Math 32AH
Homework 5 Solutions

I graded 4 of the problems:
Page 137: 14, 31;
Page 145: 4, 7.

Each problem is worth 3 points. A grade of 0 indicates no solution or a substantially wrong solution. A grade of 3 indicates a correct or nearly correct solution. Otherwise the grade given is 1 or 2 depending upon how much work was put in and how close the solution is to being correct. How neat and clear your solution is also affects the grade I give.

If you believe a problem was misgraded, or I made some addition or other error, please write a short note explaining the situation, attach it to your homework, and return it to me (either in person, in my mailbox, or under my office door). I'll take a look and return the homework in the next section.

The following are solutions to the homework problems and additional comments for the problems I graded.

General Comments
The maximum number of points was 12. The high score was 12, the median was 12 and the mean was 11.3. Everyone did very well, and there are a few quite good artists in the class also.

Note: Since graphs are hard to include in LaTeX files, I haven't tried. See me if you need any help drawing these graphs.

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2. Since x can be anything, consider the graph restricted to the yz-plane. This is a parabola. For any fixed value of x we get this same parabola, so the graph is a parabolic cylinder and looks like a sort of trough.

6. Consider what happens for fixed values of z. At $z = 0$ the only point satisfying the equation is $(0, 0, 0)$. For $z < 0$ no points satisfy the equation. Otherwise if $z = c$ for some constant $c > 0$ we have $x^2 + y^2 = 4c$, which is a circle with radius $2\sqrt{c}$. We get a paraboliod of revolution whose picture looks similar to Figure 3.21.

10. We have $x = \pm\sqrt{y}$, and it is enough to revolve the positive branch $x = \sqrt{y}$. Using Theorem 35, we have $r = y$, $s = x$, and $t = z$. The equation is then $x^2 + z^2 = y$.

14. We have $x = \pm 2\sqrt{1 + \frac{y^2}{9}}$, and it is enough to revolve the positive branch $x = 2\sqrt{1 + \frac{y^2}{9}}$. Using Theorem 35, we have $r = y$, $s = x$, and $t = z$. The equation is then $x^2 + z^2 = 4(1 + \frac{y^2}{9})$, which can also be written as $\frac{x^2}{4} - \frac{y^2}{9} + \frac{z^2}{4} = 1$.

22. This is not a surface of revolution. Each of the coefficients of x^2, y^2, z^2 is different.

28. These are ellipses.

31. The level surfaces are spheres centered at the origin of radius $\sqrt{9 - w^2}$. For $w^2 = 9$ the sphere degenerates to a point. For $w^2 > 9$ the are no points in the level surface. For the specific values $w = 0, 2, 3$, the radii of the spheres are $3, \sqrt{5}, 0$ respectively.

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2. Since z can be anything, consider the graph restricted to the xy-plane. This is a hyperbola. For any fixed value of z we get this same hyperbola, so the graph is a hyperbolic cylinder and looks like a sort of pair of troughs.

4. This is symmetric about all three planes. It is a right elliptical cone whose axis is the y axis. For fixed y the graph looks like an ellipse; for fixed x or z the graph looks like two lines intersecting at the origin.

7. This is an elliptical paraboloid, symmetric about the xy and yz planes but not the xz plane. For fixed negative y we get ellipses in the xz plane; for fixed positive y there are no points satisfying the equation, and for $y = 0$ there is the single point at the origin.

12. This is an ellipsoid, symmetric about all three planes.