Honors Analysis

Name ______________________________

Copy original problem.

Per ________ Date ______________

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

Chapter 4 Applications Exam

I

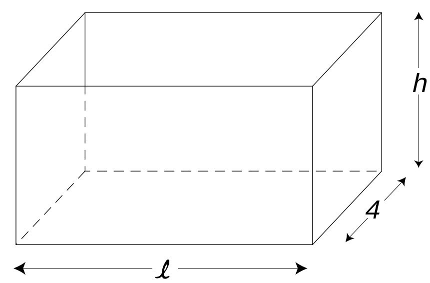
Let $f(x)=12-x^2$ for $x\geq 0$ and $f(x)\geq 0$. (15 pts ea)

a) The line tangent to the graph of $f(x)$ at the point $(k, f(k))$ intercepts the x-axis at $x=4$. Draw a useful sketch and label the points stated and draw the tangent line. Determine the value of k .

b) An isosceles triangle whose base is the interval from $(0,0)$ to $(c,0)$ has its vertex on the graph of $f(x)$. Draw a new picture which includes the triangle. Be sure all significant points are clearly labled. For what values of c does the triangle have maximum area? Justify, of course.

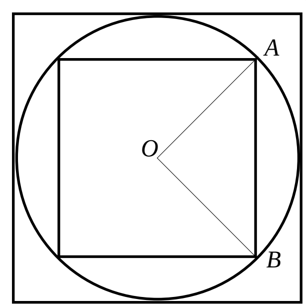
II

A tank with a rectangular base and rectangular sides is to be open at the top. It is to be constructed so that its width is 4 meters and its volume is 36 cubic meters. If building the tank costs \$10 per square meter for the base and \$5 per square meter for the sides, what is the cost of the least expensive tank?
(30 pts)



III

Consider the figure on the right composed of two squares and a circle. The circle has center *O*. r is the radius of the circle and is lengthening at 6 units per second. The sides of the squares lengthen to maintain the same general shape as the figure. (30 pts tot)



a) Explain how you know that $\overline{OC}=\overline{OB}$.

b) How fast is the area of the circle changing when *r* = 3?

c) How fast is the area of the large square changing when *r* = 4?

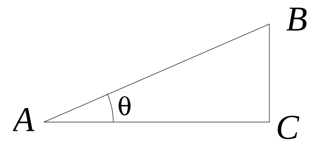
d) How fast is the area of the small square changing when *r* = 5?

e) How many times faster is the rate of change of the perimeter of the outside square as compared to the perimeter of the inside square when *r* = 6?

f) Let area *p* be the area outside of the circle and inside the large square. Let area q be the area outside of the inside square and inside the circle. What is the ratio of the area *p* to the area *q*. Round your answer to 3 decimal places.

IV

Let triangle ABC be a right triangle with a fixed hypotenuse = 1 meter. If θ is increasing at the rate of 4π radians per minute, find the rate at which the side "*a*" is increasing when $\theta=\pi/3$. (10 pts)



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

A group of hikers leave the foot of a mountain at 7:00 A.M. and hikes to the top arriving by 2:00 P.M. They spend the night on the mountain and hike back down the next morning, again leaving at 7:00 A.M. but arriving back at base camp at exactly at noon. Assuming that only one trail exists, did the hikers pass any point at the same *time* on both days? Explain.