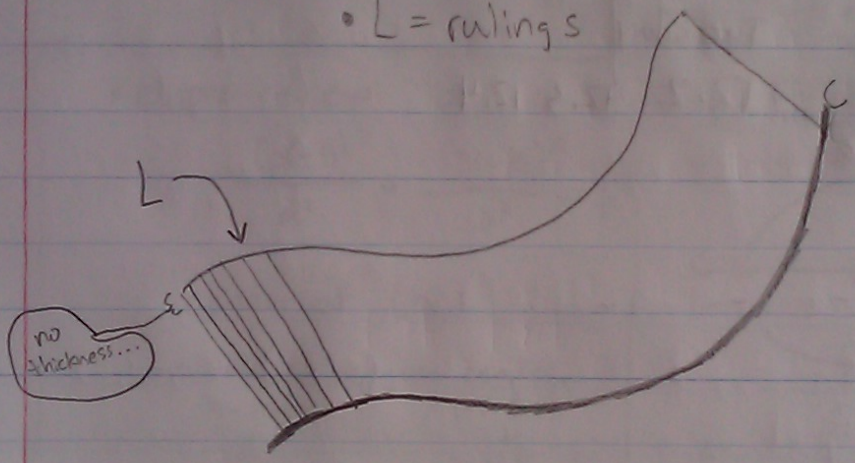
11.6 Surfaces in Space

* pg 812-813 → Lists of surfaces → look at names

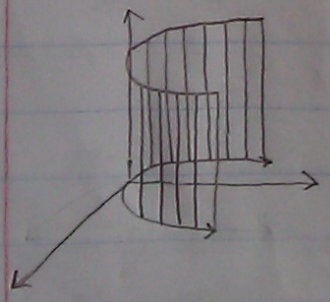
Cylinders (any extruded curve like)

Let C be a curve in a plane and
Let L be a line not parallel in that plane.
The set of all lines parallel to L and intersecting C is a cylinder

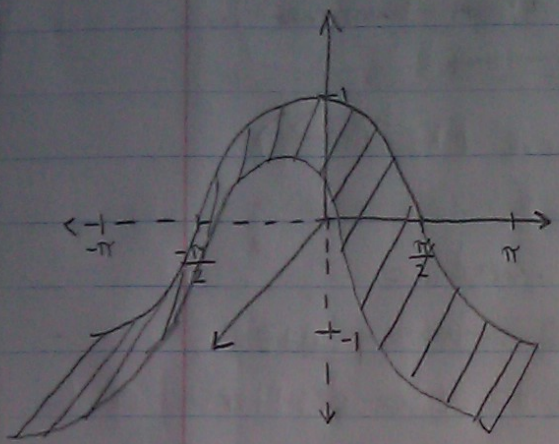
- C = generating curve
- L = rulings



Example $Y = X^2$ is a parabola in the xy plane
Since z is absent, our rulings will be parallel to the z axis



Example $z = \cos y \quad -\pi \leq y \leq \pi$



Calendar

Monday Tuesday

11.6 11.7 12.2 12.3 12.4

Quadrant Surfaces

A quadrant surface is generated by the combination of the three possible traces in $\mathbb{R}^3$

Pg 812-813 (spec)

- Review graphs in pre-calculus
  - conics, parabolas, circles, ellipses

Example

1. $\frac{x^2}{4} + y^2 + \frac{z^2}{9} = 1$

xy-trace

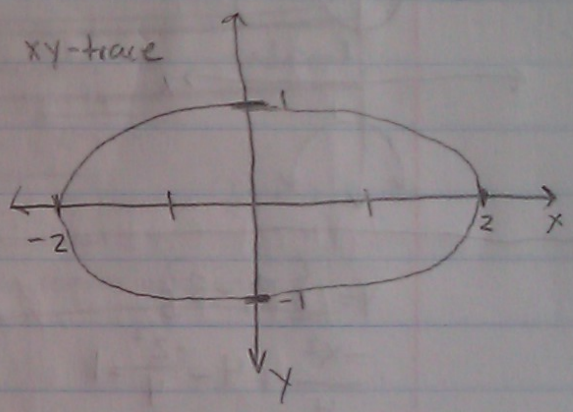
$\frac{x^2}{4} + \frac{y^2}{1} = 1$ $\quad \frac{x^2}{2^2} + \frac{y^2}{1^2} = 1$

- ellipse review

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

center of (h, k)

