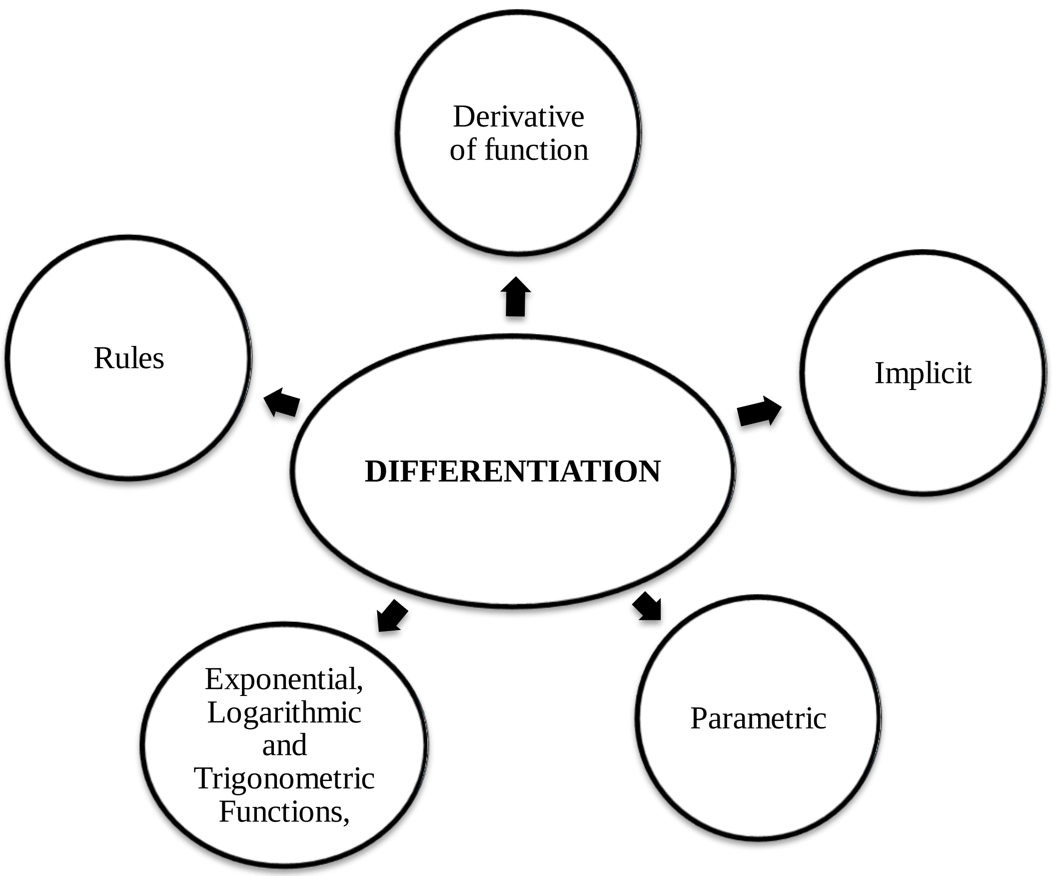
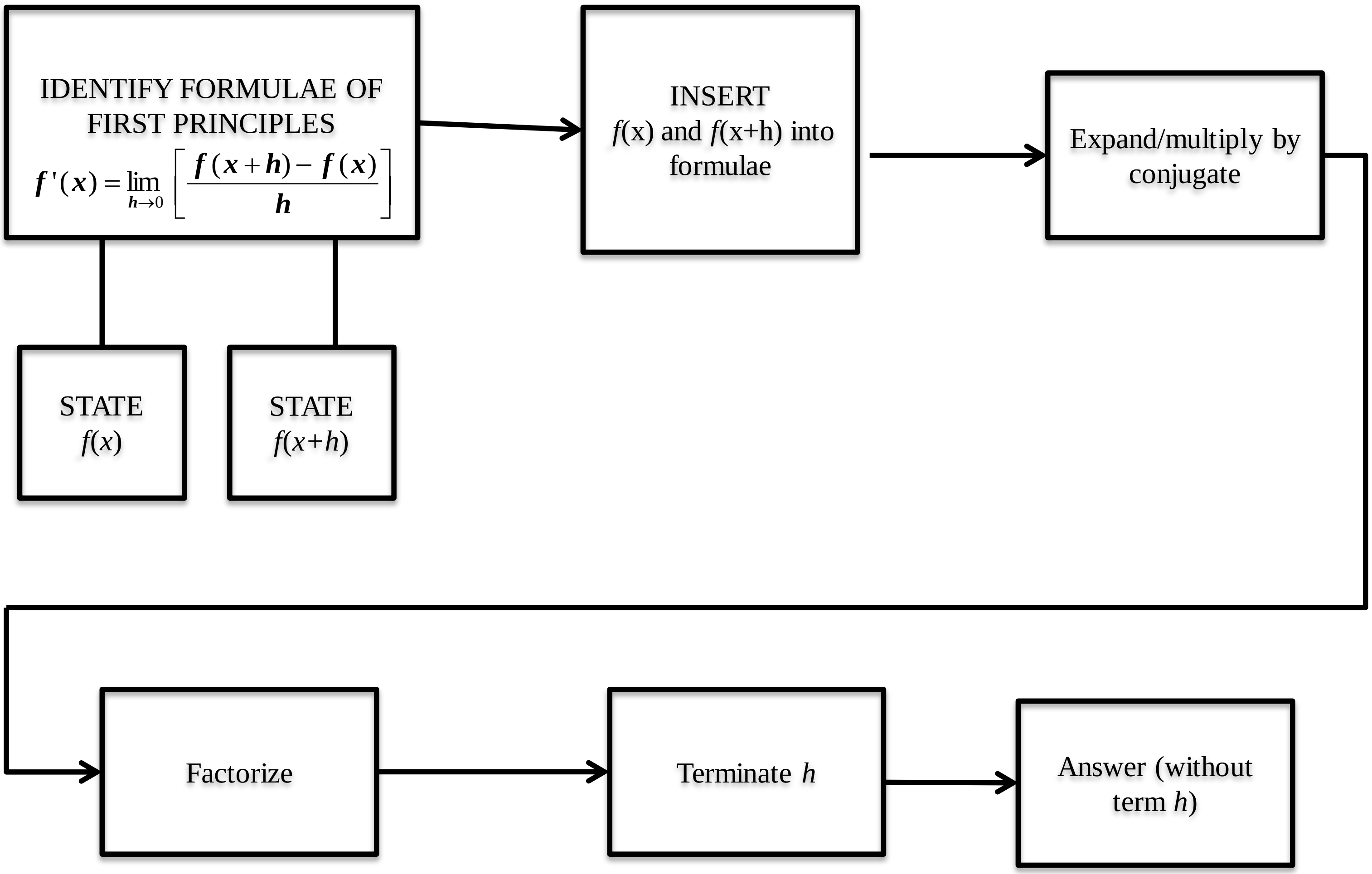
TOPIC 9: DIFFERENTIATION
THINKING MAP: BUBLE MAP
THINKING PROCESS: EXPLANATION (ADJECTIVE)



