DER 1

$$\left(\operatorname{arctg}\frac{tg\,x}{\sqrt{2}}\right)' = \frac{1}{\sqrt{2}}\frac{1}{\cos^2 x}\cdot\frac{1}{1+\frac{1}{2}tg^2 x} =$$

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

DER2

$$\left(\left(\frac{1}{3}\right)^{\arcsin x^2}\right)' = \left(\frac{1}{3}\right)^{\arcsin x^2}\cdot\ln\frac{1}{3}\cdot\left(\arcsin x^2\right)' =$$

$$= \left(\frac{1}{3}\right)^{\arcsin x^2}\ln\frac{1}{3}\cdot\frac{2x}{\sqrt{1-x^4}}$$

DER3

$$\left(\frac{2+x^2}{\sqrt{1+x^2}}\right)' = \frac{2x\sqrt{1+x^2} - \frac{x(2+x^2)}{\sqrt{1+x^2}}}{1+x^2} =$$

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

DER4

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

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

DER5

$$\left(\frac{\sin 2x+1}{\sin x-\cos x}\right)' = \frac{2\cos 2x(\sin x-\cos x)-(\cos x+\sin x)(\sin 2x+1)}{\sin^2 x - 2\sin x\cos x + \cos^2 x} =$$

$$= \frac{-2(\cos x-\sin x)(\cos x-\sin x)(\cos x+\sin x)-(\cos x+\sin x)(\sin 2x+1)}{1-\sin 2x} =$$

$$= \frac{(\cos x+\sin x)(-2+2\sin 2x-\sin 2x-1)}{1-\sin 2x} = \frac{(\cos x+\sin x)(\sin 2x-3)}{1-\sin 2x}$$

**DER6**

$$\left(e^{-x}\frac{x-2}{(1-x)^2}\right)' = -e^{-x}\frac{x-2}{(1-x)^2} + e^{-x}\frac{(1-x)^2+2(1-x)(x-2)}{(1-x)^4} =$$

$$= e^{-x}\cdot\frac{(2-x)(1-x)+1-x+2x-4}{(1-x)^3} =$$

$$= e^{-x}\frac{2-\cancel{2x}-x+x^2+1-x+2x-4}{(1-x)^3} = \frac{x^2-2x-1}{(1-x)^3}e^{-x}$$

**DER7**

$$\left(e^{2x}(3\cos 3x-2\sin 3x)\right)' = 2e^{3x}(3\cos 3x-2\sin 3x)+$$

$$+e^{2x}(-9\sin 3x-6\cos 3x) = e^{2x}(\cancel{6\cos 3x}-4\sin 3x$$

$$-9\sin 3x-\cancel{6\cos 3x}) = -13\sin 3x\cdot e^{2x}$$

**DER8**

$$\left((e^x+e^{-x})^{\cos 2x}\right)' = \left(e^{\cos 2x\ln(e^x+e^{-x})}\right)' =$$

$$=(e^x+e^{-x})^{\cos 2x}\left(-2\sin 2x\ln(e^x+e^{-x})+\cos 2x\frac{e^x-e^{-x}}{e^x+e^{-x}}\right)$$

**DER9**

$$\left(3^{\sin^2\frac{x}{2}}\right)' = 3^{\sin^2\frac{x}{2}}\cdot\ln 3\cdot 2\sin\frac{x}{2}\cdot\cos\frac{x}{2}\cdot\frac{1}{2} =$$

$$= 3^{\sin^2\frac{x}{2}}\cdot\ln 3\cdot\frac{1}{2}\cdot\sin x$$

**DER10**

$$\left(2^{\operatorname{arcctg}\sqrt{x^2+1}}\right)' = \ln 2\cdot 2^{\operatorname{arcctg}\sqrt{x^2+1}}\cdot\frac{-1}{1+x^2+1}\cdot\frac{1}{2}\frac{2x}{\sqrt{x^2+1}} =$$

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

DER11

$$\left(x \ln\left(x+\sqrt{x^2+1}\right)\right)' = \ln\left(x+\sqrt{x^2+1}\right) +$$

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

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

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

DER12

$$\left(\arcsin\frac{x+2}{2x+2}\right)' = \frac{1}{1-\left(\frac{x+2}{2x+2}\right)^2}\cdot\frac{2x+2-2x-4}{(2x+2)^2} =$$

$$= \frac{-2}{(2x+2)\sqrt{(2x+2)^2-(x+2)^2}} = \frac{-2}{(2x+2)\sqrt{3x^2+4x}} = -\frac{1}{(x+1)\sqrt{3x^2+4x}}$$

DER13

$$\left(\ln tg x + \frac{1}{2} ctg 2x\right)' = \frac{1}{tg x\cdot\cos^2 x} - \frac{1}{\sin^2 2x} =$$

