Math 107H, Fall '10 **Test 3** **Score:** _____

Name: _____ **TA's Name:** _____

Instructions: You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

1(15pts) Two points, $P(1,1,1), Q(2,2,0)$, are given.

(a) Find the mid-point between P and Q. (Suggestion: draw a picture, not necessarily to the scale, to show the mid-point.)

(b) If $\vec{v} =< 1,2,3 >$, find the point R that is $2\vec{v}$ from the point P.

(c) Find the angle between $\vec{PQ}$ and $\vec{v}$.

2(10pts) (a) Find the equation in the polar coordinate for the curve by the equation $\sqrt{x^2+y^2} + \frac{y}{x} = 1$.

(b) Find the equation for the curve $r = \sin\theta$ in the Cartesian coordinate.

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3(10pts) You are given two points $P(1,1,1), Q(2,2,0)$.

(a) Find a system of parametric equations for the line through the points P, Q.

(b) Find the distance from a third point $R(1,2,3)$ to the line through P, Q. (Suggestion: draw a picture, not necessarily to the scale, to assist your solution.)

4(10pts) You are given three points $P(1,1,1), Q(2,2,0), R(3,0,1)$.

(a) Find the area of the triangle with the vertexes P, Q, R.

(b) Find an equation of the plane containing these points.

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5(10pts) (a) For this six-leaved rose $r = \cos(\frac{3}{2}\theta)$, find the point in the Cartesian coordinate corresponding to $\theta = \frac{\pi}{6}$.

(b) Find the slope of the tangent line to the curve at that point.

6(10pts) (a) Find the intersections of the circles $r = 1$ and $r = 2\cos\theta$.

(b) Sketch a graph of each circle, and find the area outside $r = 1$ but inside $r = 2\cos\theta$.

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7(10pts) The trajectory of a particle moving in space is given as $\vec{r}(t) = 2\vec{i} + \ln(t^2+1)\vec{j} + (1+t)\vec{k}$. Find the acceleration at the point $\vec{r}(0)$.

8(10pts) A force of 10 lb pulling an object at an angle of 45° with a plane. Find the work done to move it 5 feet on the plane.

9(15pts) A bomb was dropped from a bomber at an altitude of 1000 m when it travels at a ground speed of 180 m/sec. Find the distance ahead at which the bomb will hit the ground.

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2 Bonus Points: Calculus was invented in (a) the 16th century, (b) the 17th century, (c) the 18th century, (d) the 19th century. (*... The End*)