Math 2030, Winter 2011, Test 1

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1. Find the intersection of the line through $(1, 2, 1)$ and $(2, 1, 2)$ with the plane $2x - z = 3$. (10 pts)
2. Find the plane through $(5, 1, 4)$, $(1, -2, 3)$ and $(2, 1, 0)$. (5 pts)
3. Name, sketch, or otherwise describe the surfaces
   (a) $x^2 - 2y^2 - 3z^2 = 4$ (5 pts)
   (b) $x^2 + 2y^2 + 3z^2 = 4$. (5 pts)
4. Find the projection of $\overrightarrow{(11, 1, 7)}$ onto $\overrightarrow{(2, 1, 1)}$. Write $\overrightarrow{(11, 1, 7)}$ as the sum of a vector parallel to $\overrightarrow{(2, 1, 1)}$ and a vector perpendicular to $\overrightarrow{(2, 1, 1)}$. (10 pts)
5. Find the line of intersection of the planes $2x - y + z = 1$ and $x + y + z = 1$. (10 pts)
6. (a) Find the point of the plane $5x - y - z = 2$ closest to $(-9, 4, 3)$. (10 pts)
   (b) Find a point half way between $(-9, 4, 3)$ and the plane. (5 pts)
7. Show that the line through $(1, 3, 3)$ and $(2, 3, 6)$ lies in the paraboloid $z = xy$. (10 pts)
8. Let $\vec{r}(t) = (t^2 - t, t^3 + t, t^2 - t^3)$.
   (a) Compute $\vec{v}(t)$. (5 pts)
   (b) Compute $\vec{a}(t)$. (5 pts)
   (c) Decompose $\vec{a}(1)$ into normal and tangential components. (5 pts)
   (d) Compute (ds/dt) when $t = 1$. (5 pts)
   (e) Compute the curvature κ at $t = 1$. (5 pts)
   (f) Write an equation for the line tangent to the curve at $t = 1$. (5 pts)

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