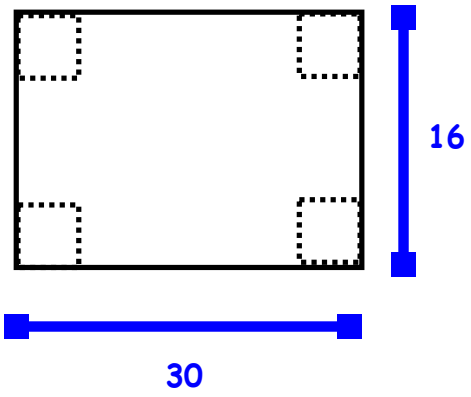
   • Check endpoints when necessary!

Ex 1) Find two positive numbers whose sum is 20, and whose product is a ***maximum***.

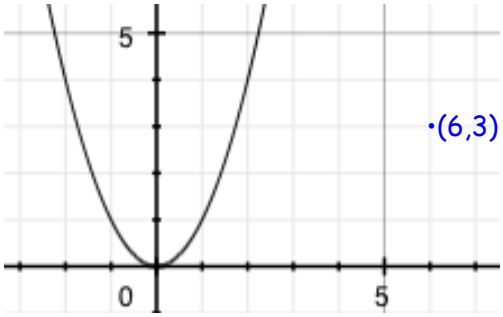
Ex 2) A Farmer wishes to put up a fence to corral his cows in the shape of a rectangle. He has 100 yards of fencing. What should the length and width be of the corral to have the maximum area?

Ex 3) You are an ice cream fanatic. A cone with a slant height of 6 in. is to be constructed. What should be the height and radius of the cone so that the volume of ice cream in the cone is a maximum ?

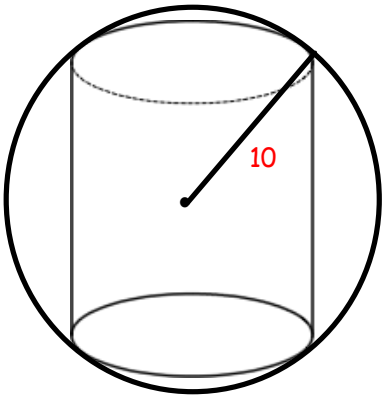
Ex 4) An OPEN box is to be made from a 16" by 30" piece of cardboard by cutting out squares of equal size from 4 corners and bending the sides up. What size should the squares be to obtain a box with the largest possible volume?



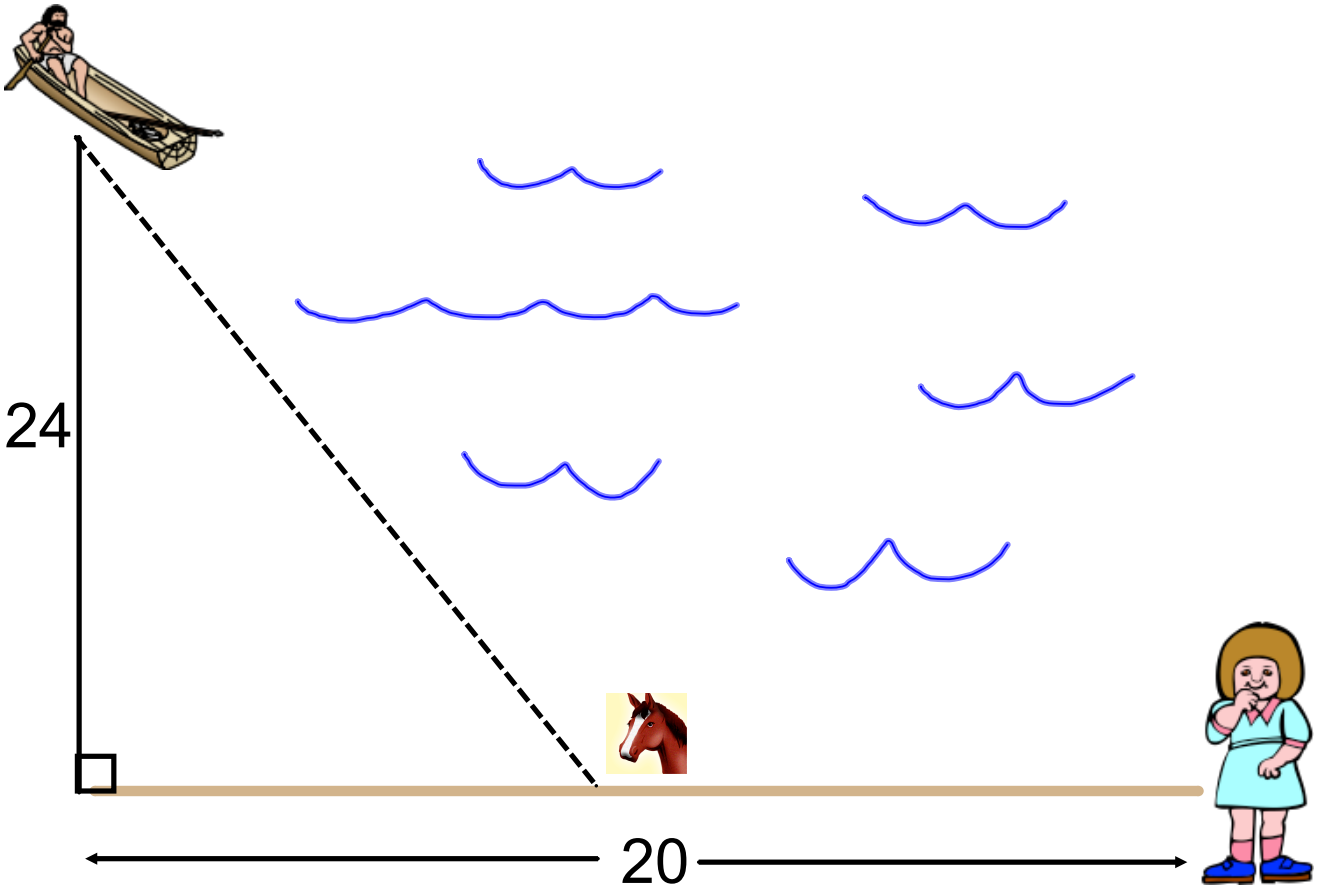
Ex 5) Find the point on the curve $y = x^2$ which is closest to the point (6,3).



Ex 6) Find the volume of the largest right circular cylinder that can be inscribed in a sphere with a radius of 10 inches.



Ex 7) A man in a boat is 24 miles from a straight shore and wishes to reach a point 20 miles down shore to see his honey bunch, . He can travel 5 miles per hour in the boat and 13 miles per hour by horse on land. At what point should he land his boat on the other side in order to MINIMIZE the time required to meet his desired destination



Ex 8) A cylindrical soda keg is to hold 12 L. The cost of the material for the top and the bottom is $\$.03/m^2$ and the material for the sides costs $\$.02/m^2$.
Find the radius and the height for the most economical keg.

Ex 9) What is the largest rectangle that can be inscribed in the circle $x^2 + y^2 = 4$, where all vertices are ON the circle ?