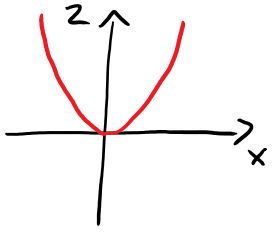
# Section 29.2: Curves and Surfaces in 3D

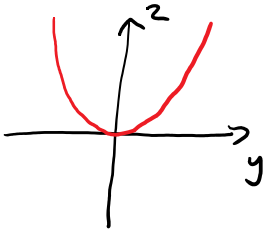
Tuesday, January 23, 2018 10:23 AM

okay, so what does $f(x,y) = x^2 + y^2$ look like?

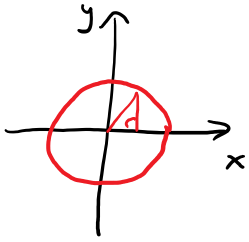
$z = x^2 + y^2$ ← 3D graph



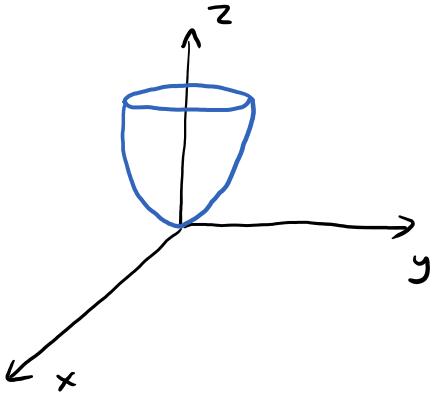

let $y = 0$
$z = x^2$




let $x = 0$
$z = y^2$



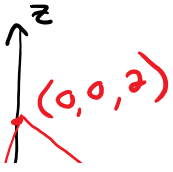

let $z$ = positive constant
$x^2 + y^2 = 4$



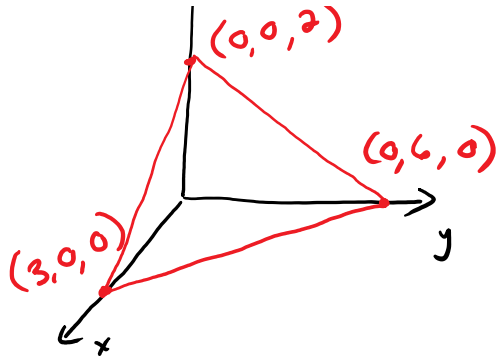

what about $ax + by + cz = d$, where $a, b, c$, and $d$ are constants?

plane

example: sketch $2x + y + 3z = 6$




set $y = z = 0$
what's $x$? 3




set $y = z = 0$
what's $x$? 3
$(3,0,0)$ is on plane

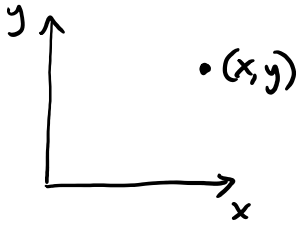
note: this triangle is the shape of the surface of the equation in the first octant

↑ like the first quadrant in 2D

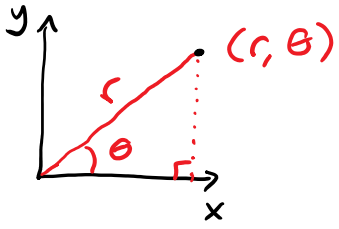
octant is for 3D

coordinate systems:

2D:




rectangular

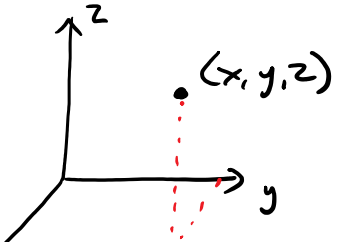


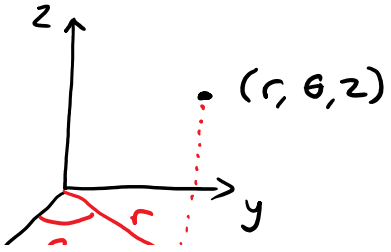

polar

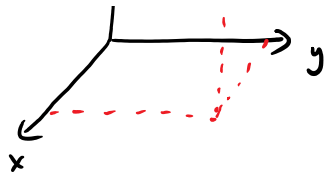
where $x = r\cos\theta$
$y = r\sin\theta$

$r = \sqrt{x^2 + y^2}$
$\tan\theta = \frac{y}{x}$

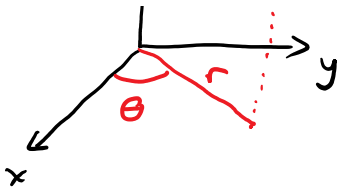
3D:



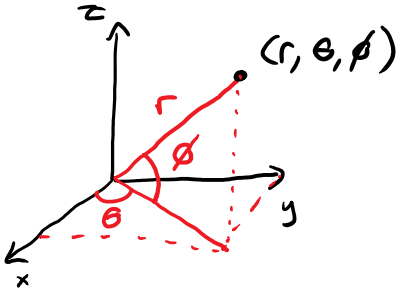






rectangular




cylindrical




spherical

← we will not use this in MATH 193

example: rewrite the following equation using cylindrical coords:

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

recall: cylindrical is $(r, \theta, z)$ so leave $z$ unchanged and substitute for $x$ and $y$:

$$x = r\cos\theta$$
$$y = r\sin\theta$$

$$\begin{aligned} z &= x^2 + y^2 \\ &= r^2\cos^2\theta + r^2\sin^2\theta \\ &= r^2(\cos^2\theta + \sin^2\theta) \\ &= r^2 \end{aligned}$$