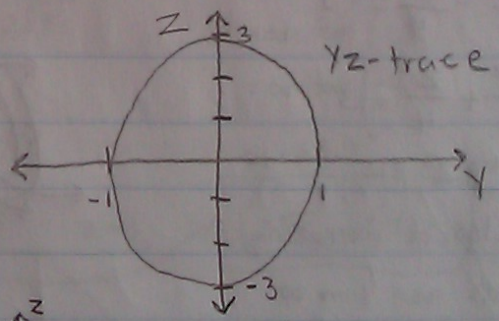
distance between center...
x-radius (a) y-radius (b)



yz-trace

$y^2 + \frac{z^2}{9} = 1$

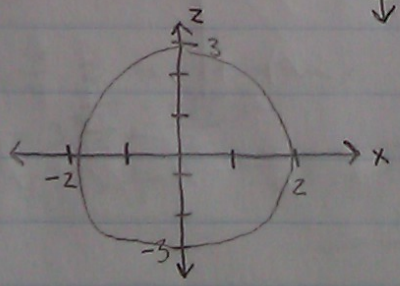
$\frac{y^2}{1^2} + \frac{z^2}{3^2} = 1$

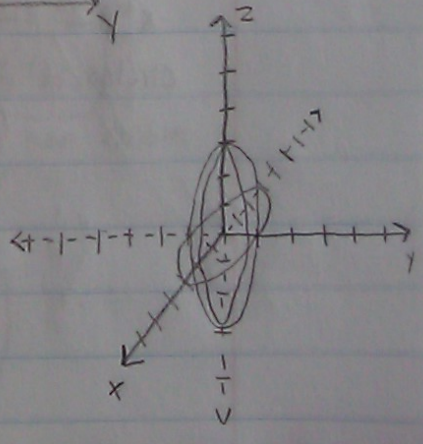


xz-trace

$\frac{x^2}{4} + \frac{z^2}{9} = 1$

$\frac{x^2}{2^2} + \frac{z^2}{3^2} = 1$





• Sum or difference w/ different coefficients, set it equal to 1

② $4x^2 - y^2 + 4z^2 = -16$

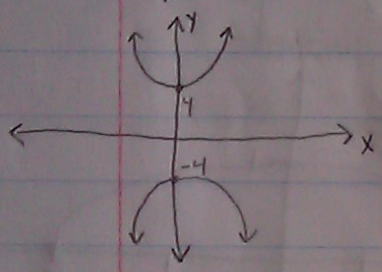
$\frac{-x^2}{4} + \frac{y^2}{16} - \frac{z^2}{4} = 1$

xy-trace

$\frac{-x^2}{4} + \frac{y^2}{16} = 1$

$\frac{y^2}{4^2} - \frac{x^2}{2^2} = 1$

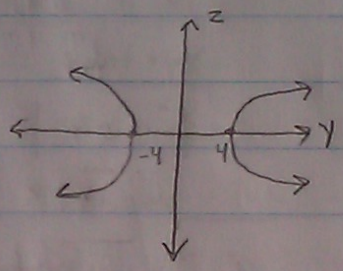
• opens vertically, since y is positive



yz-trace

$\frac{y^2}{16} - \frac{z^2}{4} = 1$

$\frac{y^2}{4^2} - \frac{z^2}{2^2} = 1$



xz trace

$\frac{-x^2}{4} - \frac{z^2}{4} = 1$

cannot happen when $x, z \in \mathbb{R}$

Let's see the minimum values y can be...

$y = \{4, -4\}$

$\frac{-x^2}{4} + 1 - \frac{z^2}{4} = 1$

$\frac{-x^2}{4} - \frac{z^2}{4} = 0$

x and z must both be zero

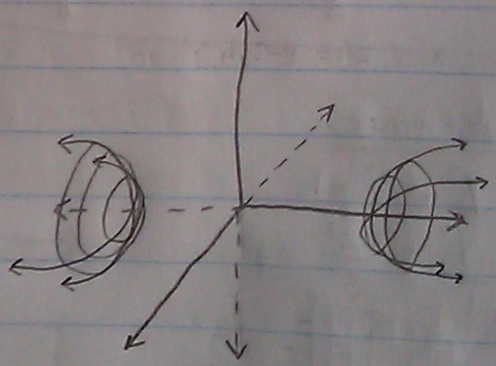
$(0, 4, 0)$ $(0, -4, 0)$

$y = \{8, -8\}$

$\frac{-x^2}{4} + 4 - \frac{z^2}{4} = 1$

$\frac{-x^2}{4} - \frac{z^2}{4} = -3$

$\frac{x^2}{4} + \frac{z^2}{4} = 3$

$x^2 + z^2 = 12$

circles of increasing radius as $y \to \infty$, $y \to -\infty$