TOPIC 9: DIFFERENTIATION
FIRST PRINCIPLES
THINKING MAP: FLOW MAP
THINKING PROCESS:SEQUENCES, STEP



TOPIC 9: DIFFERENTIATION
THINKING MAP: TREE MAP
THINKING PROCESS: CLASSIFICATION,CATEGORIES

DIFFERENTIATION

<u>Derivative of a function</u>

determine the differentiability of a function at

$$x = a$$

Use formulae $$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

<u>Rules</u>

- Basic
- Sum
- Product
- Quotient
- Chain

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TOPIC 9: DIFFERENTIATION
DERIVATIVE OF A FUNCTION
THINKING MAP: BRACE MAP
THINKING PROCESS: RELATIONSHIP OF ALL PARTS OF THE STRUCTURES

To Determine the Differentiability of a Function at $x = a$

- $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ exist at $x = a$
  - $\lim_{x \to a^-} \frac{f(x) - f(a)}{x - a}$
  - $\lim_{x \to a^+} \frac{f(x) - f(a)}{x - a}$

TOPIC 9: DIFFERENTIATION

RULE OF DIFFERENTIATION

THINKING MAP: BRACE MAP

THINKING PROCESS: RELATIONSHIP OF ALL PARTS OF THE STRUCTURES

Rules of Differentiation

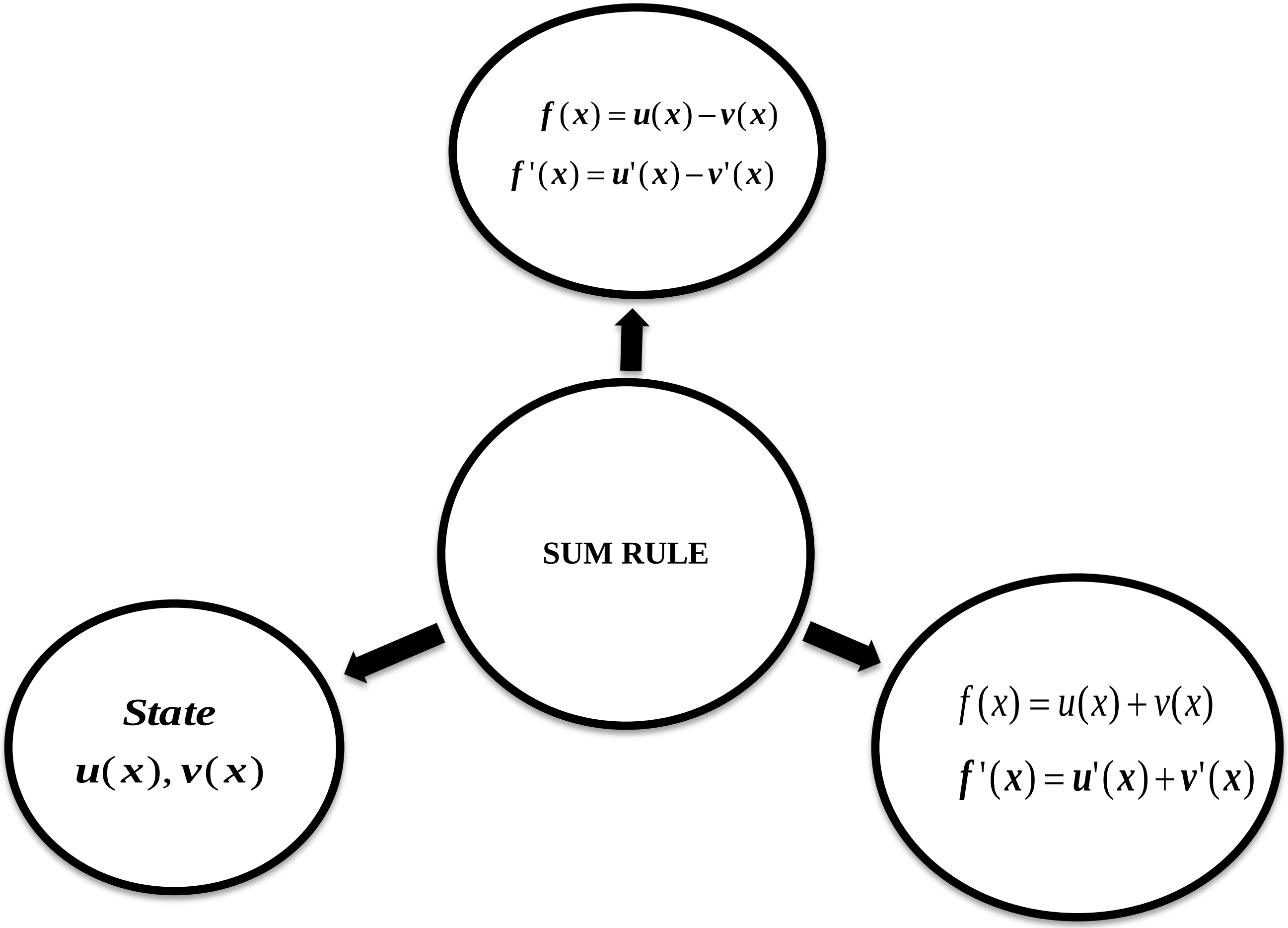
- **Basic Rule**
  - if $f(x) = k$, then $f'(x) = 0$
  - if $f(x) = x^n$, then $f'(x) = nx^{n-1}$
  - if $f(x) = kx^n$, then $f'(x) = knx^{n-1}$

