

Well (never) give up!
 Emotion (never) won't help!
 Impersonal expressions are essential!
 Required: reorganization (rearrange),
 repeat, refer to context!
 1. ADDITIVE
 2. MULTIPLICATIVE
 3. DIVISIVE
 4. SUBTRACTIVE
 5. INVERSE
 6. SUBSTITUTION
 7. SIMILARITY
 8. ANALOGY
 9. CONTRAST
 10. CAUSATION
 11. COMPARISON
 12. DEFINITION
 13. EXPLANATION
 14. EVALUATION
 15. IDENTIFICATION
 16. ILLUSTRATION
 17. INTERPRETATION
 18. JUDGEMENT
 19. REASONING
 20. REVELATION
 21. SENSATION
 22. STATEMENT
 23. THESIS
 24. VERIFICATION
 25. VOUCHER

Derivative of $\exp(x)$ or
equiv $\frac{d}{dx} e^x$

$$y = e^x \quad \text{get } \frac{dy}{dx}$$

$$\ln y = \ln(e^x)$$

$$\ln y = x$$

$$\frac{d}{dx} \ln y \frac{dy}{dx} = \frac{d}{dx} x, \quad y \text{ is fun of } x$$

$$\frac{1}{y} \frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = y$$

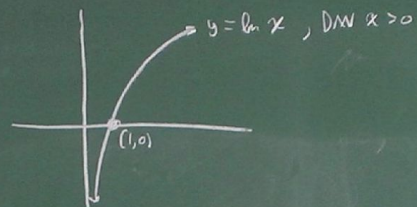
$$\frac{dy}{dx} = e^x$$

$$\boxed{\frac{d}{dx} e^x = e^x}$$

CHAIN RULE

$$\boxed{\frac{d}{dx} e^u = e^u \frac{du}{dx}}$$

[7.3] Exponential function



$y = \ln x$, strictly increase

$$\frac{dy}{dx} = \frac{1}{x} > 0$$

$\Rightarrow \ln x$ 1-1

$\Leftrightarrow \ln x$ invertible

Find the inverse fn.

$y = \ln x$ invertible
 call its inverse
 "the exponential fn"
 $y = \exp(x)$
 $y = \exp x$

Infer,

$$y = \ln x \equiv x = \exp y$$

$$y = \exp x \equiv x = \ln y$$

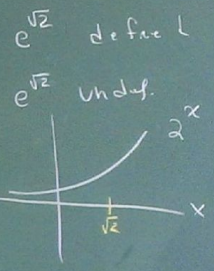
DMN of $\exp(x)$ is $\forall x \in \mathbb{R}$

RNG of $\exp(x)$ is $y > 0$

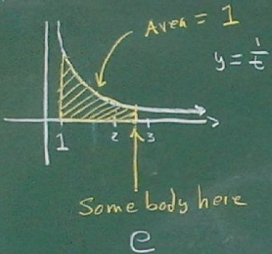
$$\exp(\ln x) = x, \quad x > 0$$

$$\ln(\exp x) = x, \quad x \in \mathbb{R}$$

$$\exp(0) = 1, \quad \therefore 0 = \ln 1$$



meet e



$$\int_1^e \frac{dt}{t} = 1$$

$$\boxed{\ln e = 1}$$

No news, for r rational

$$\begin{aligned} e^r &= \exp(\ln e^r) \\ &= \exp(r \ln e) \\ &= \exp(r) \end{aligned}$$

$$\boxed{e^r = \exp(r)}$$

Idra...

Definition

$$e^x = \exp(x) \text{ for } x \in \mathbb{R}$$

Inv fn

$\because r$ rational
 $\therefore \ln e = 1$

Hope that w/ this def,
exponent laws hold

Prove exp laws

Prove $e^a e^b = e^{a+b}$, $a, b \in \mathbb{R}$

Proof

$$\begin{aligned} e^a e^b &= \exp(\ln e^a e^b) \\ &= \exp(\ln e^a + \ln e^b) \\ &= \exp(a \ln e + b \ln e) \\ &= \exp(a+b) \\ &= e^{a+b} \end{aligned}$$

□

$$\begin{aligned} \textcircled{1} \frac{d}{dx} e^{\sqrt{x}} &= e^{\sqrt{x}} \frac{d}{dx} \sqrt{x} \\ &= \frac{e^{\sqrt{x}}}{2\sqrt{x}} \end{aligned}$$

$$\begin{aligned} \textcircled{2} \frac{d}{dx} e^{x^2 \ln x} &= e^{x^2 \ln x} \left[2x \ln x + \frac{x^2}{x} \right] \\ &= x e^{x^2 \ln x} (2 \ln x + 1) \\ &= x e^{x^2 \ln x} (1 + \ln x^2) \end{aligned}$$