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

$$\frac{1}{\sqrt{1-\left(\frac{x}{2}\right)^2}}\cdot\frac{1}{2}$$

$$(x-1)^2$$

$$\left(1-\frac{x^2}{4}\right)^{\frac{1}{2}}$$

$$\frac{1}{2\sqrt{\frac{4}{4}-\frac{x^2}{4}}}$$

$$\frac{1}{2\frac{\sqrt{4-x^2}}{\sqrt{4}}}=\frac{1}{\cancel{2}\frac{\sqrt{4-x^2}}{\cancel{2}}}=\frac{1}{\sqrt{4-x^2}}$$

78c.

$$P=\frac{200}{1+e^{5-t}}$$

$$P'=\frac{\cancel{(\ )}(0)+200\left(e^{5-t}\right)(+1)}{\left(1+e^{5-t}\right)^2}$$

$$=\frac{200e^{5-t}}{\left(1+e^{5-t}\right)^2}$$

15.

$$y = e^{(1+\ln x)}$$

$$y' = \boxed{e^{(1+\ln x)}} \cdot \frac{1}{x}$$

$$e^{1} \cdot e^{\ln x} \cdot \frac{1}{x}$$

$$e \cdot \cancel{x} \cdot \frac{1}{\cancel{x}} = e$$

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

$$\ln y = \ln\left(x^{\ln x}\right)$$

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

$$\ln y = (\ln x)^2$$

$$\cancel{\frac{1}{y}} \frac{dy}{dx} = 2(\ln x)' \cdot \frac{1}{x} \cdot y$$

$$2 \ln x \cdot \frac{1}{x} \cdot x^{\ln x}$$

24.

$$y = \sin^{-1}\sqrt{1-u^2}$$

$$y' = \frac{1}{\sqrt{1-(\cancel{\sqrt{1-u^2}})^{\cancel{2}}}} \cdot \frac{1}{\cancel{2}}(1-u^2)^{-\frac{1}{2}} \cdot -\cancel{2}u$$

$$\frac{1}{\sqrt{\cancel{1}-\cancel{1}+u^2}} \cdot \frac{-u}{\sqrt{1-u^2}} \qquad \cancel{\sqrt{(-5)^{2}}}$$

$$\frac{-u}{|u|\sqrt{1-u^2}}$$

22.

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

$$\ln y = \ln 2x + \underbrace{x\ln 2}_{\ln 2^x} - \frac{1}{2}\ln(x^2+1)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{\cancel{2}x}\cdot\cancel{2} + \frac{1}{\cancel{2^x}}\cdot\cancel{2^x}\ln 2 - \frac{1}{2}\left(\frac{1}{x^2+1}\cdot 2x\right)$$

$$\cancel{\frac{1}{y}}\frac{dy}{dx} = \left(\frac{1}{x} + \ln 2 - \frac{x}{x^2+1}\right)\frac{2x\,2^x}{\sqrt{x^2+1}}$$

23.

$$23. = e^{\tan^{-1}x}$$

$$e^{\tan^{-1}x}\left(\frac{1}{1+(x)^2}\right)\cdot 1$$

25.

$$y = \underbrace{t}\,\underbrace{\sec^{-1}t} - \frac{1}{2}\ln t$$

$$y' = t\left(\frac{1}{|t|\sqrt{t^2-1}}\right) + \sec^{-1}t - \frac{1}{2}\left(\frac{1}{t}\right)$$

$$\frac{t}{|t|\sqrt{t^2-1}} + \sec^{-1}(t) - \frac{1}{2t}$$

20.

$\ln y = \ln 8^{-t}$

$-t \ln 8$

$\frac{1}{\cancel{y}} \frac{dy}{dt} = -\ln 8 \left(8^{-t}\right)$ $\quad y' = 8^{-t} \ln 8 \cdot -1$

e^{u} $\qquad a^{u}$

$e^{u} \frac{du}{dx}$ $\qquad a^{u} \ln a \frac{du}{dx}$

$\ln u$ $\qquad \log_a u$

$\frac{1}{u} \frac{du}{dx}$ $\qquad \frac{1}{u \ln a} \cdot \frac{du}{dx}$

$$y = z\cos^{-1} z - \sqrt{1-z^2}$$

$$y' = z\frac{-1}{\sqrt{1-(z)^2}} + \cos^{-1} z + \frac{1}{\cancel{2}}(1-z^2)^{-\frac{1}{2}} \cdot \cancel{2}z$$

$$\cancel{\frac{-z}{\sqrt{1-z^2}}} + \cos^{-1} z + \cancel{\frac{z}{\sqrt{1-z^2}}}$$

51.

$$x = 3\sec t \qquad y = 5\tan t \qquad t = \frac{\pi}{6}$$

$$\frac{dy}{dx} = \frac{5\sec^2 t}{3\cancel{\sec t}\tan t} = \frac{5\sec t}{3\tan t}\Bigg|_{t=\frac{\pi}{6}} = \frac{5\cdot\frac{2}{\sqrt{3}}}{\cancel{3}\frac{\sqrt{3}}{\cancel{3}}}$$

$$\frac{dy}{dx} = \frac{\frac{10}{\sqrt{3}}\cdot\frac{1}{\sqrt{3}}}{\cancel{\sqrt{3}\cdot\frac{1}{\sqrt{3}}}} = \frac{10}{3} \qquad \left(\frac{6}{\sqrt{3}}, \frac{5\sqrt{3}}{3}\right)$$

$$y = \frac{10}{3}\left(x - 2\sqrt{3}\right) + \frac{5\sqrt{3}}{3}$$

39. $x^3 + y^3 = (1 - x^3)$

$$\cancel{3}x^2 + \cancel{3}y^2 \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = \frac{-x^2}{y^2}$$

$$\frac{d^2y}{dx^2} = \frac{y^2(-2x) - (-x^2)(2y\frac{dy}{dx})}{(y^2)^2}$$

$$\frac{-2xy^2 + 2x^2y\frac{dy}{dx}}{y^4}$$

$$\frac{-2xy^2 + 2x^2y\left(\frac{-x^2}{y^2}\right)}{y^4}$$

$$\frac{-2xy^2}{y^4} \quad - \quad \frac{\frac{2x^4y}{y^2}\cdot\frac{1}{y^4}}{\cancel{y^4}}$$

$$\frac{-2xy^3}{y^5} \quad \frac{-2x^4}{y^5}$$

$$\frac{-2x(1-x^3) - 2x^4}{y^5}$$