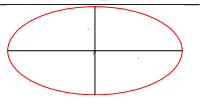
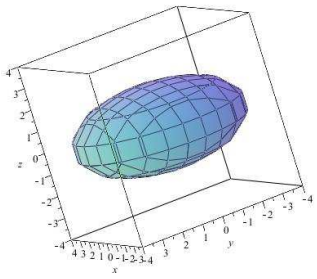
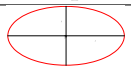
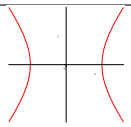
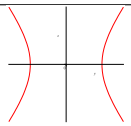
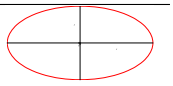
Math 323
A Catalog of Quadric Surfaces

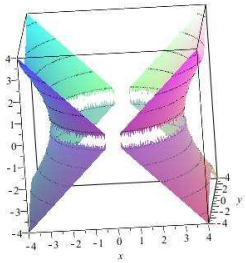
A: Ellipsoids These have equations of the form: $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$

Traces:	**Graph:**
$z=0:\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$	
$y=0:\frac{x^2}{a^2}+\frac{z^2}{c^2}=1$	
$x=0:\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$	

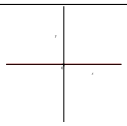
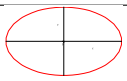
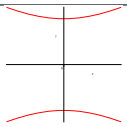
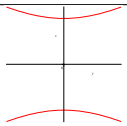


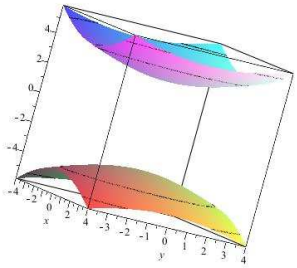
B: Hyperboloids of One Sheet These have equations of the form: $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$

Traces:	**Graph:**
$z=0:\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$	
$y=0:\frac{x^2}{a^2}-\frac{z^2}{c^2}=1$	
$x=0:\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$	
$z=k:\frac{x^2}{b^2}+\frac{y^2}{b^2}=1+\frac{k^2}{c^2}$	

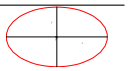
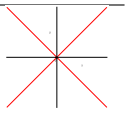
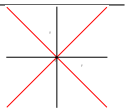


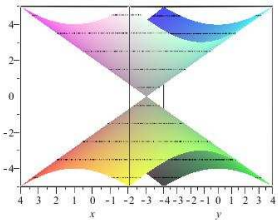
C: Hyperboloids of Two Sheets These have equations of the form: $-\frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$

Traces:	**Graph:**
$z=0:-\frac{x^2}{a^2}+-\frac{y^2}{b^2}=1$	No Solution
$\lvert z\rvert=c:\frac{x^2}{a^2}+\frac{y^2}{b^2}=0$	
$\lvert z\rvert=k>c:\frac{x^2}{a^2}+\frac{y^2}{b^2}=\frac{k^2}{c^2}-1$	
$y=0:-\frac{x^2}{a^2}+\frac{z^2}{c^2}=1$	
$x=0:-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$	

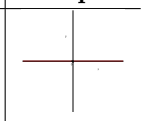
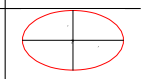
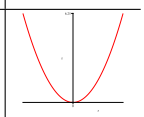
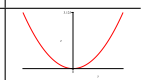


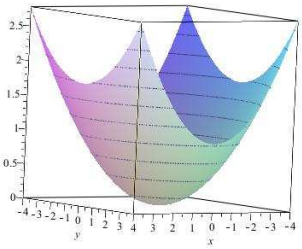
D: Cones These have equations of the form: $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=0$

Traces:	Graph:
$z=0:\frac{x^2}{a^2}+\frac{y^2}{b^2}=0$	
$\lvert z\rvert=k:\frac{x^2}{a^2}+\frac{y^2}{b^2}=\frac{k^2}{c^2}$	
$y=0:\frac{x}{a}=\pm\frac{z}{c}$	
$x=0:\frac{y}{b}=\pm\frac{z}{c}$	

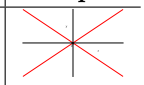
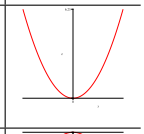
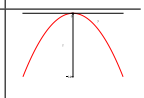
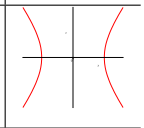


E: Paraboloid These have equations of the form: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=cz$

Traces:	Graph:
$z=0:\frac{x^2}{a^2}+\frac{y^2}{b^2}=0$	
$z=k>0:\frac{x^2}{a^2}+\frac{y^2}{b^2}=ck$	
$y=0:z=\frac{1}{a^2c}x^2$	
$x=0:z=\frac{1}{b^2c}y^2$	



F: Hyperbolic Paraboloid [Saddle] These have equations of the form: $\frac{x^2}{a^2}-\frac{y^2}{b^2}=cz$

Traces:	Graph:
$z=0:y=\pm\frac{b}{a}x$	
$y=0:z=\frac{1}{a^2c}x^2$	
$x=0:z=-\frac{1}{b^2c}y^2$	
$z=k>0:\frac{x^2}{a^2}-\frac{y^2}{b^2}=ck$	
$z=k<0:\frac{x^2}{a^2}-\frac{y^2}{b^2}=ck$