**Advanced Placement Calculus** Name _____

Copy original problem. Per _____ Date _____

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

# Last Regular Exam

## I

Given $\frac{1}{2}y^2 = 2x$ and $y - b = 2x$

a) Sketch both graphs such that the two graphs have no intersection. Identify a typical value for *b*. (5 pts)

b) Sketch both graphs such that the two graphs have 2 distinct intersections. Identify a typical value for *b*. (5 pts)

c) Compute the set of values for $b$ such that there will be ... (10 pts tot)

1) no intersection.
2) exactly 1 intersection.
3) exactly 2 intersections.

d) In the case where $b = -4$, let $R$ be the area trapped between the curves. (10 pts ea)

1) Set up but do not evaluate the integral which describes the area of $R$ using horizontal sections.
2) Set up but do not evaluate the integral which describes the area of $R$ using vertical sections.

e) Let $b = 0$. (15 pts tot)

1) Let $R$ be the area in the first quadrant between the curves. Sketch $R$. Set up but do not evaluate the integral which describes the volume of the solid when $R$ is revolved about the *y*-axis using the method of "shells".
2) Let $R$ be the area in the first quadrant between the curves. Sketch $R$. Set up but do not evaluate the integral which describes the volume of the solid when $R$ is revolved about the *x*-axis using the method of "washers".

## II

Given: $r = 1 - \cos\theta$ and $\theta \in [0, \pi]$. (15 pts ea)

1) Set up but do not evaluate the expression which describes the length of the curve.
2) Set up but do not evaluate the expression which describes the area contained by the curve and above the Cartesian *x*-axis.
3) Allow the curve to rotate about the Cartesian *x*-axis. Set up but do not evaluate the integral which yields **surface** area.

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

Let $R$ be the area trapped below the line $y = 9$ and above the curve $y = x^2$. The line $y = k$ divides $R$ such that the part of $R$ above $y = k$ is equal to the part of $R$ below $y = k$. Find $k$. Justify.