Differentiation practice II

1. Compute the derivative.

\[
f[x_] = x^5 + \pi \times x^{1/7}
\]
\[
\partial_x f[x]
\]

2. Compute the derivative.

\[
f[x_] = x^3 + 3 \times (x^2 + \pi^2)
\]
\[
\partial_x f[x]
\]

3. Compute the derivative.

\[
f[x_] = (x + 1)^2 (x^3 - 5)
\]
\[
\partial_x f[x]
\]
\[
\text{Expand}[\%]
\]

4. Compute the derivative.

\[
f[\theta_] = (\theta^2 + \text{Sec}[\theta] + 1)^3
\]
\[
\partial_\theta f[\theta]
\]
5. Compute the derivative.

\[ f[t_] = \frac{\sqrt{t}}{1 + \sqrt{t}} \]
\[ \frac{\partial}{\partial t} f[t] \]

Together[%]

6. Compute the derivative. Remark: the traditional way of writing this function would be

\[ f(x) = 2 \tan^2(x) - 2 \sec^2(x) \]

\[ f[x_] = 2 \tan^2(x) - 2 \sec^2(x) \]
\[ \frac{\partial}{\partial x} f[x] \]

7. Compute the derivative. The traditional way of writing this function would be

\[ \frac{1}{\sin^2(x)} - \frac{\pi}{\sin(2\pi x)} \]

\[ f[x_] := \frac{1}{\sin[x]^2} - \frac{\pi}{\sin[2\pi x]} \]
\[ \frac{\partial}{\partial x} f[x] \]

8. Compute the derivative. The traditional way of writing this function would be

\[ \cot^3 \left( \frac{2}{t^2} \right) \]

\[ f[x_] := \cot \left( \frac{2}{t^2} \right)^3 \]
\[ \frac{\partial}{\partial t} f[t] \]
9 Compute the derivative.

\[
f[\theta] = \sin[\sqrt{2} \theta]
\]

\[
\partial_\theta f[\theta]
\]

10 Compute the derivative.

\[
f[x] = \frac{1}{2} x^2 \cot[x]^2
\]

\[
\partial_x f[x]
\]

11 Compute the derivative. The traditional form of the function would be

\[
\sqrt{x} 2 \csc((x + 1)^3)
\]

\[
f[x] := \sqrt{x} 2 \csc[(x + 1)^3]
\]

\[
\partial_x f[x]
\]

12 Compute the derivative. The traditional form of the function would be

\[
\sqrt{x} 2 \csc^3(x + 1)
\]

\[
f[x] = \sqrt{x} 2 \csc(x + 1)^3
\]

\[
\partial_x f[x]
\]

13 Compute the derivative. The traditional form of the function would be

\[
\frac{\sin^2(x^3)}{x^2}
\]

\[
f[x] = \frac{\sin[x^3]^2}{x^2}
\]

\[
\partial_x f[x]
\]
14 Compute the derivative.

\[ f[\theta_] = \frac{\sin[\theta]}{\cos[\theta] + 1} \]
\[ \partial_\theta f[\theta] \]
\[ \text{Together}[\%] \]

15 Compute the derivative.

\[ f[\theta_] = \frac{\sin[\pi/2] \sin[\theta]}{\cos[\theta] + 1} \]
\[ \partial_\theta f[\theta] \]

16 Compute the derivative.

\[ f[x_] := \sin[x] \sqrt{x^2 + 1} e^x \]
\[ \partial_x f[x] \]

17 Compute the derivative.

\[ f[x_] = \cos[e^{x^2}] \]
\[ \partial_x f[x] \]

18 Compute the derivative.

\[ f[x_] = \frac{\sin[e^x]}{x^2} \]
\[ \partial_x f[x] \]
\[ \text{Together}[\partial_x f[x]] \]
19 Compute the derivative. The traditional form would be

\[
\frac{\sin^2(e^x)}{x^2}
\]

\[
\frac{\sin[e^x]^2}{x^2}
\]

\[
f[x_] = \frac{\sin[e^x]^2}{x^2}
\]

\[
\partial_x f[x]
\]

20 Compute the derivative.

\[
f[x_] = \log[e^x];
\]

\[
\partial_x f[x]
\]

21 Compute the derivative.

\[
f[x_] = \tan[\log[x]};
\]

\[
\partial_x f[x]
\]

22 Compute the derivative.

\[
f[x_] = \frac{\cos[x]}{x} + \frac{x}{\cos[x]}
\]

\[
\partial_x f[x]
\]

\[
\text{Together}[%]
\]

23 Compute the derivative.

\[
f[x_] = \frac{1 + \csc[x]}{1 - \csc[x]}
\]

\[
\partial_x f[x]
\]

\[
\text{Together}[%]
\]
24 Compute the derivative. \( \log_{10}x \) means log base 10 of \( x \).

\[
\begin{align*}
  f[x_] &= \text{Log}[10, x^3]; \\
  \partial_x f[x]
\end{align*}
\]

25 Compute the derivative.

\[
\begin{align*}
  f[x_] &= A e^{-\alpha x} + A e^{\beta x} \\
  \partial_x f[x]
\end{align*}
\]