

9.10

$$\begin{aligned} 1) \quad f'(x) &= (\ln(x-2))' \\ &= \ln'(x-2) (x-2)' \\ &= \frac{1}{x-2} \cdot 1 \\ &= \frac{1}{x-2} \end{aligned}$$

$$\begin{aligned} 2) \quad f'(x) &= (e^{5x})' \\ &= (\exp(5x))' \\ &= \exp'(5x) (5x)' \\ &= \exp(5x) \cdot 5 \\ &= 5 e^{5x} \end{aligned}$$

$$\begin{aligned} 3) \quad f'(x) &= (e^{x^2})' \\ &= (\exp(x^2))' \\ &= \exp'(x^2) (x^2)' \\ &= \exp(x^2) 2x \\ &= 2x e^{x^2} \end{aligned}$$

$$\begin{aligned} 4) \quad f'(x) &= (\ln(3x^5))' \\ &= \ln'(3x^5) (3x^5)' \\ &= \frac{1}{3x^5} 15x^4 \\ &= \frac{15x^4}{3x^5} \\ &= \frac{5}{x} \end{aligned}$$

$$\begin{aligned} 5) \quad f'(x) &= (x \ln(x))' \\ &= (x)' \ln(x) + x (\ln(x))' \\ &= 1 \cdot \ln(x) + x \cdot \frac{1}{x} \\ &= \ln(x) + 1 \end{aligned}$$

$$\begin{aligned} 6) \quad f'(x) &= (e^{\frac{1}{x}})' \\ &= (\exp(\frac{1}{x}))' \\ &= \exp'(\frac{1}{x}) (\frac{1}{x})' \\ &= \exp(\frac{1}{x}) (x^{-1})' \\ &= e^{\frac{1}{x}} (-1) x^{-2} \\ &= -\frac{1}{x^2} e^{\frac{1}{x}} \end{aligned}$$

$$\begin{aligned}
7) \quad f'(x) &= \left(\ln\left(\frac{x+1}{x-1}\right) \right)' \\
&= \ln'\left(\frac{x+1}{x-1}\right) \left(\frac{x+1}{x-1}\right)' \\
&= \frac{1}{\frac{x+1}{x-1}} \cdot \frac{(x+1)'(x-1) - (x+1)(x-1)'}{(x-1)^2} \\
&= \frac{x-1}{x+1} \cdot \frac{1 \cdot (x-1) - (x+1) \cdot 1}{(x-1)^2} \\
&= \frac{x-1}{x+1} \cdot \frac{-2}{(x-1)^2} \\
&= -\frac{2}{(x+1)(x-1)}
\end{aligned}$$

$$\begin{aligned}
8) \quad f'(x) &= (x^2 e^x)' \\
&= (x^2)' e^x + x^2 (e^x)' \\
&= 2x e^x + x^2 e^x \\
&= x e^x (2 + x) \\
&= x (x + 2) e^x
\end{aligned}$$

$$\begin{aligned}
9) \quad f'(x) &= \left(x (\ln(x) - 1) \right)' \\
&= (x)' (\ln(x) - 1) + x (\ln(x) - 1)' \\
&= 1 \cdot (\ln(x) - 1) + x \left(\frac{1}{x} - 0 \right) \\
&= \ln(x) - 1 + x \cdot \frac{1}{x} \\
&= \ln(x) - 1 + 1 \\
&= \ln(x)
\end{aligned}$$

$$\begin{aligned}
10) \quad f'(x) &= \left((2x^2 - 3) e^{3x} \right)' \\
&= (2x^2 - 3)' e^{3x} + (2x^2 - 3) (e^{3x})' \\
&= 4x e^{3x} + (2x^2 - 3) e^{3x} (3x)' \\
&= 4x e^{3x} + 3(2x^2 - 3) e^{3x} \\
&= e^{3x} (4x + 3(2x^2 - 3)) \\
&= e^{3x} (6x^2 + 4x - 9)
\end{aligned}$$

$$\begin{aligned}
11) \quad f'(x) &= (\ln(\sqrt[3]{x}))' \\
&= \ln'(\sqrt[3]{x}) (\sqrt[3]{x})' \\
&= \frac{1}{\sqrt[3]{x}} (x^{\frac{1}{3}})' \\
&= \frac{1}{\sqrt[3]{x}} \frac{1}{3} x^{-\frac{2}{3}} \\
&= \frac{1}{\sqrt[3]{x}} \cdot \frac{1}{3} \cdot \frac{1}{\sqrt[3]{x^2}} \\
&= \frac{1}{3} \cdot \frac{1}{\sqrt[3]{x^3}} \\
&= \frac{1}{3x}
\end{aligned}$$

$$\begin{aligned}
12) \quad f'(x) &= (\sqrt{e^x})' \\
&= ((e^x)^{\frac{1}{2}})' \\
&= (e^{x \cdot \frac{1}{2}})' \\
&= (\exp(\frac{1}{2}x))' \\
&= \exp'(\frac{1}{2}x) (\frac{1}{2}x)' \\
&= \exp(\frac{1}{2}x) \cdot \frac{1}{2} \\
&= \frac{1}{2} e^{\frac{1}{2}x} \\
&= \frac{1}{2} (e^x)^{\frac{1}{2}} \\
&= \frac{1}{2} \sqrt{e^x}
\end{aligned}$$