PRINT NAME: ______________________________

Calculus III [2433–001] Midterm III

For full credit, give reasons for all your answers.

Q1]...[points] Find a vector which is perpendicular to the vector $\langle 1, 2\rangle$. Show that your vector is indeed orthogonal to $\langle 1, 2\rangle$.
Find two vectors which are perpendicular to each other and are both perpendicular to the vector $\langle 1, 2, 3\rangle$. Again, verify that all three vectors are mutually perpendicular.
Q2]...[points] Find an equation for the plane which contains the three points $(1, 0, 1)$, $(2, 1, -1)$ and $(2, 2, -2)$. Make sure that you clearly show all the steps in your work.
Write down an equation for the plane which is parallel to the plane above and which contains the point $(0, 0, 0)$. What is the distance between the two planes in this problem?
Q3]...[points] Find a set of parametric equations for the tangent line to the curve

$$\mathbf{r}(t) \;=\; \langle t, t^2, t^3\rangle$$

at the point $(-2, 4, -8)$.
Show that if a point travels along a path with constant speed (i.e. $|\mathbf{v}(t)| = c$, a constant) then it's acceleration is perpendicular to it's velocity at all times (i.e. show that $\frac{d\mathbf{v}(t)}{dt}$ is orthogonal to $\mathbf{v}(t)$).
Q4]...[points] Sketch the polar curve $r = 1 - \sin\theta$.
Compute the area inside the curve $r = 1 - \sin\theta$.
Compute the length of the polar curve $r = \theta^2$ for $0 \le \theta \le 2\pi$.