

$$\textcircled{1} \quad \lim_{x \rightarrow -7} \frac{x^2 + 9x + 14}{x^2 + 12x + 35}$$

$$= \lim_{x \rightarrow -7} \frac{(x+2)(x+7)}{(x+5)(x+7)}$$

$$= \lim_{x \rightarrow -7} \frac{x+2}{x+5}$$

$$= \frac{-5}{-2}$$

$$= \frac{5}{2}$$

$$\textcircled{2} \quad f(x) = 3x^2 - 2x$$

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

$$= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 2(x+h) - [3x^2 - 2x]}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3(x^2 + 2xh + h^2) - 2x - 2h - 3x^2 + 2x}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 2h - 3x^2}{h}$$

$$= \lim_{h \rightarrow 0} \frac{6xh + 3h^2 - 2h}{h}$$

$$= \lim_{h \rightarrow 0} \frac{h(6x + 3h - 2)}{h}$$

$$= \lim_{h \rightarrow 0} 6x + 3h - 2$$

$$= 6x - 2$$

$$(3) \quad f(x) = 3x - \frac{2}{x+4}$$

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

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[3(x+h) - \frac{2}{x+h+4} - \left(3x - \frac{2}{x+4} \right) \right]$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[3x + 3h - 3x + \frac{2}{x+4} - \frac{2}{x+h+4} \right]$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[3h + \frac{2(x+h+4) - 2(x+4)}{(x+4)(x+h+4)} \right]$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[3h + \frac{2x+2h+8-2x-8}{(x+4)(x+h+4)} \right]$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[3h + \frac{2h}{(x+4)(x+h+4)} \right]$$

$$= \lim_{h \rightarrow 0} \left[3 + \frac{2}{(x+4)(x+h+4)} \right]$$

$$= 3 + \frac{2}{(x+4)^2}$$

$$(4) \quad s(t) = 3.6t^3 - 2.8t^2 + 2.2$$

$$v(t) = 10.8t^2 - 5.6t$$

$$a(t) = 21.6t - 5.6$$

$$a(2.5) = 48.4 \quad \text{m/s}^2$$

(5)

$$f(x) = \frac{2x^2}{5x+1} \quad \begin{array}{l} \leftarrow u \\ \leftarrow v \end{array}$$

$$f'(x) = \frac{vu' - uv'}{v^2}$$

Quotient Rule

$$f'(x) = \frac{(5x+1)(4x) - 2x^2(5)}{(5x+1)^2}$$

$$= \frac{20x^2 + 4x - 10x^2}{(5x+1)^2}$$

$$= \frac{10x^2 + 4x}{(5x+1)^2}$$

$$\text{or } \frac{2x(5x+2)}{(5x+1)^2}$$

(6)

$$y = 5x^2 - 6\sqrt{x} + \frac{4}{x} + 3$$

$$y = 5x^2 - 6x^{1/2} + 4x^{-1} + 3$$

$$y' = 10x - 3x^{-1/2} - 4x^{-2}$$

$$\begin{aligned} y' \Big|_{x=4} &= 40 - \frac{3}{\sqrt{4}} - \frac{4}{4^2} \\ &= 38.25 \quad \text{or} \quad \frac{153}{4} \end{aligned}$$

$$\textcircled{7} \quad a) \quad y = \frac{-2}{(4x+3)^5}$$

$$y = -2(4x+3)^{-5}$$

$$y' = 10(4x+3)^{-6}(4)$$

$$y' = 40(4x+3)^{-6}$$

$$b) \quad y = 9 \cdot \sqrt{3x^2+1}$$

$$y = 9(3x^2+1)^{1/2}$$

$$y' = \frac{9}{2}(3x^2+1)^{-1/2}(6x)$$

$$y' = 27x(3x^2+1)^{-1/2}$$

$$c) \quad y = \underbrace{3x}_u \underbrace{(2x+1)^8}_v$$

$$y' = uv' + v u' \quad \text{Product Rule}$$

$$y' = 3x [8(2x+1)^7(2)] + (2x+1)^8(3)$$

$$y' = 48x(2x+1)^7 + 3(2x+1)^8$$

or $y' = 3(2x+1)^7 [16x + 2x+1]$

$$y' = 3(2x+1)^7 (18x+1)$$