TOPIC 9: DIFFERENTIATION

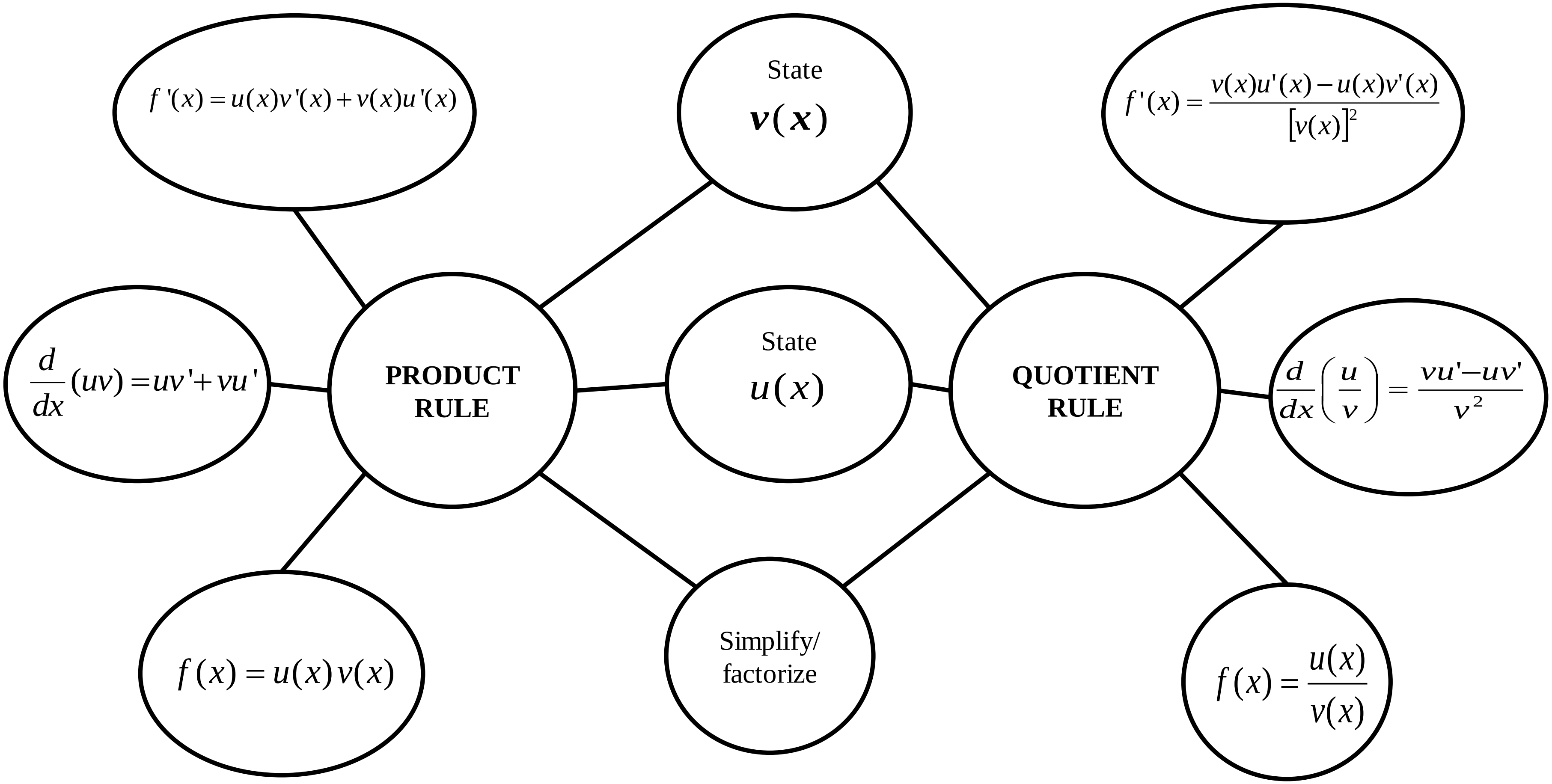
RULE OF DIFFERENTIATION

THINKING MAP: BUBLE MAP

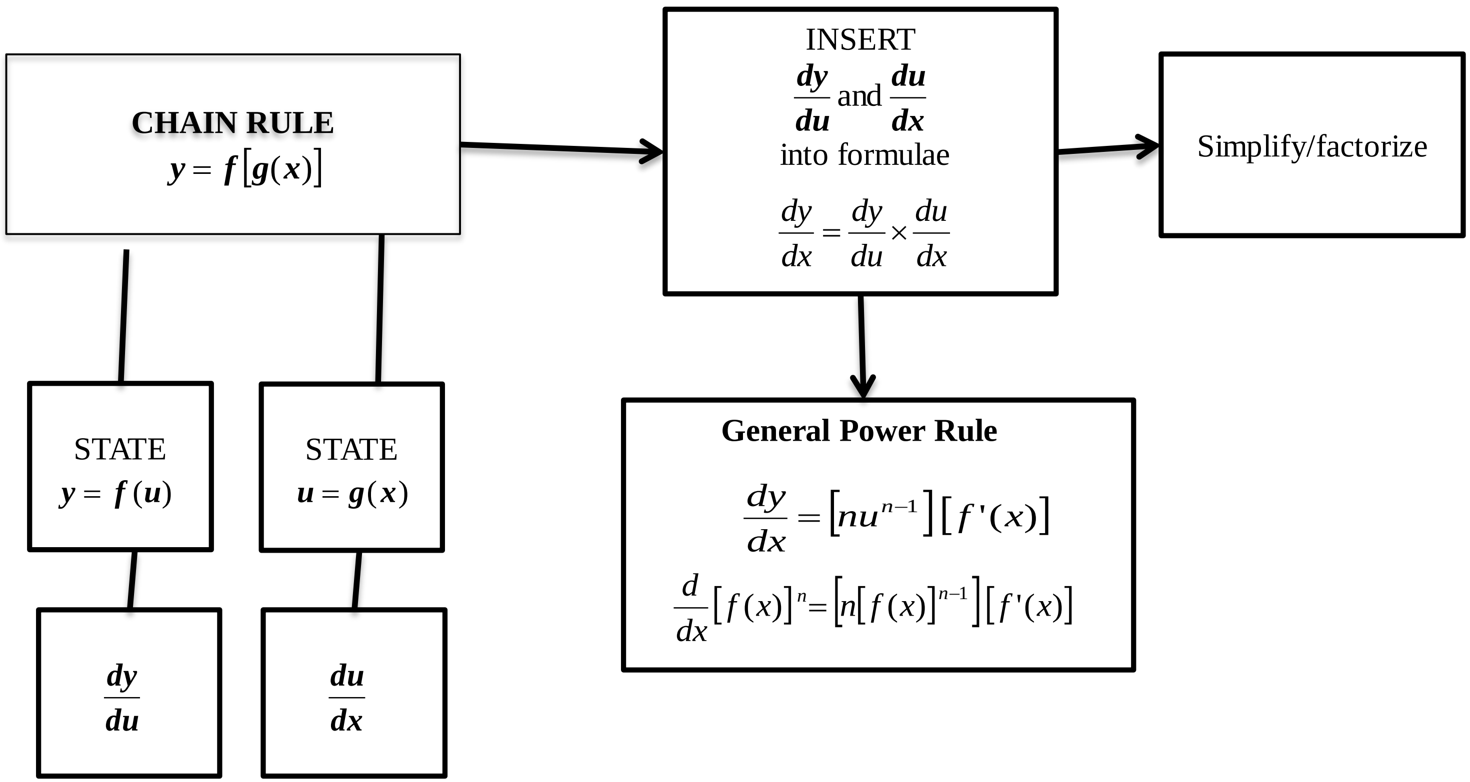
THINKING PROCESS:EXPLANATION (ADJECTIVE)



