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

$$\frac{1}{1+\frac{y^2}{x^2}} \cdot \frac{y'x-y}{x^2} = \frac{2x+2yy'}{\sqrt{x^2+y^2}}$$

$$\frac{\cancel{x^2}}{x^2+y^2} \cdot \frac{y'x-y}{\cancel{x^2}} - \frac{2x+2yy'}{\sqrt{x^2+y^2}} = 0$$

$$\frac{y'x-y}{x^2+y^2} - \frac{2x+2yy'}{\sqrt{x^2+y^2}} = 0$$

$$y'x-y-2\sqrt{x^2+y^2}\,(x+yy') = 0$$

$$\boxed{\begin{array}{l} x \neq 0 \\ y \neq 0 \end{array}}$$

$$y'x-y-2x\sqrt{x^2+y^2}+2yy'\sqrt{x^2+y^2} = 0$$

$$y'x+2yy'\sqrt{x^2+y^2} = y+2x\sqrt{x^2+y^2}$$

$$y' = \frac{y+2x\sqrt{x^2+y^2}}{x+2y\sqrt{x^2+y^2}}$$

2) $\begin{cases} y = \frac{t^2}{t-1} \\ x = \frac{t}{t^2-1} \end{cases}$ $\qquad y'_x = \frac{y'_t}{x'_t}$

$$y'_t = \frac{2t(t-1)-t^2}{(t-1)^2}$$

$$x'_t = \frac{t^2-1-t\cdot 2t}{(t^2-1)^2} = \frac{t^2-2t-1}{(t^2-1)^2}$$

$$y'_x = \frac{(2t^2-2t-t^2)(t^2-1)^2}{(t-1)^2(t^2-2t-1)}$$

3) $y=(x^2+2)^5(3x-x^3)^3$

$\ln y = 5\ln(x^2+2)\cdot 3\ln(3x-x^3)$

$\frac{y'}{y}=\frac{10x}{x^2+2}\cdot 3\ln(3x-x^3) + 15\ln(x^2+2)\cdot\frac{3-3x^2}{3x-x^3}$

$y'=\underline{30x\ln(3x-x^3)}\cdot(x^2+2)^4\cdot(3x-x^3)^3 +$

$+45\ln(x^2+2)\cdot(1-x^2)(3x-x^3)^2\cdot(x^2+2)^5 =$

$=15(x^2+2)^4\cdot(3x-x^3)^2\,(2x\ln(3x-x^3)\cdot(3x-x^3)+$

$+3\ln(x^2+2)(1-x^2)(x^2+2))$

4) $y=x^x$

$\ln y = x\ln x$

$\frac{y'}{y}=\ln x+1$

$y'=x^x(\ln x+1)$

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

$$\ln y = 3\ln(2-x^2)+2\ln(x-1)-\ln(2x^3-3x)-x$$

$$\frac{y'}{y} = \frac{-6x}{2-x^2}+\frac{2}{x-1}-\frac{6x^2-3}{2x^3-3x}-1$$

$$y' = \left(-\frac{6x}{2-x^2}+\frac{2}{x-1}-\frac{6x^2-3}{x(2x^2-3)}-1\right)\frac{(2-x^2)^3(x-1)^2}{e^x(2x^3-3x)}$$

7) $2x+2y=144$

$(xy)'=0$

$y=72-x$

$(72x-x^2)'=0$

$\cancel{x=72}$

~~$2x=0$ не физично $\boxed{x=72}$ $y=0$~~

забыл взять производную

$2x-72=0$

$x=36$ $\qquad y=\cancel{1}\,72-36=36$