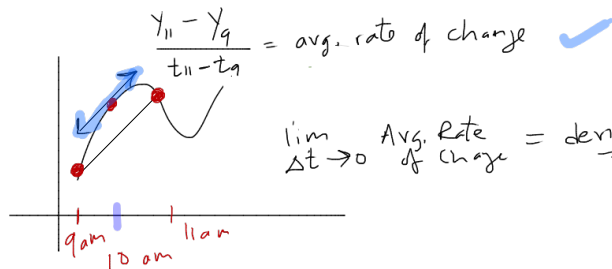Calc II :   4   Sections = {Integration Techniques, Trig Integration, Sequences & Series, Applications, polar coords }
(differential equations)

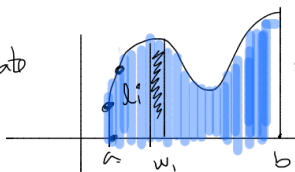What   Is   Calculus ?   Process of Approx. — Refine. — Repeat.

$$\frac{y_{11} - y_9}{t_{11} - t_9} = \text{avg. rate of change}$$

Derivatives :
study of how things change

$$\lim_{\Delta t \to 0} \text{Avg. Rate of Change} = \text{derivative}$$

9am   10 am   11am

Integrals
study of how things accumulate

Similarly

$$\lim_{N \to \infty} \sum_{i=1}^{N} \ell_i \cdot w_i = \int_a^b \ell \, dw$$

a w_1 b

$$\frac{d}{dx} = \begin{array}{c} \text{derivative} \\ \text{with respect } \{x = \text{variable}\} \\ \text{to } x \end{array} \qquad \int f(x)\,dx = \text{all functions } \underline{\text{whose derivative is } f(x)}$$

you need to be able to finish these in less than a minute . . . ..

recall:

$$\frac{d}{dx}\left(x^3\right) = 3x^2 \cdot 1$$

ε,

$$\frac{d}{dx}\left(\left(3x+1\right)^2\right) = 2(3x+1)^1 \cdot 3 = 6(3x+1)$$

[chain rule]

$$\frac{d}{dx}\left(\tan^{-1}x\right)$$

"

$$\boxed{\frac{1}{1+x^2}}$$

$$\tan x = \frac{\sin x}{\cos x} = \frac{rise}{run} = slope$$

1.
$$\int x\,dx = \frac{x^2}{2} + c$$

2.
$$\int \sqrt[3]{x}\,dx = \int x^{\frac{1}{3}}\,dx = \frac{3}{4}x^{\frac{4}{3}} + c$$

3.
$$\int \frac{1}{x}\,dx =$$

4.
$$\int \frac{1}{\sqrt{x}}\,dx =$$

5.
$$\int \frac{1}{1+x^2}\,dx = \tan^{-1}x$$

6.
$$\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1}x$$

7.
$$\int \frac{1}{x\sqrt{x^2-1}}\,dx = \sec^{-1}x$$

8.
$$\int e^x\,dx = e^x$$

9.
$$\int \sin x\,dx = -\cos x$$

10.
$$\int \cos x\,dx = \sin x$$

11.
$$\int \sec^2 x\,dx = \tan x$$

12.
$$\int \sec x \tan x\,dx = \sec x$$