Math 344

Exam 2 11 probs @ 10pts each

100pts = 100%

14.1 Intro to $f: \mathbb{R}^n \to \mathbb{R}$ (0 probs)

14.2 Limits and Cont. (1 prob)

① limit that does not exist

14.3 Partial Deriv's (2 prob)

① 1st partials (ex) $f(x,y,z)$ → f_x? f_y? f_z?

② 2nd order partials

14.4 Tangent Planes and Linear Approximations (2 probs)

① Find Linear Approx to $f(x,y)$ @ (a,b)

(ex) $f(x,y) = xy\sin(x+y)$ @ $(0,0)$

give $L(x,y) \approx f(x,y)$ near $(0,0)$

② word problem use differentials to estimate Maximum (or rel.) error.

14.5 Chain Rule (1 prob)

① use chain rule to find 1st partials

Idea: $f(x(s,t), y(s,t), z(s,t))$

Find f_s, f_t by chain rule.

14.6 Directional Derivs and ∇f (1 prob)

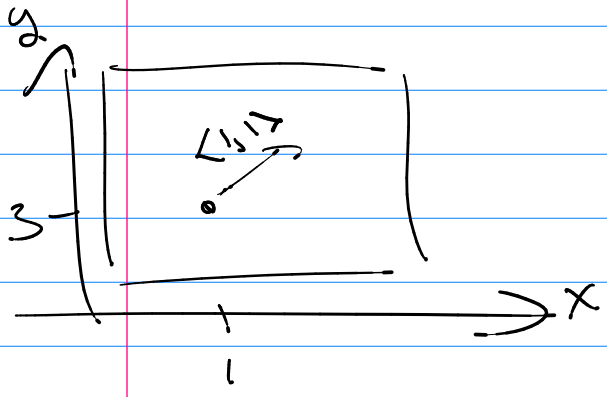
① word problem: $D_{\vec{u}} f$?

Find max rate of change and direction for it?

ex $T(x,y) =$ [redacted]

a) $(1,3)$ rate of change in temp in direction of $\langle 1,1 \rangle$?

$D_{\langle 1,1 \rangle} T(1,3) = ?$



14.7 Max/Min problems (2 probs)

① Find critical points and label as max/min/or saddle

② Find the abs. max/min.

14.8 Lagrange Multipliers (2 probs)

① Solve $\begin{cases} \nabla f(x,y) = \lambda \nabla g(x,y) \\ g(x,y) = k \end{cases}$

(f)

p $\begin{cases} f_x = \lambda g_x \\ f_y = \lambda g_y \\ g(x,y) = k \end{cases} \rightarrow (x,y,k)$

② Setup a 2 constraint problem

$f(x,y,z)$
$g(x,y,z)$
$h(x,y,z)$

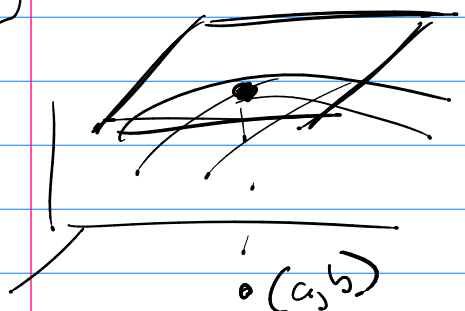
$\begin{cases} \nabla f = \lambda \nabla g + \mu \nabla h \\ g = k_1 \\ h = k_2 \end{cases}$

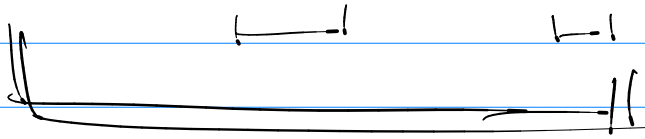
Qs

Linear Approximations of $f(x,y)$ @ (a,b)

