# Lesson 5 Homework

$x^{\frac{1}{3}} = \frac{1}{3}x^{-\frac{1}{3}} = \frac{1}{3\sqrt[3]{x}}$

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

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

$= 1 + \frac{1}{x} - \frac{5}{3x^2} + \frac{1}{2\sqrt{x}} - \frac{1}{3\sqrt[3]{x}} + 6\sqrt{x}$

② $y = x \cdot \sqrt{1+x^2}$

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

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

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

③ $y = \frac{2x}{1-x^2}$

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

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

⑤ $y = \ln\left(x + \sqrt{x^2+1}\right)$

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

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

⑥ $y = x \cdot \ln\left(x+\sqrt{x^2+1}\right) - \sqrt{x^2+1}$

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

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

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

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