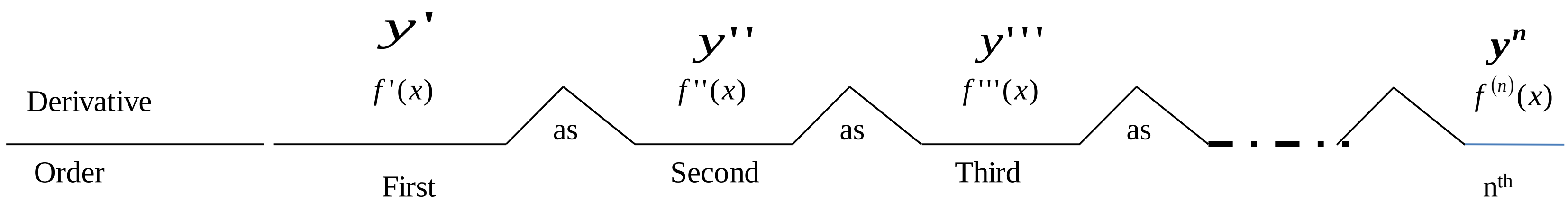
TOPIC 9: DIFFERENTIATION
RULE OF DIFFERENTIATION
THINKING MAP : DOUBLE BUBBLE
THINKING PROCESS : COMPARING AND CONTRASTING



