Chain Rule

$f(x,y)$ $\begin{cases} \nearrow f_x \\ \searrow f_y \end{cases}$

$f(x(t), y(t))$

$$\frac{df}{dt} = \frac{\partial f}{\partial x}\cdot\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dy}{dt}$$

$f(x(t), y(t), z(t))$

$$\frac{df}{dt} = \frac{\partial f}{\partial x}\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dy}{dt} + \frac{\partial f}{\partial z}\frac{dz}{dt}$$

$f(x(s,t), y(s,t))$. $z(s,t)$

$$\frac{\partial f}{\partial t} = \frac{\partial f}{\partial x}\frac{\partial x}{\partial t} + \frac{\partial f}{\partial y}\frac{\partial y}{\partial t} + \frac{\partial f}{\partial z}\frac{\partial z}{\partial t}$$

Implicit Differentiation

Equation $\{x, y, z$ mixed through.

Ex $xy + 3xz^2 = zy$

$F(x,y,z) = xy + 3xz^2 - zy = 0$

$\frac{dz}{dx} = ?$

$$0 = \frac{dF}{dx} = \frac{\partial F}{\partial x}\frac{dx}{dx} + \frac{\partial F}{\partial y}\frac{dy}{dx} + \frac{\partial F}{\partial z}\frac{dz}{dx}$$

$$0 = F_x + 0 + F_z\frac{dz}{dx}$$

$$-\frac{F_x}{F_z} = \frac{dz}{dx}$$

$$-\frac{y + 3z^2}{6xz - y} = \frac{dz}{dx}$$

$$-\frac{F_t}{F_w} = \frac{dw}{dt}$$

Gradient $\nabla f(x,y)$

$$= \langle f_x, f_y \rangle$$

$\frac{d}{dx} F$ ← operator

$\nabla f^{(x,y,z)} = \langle f_x, f_y, f_z \rangle$

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

$$\nabla f = \langle f_x, f_y \rangle = \langle y^2 + \cos(x), 2xy \rangle$$

at $(0,0) \Rightarrow \nabla f(0,0) = \langle 1, 0 \rangle$

Directional Derivative $D_{\vec{u}} f(x,y)$

Slope of the tangent line in direction of $\vec{u}$

$\vec{u}$ is a unit vector $= \langle u_1, u_2 \rangle$

$$D_{\vec{u}} f = \nabla f \cdot \vec{u} = f_x u_1 + f_y u_2$$

$$= |\nabla f| |\vec{u}| \cos\theta$$

$D_{\vec{u}}$ is has Biggest value of $|\nabla f|$ when $\vec{u}$ is a direct. ∇f

($|\vec{u}| = 1$, $\cos\theta = 1$)

$$z = f(x,y) = Ax + By + C$$

$$\nabla f = \langle z_x, z_y \rangle = \langle A, B \rangle$$

Steepest Decline is $\langle -A, -B \rangle$

GROUP NAME: Logo:	Student Names (First and Last) Speaker/Presenter: _____
Date:_____ Topics:	Writer/Prep:_____ QC/Leader:_____

Instructions:

GROUP NAME: Team OP (Pronounced Oh-Pee)

Logo: 

Date: 10/3/13

Topics: Gradient

Student Names (First and Last)

Speaker/Presenter: Amanda Fann

Writer/Prep: Nyla Smith

QC/Leader: Javier Blanco

Instructions: Find the ∇ & which way you are falling

$28.39(x-60)+113.5(y-90)+416.9=z$

$28.39x-1703.4+113.5y-10215+416.9=z$

$28.39x+113.5y-11,501.5=z$

$\nabla\langle 28.39, 113.5\rangle$

FALL $\langle -28.39, -113.5\rangle$

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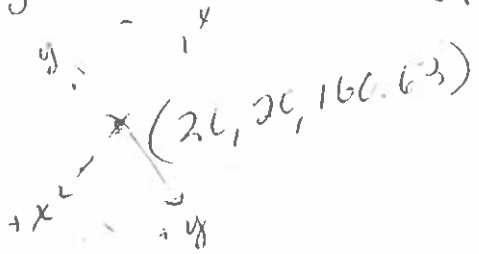
Date:_____ Topics:	Writer/Prep:_____ QC/Leader:_____

Instructions:

GROUP NAME: 42	Student Names (First and Last)
Logo:	Speaker/Presenter: Kyle Hamilton
Date:	Writer/Prep: Ben Durbick
Topics:	QC/Leader: Greg Greenley

Instructions:

$166.63 - .485x - .485y = z$ ← (equation of plane above dome



$\nabla f = \langle z_x, z_y \rangle = \langle -.485, -.485 \rangle$ going up both x and y more in the negative direction

$\langle .485, .485 \rangle$ going down, x and y go with the positive direction.