1. $y = \frac{1}{x} + \frac{2}{x^2} - \frac{5}{x^3} + \sqrt{x} - \sqrt[3]{x} + \frac{3}{\sqrt{x}}$

$y' = -\frac{1}{x^2} - \frac{4}{x^3} + \frac{15}{x^4} + \frac{1}{2\sqrt{x}} - \frac{1}{3\sqrt[3]{x^2}} - \frac{3}{2\sqrt{x^3}}$

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

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

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

3. $y = \frac{2x}{1-x^2}$

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

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

4. $y = \sqrt{x + \sqrt{x + \sqrt{x}}}$

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

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

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

~~$=(x^2+2)^5(3x-x^3)^3\cdot\left(\frac{1}{(x^2+2)^5}+\frac{1}{(3x-x^3)^3}\right)\cdot 5(x^2+2)^1\cdot 2x$~~

$=(x^2+2)^5(3x-x^3)^3\left(\frac{5(x^2+2)^4\cdot 2x}{(x^2+2)^5}+\frac{3(3x-x^3)^2\cdot(3-3x^2)}{(3x-x^3)^3}\right)=$

$=(x^2+2)^5(3x-x^3)^3\left(\frac{10x}{(x^2+2)}+\frac{9-9x^2}{3x-x^3}\right)=$

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

6. $y=\sqrt[x]{x}$

$y'=\sqrt[x]{x}\left(\ln\left(\sqrt[x]{x}\right)\right)'=\sqrt[x]{x}\cdot\frac{\left(\sqrt[x]{x}\right)'}{\sqrt[x]{x}}=x^{-\frac{1}{x}}$

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

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

$(\ln y)'=\left(\ln(2-x^2)^3+\ln(x-1)^2-\ln(2x^3-3x)-\ln e^x\right)'=$

$=\frac{3\cdot(-2x)}{(2-x^2)}+\frac{2}{x-1}-\frac{6x^2-3}{2x^3-3x}-1$

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

8. $$\begin{cases} x = \dfrac{t^2}{t-1} \\ y = \dfrac{t}{t^2-1} \end{cases} \Rightarrow \begin{cases} x_t' = \dfrac{2t}{1} = 2t \\ y_t' = \dfrac{1}{2t} \end{cases} \Rightarrow$$

$$y_x' = \frac{y_t'}{x_t'} = \frac{1}{2t} : \frac{1}{2t} = 1$$

9. $$\operatorname{arctg}\frac{y}{x} = \ln\sqrt{x^2+y^2} \Rightarrow$$

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

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

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

$$\Rightarrow y' = \frac{x}{x^2-y}$$

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

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

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

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

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

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

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

12. $y = \arcsin(\sin x)$

$$y' = -\frac{\cos x}{\sqrt{1-\sin^2 x}} = -\frac{\cos x}{\sqrt{\cos^2 x}} = -\frac{\cos x}{\pm\cos x} = \pm 1$$

13. $x = ?$ $y = ?$ $P = 144$

$$\begin{cases} x + y = 144 \\ x \cdot y = S_{max} \end{cases} \Rightarrow \begin{cases} y = 144 - x \\ S_m = xy \end{cases} \Rightarrow S = x(144 - x)$$

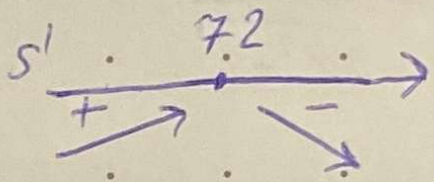
$$S_x' = 144 - 2x = 0$$

$$144 - 2x = 0$$

$$x = \underline{72}$$

Берем $x = 73$

$$S_{73}' = 144 - 2 \cdot 73 = -2$$



Берем $x = 71$

$$S_{71}' = 144 - 2 \cdot 71 = 2$$

$$y = 144 - 72 = \underline{72}$$

$$S_{max} = 72 \cdot 72 = 5184$$