

should be 3

HW 2: Limits Algebraically

$$\textcircled{1} \lim_{x \rightarrow 2} (x^2 - x + 1) =$$

$$\lim_{x \rightarrow 2} (2^2 - 2 + 1) = \boxed{3}$$

$$\textcircled{2} \lim_{x \rightarrow 1} \left(\frac{2x+1}{3x-2} \right) =$$

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

$$\textcircled{3} \lim_{x \rightarrow 1} \sqrt{10x-1} =$$

$$\lim_{x \rightarrow 1} \sqrt{10(1)-1} = \boxed{3}$$

$$\textcircled{4} \lim_{x \rightarrow 1} \left(\frac{x^2 - x - 2}{x - 2} \right) =$$

$$\lim_{x \rightarrow 1} \left(\frac{1^2 - 1 - 2}{1 - 2} \right) = \boxed{2}$$

$$\textcircled{5} \lim_{x \rightarrow 2} \left(\frac{x^2 - x - 2}{x - 2} \right) =$$

$$\lim_{x \rightarrow 2} \left(\frac{2^2 - 2 - 2}{2 - 2} \right) = \frac{0}{0}$$

$$\lim_{x \rightarrow 2} \left(\frac{\cancel{x-2}(x+1)}{\cancel{x-2}} \right) =$$

$$\lim_{x \rightarrow 2} (x+1) = \boxed{3}$$

$$\textcircled{6} \lim_{x \rightarrow 4} \left(\frac{\sqrt{x} - 2}{x - 4} \right) =$$

$$\lim_{x \rightarrow 4} \left(\frac{\sqrt{4} - 2}{4 - 4} \right) = \frac{0}{0}$$

$$\lim_{x \rightarrow 4} \left(\frac{(\sqrt{x} - 2)(\sqrt{x} + 2)}{(x - 4)(\sqrt{x} + 2)} \right) =$$

$$\lim_{x \rightarrow 4} \left(\frac{\cancel{x-4}}{\cancel{x-4}(\sqrt{x} + 2)} \right) =$$

$$\lim_{x \rightarrow 4} \left(\frac{1}{\sqrt{x} + 2} \right) = \boxed{\frac{1}{4}}$$

$$\textcircled{7} \lim_{x \rightarrow -3} \left(\frac{x^2 - 9}{x + 3} \right) =$$

$$\lim_{x \rightarrow -3} \left(\frac{(-3)^2 - 9}{-3 + 3} \right) = \frac{0}{0}$$

$$\lim_{x \rightarrow -3} \left(\frac{\cancel{x+3}(x-3)}{\cancel{x+3}} \right) =$$

$$\lim_{x \rightarrow -3} (x - 3) = \boxed{-6}$$

$$\textcircled{8} \lim_{x \rightarrow -3} \left(\frac{x^2 - 9}{2x^2 + 7x + 3} \right) =$$

$$\lim_{x \rightarrow -3} \left(\frac{(-3)^2 - 9}{2(-3)^2 + 7(-3) + 3} \right) = \frac{0}{0}$$

$$\lim_{x \rightarrow -3} \left(\frac{\cancel{x+3}(x-3)}{\cancel{x+3}(2x+1)} \right) =$$

$$\lim_{x \rightarrow -3} \left(\frac{x-3}{2x+1} \right) = \boxed{\frac{6}{5}}$$

$$\textcircled{9} \lim_{x \rightarrow 9} \left(\frac{\sqrt{x} - 3}{x - 9} \right) = \frac{0}{0}$$

$$\lim_{x \rightarrow 9} \left(\frac{(\sqrt{x} - 3)(\sqrt{x} + 3)}{(x - 9)(\sqrt{x} + 3)} \right) =$$

$$\lim_{x \rightarrow 9} \left(\frac{\cancel{\sqrt{x}-3}}{\cancel{\sqrt{x}-3}} \right) = \boxed{\frac{1}{6}}$$

$$\textcircled{10} \lim_{h \rightarrow 0} \left(\frac{(1+h)^2 - 1^2}{h} \right) = \frac{0}{0}$$

$$\lim_{h \rightarrow 0} \left(\frac{h^2 + 2h + 1 - 1}{h} \right) =$$

$$\lim_{h \rightarrow 0} \left(\frac{h^2 + 2h}{h} \right) = \boxed{2}$$

$$\begin{aligned} \textcircled{11} \quad \lim_{h \rightarrow 0} \left(\frac{(3+h)^2 - 3^2}{h} \right) &= \frac{0}{0} & \textcircled{12} \quad \lim_{h \rightarrow 0} \left(\frac{(x+h)^2 - x^2}{h} \right) &= \frac{0}{0} \\ \lim_{h \rightarrow 0} \left(\frac{9 + 6h + h^2 - 9}{h} \right) &= & \lim_{h \rightarrow 0} \left(\frac{x^2 + 2xh + h^2 - x^2}{h} \right) &= \\ \lim_{h \rightarrow 0} \left(\frac{h(6+h)}{h} \right) &= \boxed{6} & \lim_{h \rightarrow 0} \left(\frac{h(2x+h)}{h} \right) &= \boxed{2x} \end{aligned}$$

$$13-20 \quad f(x) = \begin{cases} x+1, & x < 2 \\ x^2-2, & 2 < x < 4 \\ \sqrt{x+5}, & x \geq 4 \end{cases}$$

$$\textcircled{13} \quad \lim_{x \rightarrow 1} f(x) = 1+1 = \boxed{2}$$

$$\textcircled{14} \quad \lim_{x \rightarrow 2} f(x) =$$

$$\lim_{x \rightarrow 2^-} (2+1) = 3$$

$$\lim_{x \rightarrow 2^+} (2^2-2) = 2$$

$$\lim_{x \rightarrow 2} f(x) = \boxed{\text{DNE}}$$

$$\textcircled{15} \quad \lim_{x \rightarrow 3} f(x) =$$

$$\lim_{x \rightarrow 3} (3^2-2) = \boxed{7}$$

$$\textcircled{16} \quad \lim_{x \rightarrow 4} f(x) =$$

$$\lim_{x \rightarrow 4^-} (4^2-2) = 14$$

$$\lim_{x \rightarrow 4^+} (\sqrt{9}) = 3$$

$$\lim_{x \rightarrow 4} f(x) = \boxed{\text{DNE}}$$

$$\textcircled{17} \quad f(1) = 1+1 = \boxed{2}$$

$$\textcircled{18} \quad f(2) = \boxed{\text{undefined}}$$

$$\textcircled{19} \quad f(3) = 3^2-4 = \boxed{5}$$

$$\textcircled{20} \quad f(4) = \sqrt{4+5} = \boxed{3}$$