

$$3. f(x) = \sqrt{x-3}$$

$$\textcircled{1} f(x) = \sqrt{x-3}$$

$$\textcircled{2} f(\underline{x+h}) = \sqrt{(\underline{x+h})-3}$$
$$= \sqrt{x+h-3}$$

$$\textcircled{3} f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$
$$= \lim_{h \rightarrow 0} \frac{\sqrt{x+h-3} - \sqrt{x-3}}{h}$$
$$= \lim_{h \rightarrow 0} \frac{\sqrt{x+h-3} - \sqrt{x-3}}{h} \cdot \frac{\sqrt{x+h-3} + \sqrt{x-3}}{\sqrt{x+h-3} + \sqrt{x-3}}$$
$$= \lim_{h \rightarrow 0} \frac{\sqrt{x+h-3} \sqrt{x+h-3} - \sqrt{x-3} \sqrt{x-3}}{h(\sqrt{x+h-3} + \sqrt{x-3})}$$

$$= \lim_{h \rightarrow 0} \frac{x+h-3 - (x-3)}{h(\sqrt{x+h-3} + \sqrt{x-3})}$$

$$= \lim_{h \rightarrow 0} \frac{\overset{\cdot}{x} + \overset{\cdot}{h} - \overset{\cdot}{3} - \overset{\cdot}{x} + \overset{\cdot}{3}}{h(\sqrt{x+h-3} + \sqrt{x-3})}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{h}}{\cancel{h}(\sqrt{x+h-3} + \sqrt{x-3})}$$

$$= \lim_{h \rightarrow 0} \frac{1}{\sqrt{x+h-3} + \sqrt{x-3}}$$

$$= \frac{1}{\sqrt{x+0-3} + \sqrt{x-3}}$$

$$= \frac{1}{\sqrt{x-3} + \sqrt{x-3}}$$
$$= \frac{1}{2\sqrt{x-3}}$$