Sec. 3.1

p. 125 #4, 5, 6

(4) $f(x) = x^2 + 9x \quad a = 2 \quad f'(x) = 2x + 9 \quad \boxed{f'(2) = 13}$

$$\lim_{x \to 2} \frac{x^2 + 9x - 22}{x - 2} = \lim_{x \to 2} \frac{(x+11)(x-2)}{(x-2)} = \lim_{x \to 2} x + 11 = \boxed{13}$$

$$\lim_{h \to 0} \frac{(x+h)^2 + 9(x+h) - (x^2 + 9x)}{h} =$$

$$\lim_{h \to 0} \frac{x^2 + 2xh + h^2 + 9x + 9h - x^2 - 9x}{h}$$

$$\lim_{h \to 0} 2x + h + 9 = 2x + 9 \text{ @ } x = 2 \quad 2(2) + 9 = \boxed{13}$$

(5) $f(x) = 3x^2 + 4x + 2 \quad a = -1 \quad f'(x) = 6x + 4 \quad \boxed{f'(-1) = -2}$

$$\lim_{x \to -1} \frac{3x^2 + 4x + 2 - 1}{x + 1} = \lim_{x \to -1} \frac{3x^2 + 4x + 1}{x + 1}$$

$x^2 + 4x + 3$

$(x + 3)(x + 1)$

$3 \quad 3$

$$\lim_{x \to -1} \frac{(x+1)(3x+1)}{x+1} = \lim_{x \to -1} 3x + 1 = \boxed{-2}$$

$$\lim_{h \to 0} \frac{3(x+h)^2 + 4(x+h) + 2 - (3x^2 + 4x + 2)}{h}$$

$$\lim_{h \to 0} \frac{3x^2 + 6xh + 3h^2 + 4x + 4h + 2 - 3x^2 - 4x - 2}{h}$$

$$\lim_{h \to 0} 6x + 3h + 4 = 6x + 4 \text{ @ } x = -1 \quad 6(-1) + 4 = \boxed{-2}$$

⑥ $f(x) = x^3 \quad a = 2 \quad f'(x) = 3x^2$ $\boxed{f'(2) = 12}$

$$\lim_{x \to 2} \frac{x^3 - 8}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x^2+2x+4)}{x-2} = \lim_{x \to 2} x^2 + 2x + 4 = \boxed{12}$$

$$\lim_{h \to 0} \frac{(x+h)^3 - x^3}{h}$$

$$(x+h)(x^2+2xh+h^2)$$
$$x^3 + 2x^2h + xh^2$$
$$x^2h + 2xh^2 + h^3$$
$$x^3 + 3x^2h + 3xh^2 + h^3$$

$$\lim_{h \to 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h}$$

$$\lim_{h \to 0} 3x^2 + 3xh + h^2 = 3x^2 \quad @ \; x = 2 \quad 3(2)^2 = \boxed{12}$$