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Complete the following problems. Show all work to receive full credit.

1. Compute the derivatives.

(a)  $\frac{d}{dx} (e^{\sqrt{x}} + x^\pi)$

$$\begin{aligned} &= e^{\sqrt{x}} \frac{1}{2} x^{-\frac{1}{2}} + \pi x^{\pi-1} \\ &= \frac{e^{\sqrt{x}}}{2\sqrt{x}} + \pi x^{\pi-1} \end{aligned}$$

(b)  $\frac{d}{dx} \left( \ln \left( \frac{1}{x} \right) \right)$

$$\begin{aligned} &= \frac{1}{\frac{1}{x}} \cdot -x^{-2} \\ &= x \cdot -\frac{1}{x^2} = -\frac{1}{x} \end{aligned}$$

(c)  $\frac{d}{dx} (\log_5 \sqrt{x})$

$$\begin{aligned} &= \frac{d}{dx} \left( \frac{\ln \sqrt{x}}{\ln 5} \right) \\ &= \frac{1}{\ln 5} \frac{1}{\sqrt{x}} \cdot \frac{1}{2} x^{-\frac{1}{2}} \\ &= \frac{1}{(2 \ln 5) \sqrt{x} \sqrt{x}} = \frac{1}{2x \ln 5} \end{aligned}$$

(d)  $\frac{d}{dx} (x^{\tan x})$

$$\begin{aligned} y &= x^{\tan x} \\ \ln y &= \ln x^{\tan x} \\ \ln y &= \tan x \ln x \\ \frac{1}{y} \frac{dy}{dx} &= \sec^2 x \ln x + \frac{1}{x} \tan x \\ \frac{dy}{dx} &= y \left( \sec^2 x \ln x + \frac{\tan x}{x} \right) \\ \frac{dy}{dx} &= x^{\tan x} \left( \sec^2 x \ln x + \frac{\tan x}{x} \right) \end{aligned}$$