~~73~~
~~47~~
49
55
a
b
~~15~~
22

73/ $y = e^{-2x^2}$ Find $\frac{d^2y}{dx^2}$

$\frac{dy}{dx} = e^{-2x^2} \cdot -4x$

$\frac{d^2y}{dx^2} = e^{-2x^2} \cdot -4 + -4x \cdot e^{-2x^2} \cdot -4x$

$= -4e^{-2x^2}[1 - 4x^2]$

15/ $f(x) = \ln\left(\frac{x+1}{x-1}\right)$

$f'(x) = \frac{1}{\frac{x+1}{x-1}} \cdot \left[\frac{(x-1)\cdot 1 + (x+1)\cdot 1}{(x-1)^2}\right]$

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

$= \frac{-2}{x^2-1}$

47 $f(x) = x^{\sqrt{x}}$

$f(x) = e^{\ln x^{\sqrt{x}}} = e^{\sqrt{x}\cdot \ln x}$

$f'(x) = e^{\sqrt{x}\cdot \ln x} \cdot \left[x^{1/2} \cdot \frac{1}{x} + \ln x \cdot \frac{1}{2} x^{-1/2} \right]$

$= x^{\sqrt{x}} \cdot x^{-1/2} \left[x \cdot \frac{1}{x} + \frac{1}{2} \ln x \right]$

$x^{1/2} = \frac{1}{2}$

$x^{\sqrt{x}} \cdot \frac{1}{\sqrt{x}} \left[\frac{2}{2} + \frac{\ln x}{2} \right]$

$x^{\sqrt{x}} \left(\frac{2 + \ln x}{2\sqrt{x}} \right)$

$\frac{x^{\sqrt{x}}}{\sqrt{x}} \left[\frac{2 + \ln x}{2} \right]$

$4^{\sqrt{4}} \left[\frac{2 + \ln 4}{2} \right]$

$4(2 + \ln 4)$

$8 + 4 \ln 4$

49 $f(x)=(\sin x)^{\ln x} = e^{\ln \sin x^{\ln x}} = e^{\ln x \cdot \ln(\sin x)}$

$f'(x) = e^{\ln x \cdot \ln(\sin x)} \left[\ln x \cdot \frac{1}{\sin x} \cdot \cos x + \ln(\sin x) \cdot \frac{1}{x}\right]$

$= (\sin x)^{\ln x} \left[\frac{x \ln x \cot x}{x} + \frac{\ln(\sin x)}{x}\right]$

$(\sin x)^{\ln x} \left[\frac{x \ln x \cot x + \ln(\sin x)}{x}\right]$

$1^{\ln \pi/2} \left[\frac{\pi/2 \cdot \ln \pi/2 \cdot 0 + \ln 1}{\pi/2}\right]$

$1^{\ln \pi/2} \cdot 0 = \boxed{0}$

Find $\frac{dy}{dx}$.

$$y + \ln(xy) = 1$$

$$1 \cdot \frac{dy}{dx} + \frac{1}{xy} \cdot \left[x \cdot \frac{dy}{dx} + y \cdot 1\right] = 0$$

$$\frac{dy}{dx} + \frac{1}{y}\frac{dy}{dx} + \frac{1}{x} = 0$$

$$\frac{dy}{dx}\left[\frac{y}{y} + \frac{1}{y}\right] = -\frac{1}{x}$$

$$\frac{dy}{dx}\left[\frac{y+1}{y}\right] = -\frac{1}{x} \cdot \frac{y}{y+1}$$

$$= \frac{-y}{x(y+1)}$$

(b) $y = x^2 \log_2(3-2x)$

$= x^2 \cdot \dfrac{\ln(3-2x)}{\ln 2}$

$= \dfrac{1}{\ln 2}\left[x^2 \cdot \ln(3-2x)\right]$

$= \dfrac{1}{\ln 2}\left[x^2 \cdot \dfrac{1}{3-2x} \cdot -2 + \ln(3-2x) \cdot 2x\right]$