TOPIC 9: DIFFERENTIATION
CHAIN RULE
THINKING MAP: FLOW MAP
THINKING PROCESS: SEQUENCES, STEP



TOPIC 9: DIFFERENTIATION
THINKING MAP: BRIDGE MAP
THINKING PROCESS:ANALOGY



TOPIC 9: DIFFERENTIATION
THINKING MAP: BRIDGE MAP
THINKING PROCESS:ANALOGY

Find the first, second and third order derivatives of $p(x) = -2x^4 + 9x^3 - 5x^2 + 7$

Derivative	$p'(x) = -8x^3 + 27x^2 - 10x$	as	$p''(x) = -24x^2 + 54x - 10$	as	$p'''(x) = -48x + 54$
Order	First		Second		Third

TOPIC 9: DIFFERENTIATION

DIFFERENTIATION OF EXPONENTIAL FUNCTIONS

THINKING MAP: BRIDGE MAP

THINKING PROCESS:ANALOGY,- SAME RELATIONSHIP

Differentiate	$\frac{d}{dx}\left[a^{x}\right]$	as	$\frac{d}{dx}\left[a^{f(x)}\right]$
Get	$a^{x}\left(\ln a\right)\frac{d}{dx}\left(x\right)$		$a^{f(x)}\left(\ln a\right)f'\left(x\right)$

Differentiate	$\frac{d}{dx}\left[e^{x}\right]$	as	$\frac{d}{dx}\left[e^{f(x)}\right]$
Get	$e^{x}\left(\ln e\right)\frac{d}{dx}\left(x\right)$		$e^{f(x)}\,f'\left(x\right)$

TOPIC 9: DIFFERENTIATION

DIFFERENTIATION OF LOGARITHMIC FUNCTIONS

THINKING MAP: BRIDGE MAP

THINKING PROCESS:ANALOGY,- SAME RELATIONSHIP

Differentiate	$\frac{d}{dx}(\ln x)$	as	$\frac{d}{dx}[\ln f(x)]$
Get	$\frac{1}{x}$		$\frac{f'(x)}{f(x)}$

TOPIC 9: DIFFERENTIATION

DIFFERENTIATION OF TRIGONOMETRIC FUNCTIONS

THINKING MAP: BRIDGE MAP

THINKING PROCESS:ANALOGY,- SAME RELATIONSHIP

Differentiate	$\sin x$	as	$\tan x$	as	$\sec x$
Get	$\cos x$		$\sec^2 x$		$\sec x \tan x$

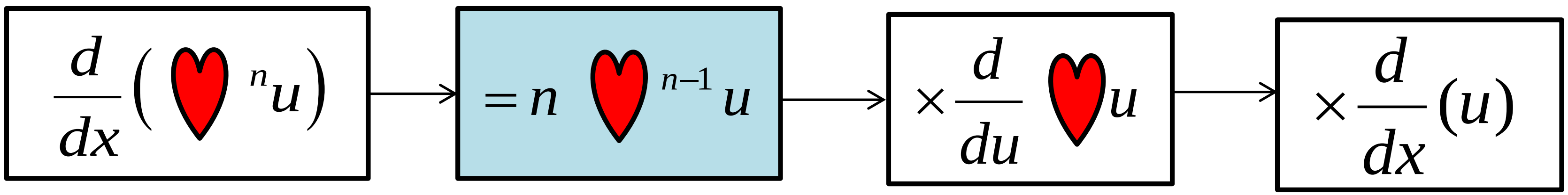
Differentiate	$\cos x$	as	$\cot x$	as	$\cos ecx$
Get	$-\sin x$		$-\cos ec^2 x$		$-\cos ec\, x \cot x$

