2/16

Announcements:

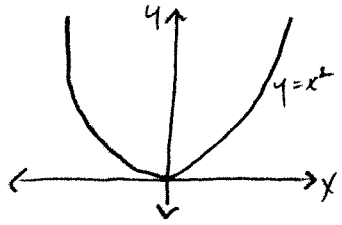
- Th BNW 128 4pm
  Prof. Demers
  "The Google Algorithm"
- Exam Th 2/25
- Review W 2/24
- W Fish
  BNW 319
  Game Night

Surfaces in 3-space

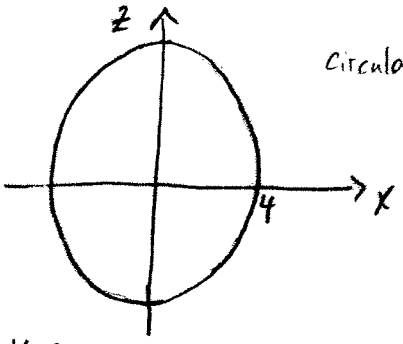
Refer to p. 844 (Table 1) (Quadric Surfaces)

Cylinders (surfaces that are missing a variable)

$y = x^2$
"trough"

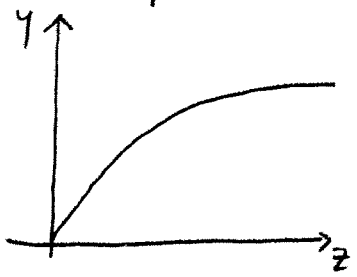


$x^2 + z^2 = 16$

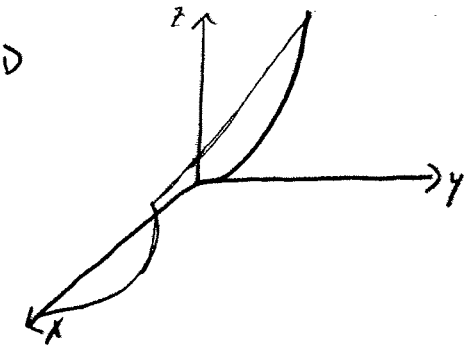


circular cylinder

$y = \sqrt{z}$



in 3-D

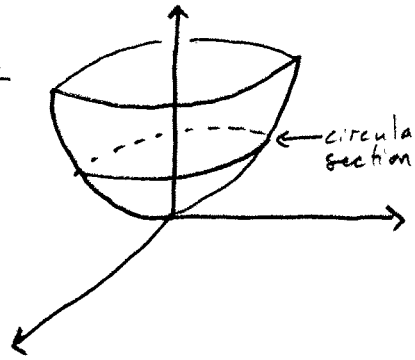


*Visualize cylinders by drawing in a 2-D plane first.

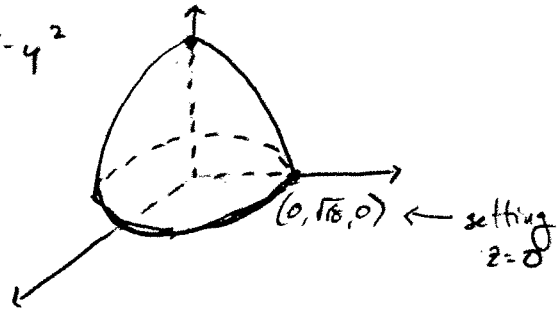
Paraboloids

examples
- $z = x^2 + y^2$
- $z = 3x^2 + 4y^2$
- $x = y^2 + z^2$
- $y = 2x^2 + 3z^2$
- $z = 18 - x^2 - y^2$
- $y = 4 - x^2 - z^2$

