the bradkovach.com

Calculus: Test 4 Note Card

Chain Rule

$$\frac{d}{dx}whole \cdot \frac{d}{dx}inside$$

Works with product and quotient rules
Works with trig functions
$\frac{d}{dx}\sin x^2$ where $whole = \sin x^2$ and $inside = x^2$
Works with e
$\frac{d}{dx}e^u = e^u * \ln e * \frac{d}{dx}u$

Trigonometric Differentiation

$\frac{d}{dx}\sin x = \cos x$ $\quad$ $\frac{d}{dx}\cos x = -\sin x$

$\frac{d}{dx}\tan x = \sec^2 x$ $\quad$ $\frac{d}{dx}\csc x = -\csc x \cot x$

$\frac{d}{dx}\sec x = -\sec x \tan x$ $\quad$ $\frac{d}{dx}\cot x = -\csc^2 x$

Logarithmic Differentiation

$\frac{d}{dx}\log_a u = \frac{du}{u \cdot \ln a}$ $\quad$ $\frac{d}{dx}\ln u = \frac{du}{u}$

Arc Differentiation

$\frac{d}{dx}\sin^{-1} x = \frac{du}{\sqrt{1-u^2}}$ $\quad$ $\frac{d}{dx}\tan^{-1} x = \frac{du}{1+u^2}$

Differentiation Laws

$\frac{d}{dx}x^n = nx^{n-1}$ $\quad$ $\frac{d}{dx}c = 0$

$\frac{d}{dx}cx^n = c * nx^{n-1}$ $\quad$ $\frac{d}{dx}e^u = e^u * ln\, e * \frac{d}{dx}u$

$\frac{a}{x^2} = ax^{-2}$ *(for speedier differentiation)*

Product Rule $\quad$ ***Quotient Rule***

$f * s' + s * f'$ $\quad$ $\frac{b*t'-t*b'}{b^2}$

Inc/Dec, etc.

Always use x-intervals
There are two methods: graphing and using differentiation.

Inc/Dec Solve the first derivative by setting it equal to zero. Set up the intervals using the values. Pick numbers inside each interval and solve using first derivative. Positive value: increasing. Negative value: decreasing.

Concave up/down Solve the second derivative by setting it equal to zero. Setup the intervals using the values. Pick a value from each interval and plug into second derivative. Positive value: concave up. Negative value: concave down.

Inflection Points Take solved x-values from second derivative and plug into the original *eqn*.

Max/Min Solve the first derivative for x. Using those x-values, find y-values by plugging into the original equation.

L'Hospital's Rule

There are several indeterminate forms. Derive *without* product rule or quotient rule until the *eqn* isn't indeterminate.

Indeterminate Forms

$$\frac{0}{0}, \frac{\infty}{\infty}, \frac{-\infty}{-\infty}, 0 \cdot \infty, \infty - \infty, 0^0, \infty^0, 1^\infty$$

Optimization

1. Draw pictures: Label known and unknown parts
2. Find equations
   a. If *eqn* has 1 variable, skip to step 3
   b. If 2 variables, plug one equation into another
3. Take the first derivative, set it to 0, and solve. Plug x-value(s) into the original equation and solve.

Anti-Derivatives

For each term:
1. Add one to the exponent
2. Divide by the new exponent

At the end, add "+C"

OMG DISCLAIMER

I threw this together in 20 minutes! It's 10:30 at night as I type this. Please check all of this with your own notes before trusting it—especially the Inc/Dec, etc part!

Good luck on your test!
And remember: there's all sorts of cool crap on bradkovach.com!