1. a. $f(x) = \sqrt{x+4}$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{x+4+\Delta x} - \sqrt{x+4}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{x+\Delta x+4} - \sqrt{x+4}}{\Delta x} \cdot \frac{\sqrt{x+\Delta x+4} + \sqrt{x+4}}{\sqrt{x+\Delta x+4} + \sqrt{x+4}}$$

$$= \lim_{\Delta x \to 0} \frac{x+\Delta x+4 - (x+4)}{\Delta x(\sqrt{x+\Delta x+4} + \sqrt{x+4})}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x}{\Delta x(\sqrt{x+\Delta x+4} + \sqrt{x+4})}$$

$$= \lim_{\Delta x \to 0} \frac{1}{\sqrt{x+\Delta x+4} + \sqrt{x+4}}$$

$$= \frac{1}{\sqrt{x+4} + \sqrt{x+4}}$$

$$= \frac{1}{2\sqrt{x+4}}$$

b. $f(x) = \frac{3}{x}$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\frac{3}{x+\Delta x} - \frac{3}{x}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\frac{3x}{x(x+\Delta x)} - \frac{3(x+\Delta x)}{x(x+\Delta x)}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\frac{3x - 3x - 3\Delta x}{x(x+\Delta x)}}{\Delta x}$$

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

$$= \lim_{\Delta x \to 0} \frac{-3\Delta x^2}{x^2 + \Delta x \cdot x}$$

$$= -\frac{3}{x^2}$$

2. a. $f(x) = 3x^3 - \frac{4}{x^2}$

$f'(x) = 3 \cdot 3x^2 - 4 \cdot (-2) \cdot x^{-3}$

$= 9x^2 + 8 \cdot \frac{1}{x^3}$

$= 9x^2 + \frac{8}{x^3}$

b. $f(x) = (4-x^2)^3$

$f'(x) = 3 \cdot (4-x^2)^2 \cdot (0-2x)$

$= 3(4-x^2)^2 \cdot (-2x)$

$= -6x(4-x^2)^2$

c. $f(x) = e^{\sin(x)}$

$f'(x) = e^{\sin(x)} \cdot \frac{d}{dx}[\sin(x)]$

$= \cos(x)\, e^{\sin(x)}$

d. $f(x) = \ln(x+2)$

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

$= \frac{1}{x+2} \cdot 1$

$= \frac{1}{x+2}$

e. $f(x) = x^2\cos(x) + x\tan(x)$

$f'(x) = 2x \cdot \cos(x) + x^2 \cdot (-\sin(x)) + 1 \cdot \tan(x) + x \cdot \sec^2(x)$

$= \tan(x) - x^2\sin(x) + x\sec^2(x) + 2x\cos(x)$

f. $f(x) = \sqrt{3x^2+2}$

$$f'(x) = \frac{1}{2}(3x^2+2)^{-\frac{1}{2}} \cdot \frac{d}{dx}(3x^2+2)$$

$$= \frac{1}{2}(3x^2+2)^{-\frac{1}{2}} \cdot 6x$$

$$= \frac{3x}{\sqrt{3x^2+2}}$$

$$= \frac{3x\sqrt{3x^2+2}}{3x^2+2}$$

g. $f(x) = \frac{x}{4} \sin^{-1}(x)$

$$f'(x) = \frac{1}{4} \cdot \left(\arcsin(x) + x \cdot \frac{1}{\sqrt{1-x^2}}\right)$$

$$= \frac{\arcsin(x) + \frac{x}{\sqrt{1-x^2}}}{4}$$

h. $x^2y = (y+2) + xy\sin(x)$

$$(2x)'y + x^2 \cdot y' = y\sin(x) + \cos(x) \cdot xy$$

$$x^2 \cdot y' = y\sin(x) + \cos(x) \cdot xy - (2x)'y$$

$$y' = \frac{y\sin x + y \cdot \cos(x) \cdot x - 2y}{x^2}$$

$$y' = \frac{y(\sin x + \cos(x) \cdot x - 2)}{x^2}$$

3. a. hour 39.

$$f'(39) = \frac{f(39+10) - f(39-10)}{(2 * 10)}$$

$$= \frac{f(49) - f(29)}{20}$$

$$= \frac{145 - 115}{20}$$

$$= 1.5$$

physical meaning: The speed of wind is increasing at 1.5 mph/hour at the time of 39 hours.

b. hour 83

$$f'(83) = \frac{f(83+2) - f(83-2)}{(2*2)}$$

$$= \frac{f(85) - f(81)}{4}$$

$$= \frac{95 - 125}{4}$$

$$= -7.5$$

physical meaning: The speed of wind is decreasing at 7.5 mph/hour at the time of 83 hours