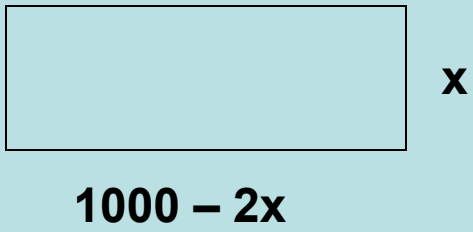
3. A rectangular field is to be bounded by a fence on three sides and by a straight stream on the fourth side. Find the dimensions of the field with maximum area that can be enclosed by using 1000 ft of fence.

$\text{Area} = x(1000-2x)$

$A' = 1000 - 4x = 0$

$X=250$



or

Vertex of inverted parabola x value is:

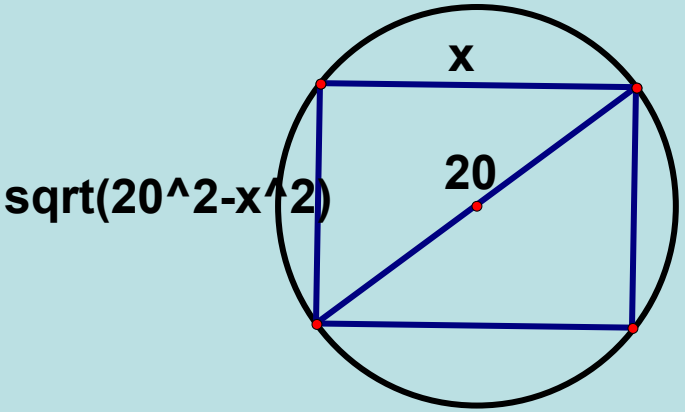
$$\frac{-b}{2a} = \frac{1000}{2(2)} = 250$$

9. Find the dimensions of the rectangle with maximum area that can be inscribed in a circle of radius 10

$$\text{Area} = x\sqrt{20^2 - x^2}$$

$$A' = \frac{400 - 2x^2}{\sqrt{400 - x^2}}$$

$$A' = 0 \text{ @ } x = \sqrt{200} = 10\sqrt{2}$$



15. Suppose that the number of bacteria in a culture at time t is given by N = 5000(25 + te^(-t/20). (a) Find the largest and smallest number of bacteria in the culture during the time interval $0 \leq t \leq 100$. (b) At what time during the time interval is the number of bacteria decreasing most rapidly?

21. A closed rectangular container with a square base is to have a volume of 2000 cm^3. It costs twice as much per square centimeter for the top and bottom as it does for the sides. Find the dimensions of the container of least cost.

$$V = \pi r^2 h = 2000\ cm^3 \qquad h = \frac{2000}{\pi r^2}$$

$$SA = 2\pi r^2 + 2\pi r h$$

$$SA = 2\pi r^2 + 2\pi r\left(\frac{2000}{\pi r^2}\right) = 2\pi r^2 + \frac{4000}{r}$$

$$SA' = 4\pi r - \frac{4000}{r^2} = \frac{4\pi r^3 - 4000}{r^2} \qquad h = \frac{2000}{\pi\left(\sqrt[3]{\frac{1000}{\pi}}\right)^2}$$

$$\frac{4(\pi r^3 - 1000)}{r^2} = 0 \quad @ \quad r = \sqrt[3]{\frac{1000}{\pi}}$$