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

DER14

$$\log_2\frac{\cos x + x\sin x}{\sin x - x\cos x} = \frac{1}{\ln 2}\cdot\frac{\sin x - x\cos x}{\cos x + x\sin x}\cdot$$

$$\frac{(-\sin x+\sin x+x\cos x)(\cos x-\cos x+x\sin x)}{(\sin x - x\cos x)^2} =$$

$$= \frac{x^2}{\ln 2}\cdot\frac{\cos x + \sin x}{(\cos x + x\sin x)(\sin x - x\cos x)} =$$

$$= \frac{x^2}{\ln 2}\cdot\frac{\cos x + \sin x}{\cos x\cdot\sin x - x\cos^2 x + x\sin^2 x - x^2\cos x\sin x} =$$

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

DER14

$$\left(\log_2(\cos x + x\sin x) - \log_2(\sin x - x\cos x)\right)' =$$

$$= \frac{1}{\log 2}\left(\frac{-\sin x + \sin x + x\cos x}{\cos x + x\sin x} - \frac{\cos x - \cos x + x\sin x}{-x\cos x + \sin x}\right) =$$

$$= \frac{1}{\log 2}\;\frac{x\cos x(\sin x - x\cos x) - x\sin x(\cos x + x\sin x)}{(\cos x + x\sin x)(\sin x - x\cos x)} =$$

$$= \frac{1}{\ln 2}\;\frac{\cancel{x\cos x\sin x} - x^2\cos^2 x - \cancel{x\sin x\cos x} - x^2\sin^2 x}{\cos x\sin x - x^2\cos^2 x + x\sin^2 x - x^2\sin x\cos x} =$$

$$= \frac{1}{\ln 2}\;\frac{-x^2}{(1-x^2)\cos x\sin x - x\cos 2x} =$$

$$= \frac{1}{\ln 2}\;\frac{-2x^2}{(1-x^2)\sin 2x - 2x\cos 2x}$$

DER15

$$\left(x(\cos(2\ln x) + 2\sin(2\ln x))\right)' = \cos(2\ln x) + \cancel{2\sin(2\ln x)} -$$

$$- \cancel{x\sin(2\ln x)\frac{2}{x}} + 2x\cos(2\ln x)\frac{2}{x} = 5\cos(2\ln x)$$

DER16

$$\left(x\arccos x - \sqrt{1-x^2}\right)' = \arccos x - \cancel{\frac{x}{\sqrt{1-x^2}}} + \cancel{\frac{1}{2}\frac{2x}{\sqrt{1-x^2}}} =$$

$$= \arccos x$$

DER17

$$\left(x^2\sqrt[3]{x^2+4x+1}\right)' = 2x\sqrt[3]{x^2+4x+1} + \frac{1}{3}\frac{x^2(2x+4)}{\left(\sqrt[3]{x^2+4x+1}\right)^2} =$$

$$= \frac{6x(x^2+4x+1) + x^2(2x+4)}{3\left(\sqrt[3]{x^2+4x+1}\right)^2} = \frac{6x^3+24x^2+6x+2x^3+4x^2}{3\left(\sqrt[3]{x^2+4x+1}\right)^2}$$

$$= \frac{8x^3+28x^2+6x}{3\left(\sqrt[3]{x^2+4x+1}\right)^2}$$

DER 18

$$\left(\operatorname{arctg} x + \frac{1}{3}\operatorname{arctg} x^3\right)' = \frac{1}{1+x^2} + \frac{1}{\cancel{3}} \cdot \frac{\cancel{3}x^2}{1+x^6}$$

DER 19

$$\left(\frac{\sin x}{\cos^3 x}\right)' = \frac{\cos^4 x - \sin x(-\sin x)\cdot 3\cos^2 x}{\cos^6 x} = \frac{\cos^2 x + 3\sin^2 x}{\cos^4 x} =$$

$$= \frac{1+2\sin^2 x}{\cos^4 x} = \frac{2-\sin^2 x - \cos^2 x + 2\sin^2 x}{\cos^4 x} = \frac{2-\cos 2x}{\cos^4 x}$$

DER 20

$$\left(\arccos \frac{1-x^3}{1+x^3}\right)' = -\frac{1}{\sqrt{1-\frac{(1-x^3)^2}{(1+x^3)^2}}} \cdot \frac{-3x^2(1+x^3) - 3x^2(1-x^3)}{(1+x^3)^2} =$$

$$= \frac{3x^2 + \cancel{3x^5} + 3x^2 - \cancel{3x^5}}{(1+x^3)\sqrt{\cancel{1}+2x^3+\cancel{x^6}-\cancel{1}-\cancel{x^6}+2x^3}} = \frac{6x^2}{(1+x^3)\sqrt{4x^3}} = \frac{3\sqrt{x}}{1+x^3}$$

DER