$f(x,y) \approx L(x,y) = f(a,b) + f_x(a,b)(x-a) + f_y(a,b)(y-b)$

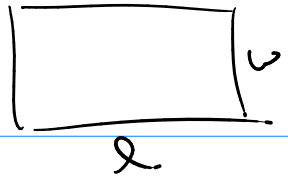
Study 14.4





Error estimates $\Delta f \approx df = f_x dx + f_y dy$

ex Given f, x, y, dx, dy

Ex 

max error in area if

$l = 2$ ft $\quad dl = \pm 1$ in

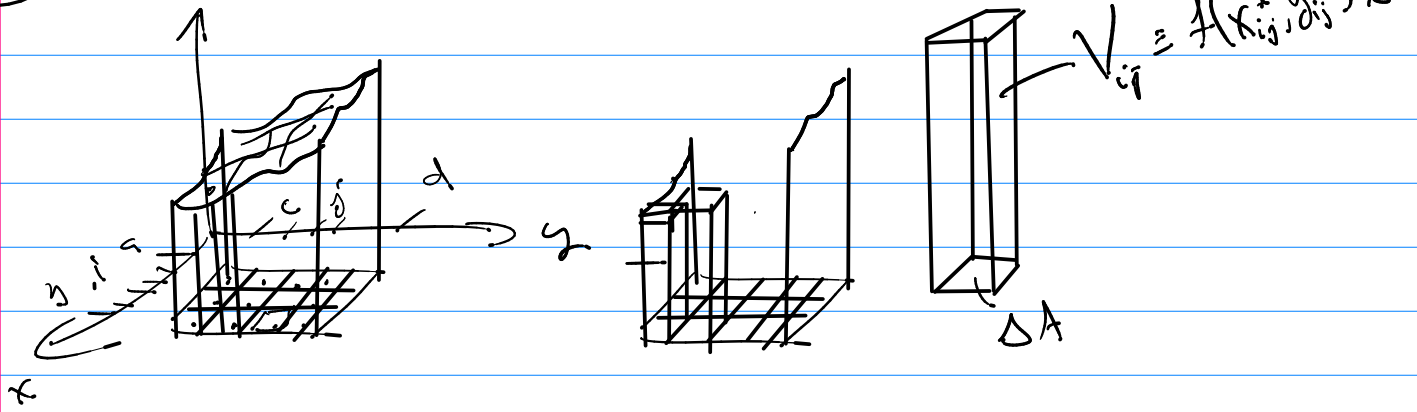
$w = 10$ in $\quad dw = \pm 0.1$ in

Ch 14 $f : \mathbb{R}^n \to \mathbb{R}$ Ex $f(x,y)$, $f(x,y,z)$ etc

↳ change partials, gradients, etc.

Ch 15 → infinitesimals of A

Ex $z = f(x,y)$



$$V \approx \sum_i \sum_j V_{ij}$$

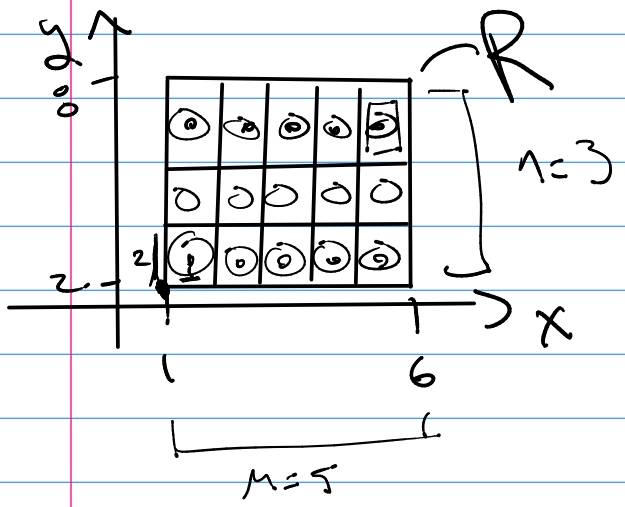
$$V = \lim_{m\to\infty} \lim_{n\to\infty} \sum_{i=1}^{m} \sum_{j=1}^{n} f(x_{ij}^*, y_{ij}^*)\Delta A$$

Def

$$\iint_R f(x,y)\,dA = \lim_{m\to\infty} \lim_{n\to\infty} \sum_{i=1}^{m} \sum_{j=1}^{n} f(x_{ij}^*, y_{ij}^*)\Delta A$$

Note: we can use this to approximate as well.

$$\iint_R f(x,y)\,dA \approx \sum_{i=1}^{n} \sum_{j=1}^{m} f(x_{ij}^*, y_{ij}^*)\,\Delta A$$



$\Delta A = 2$