$$\frac{d}{dx}(uv) = uv' + vu'$$

Differentiate.

$y = x^8 \ln x - \frac{1}{7}x^7$ $\quad u = x^8, \quad v = \ln x - \frac{1}{7}x^7$

$= x^8 \cdot \frac{1}{x} + (\ln x)(8x^7) - x^6$

$= x^7 + 8x^7 \ln x - x^6$

$= x^6(x + 8x \ln x - 1)$

Differentiate. $\quad \frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu' - uv'}{v^2}$

$y = \frac{\ln x}{x^{12}}$

$\frac{dy}{dx} = \frac{x^{12} \cdot \frac{1}{x} - \ln x\,(12x^{11})}{(x^{12})^2}$

$= \frac{x^{11} - 12x^{11} \ln x}{x^{24}}$

$= \frac{x^{11}(1 - 12 \ln x)}{x^{24}} = \frac{1 - 12 \ln x}{x^{13}}$

Differentiate.

$$f(x) = \ln\left(\frac{x^3}{6}\right)$$

$= \ln x^3 - \ln 6$

$= 3\ln x - \ln 6$

$\frac{d}{dx}(\#) = 0$

$f'(x) = \frac{3}{x}$

Differentiate.

$$y = \ln(7x^2 - 3x + 7)\ ;\quad \frac{dy}{dx} = \frac{14x - 3}{7x^2 - 3x + 7}$$

Differentiate.

$$f(x) = \ln\left(\frac{x^8 - 7}{x}\right) = \ln(x^8 - 7) - \ln x$$

$$= \frac{8x^7}{x^8 - 7} - \frac{1}{x}$$

OR

$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd}$$

$$= \frac{8x^8 - (x^8 - 7)}{x(x^8 - 7)} = \frac{7x^8 + 7}{x(x^8 - 7)}$$

$$= \frac{7(x^8 + 1)}{x(x^8 - 7)}$$

Differentiate.

$$g(x) = e^x \cdot \ln x^{11} = e^x \cdot [11 \ln x]$$

$$g'(x) = e^x \left[\frac{11}{x}\right] + 11 \ln x \cdot e^x$$

$$\frac{d}{dx}(uv) = uv' + vu'$$

$$= \frac{11e^x}{x} + 11e^x \ln x$$

$$= 11e^x\left(\frac{1}{x} + \ln x\right)$$

Differentiate. (*Hint*: Use the Extended Power Rule.) : $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} \cdot f'(x)$

$g(x) = (\ln x)^{12}$

$g'(x) = 12(\ln x)^{11} \cdot \frac{1}{x}$

$= \frac{12(\ln x)^{11}}{x}$

Find the derivative.

$y = \ln \sqrt{x+5} = \ln (x+5)^{\frac{1}{2}} = \frac{1}{2}\ln(x+5)$

$\frac{dy}{dx} = \frac{1}{2} \cdot \frac{1}{x+5} = \frac{1}{2(x+5)}$

Use logarithmic differentiation to find the derivative, $\frac{dy}{dt}$, of $y=(t+6)(t+3)(t+2)$.

Choose the correct answer below.

A. $\frac{dy}{dt}=(t+6)(t+3)(t+2)\left(\frac{1}{t+6}+\frac{1}{t+3}+\frac{1}{t+2}\right)$

B. $\frac{dy}{dt}=(t+6)(t+3)(t+2)\left(\frac{1}{(t+6)(t+3)(t+2)}\right)$

C. $\frac{dy}{dt}=\frac{1}{t+6}+\frac{1}{t+3}+\frac{1}{t+2}$

D. $\frac{dy}{dt}=\frac{1}{(t+6)(t+3)(t+2)}$

$y(t)$

$\ln(y)=\ln\left[(t+6)(t+3)(t+2)\right]$

$\ln(y)=\ln(t+6)+\ln(t+3)+\ln(t+2)$

$\frac{y'}{y}=\frac{1}{t+6}+\frac{1}{t+3}+\frac{1}{t+2}$

$y'=y\left(\frac{1}{t+6}+\frac{1}{t+3}+\frac{1}{t+2}\right)$

$=(t+6)(t+3)(t+2)\left(\frac{1}{t+6}+\frac{1}{t+3}+\frac{1}{t+2}\right)$