1360
Lecture
Monday
Aug. 24
2009

39 hw, drop 3	100 pts	
11 quizzes, drop 1	50 pts	
3 Midterms	100 pts	Each
Final, cumulative	200 pts	
	650 pts	for course.

Review Topics: Differentiation, Integration } 2 main tools of Calc 1.
Limits } used to define these

Differentiation

- Instantaneous Rate of Change
- Slope of tangent line at pt.

Rules

1) $\frac{d}{dx} c = 0$ — const. rule

2) $\frac{d}{dx} x^n = n x^{n-1}$ — power rule / ANY number $n \neq 0$

3) $\frac{d}{dx}(cu) = c \cdot \frac{du}{dx}$ — const. mult rule

4) $\frac{d}{dx}(f \pm g) = \frac{d}{dx} f \pm \frac{d}{dx} g$ — sum/diff. rule.

5) $\frac{d}{dx}(f \cdot g) = \frac{d}{dx} f \cdot g + f \cdot \frac{d}{dx} g$ — product rule

6) $\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{f'g - g'f}{g^2}$ — quotient rule

Derivatives of Trig Functions

p. 152

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

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

$\frac{d}{dx}\tan x = \sec^2 x$

$\frac{d}{dx}\sec x = \sec x \tan x$

$\frac{d}{dx}\csc x = -\csc x \cot x$

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

Chain Rule

$$(f(g(x)))' = f'(g(x)) \cdot g'(x)$$

Notation $(f \circ g)' = f'(g) \cdot g'$

or $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

p. 160-161

Exponentials & Logarithms

$$\frac{d}{dx} a^u = a^u \cdot \ln a \, \frac{du}{dx}$$

↑ chain rule

$$\frac{d}{dx} \log_a u = \frac{1}{\ln a} \cdot \frac{1}{u} \cdot \frac{du}{dx}$$

Easy cases: e^x, $\ln x$

$$\frac{d}{dx} e^x = e^x \quad , \quad \frac{d}{dx} \ln x = \frac{1}{x}$$

Ex (#10) $y = 9^{2t}$

$$\frac{dy}{dt} = 9^{2t} \cdot \ln 9 \cdot (2t)'$$

↓ Rule & chain rule

$$= 9^{2t} \ln 9 \cdot 2$$

↓ & simplify

$$= 2 \ln 9 \cdot 9^{2t}$$

Ex $y = (x+7)^{(x+7)}$

use logarithmic differentiation

$$\ln y = \ln\left[(x+7)^{(x+7)}\right]$$

↓ simplify

$$\ln y = (x+7)\ln(x+7)$$

↓ diff. both sides

$$\frac{1}{y} \cdot \frac{dy}{dx} = 1 \cdot \ln(x+7) + (x+7) \cdot \frac{1}{(x+7)} \cdot 1$$

↑ chain rule

↑ Product Rule

Solve for $\frac{dy}{dx}$

$$\frac{dy}{dx} = y\left[\ln(x+7) + 1\right]$$ sub in for y

$$\boxed{\frac{dy}{dx} = (x+7)^{(x+7)}\left[\ln(x+7) + 1\right]}$$

More Log. Diff

26

$$y = \sqrt[10]{\frac{3x+4}{2x-4}}$$

~~Edy~~

$$\ln y = \ln\left[\left(\frac{3x+4}{2x-4}\right)^{10}\right]$$

$$\ln y = 10\left[\ln(3x+4) - \ln(2x-4)\right]$$

$$\frac{1}{y}\cdot\frac{dy}{dx} = 10\cdot\frac{1}{3x+4}\cdot 3 - 10\frac{1}{2x-4}\cdot 2$$

$$\frac{dy}{dx} = \left[\frac{30}{3x+4} - \frac{20}{2x-4}\right]\cdot y$$

$$\boxed{\frac{dy}{dx} = \left[\frac{30}{3x+4} - \frac{20}{2x-4}\right]\left[\frac{3x+4}{2x-4}\right]^{10}}$$

Rules of Logarithms

1) $\ln[ab] = \ln a + \ln b$

2) $\ln\left[\frac{a}{b}\right] = \ln a - \ln b$

3) $\ln[a^n] = n \cdot \ln a$

Rules of Exponents

1) $e^a e^b = e^{a+b}$

2) $\frac{e^a}{e^b} = e^{a-b}$

3) $(e^a)^b = e^{ab}$

Integration

Table p. 277

1. $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

2. $\int dx = x + C$

3. $\int \sin x \, dx = -\cos x + C$

etc. trig functions

Not in table

4. $\int \sin ax = -\frac{\cos ax}{a} + C$

etc.

Ex: $\int \sin^2 x \, dx = \int \frac{1-\cos 2x}{2} \, dx$

$\vdots$

$$= \frac{x}{2} - \frac{\sin 2x}{4} + C$$

Integration by Substitution

Formula... $\int f(g) \cdot g' \, dx$

$u = g(x)$

$du = g'(x) \, dx$

$= \int f(u) \, du$

$= F(u) + C$

$= F(g(x)) + C$

Better...

Ex: $\int \sin 3x \, dx$

$u = 3x$

$du = 3 dx$

$\frac{du}{3} = dx$

p.296

$= \int \sin u \cdot \frac{du}{3}$

$= \frac{1}{3}(-\cos u) + C$

$= -\frac{1}{3} \cos 3x + C$ ■

Ex: $\int \frac{4y \, dy}{\sqrt{2y^2+1}}$

$u = 2y^2 + 1$

$du = 4y \, dy$

$= \int \frac{du}{\sqrt{u}}$

$= \int u^{1/2} \, du = \frac{u^{3/2}}{3/2} + C = \boxed{\frac{2}{3}(2y^2+1)^{3/2} + C}$