6. $f(x) = (2x+1)^x$

Logarithmic Differentiation

$$\ln f(x) = \ln\left[(2x+1)^x\right]$$

$$\ln f(x) = x \cdot \ln(2x+1)$$

$$\frac{d}{dx} \ln f(x) = \frac{d}{dx}\left[x \cdot \ln(2x+1)\right]$$

$$\frac{f'(x)}{f(x)} = \frac{dx}{dx} \cdot \ln(2x+1) + x \cdot \frac{d}{dx} \ln(2x+1)$$

$$\frac{f'(x)}{f(x)} = \ln(2x+1) + x \cdot \frac{\cancel{\frac{d}{dx}(2x+1)}^{\,2}}{(2x+1)}$$

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

multiply both sides by $f(x)$ to get $f'(x)$

$$f'(x) = f(x)\left[\ln(2x+1) + \frac{2x}{2x+1}\right]$$

$$f'(x) = (2x+1)^x\left[\ln(2x+1) + \frac{2x}{2x+1}\right]$$

Now evaluate at $x = 1$

$$f'(1) = (2\cdot 1+1)^1 \cdot \left[\ln(2\cdot 1+1) + \frac{2\cdot 1}{2\cdot 1+1}\right]$$

$$= 3 \cdot \left[\ln 3 + \frac{2}{3}\right]$$

$$f'(1) = \overbrace{3\ln 3 + \underset{(3)}{2}}^{\text{exact}} \cong \boxed{5.2958} \text{ to 4 decimal places.}$$