5.

$$\cos(x+y)\cdot(1+y') - x^2\cdot 2yy' - y^2\cdot 2x = 1$$

$$\cos(x+y) + \underline{y'\cos(x+y)} - \underline{2x^2yy'} - 2xy^2 = 1$$

$$\boxed{y' = \frac{1+2xy^2-\cos(x+y)}{\cos(x+y)-2x^2y}}$$

*6. $3x^2 + (\underline{x^2y'} + y\cdot 2x) - (\underline{x3y^2y'} + y^3)$

$+ \underline{4y^3y'} = 0$

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

*1. $y = \ln x^4 = \underline{4}\ln x$ log rule $\boxed{a\ln b = \ln b^a}$

$$y' = 4\cdot\frac{1}{x} = \frac{4}{x}$$

$$y' = \frac{1}{\cancel{x^4}}\cdot 4\cancel{x^3} = \frac{4}{x}$$

#2. $v'(t) = \frac{dv}{dt} = t \cdot \frac{1}{t} + \ln t \cdot 1$

$= 1 + \ln t$

#3. $\frac{dr}{d\theta} = \frac{\theta \cdot \frac{1}{\theta} - \ln\theta \cdot 1}{\theta^2} = \frac{1 - \ln\theta}{\theta^2}$

#4. $a'(t) = t^2 \cdot \frac{1}{\sqrt{1-t^2}} + \sin^{-1} t \cdot 2t$

#5. $\frac{dy}{dx} = \frac{-1}{\sqrt{1-(2x)^2}} \cdot 2$

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

$y = \sqrt{1-x^2}$

$y^2 = 1 - x^2$

$x^2 + y^2 = 1$

#6. $f'(s) = \frac{s^2 \cdot \frac{1}{1+s^2} - \tan^{-1} s \cdot 2s}{s^4}$

$= \frac{\frac{s}{1+s^2} - 2\tan^{-1} s}{s^3}$

The "unnatural" exponentials

$$\boxed{\begin{aligned} y &= e^x \\ \frac{dy}{dx} &= e^x \end{aligned}}$$

$$\boxed{\begin{aligned} y &= a^x, \quad 0 < a < 1 \text{ or } a > 1 \\ \frac{dy}{dx} &= a^x \cdot \ln a \end{aligned}}$$

$\cancel{y = (-2)^{\frac{1}{2}}}$

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

$$\frac{dy}{dx} = e^{x \cdot \ln a} \cdot \ln a = a^x \cdot \ln a$$

Ex. $\frac{d}{dx}\left[x \cdot 5^x\right] = x \cdot 5^x \cdot \ln 5 + 5^x$

$$= \underbrace{5^x}\,\underbrace{(x \ln 5 + 1)}$$

Ex. $y = 2^{\sin^{-1} x}$

$$\frac{dy}{dx} = 2^{\sin^{-1} x} \cdot \ln 2 \cdot \frac{1}{\sqrt{1-x^2}}$$

\# 11. $f(y) = \ln(\csc y - \cot y)$

$$f'(y) = \frac{-\csc y \cot y + \csc^2 y}{\csc y - \cot y}$$

$$= \frac{+\csc y \cancel{(\csc y - \cot y)}}{\cancel{\csc y - \cot y}} = \csc y$$

HW Derivs of all sorts # 1, 4, 5,

6, 8, 11, 12