$z = x^2 + y^2$



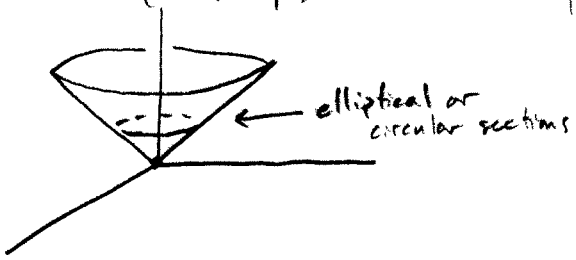
$z = 18 - x^2 - y^2$

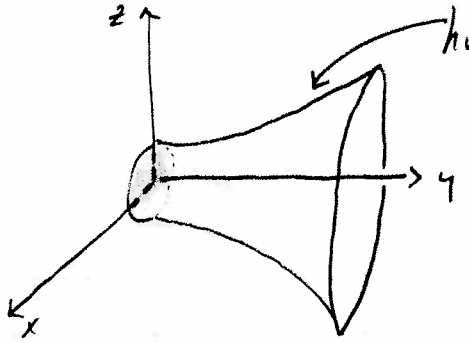


Cones

$z = \sqrt{ax^2 + by^2}$ $\quad a, b > 0$

$z = \sqrt{x^2 + y^2}$ $\quad (z^2 = x^2 + y^2)$ ← similar to paraboloid



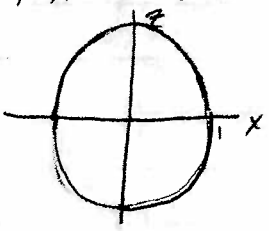


hyperboloid

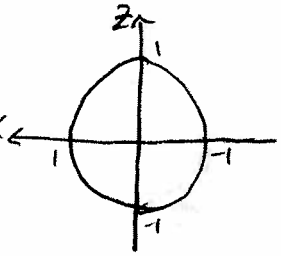
$1 = x^2 + z^2 - y^2$

Let E be the solid bounded by this surface and the planes $y = 0$ & $y = 4$

$y = 0$: $1 = x^2 + z^2 - 0^2$



turned 180° →

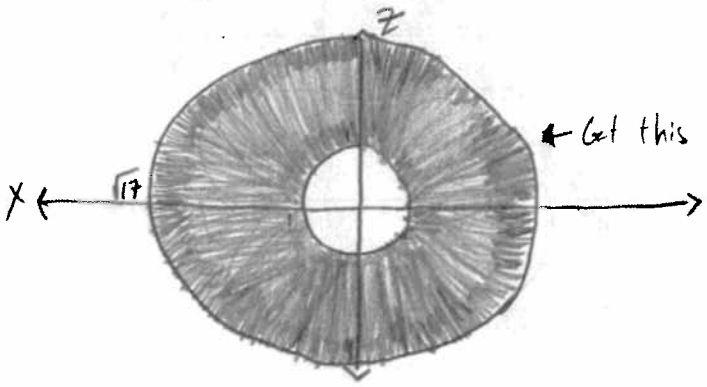


Find object's volume.

We will do so by: $V = \iiint_E 1 \, dV$

integrate constant function 1 anytime you want volume or area.

- Describe E as region between two graphs over a 2-D shadow in one of the 3 coordinate planes.



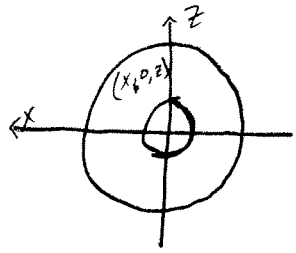
← Get this by setting $y = 4$

$\therefore \; 17 = x^2 + z^2$

Find the two graphs:

$y = \sqrt{x^2 + z^2 - 1}$ where we enter

$y = 4$ where we leave



$\sqrt{x^2+z^2-1} \le y \le 4$

$1 \le r \le \sqrt{17}$

$0 \le \theta \le 2\pi$

$$\int_0^{2\pi} \int_1^{\sqrt{17}} \int_{\sqrt{r^2-1}}^{4} dy\, r\, dr\, d\theta$$