Problem 24:

Expand the logarithmic expression:

$$ln(xyz) = ln(x \times y \times z)$$

$$= ln(x) + ln(y) + ln(z)$$

Problem 26:

Expand the logarithmic expression:

$$ln\sqrt{a-1} = ln(a-1)^{\frac{1}{2}}$$

$$= \frac{1}{2} \times ln(a-1)$$

Problem 34:

Express as a single logarithm:

$$2[ln(x) - ln(x+1) - ln(x-1)]$$

$$= ln(x^2) - [ln(x+1)^2 + ln(x-1)^2]$$

$$= ln\left[\frac{x}{(x+1) \times (x-1)}^2\right]$$

$$= ln\left(\frac{x^2}{x^2-1}\right)$$

Problem 42:

Find the limit:

$$\lim_{x \to 5^+} ln\left[\frac{x}{\sqrt{x-4}}\right]$$

$$= ln\left[\frac{5}{\sqrt{5-4}}\right]$$

$$= ln(5)$$

Problem 62:

Find the derivative of the function:

$$y = ln(ln(x))$$

$$y' = \frac{\frac{d}{dx}(ln(x))}{ln(x)}$$

$$y' = \frac{\frac{1}{x}}{ln(x)}$$

$$y' = \frac{1}{x \times ln(x)}$$

Problem 104:

Use logarithmic differentiation:

$y = \sqrt{\frac{x^2-1}{x^2+1}}$, in the region where $x > 1$

$$y = \sqrt{\frac{x^2-1}{x^2+1}}$$

$$ln(y) = ln\left[\sqrt{\frac{x^2-1}{x^2+1}}\right]$$

$$ln(y) = \frac{1}{2} \times [ln(x^2-1) - ln(x^2+1)]$$

Differentiate each side:

$$\frac{y'}{y} = \frac{1}{2} \times \left[\frac{\frac{d}{dx}(x^2-1)}{x^2-1} - \frac{\frac{d}{dx}(x^2+1)}{x^2+1}\right]$$

$$y' = \frac{y}{2} \times \left[\frac{2x}{x^2-1} - \frac{2x}{x^2+1}\right]$$

$$y' = \frac{1}{2} \times \sqrt{\frac{x^2-1}{x^2+1}} \times \left[\frac{2x}{x^2-1} - \frac{2x}{x^2+1}\right]$$

$$y' = \sqrt{\frac{x^2-1}{x^2+1}} \times \frac{x}{x^4-1}$$