Today! Start 14.1 & 14.3: Functions of 2 variables & their partial derivatives.

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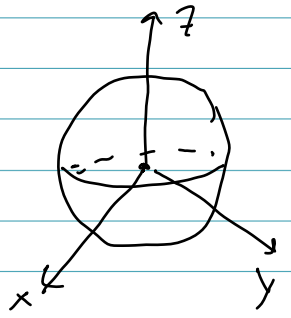
Sphere

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



$z=f(x,y)$

$z=\sqrt{1-x^2-y^2}$ (?)

$=f(x,y)$ hemisphere

Midterm up to last Friday

Our 10.5 & 12.6 (Degree 2 Equations)

(1) Earth & Sun: Ellipse (10.5)

(2) Earth Surface: Ellipsoid (12.6)

$\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$

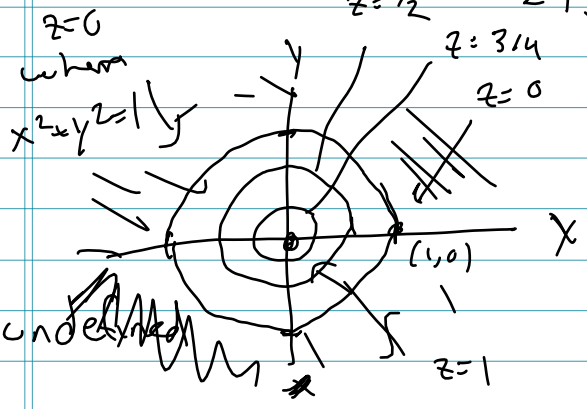
or $\left(\frac{x}{a}\right)^2+\left(\frac{y}{b}\right)^2+\left(\frac{z}{c}\right)^2=1$

(3) Telescope (reflector), Satellite Dishes,--

Circular Paraboloid

$\frac{z}{c}=\frac{x^2}{a^2}+\frac{y^2}{b^2}$ $a=b$

or $z=\frac{1}{4p}(x^2+y^2)$, focus $(0,0,p)$



$z=f(x,y)=\sqrt{1-x^2-y^2}$

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Domain of $f(x,y)$ is the set of (x,y) where f is defined.

Level sets are (x,y) where

When we write

$z=\sqrt{1-x^2-y^2}$:

(1) describing

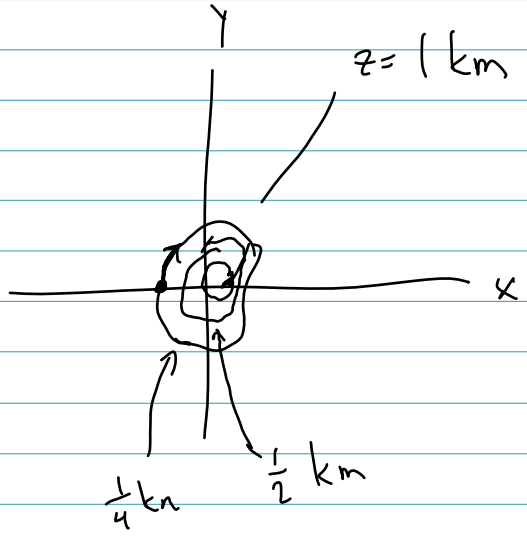
$x^2+y^2+z^2=1,\quad z\geq 0$

(2) Only want to define

$f(x,y)=\sqrt{1-x^2-y^2}$

for $x^2+y^2\leq 1$

Mountain



= 14.3

$f(x,y)$ = some fixed value

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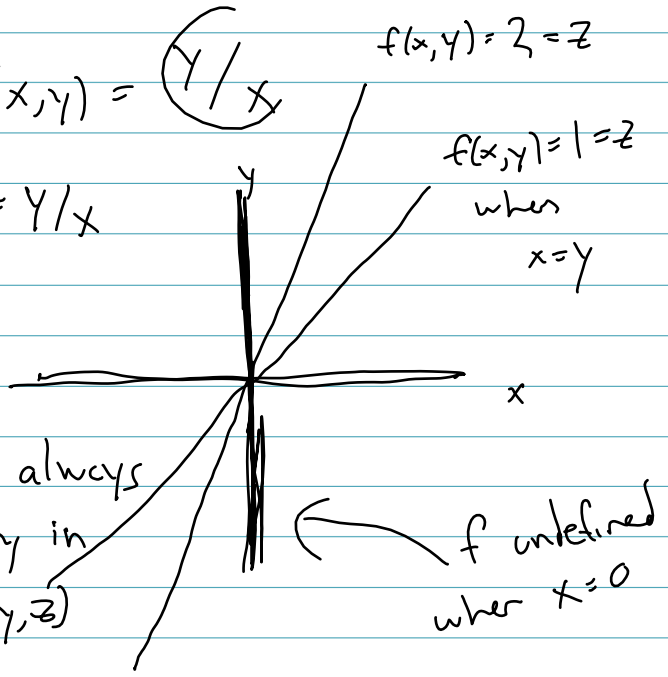
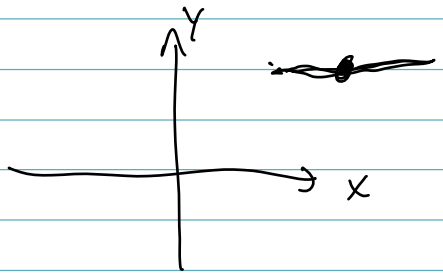
$f(x,y) = y/x$

$z = y/x$



Partial Derivatives

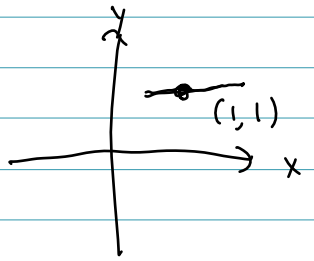
$z = f(x,y) = x^2 + 5xy + \sin(y)$



how does f change in x direction

Fix y as some value, differentiate in x

$(x_0, y_0) = (1, 1)$



View $y = 1$ fixed

$f(x,y) = f(x,1)$

$= x^2 + 5 \cdot x \cdot 1 + \sin(1)$

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$\frac{d}{dx}(x^2 + 5x + \sin(1))$

$= 2x + 5 + 0$

$$\frac{\partial f}{\partial y} = \frac{\partial}{\partial y} f$$ (View x as fixed, y as varying)

$$= \frac{\partial}{\partial y}\left(x^2 + 5xy + \sin(y)\right)$$

$$= \frac{\partial}{\partial y}(x^2) + \frac{\partial}{\partial y}5xy + \frac{\partial}{\partial y}\sin(y)$$

$$= 0 + 5x + \cos(y)$$

$$\frac{\partial}{\partial y}\left(f(x,y)\cdot g(x,y)\right) = ?$$

This written

$$\frac{\partial f}{\partial x}(1,1) = \frac{\partial z}{\partial x}(1,1)$$

$$\left(z = f(x,y)\right) = f_x(1,1)$$

$$= z_x(1,1) = \ldots$$

$$f(x,y) = x^2 + 5xy + \sin(y)$$

$$\frac{\partial f}{\partial x}(x,y) = 2x + 5y + 0$$

$$= 2x + 5y$$

Recall

$$(fg)' = fg' + f'g$$

$$\frac{\partial}{\partial y}(fg)$$

$$= f\frac{\partial g}{\partial y} + \frac{\partial f}{\partial y}g$$

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