1. Find the largest rectangle in the first quadrant that one can find within the region bounded by the curve of $y = 1 - x^2$, $x - axis$ and $y - axis$.
2. Find the largest rectangle that one can find within the region bounded by the line connecting $(0, 8)$ and $(5, 0)$, $x - axis$ and the $y - axis$.
3. Find the shortest distance from the point $(0, 1)$ to the curve $y = 2 - x^2$.
4. An open box is to be made from a 16 inches by 30 inches piece of cardboards by cutting out squares of equal size from the four corners and bending up the sides. What size should the squares be to obtain a box with largest possible volume?
5. The temperature T of food placed in a refrigerator is modeled by

$$T(t) = 20\left(\frac{4t^2 + 16t + 75}{t^2 + 4t + 10}\right),$$

where t is the time (in hours).

   a. Find $T'(t)$.
   b. Find the instantaneous rate of change of T with repect to t when $t = 2, t = 4, t = 6$, and $t = 10$ respectively.
   c. What can you conclude from (b)?
6. If $P(x) = -0.25x^2 + 2000x + 250$ represent the profit function.

   a. Find the marginal profit.
   b. Use the **marginal profit** to estimate the profit for the $30th$ unit.
   c. Find the number of units produced which will maximize the profit.