4.3 $\frac{d}{dx} e^x$ and $\frac{d}{dx} \ln x$ [cont'd]

20) $f(x) = \ln e^x = x$

↑ easy way

So $f'(x) = 1$.

Hard way:

$$f'(x) = \frac{1}{e^x} \cdot \frac{d}{dx}[e^x] = \frac{e^x}{e^x} = 1$$

18) $f(x) = x \ln x - x$

$$f'(x) = \frac{d}{dx}[x \ln x] - \frac{d}{dx}[x]$$

$$= \frac{d[x]}{dx} \cdot \ln x + x \cdot \frac{d}{dx}[\ln x] - 1$$

$$= 1 \cdot \ln x + x \cdot \frac{1}{x} - 1$$

$$= \ln x + 1 - 1 = \ln x$$

26) $f(x) = \sqrt{e} = e^{1/2}$, $f'(x) = 0$

24) $f(x) = ex$, $f'(x) = e \approx 2.718281828$

Similar to:

$g(x) = 3x \quad g'(x) = 3$

28) $f(x) = x^2 e^x - 2\ln x + (x^2+1)^3$

$$f'(x) = \frac{d}{dx}[x^2]\cdot e^x + x^2 \cdot \frac{d}{dx}[e^x] - 2\cdot\frac{1}{x} + 3(x^2+1)^2 \cdot \overbrace{\frac{d}{dx}[x^2+1]}^{2x}$$

$$= \underbrace{2xe^x + x^2 e^x}_{\text{optional: } (2x+x^2)e^x} - \frac{2}{x} + 6x(x^2+1)^2$$

34) $f(x) = \ln \frac{1}{e^{x^2}}$ what is the easy way?

$= \ln e^{-x^2}$ by properties of exponents

$= -x^2$

$f'(x) = -2x$

38) $f(t) = (2t + \ln t)^3$ Chain Rule

$f'(t) = 3(2t+\ln t)^2 \cdot \frac{d}{dt}[2t + \ln t]$

$= 3(2t+\ln t)^2 \cdot \left(2 + \frac{1}{t}\right)$

Try this: 36) $f(t) = \sqrt{e^{2t}+4} = (e^{2t}+4)^{1/2}$

ANSWER: $f'(t) = \frac{1}{2}(e^{2t}+4)^{-1/2} \cdot \frac{d}{dt}[e^{2t}+4]$

$= \frac{1}{2}(e^{2t}+4)^{-1/2} \cdot 2e^{2t}$

$$= \frac{e^{2t}}{\sqrt{e^{2t}+4}}$$