#15 $y = e^{1+\ln x}$

Rule:

$\frac{d}{dx} e^x = e^x$

#22 $y = \frac{(2x) \cdot 2^x}{\sqrt{x^2+1}}$ $\begin{matrix} U \\ V \end{matrix}$

numerator

$u = 2x \quad v = 2^x$

$u' = 2 \quad v' = 2^x \ln 2$

$U' = u'v + uv'$

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

$V = (x^2+1)^{1/2}$

$V' = \frac{1}{2}(x^2+1)^{-1/2} \cdot 2x$

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

Quotient: $\frac{U'V - UV'}{V^2}$

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

$$= \frac{(2^{x+1} + 2^{x+1} \cdot x \ln 2)(x^2+1) - 2^{x+1} \cdot x^2}{(x^2+1)^{3/2}}$$

$$= \frac{2^{x+1}x^2 + 2^{x+1} + 2^{x+1}x^3 \ln 2 + 2^{x+1} x \ln 2 - 2^{x-1} x^2}{(x^2+1)^{3/2}}$$

$$= \frac{2^{x+1}(1 + x^3 \ln 2 + x \ln 2)}{(x^2+1)^{3/2}}$$

#24 $y = \sin^{-1}\sqrt{1-u^2}$

find $\frac{dy}{du}$

Rule

$\frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}}$

$\frac{dy}{du} = \frac{1}{\sqrt{1-(1-u^2)}} \cdot \frac{-u}{\sqrt{1-u^2}}$

$= \frac{1}{\sqrt{u^2}} \cdot \frac{-u}{\sqrt{1-u^2}}$

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

$\frac{d}{u}\left((1-u^2)^{1/2}\right)$

$= \frac{1}{2}(1-u^2)^{-1/2} \cdot -2u$

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

#26 $y = (1+t^2)\cot^{-1}(2t)$

$u = 1+t^2$

$u' = 2t$

$v = \cot^{-1}(2t)$

$v' = \frac{-2}{1+4t^2}$

$\frac{d}{dx}(\cot^{-1}x) = \frac{-1}{1+x^2}$

#39 $x^3+y^3=1$ find $\frac{d^2y}{dx^2}$

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

$$3y^2\frac{dy}{dx}=-3x^2$$

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

find $\frac{d^2y}{dx^2}$ $\quad \frac{d^2y}{dx^2}=-\frac{2xy^2-x^2\cdot\left(\frac{-2x^2}{y}\right)}{y^4}$

$u=x^2$

$u'=2x$ $\quad =-\frac{2xy^3+2x^4}{y^5}$

$v=y^2$

$v'=2y\frac{dy}{dx}=\frac{2y}{1}\cdot\frac{-x^2}{y^2}=\frac{-2x^2}{y}$