

EXAM 2

Allowed:

1. A **Ti-30x IIS Calculator**
2. An 8.5 by 11 inch sheet of handwritten notes (front/back)
3. A pencil or black/blue pen

Details and rules:

1. 4 pages of questions, 50 minutes, use your time effectively.

2. **Show your work using methods from class.** The correct answer with no supporting work is worth zero points.
Must show full methods.

Quick Review

(13.4) Acceleration

$$a_T = \frac{\vec{r}' \cdot \vec{r}''}{|\vec{r}'|}, a_N = \frac{|\vec{r}' \times \vec{r}''|}{|\vec{r}'|}$$

(14.1, 14.3, 14.4) Analyzing Surfaces

- Sketch domain, sketch level curves.
- Compute partial derivatives
 - slope in x-direction, y-direction
 - concavity in x-direction, y-direction
- Tangent planes/linear approx

$$z - z_0 = f_x (x - x_0) + f_y (y - y_0)$$

$$L(x, y) = z_0 + f_x (x - x_0) + f_y (y - y_0)$$

(14.7) Critical Points, Max/Min

- Set $f_x = 0$ and $f_y = 0$
combine and solve (and check).

- *Classify as local max/min, or saddle*

$$D = f_{xx}f_{yy} - (f_{xy})^2$$

- i) $D > 0, f_{xx} > 0 \rightarrow$ local min
- ii) $D > 0, f_{xx} < 0 \rightarrow$ local max
- iii) $D < 0 \rightarrow$ saddle pt.

- *Absolute max/min*

- i) Critical points inside region?
- ii) Study boundaries.
 $z =$ "one variable function"
on each boundary
- iii) Absolute max/min must occur at a critical point inside region or a boundary.
See what gives biggest z .

- *Applied max/min*

What are you optimizing?

Constraints?

Give two variable function for what you are optimizing, find critical point(s).

(15.1-4): Double Integrals

Other applications:

$$\iint_R f(x, y) dA = \begin{array}{l} \text{volume below } f(x, y) \\ \text{and above } R \end{array}$$

$$\iint_R 1 dA = \text{area of } R$$

Setting up

- i) Integrand? ($z=???$)
- ii) Draw Region
 - Draw given xy-bounds.
 - Draw intersection of surfaces.
- iii) Choose how to describe region

$$\text{Top/Bottom: } \int_a^b \int_{g_1(x)}^{g_2(x)} f(x, y) dy dx$$

$$\text{Left/Right: } \int_c^d \int_{h_1(y)}^{h_2(y)} f(x, y) dx dy$$

$$\text{Polar: } \int_{\alpha}^{\beta} \int_{r_1(\theta)}^{r_2(\theta)} f(r \cos(\theta), r \sin(\theta)) r dr d\theta$$

$$M_y = \iint_R x p(x, y) dA,$$

$$M_x = \iint_R y p(x, y) dA,$$

$$M = \iint_R p(x, y) dA,$$

$$\bar{x} = \frac{M_y}{M}, \quad \bar{y} = \frac{M_x}{M}$$