6/5/24 HW2

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#88, 115

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#89, 90, 92, 93, 96, 97, 98, 101, 102, 106, 111, 117, 118, 119, 126, 127

preview problems:

88. $\lim_{x\to -2} (4x^2-1) = 4(-2)^2-1 = \boxed{15}$

115. a. $\lim_{x\to 3} f(x) = \boxed{9}$ b. $\lim_{x\to 3^+} f(x) = \boxed{7}$

hw:

89. $\lim_{x\to 0} \frac{1}{1+\sin x} = \frac{1}{1+\sin(0)} = \boxed{1}$

90. $\lim_{x\to 2} e^{2x-x^2} = e^{2\cdot 2-2^2} = e^0 = \boxed{1}$

92. $\lim_{x\to 3} \ln e^{3x} = \ln e^9 = \boxed{9}$

93. $\lim_{x\to 4} \frac{x^2-16}{x-4} \Rightarrow \frac{4^2-16}{4-4} = \frac{0}{0}$

$\Downarrow$

$= \lim_{x\to 4} \frac{\cancel{(x-4)}(x+4)}{\cancel{x-4}} = 4+4 = \boxed{8}$

96. $\lim_{h\to 0} \frac{(1+h)^2-1}{h} \Rightarrow \frac{(1+0)^2-1}{0} = \frac{0}{0}$

$\Downarrow$

$\lim_{h\to 0} \frac{h^2+2h+\cancel{1-1}}{h} = \lim_{h\to 0} \frac{\cancel{h}(h+2)}{\cancel{h}} = \boxed{2}$

97. $\lim_{t\to 9} \frac{t-9}{\sqrt{t}-3} \Rightarrow \frac{9-9}{\sqrt{9}-3} = \frac{0}{0}$

$\Downarrow$

$= \lim_{t\to 9} \frac{\cancel{(\sqrt{t}-3)}(\sqrt{t}+3)}{\cancel{\sqrt{t}-3}} = \sqrt{9}+3 = \boxed{6}$

98. $\lim_{h\to 0} \frac{\frac{1}{a+h}-\frac{1}{a}}{h} \Rightarrow \frac{\frac{1}{a}-\frac{1}{a}}{0} = \frac{0}{0}$

$\Downarrow$

$= \lim_{h\to 0} \frac{\frac{a-(a+h)}{a(a+h)}}{h} = \lim_{h\to 0} \frac{-\cancel{h}}{a\cancel{h}(a+h)} = -\frac{1}{a(a+0)} = \boxed{\frac{-1}{a^2}}$

101. $\lim_{x\to \frac{1}{2}} \frac{2x^2+3x-2}{2x-1} \Rightarrow \frac{2\cdot(\frac{1}{2})^2+3\cdot\frac{1}{2}-2}{2(\frac{1}{2})-1} = \frac{0}{0}$

$\Downarrow$

$= \lim_{x\to \frac{1}{2}} \frac{\cancel{(2x-1)}(x+2)}{\cancel{2x-1}} = \frac{1}{2}+2 = \boxed{\frac{5}{2}}$

102. $\lim_{x\to -3} \frac{\sqrt{x+4}-1}{x+3} = \lim_{x\to -3} \frac{(\sqrt{x+4}-1)(\sqrt{x+4}+1)}{(x+3)(\sqrt{x+4}+1)}$

$= \lim_{x\to -3} \frac{\cancel{x+4-1}}{\cancel{(x+3)}(\sqrt{x+4}+1)} = \lim_{x\to -3} \frac{1}{\sqrt{x+4}+1} = \frac{1}{1+1} = \boxed{\frac{1}{2}}$

106. $\lim_{x\to 1^+} \frac{2x^2+7x-4}{x^2+x-2} = \lim_{x\to 1^+} \frac{(2x-1)(x+4)}{(x-1)(x+2)}$

$\lim_{x\to 1^+} \frac{\overset{1}{(2x-1)}\overset{5}{(x+4)}}{(x+2)} \cdot \lim_{x\to 1^+} \frac{1}{(x-1)}$

as $x\to 1^+$, $(x-1)\to 0^+$, so $\frac{1}{(x-1)}\to\infty$

$\frac{(2\cdot 1-1)(1+4)}{(1+2)} \cdot \infty = \boxed{\infty}$

111. $\lim_{x\to 6} \sqrt{g(x)-f(x)} = \sqrt{\lim_{x\to 6} g(x) - \lim_{x\to 6} f(x)}$

$= \sqrt{9-4} = \boxed{\sqrt{5}}$

117. a. $\lim_{x\to 2^-} h(x) = \boxed{1}$ b. $\lim_{x\to 2^+} h(x) = \boxed{1}$

118. $\lim_{x\to -3^+} (f(x)+g(x)) = \lim_{x\to -3^+} f(x) + \lim_{x\to -3^+} g(x)$

$= -2+2 = \boxed{0}$

119. $\lim_{x\to 3^-}(f(x)-3g(x)) = \lim_{x\to 3^-} f(x) - 3\lim_{x\to 3^-} g(x)$

$= 0-3\cdot(-2) = \boxed{6}$

126. $2\cdot 2-1 \le g(2) \le \cancel{2^2-2\cdot 2}+3$

$3 \le g(2) \le 3$

$\boxed{\text{False}}$

122. $\lim_{\theta\to 0} \theta^2 \cdot \cos\left(\frac{1}{\theta}\right) = \boxed{0}$