Basic Derivative Rules
2.5A – Differentiating $e^{f(x)}$ and $\ln f(x)$

A: Find the derivative of each function.

#1) $f(x) = (x^2 + \mathrm{x})\ln(x)$

#2) $f(x) = \ln\left(\sqrt{x}\right)$

#3) $f(x) = \ln(x^3)$

#4) $f(x) = x\ln(x)$

#5) $f(x) = \frac{\ln(x)}{x}$

#6) $f(x) = e^x$

#7) $f(x) = e^{3x^2+9x-1}$

#8) $f(x) = e^{-x}$

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#9) $f(x) = e^{\ln(x)}$

#10) $f(x) = \ln(e^{x^2})$

#11) $f(x) = x^e$

#12) $f(x) = ex$

#13) $f(x) = \frac{x}{\ln(x)}$

#14) $f(x) = e^{21}$

#15) $f(x) = e^{3x} - x\ln(x) + 4x^2 + 1$

#16) $f(x) = e\ln(x)$

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B: Evaluate each derivative

#17) $f(x) = x^3 \ln(x)$, find $f'(e)$

#18) $\frac{d}{dx}\left(e^{x^4+4}\right)\Big|_{x=1}$

#19) $f(x) = x^2 \ln(x) - x$, find $f'(1)$

#20) $\frac{d}{dx}\left(e^{\sqrt{x}}\right)\Big|_{x=1}$

Investment
#21) A sum of $1000 at 5% interest compounded continuously will grow to $V(t) = 1000e^{0.05t}$ dollars in t years. Find the rate of growth after:
  a. 0 years
  b. 10 years

Depreciation
#22) A $30,000 automobile depreciates so that its value after t years is $V(t) = 30{,}000e^{-0.35t}$ dollars. Find the rate of change of its value …
  a. when it is brand spanking new
  b. after 2 years

Candle Sticks
#23) If $D(p) = 1000e^{-0.01p}$ is the consumer demand for George's homemade candle sticks (which he advertises as "imported from the best Italian ears") and p is the selling price in dollars, find $D'(100)$ and interpret your answer.

Forever Burning Matches ®
#24) If $D(p) = 4000e^{-0.02p}$ is the consumer demand for George's Forever Burning Matches ® and p is the selling price in dollars, find $D'(50)$ and interpret your answer.