MyLab Problem on 3.9 Log. Differentiation

Use logarithmic differentiation to evaluate f′(x).

$f(x) = (3x)^{\ln 3x}$

$$\ln(f(x)) = \ln(3x)^{\ln(3x)} = \ln(3x)\cdot\ln(3x)$$

Use log prop.

$$f(x)\cdot\frac{f'(x)}{f(x)} = \frac{\cancel{3}}{\cancel{3}x}\cdot\ln(3x) + \ln(3x)\cdot\frac{\cancel{3}}{\cancel{3}x} = \left(\frac{2}{x}\cdot\ln(3x)\right)\cdot f(x)$$

Diff. wrt x

$$f'(x) = \frac{2}{x}\cdot\ln(3x)\cdot\underbrace{(3x)^{\ln(3x)}}$$

Get f′(x) by itself

may simplify as:

$$(3x)^{\ln(3x)} = y$$

$$\ln(3x)\cdot\ln 3x = \ln_e y$$

$$y = e^{\ln(3x)\cdot\ln(3x)}$$

$$y = e^{\ln^2(3x)}$$

re-write as:

$$\boxed{f'(x) = \frac{2\cdot\ln(3x)}{x}\cdot e^{\ln^2(3x)}}$$