. 5   1. Find the derivative of $f(x) = (e^x - e^{-x^2})x^3$

Solution. Using the product rule (see page 229 of the text), we have

$$
\begin{aligned}
f'(x) &= \frac{d}{dx}\left(e^x - e^{-x^2}\right)x^3 + \left(e^x - e^{-x^2}\right)\left(x^3\right) \\
&= \left(e^x e^{-x^2}(-2x)\right)x^3 + \left(e^x - e^{-x^2}\right)e^{-x^2}(3x^2) \\
&= \left(e^x + 2xe^{-x^2}\right)x^3 + 3x^2\left(e^x - e^{-x^2}\right) \\
&= x^2\left[\left(e^x + 2xe^{-x^2}\right)x + 3\left(e^x - e^{-x^2}\right)\right]
\end{aligned}
$$

. 5   2. Solve $3e^{4a+1} = 12$ for a.

Solution. First, we have

$$
e^{4a+1} = \frac{12}{3} = 4
$$

and next, we apply ln to both sides to get

$$
\begin{aligned}
\ln(e^{4a+1}) &= \ln 4 \\
4a + 1 &= \ln 4 \\
4a &= (\ln 4) - 1 \\
a &= \frac{(\ln 4) - 1}{4}.
\end{aligned}
$$

Thus, $a = ((\ln 4) - 1)/4$.