unit 7 a

Derivative of $\frac{1}{x} = x^{-1}$

- we know $\frac{d}{dx}\frac{1}{x} = (-1)\,x^{-2}$

- verify by taking limit.

$$\lim_{h\to 0}\left(\frac{1}{x+h} - \frac{1}{x}\right)/h$$

$$\lim_{h\to 0}\frac{\cancel{x} - (\cancel{x}+h)}{h\,x\,(x+h} =$$

$$\lim_{h\to 0}\frac{-\cancel{h}}{\cancel{h}\,x(x+h)} = \boxed{-\frac{1}{x^2}}$$

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b) $\frac{d}{dx}x^{1/2} = \frac{1}{2\sqrt{x}}$

$n = \frac{1}{2}$ Last lecture

$$\lim_{h\to 0}\frac{\sqrt{x+h} - \sqrt{x}}{h}\cdot\frac{(\sqrt{x+h}+\sqrt{x})}{(\sqrt{x+h}+\sqrt{x})}$$

$$\text{FOIL} = \frac{\cancel{x} + h - \cancel{x}}{h\left(\sqrt{x+h} + \sqrt{x}\right)} \to \frac{1}{2\sqrt{x}}$$

(c) $$\frac{d}{dx} 2^x$$

$$= \frac{d}{dx} e^{x \log 2}$$

$$= \log 2 \; e^{x \log 2}$$

$$= \log 2 \; 2^x$$

To know:

$$\boxed{b^a = e^{a \log b}}$$

b "base"

$$\boxed{b^{a+c} = b^a \cdot b^c}$$

$$\boxed{(b^a)^c = b^{ac}}$$

x

3 rules of exp

$$\frac{d}{dx}\left(\frac{5}{1+x}\right)$$

$$= \frac{-5}{(1+5)^2}$$

Homework!

$$\frac{d}{dx}(x+1)^5$$

$$\frac{d}{dx}(a+x)^n = n(a+x)^{n-1}$$

especially:

$$\frac{d}{dx}\frac{1}{a+x}$$

$$= \frac{-1}{(1+x)^2}$$