

Sec. 3.1/3.2 Practice

$$\textcircled{1} \lim_{h \rightarrow 0} \frac{\sqrt{x+h+1} - \sqrt{x+1}}{h} \cdot (\sqrt{x+h+1} + \sqrt{x+1})$$

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

$$\lim_{h \rightarrow 0} \frac{1}{\sqrt{x+h+1} + \sqrt{x+1}} = \frac{1}{2\sqrt{x+1}} \Big|_{x=8} \frac{1}{2\sqrt{8+1}} = \boxed{\frac{1}{6}}$$

pt (8, 3) slope $\frac{1}{6}$ $y-3 = \frac{1}{6}(x-8)$

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

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

$$\lim_{h \rightarrow 0} 2x + h - 1 = \boxed{2x - 1}$$

$\textcircled{3}$ a. $f(x) = \sqrt{x}$ $a=1$ b. $f(x) = \cos x$ $a=\pi$

$$\textcircled{4} y' = \frac{1}{2}(4x^3) = \boxed{2x^3}$$

$$\textcircled{5} y' = \boxed{\sqrt{2}}$$

$$\textcircled{6} y' = \boxed{0}$$

$$\textcircled{7} y = \frac{x^2}{5} + \frac{1}{5} \quad y' = \boxed{\frac{2x}{5}}$$

$$\textcircled{8} \quad y' = 24x^{-9} + 4 \cdot \frac{1}{2\sqrt{x}} = \boxed{24x^{-9} + \frac{2}{\sqrt{x}}}$$

$$\textcircled{9} \quad y = x^{\frac{2}{3}} \quad y' = \frac{2}{3} x^{-\frac{1}{3}} = \boxed{\frac{2}{3x^{\frac{1}{3}}}}$$

$$\textcircled{10} \quad y = \frac{2x}{5x} + \frac{1}{5x} = \frac{2}{5} + \frac{1}{5}x^{-1} \quad \boxed{y' = \frac{-1}{5}x^{-2} \text{ or } \frac{-1}{5x^2}}$$

$$\textcircled{11} \quad y = \frac{3}{x^2} + \frac{x}{x^2} + \frac{x^2}{x^2} + \frac{x^3}{x^2} = 3x^{-2} + x^{-1} + 1 + x$$

$$y' = -6x^{-3} - 1x^{-2} + 1 = \boxed{\frac{-6}{x^3} - \frac{1}{x^2} + 1}$$

$$\textcircled{12} \quad y = x^3 + 3x + 1$$

$$y' = 3x^2 + 3$$

$$y'' = 6x$$

$$y''' = 6$$

$$6 + x(6x) - 2(3x^2 + 3) = 0$$

$$6 + 6x^2 - 6x^2 - 6 = 0$$

$$0 = 0 \quad \checkmark$$

$$\textcircled{13} \quad y' = x^2 - 3x + 2$$

$$x^2 - 3x + 2 = 0$$

$$(x-2)(x-1) = 0$$

$$x = 2, 1$$

$$\left(2, \frac{2}{3}\right) \left(1, \frac{5}{6}\right)$$

$$\textcircled{14} \quad f'(x) = 3ax^2 + 2bx + c$$