Honors Analysis Name _____

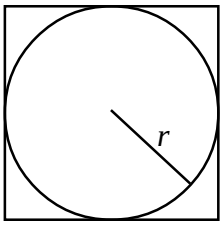
Copy original problem. Per _____ Date _____

Convince *me* that **you** understand the concept***!***

Chapter 4 Applications Exam

You may use a calculator on this exam.

I A circle is inscribed in a square as shown in the figure. The circumference of the circle is increasing at a constant rate of six inches per second. As the circle expands, the square expands to maintain the condition of tangency. (40 pts tot)



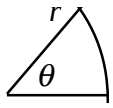
a) Find the rate at which the **perimeter** of the *square* is increasing. Indicate units of measure.

b) At the instant *when* the area of the circle is 25π square inches, find the rate of increase in the area **enclosed between** the circle and the square. Indicate units of measure.

$A_{\text{circle}} = \pi r^2$

$C_{\text{circle}} = 2\pi r$

II A region is in the shape of a wedge of a circle as shown. If the total area of the wedge is 4π, what should θ be to minimize the perimeter? Verify using f'' test. (30 pts)



$Area_{\text{sector}} = \frac{1}{2} r^2 \theta$

$Perimeter_{\text{sector}} = 2r + r\theta$

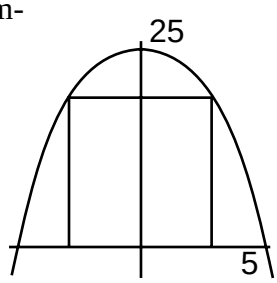
III A rectangle has two of its vertexes on the x - axis and the other two above the x - axis and on the graph of the parabola: $y = 25 - x^2$. See the picture on the right. (30 pts tot)

a) If the coordinates of **one** of the vertexes is $(3, 16)$, what is the area and perimeter of the rectangle?

b) What is the area and perimeter of the rectangle which has *largest* **area** ?

c) What is the area and perimeter of the rectangle which has *largest* **perimeter** ?

d) Are you surprised by the similarity of the answers of parts b and c?



Extra Credit ---------- 5 pts ----------

In a forest a predator feeds on prey, and the predator population at any time is a function of the number of prey in the forest at that time. Suppose that when there are x prey in the forest, the predator population is y and $y = \frac{1}{6} x^2 + 90$. Furthermore, if t weeks have elapsed since the end of the hunting season, $x = 7t + 85$. At what rate is the population of the predator growing 8 weeks after the close of the hunting season? Do not express y in terms of *t*, but use the chain rule.