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September 25, 2025

$$1. D_x \left[\ln |\cos(x)| \right] = \frac{1}{\cos(x)} D_x [\cos(x)] = -\frac{\sin(x)}{\cos(x)} = \boxed{-\tan(x)}$$

$$2. D_x \left[(\ln |\sec(x)|)^5 \right] = 5 (\ln |\sec(x)|)^4 D_x [\ln |\sec(x)|]$$

$$= 5 (\ln |\sec(x)|)^4 \frac{\sec(x) \tan(x)}{\sec(x)}$$

$$= \boxed{5 (\ln |\sec(x)|)^4 \tan(x)}$$

$$3. D_x [4x e^{\sqrt{3x+1}}] = 4e^{\sqrt{3x+1}} + 4x D_x [e^{\sqrt{3x+1}}] \quad \leftarrow \boxed{\text{product rule}}$$

$$= 4e^{\sqrt{3x+1}} + 4x e^{\sqrt{3x+1}} D_x [\sqrt{3x+1}]$$

$$= 4e^{\sqrt{3x+1}} + 4x e^{\sqrt{3x+1}} \frac{1}{2\sqrt{3x+1}} D_x [3x+1]$$

$$= \boxed{4e^{\sqrt{3x+1}} \left(1 + \frac{3x}{2\sqrt{3x+1}} \right)}$$

4. Find the equation of the tangent line to $f(x) = \frac{1}{2} \ln|x|$ at the point $(1, f(1))$.

$$f'(x) = \frac{1}{2} \frac{1}{x} = \frac{1}{2x}$$

$$\text{Point: } (1, f(1)) = (1, \frac{1}{2} \ln(1)) = (1, 0)$$

$$\text{Slope } f'(1) = \frac{1}{2 \cdot 1} = \frac{1}{2}$$

Point slope formula:

$$y - y_0 = m(x - x_0)$$

$$y - 0 = \frac{1}{2}(x - 1)$$

$$\boxed{y = \frac{1}{2}x - \frac{1}{2}}$$

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$$1. D_x \left[\ln |x^6 - 5x^2 + 1| \right] = \frac{1}{x^6 - 5x^2 + 1} \cdot D_x [x^6 - 5x^2 + 1] = \boxed{\frac{6x^5 - 10x}{x^6 - 5x^2 + 1}}$$

$$2. D_x [4xe^{\sqrt{3x+1}}] = 4e^{\sqrt{3x+1}} + 4x D_x [e^{\sqrt{3x+1}}]$$

$$= 4e^{\sqrt{3x+1}} + 4x e^{\sqrt{3x+1}} D_x [\sqrt{3x+1}] = 4e^{\sqrt{3x+1}} \left(1 + x \frac{1}{2\sqrt{3x+1}} \cdot 3 \right)$$

$$= \boxed{4e^{\sqrt{3x+1}} \left(1 + \frac{3x}{2\sqrt{3x+1}} \right)}$$

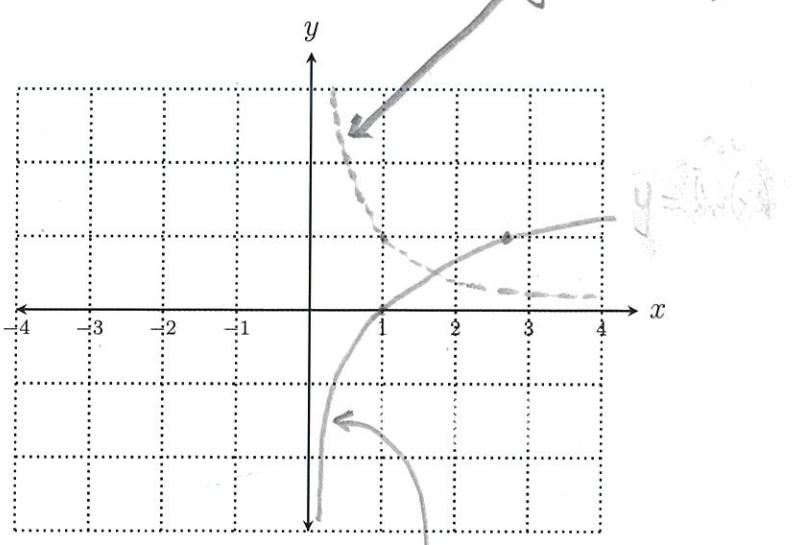
$$3. D_x \left[(\sec(\ln(x)))^3 \right] = 3(\sec(\ln(x)))^2 \cdot D_x [\sec(\ln(x))]$$

$$= \boxed{3(\sec(\ln(x)))^2 \sec(\ln(x)) \tan(\ln(x)) \frac{1}{x}}$$

$$= \boxed{\frac{3(\sec(\ln(x)))^3 \tan(\ln(x))}{x}}$$

4. Let $f(x) = \ln(x)$. Sketch and label the graphs of both $y = f(x)$ and $y = f'(x)$.

$$y = f'(x) = \frac{1}{x}$$



$$u = f(x) = \ln(x)$$