

**Exercise 77**

Find  $f'$  in terms of  $g'$ .

$$f(x) = \ln |g(x)|$$

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**Solution**

Calculate  $f'(x)$  by using the chain rule.

$$\begin{aligned} f'(x) &= \frac{d}{dx} \ln |g(x)| \\ &= \frac{d}{dx} \ln \sqrt{[g(x)]^2} \\ &= \frac{1}{\sqrt{[g(x)]^2}} \cdot \frac{d}{dx} \sqrt{[g(x)]^2} \\ &= \frac{1}{\sqrt{[g(x)]^2}} \cdot \frac{1}{2} \{[g(x)]^2\}^{-1/2} \cdot \frac{d}{dx} [g(x)]^2 \\ &= \frac{1}{\sqrt{[g(x)]^2}} \cdot \frac{1}{2} \{[g(x)]^2\}^{-1/2} \cdot 2[g(x)]^1 \cdot \left[ \frac{d}{dx} g(x) \right] \\ &= \frac{1}{\sqrt{[g(x)]^2}} \cdot \frac{1}{\sqrt{[g(x)]^2}} \cdot g(x) \cdot g'(x) \\ &= \frac{1}{[g(x)]^2} \cdot g(x) \cdot g'(x) \\ &= \frac{g'(x)}{g(x)} \end{aligned}$$