560. $y = 8^{2x}$

$y' = 8^{2x} \cdot \ln(8) \cdot 2$

$(2^3)^{2x} \cdot 2^1 \cdot \ln(8)$

$2^{6x} \cdot 2^1 \cdot \ln(8)$

$\underline{y' = 2^{6x+1} \cdot \ln(8)}$

568. $y = \ln(\sin(x))$

$y' = \frac{1}{\sin(x)} \cdot \cos(x)$

$y' = \frac{\cos(x)}{\sin(x)}$

$\underline{y' = \cot(x)}$

570. $y = \log_3(1+x)$

$y' = \frac{1}{(1+x)\ln 3} \cdot 1$

$\underline{y' = \frac{1}{(1+x)\ln 3}}$

589. $g(x) = \underset{f}{3^{2x}} \cdot \underset{g}{2^{3x^2}}$ product rule

$f = 3^{2x}$

$f' = 3^{2x} \cdot \ln 3 \cdot 2$

$2\ln 3 \cdot 3^{2x}$

$\ln 3^2 \cdot 3^{2x}$

$\underline{\ln 9 \cdot 3^{2x}}$

$g = 2^{3x^2}$

$g' = 2^{3x^2} \cdot \ln 2 \cdot 6x$

$\underline{6x \cdot \ln 2 \cdot 2^{3x^2}}$

$f'g + fg'$

$\ln 9 \cdot 3^{2x} \cdot 2^{3x^2} + 3^{2x} \cdot 6x \cdot \ln 2 \cdot 2^{3x^2}$ factor out

$\underline{3^{2x} \cdot 2^{3x^2} \cdot (\ln 9 + 6x \ln 2)}$

605. $y = \underbrace{x}_{f} \cdot \underbrace{e^{\ln 3x}}_{g}$ product rule

$\underline{f = x}$ $\quad g = \underline{e^{\ln 3x}}$

$\underline{f' = 1}$ $\quad g' = e^{\ln 3x} \cdot \frac{1}{\cancel{3}x} \cdot \cancel{3}$

$g' = \underline{e^{\ln 3x} \cdot \frac{1}{x}}$

$\boxed{f'g + fg'}$

$1 \cdot e^{\ln 3x} + \cancel{x} \cdot \frac{1}{\cancel{x}} \cdot e^{\ln 3x}$

$e^{\ln 3x} + e^{\ln 3x}$

$2e^{\ln 3x}$ or...

Back at start:

$y = x \cdot e^{\ln 3x}$

e & ln are opposite/inverse operations. They cancel.

therefore:

$e^{\ln 3x} \Rightarrow \underline{3x}$

$y = x \cdot e^{\ln 3x}$

$\Downarrow$

$y = x \cdot 3x$

$y = 3x^2 \rightarrow y' = 6x$

609. $y = \ln(\sec(x) + \tan(x))$

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

$$y' = \frac{\sec(x)\tan(x) + \sec^2(x)}{\sec(x) + \tan(x)}$$

factor numerator

$$y' = \frac{\sec(x)\cancel{(\tan(x) + \sec(x))}}{\cancel{\sec(x) + \tan(x)}}$$

$$y' = \sec(x)$$

610. $y = x \cdot e^{\tan(x)}$ product rule

$f = x \quad g = e^{\tan(x)}$

$f' = 1 \quad g' = e^{\tan(x)} \cdot \sec^2(x)$

$$y' = 1 \cdot e^{\tan(x)} + x \cdot e^{\tan(x)} \cdot \sec^2(x)$$

factor

$$\boxed{e^{\tan(x)}(1 + x \cdot \sec^2(x))}$$