CHAOS THEORY

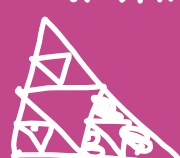
Fractals are the geometry of chaos theory

1961- Edward Lorenz

Chaos theory = a slight change in the initial condition results in significant change in the results.

butterfly effect—

Paradox = a line of infinite length surrounding a finite area



occupies more than a 1-D line but less space than a 2D object

ANTIDIFFERENTIATION = INTEGRATION

$$\int (8x^3 - 9x^2)\,dx$$

integral sign

$$= \frac{8x^4}{4} - \frac{9x^3}{3} + C$$

$$= 2x^4 - 3x^3 + C$$

$$\int \frac{dy}{\cancel{dx}} = \int x^5\,dx$$

$$y = \frac{x^6}{6} + C$$

Derivative

$f(x) = 3x^2 - 6x^5 + 7$

$f'(x) = 6x - 30x^4$

$\frac{6x^2}{2} \quad - \frac{30x^5}{5} + C$

Power Rule for Integrals

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

Derivative = power moves down; decrease exponent by 1

Integration = increase the exponent by 1

$$\int \left(8x^5 - \frac{1}{2x^6} + \sqrt[3]{x^2} - 5\right) dx \qquad y = x^3$$

$$\int \left(8x^5 - \frac{1}{2}x^{-6} + x^{2/3} - 5x^0\right) dx$$

$$= \frac{8x^6}{6} - \frac{1}{2}\frac{x^{-5}}{-5} + \frac{3}{5}\cdot x^{5/3} - \frac{5x}{1} + C$$

$$= \frac{4}{3}x^6 + \frac{1}{10x^5} + \frac{3}{5}x^{5/3} - 5x + C$$

$$\int (x^2-3)(x^5+8x)\,dx$$

FOIL

Indefinite Integrals

* $+C$
* no numerical value

$$\int (x^7+8x^3-3x^5-24x)\,dx$$

$$= \frac{x^8}{8} + \frac{8x^4}{4} - \frac{3x^6}{6} - \frac{24x^2}{2} + C$$

$$= \frac{x^8}{8} + 2x^4 - \frac{1}{2}x^6 - 12x^2 + C$$

$$\int \frac{3p^4-2p^2+9}{p^{2/3}}\,dp$$

$$\int (3p^4-2p^2+9)p^{-2/3}\,dp$$

$$= \int \left(3p^{10/3} - 2p^{4/3} + 9p^{-2/3}\right) dp$$

$$= \frac{3}{13}\cdot 3p^{13/3} - \frac{3}{7}\cdot 2p^{7/3} + 3\cdot 9p^{1/3} + C$$

$$= \frac{9}{13}p^{13/3} - \frac{6}{7}p^{7/3} + 27p^{1/3} + C$$

DEFINITE INTEGRALS

Answer is a numerical value

limits of integration

$$\int_{-1}^{2} (6x^2-2x+1)\,dx$$

$$= \frac{6x^3}{3} - \frac{2x^2}{2} + x + C \Big]_{-1}^{2}$$

$$= 2x^3 - x^2 + x + C \Big|_{-1}^{2}$$

$$= 2(2)^3 - 2^2 + 2 + C - \left[2(-1)^3 - (-1)^2 + -1 + C\right]$$

$$= 16 - 4 + 2 + \cancel{C} + \left[+2 + 1 + +1 + -\cancel{C}\right]$$

$$= \boxed{18}$$

$$\int_4^9 \left(\frac{1}{\sqrt{x}} + 2\sqrt{x}\right)dx$$

$$\int_4^9 \left(x^{-1/2} + 2x^{1/2}\right)dx$$

$$= 2 \cdot x^{1/2} + \frac{2}{3} \cdot 2x^{3/2} \Big|_4^9$$

$$= 2x^{1/2} + \frac{4}{3}x^{3/2} \Big|_4^9$$

$$= \underset{\sqrt[2]{9}}{2(9)^{1/2}} + \frac{4}{3}\underset{\sqrt[2]{9^3}}{(9)^{3/2}} + \left[-\underset{\sqrt[2]{4}}{2 \cdot 4^{1/2}} + -\frac{4}{3} \cdot \underset{2\sqrt{4^3}}{4^{3/2}}\right]$$

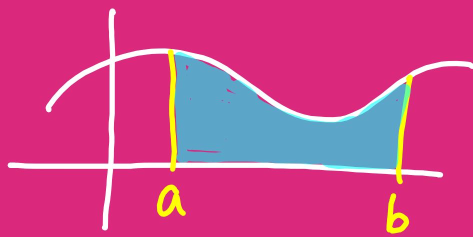
$$= 2 \cdot 3 + \frac{4}{\cancel{3}} \cdot \overset{9}{\cancel{27}} - 2 \cdot 2 + -\frac{4}{3} \cdot 8$$

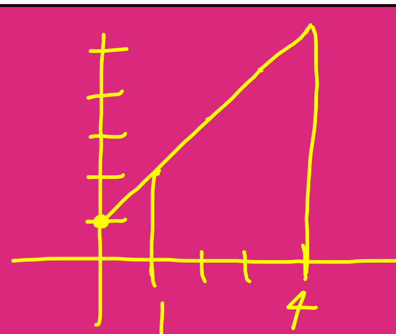
$$= 6 + 36 - 4 - \frac{32}{3}$$

$$= 38 - \frac{32}{3}$$

$$= \frac{114}{3} - \frac{32}{3}$$

$$= \frac{82}{3}$$





$f(x) = x+1$

$$\int_1^4 (x+1)\,dx$$

Integration represents the area between a function & an axis.