9/13/06

Differentiate $g(t) = -2 \cdot \frac{t^6}{e^t}$

express your answer in terms of elementary function(s)

There are 2 ways to do this problem

⇒ A. Quotient rule $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$

$g'(t) = -2\left[\frac{e^t \frac{d}{dt}(t^6) - t^6 \cdot \frac{d}{dt}(e^t)}{(e^t)^2}\right]$ - Here we apply the quotient rule.

$g'(t) = -2\left[\frac{e^t \cdot 6t^5 - t^6 e^t}{(e^t)^2}\right]$ - Here we find the derivatives of the component functions of $g(t)$.

$g'(t) = -2\left[\frac{6t^5 - t^6}{e^t}\right]$ - Here we simplify the equation by cancelling e^t from the numerator and denominator.

$\boxed{g'(t) = -12\frac{t^5}{e^t} + 2\frac{t^6}{e^t}}$ - Here we do another "simplification"

⇒ B. Product Rule $\frac{d}{dx}(f(x) \cdot g(x)) = f(x)g'(x) + g(x)f'(x)$

$g(t) = -2\frac{t^6}{e^t} = -2 \cdot t^6 \cdot e^{-t}$ Here we re-arrange the function

$g'(t) = -2\left[t^6 \frac{d}{dt}(e^{-t}) + e^{-t}\frac{d}{dt}(t^6)\right]$ Here we apply the product rule

$g'(t) = -2\left[t^6 \cdot -e^{-t} + e^{-t} \cdot 6 \cdot t^5\right]$ Here we find the derivatives of the component functions

$\boxed{g'(t) = -12\frac{t^5}{e^t} + 2\frac{t^6}{e^t}}$ Here we simplify

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Note: by re-arranging a problem we can always use the product or quotient rule.