Chapter 3 Test Prep

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3.1

Differential Rule

- $\frac{d}{dx}e^x = e^x$
- $\frac{d}{dx}c \cdot f(x) = c \cdot \frac{d}{dx}f(x)$
- $m_{tangent} \cdot m_{normal} = -1$
  - if $m_{tangent} = 8$
  - then $m_{normal} = -\frac{1}{8}$
- $v(t) = f'(x)$
- $a(t) = f''(x)$

3.2

Product and quotient rule

- $\frac{d}{dx}[f(x) \cdot g(x)] = f(x)\frac{d}{dx}[g(x)] + g(x)\frac{d}{dx}[f(x)]$
- $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\frac{d}{dx}[f(x)] - f(x)\frac{d}{dx}[g(x)]}{[g(x)]^2}$

3.3

Derivatives of trig functions

Pythag Identities

- $\sin^2\theta = 1 - \cos^2\theta$
- $\cos^2\theta = 1 - \sin^2\theta$
- $\sin^2\theta + \cos^2\theta = 1$

Limit Defs

- $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$
- $\lim_{\theta \to 0} \frac{\cos \theta - 1}{\theta} = 0$

Deriviatives of trig functions:

- $\frac{d}{dx}(\sin x) = \cos x$
- $\frac{d}{dx}(\cos x) = -\sin x$
- $\frac{d}{dx}(\tan x) = \sec^2 x$
- $\frac{d}{dx}(\csc x) = -\csc x \cot x$
- $\frac{d}{dx}(\sec x) = \sec x \tan x$
- $\frac{d}{dx}(\cot x) = -\csc^2 x$

3.4

chain rule

- **Know the chain rule**
- $\frac{d}{dx} a^x = a^x \cdot \ln a$

3.5

Implicit Differentation/derivitives of inverse trig functions

- know how to use implicit Differentation

- $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
- $\frac{d}{dx}(\csc^{-1} x) = -\frac{1}{x\sqrt{x^2-1}}$
- $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}}$
- $\frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2}$

3.6

Deriviatives of log functions

$\frac{d}{dx} \ln x = \frac{1}{x}$
$\frac{d}{dx} \log_a x = \frac{1}{x \ln a}$

Logarithmic Differentation

1. Take ln of both sides
2. Differentiate implicitly with respect to x
3. solve for y'

3.7

Rates of change in natural and social sciences

Know how to solve these problems

3.8

Exponential Growth and decay

- $y = Ce^{kt}$
  - y = population
  - C = initial value
  - k = relative growth rate
  -

Newton's law of coolig

- $T(t) = t_s + Ce^{kt}$
  - $C = t_0 - t_s$

3.9

Related rates

- Know how to solve these problems

3.10

Linear Approx and Differentials

- $L(x) = f(a) - f'(a)(x - a)$