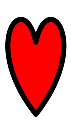
TOPIC 9: DIFFERENTIATION

DIFFERENTIATION OF TRIGONOMETRIC FUNCTIONS

THINKING MAP: FLOW MAP

THINKING PROCESS:SEQUENCES,STEP



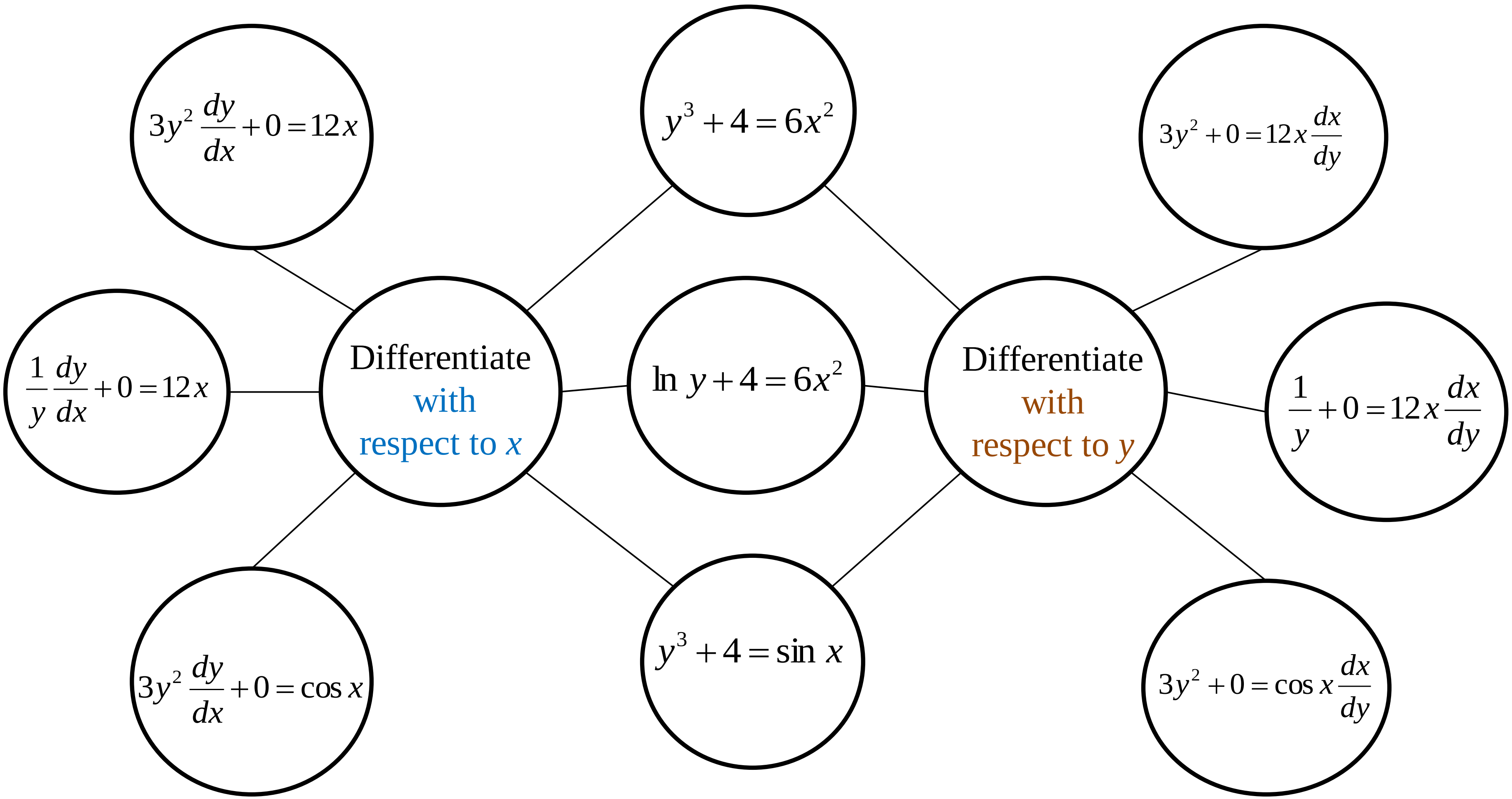
 = Trigonometric Functions

TOPIC 9: DIFFERENTIATION

IMPLICIT DIFFERENTIATION

THINKING MAP : DOUBLE BUBBLE

THINKING PROCESS : COMPARING AND CONTRASTING



TOPIC 9: DIFFERENTIATION

PARAMETRIC DIFFERENTIATION

THINKING MAP: FLOW MAP

THINKING PROCESS:SEQUENCES,STEP

$$x = f(t) \qquad y = g(t)$$

$$\frac{dy}{dx} \rightarrow = \frac{dy}{dt} \times \frac{dt}{dx}$$

$$\frac{d^2y}{dx^2} \rightarrow = \frac{d}{dx}\left(\frac{dy}{dx}\right) \rightarrow = \frac{d}{dt}\left(\frac{dy}{dx}\right) \times \frac{dt}{dx}$$