Directions: Find the limits. Show all steps. Simplify your answer.

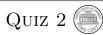
1.
$$\lim_{x \to 0} \frac{5x^2 + 3x}{3x} = \lim_{x \to 0} \frac{x(5x+3)}{3x} = \lim_{x \to 0} \frac{5x+3}{3} = \frac{5 \cdot 0 + 3}{3} = \boxed{1}$$

2.
$$\lim_{x \to 2} \frac{\sqrt{x^2 + 12} - 4}{x - 2} = \lim_{x \to 2} \frac{\sqrt{x^2 + 12} - 4}{x - 2} \cdot \frac{\sqrt{x^2 + 12} + 4}{\sqrt{x^2 + 12} + 4} = \lim_{x \to 2} \frac{\sqrt{x^2 + 12}^2 + 4\sqrt{x^2 + 12} - 4\sqrt{x^2 + 12} - 4^2}{(x - 2)(\sqrt{x^2 + 12} + 4)} = \lim_{x \to 2} \frac{\sqrt{x^2 + 12}^2 - 4^2}{(x - 2)(\sqrt{x^2 + 12} + 4)} = \lim_{x \to 2} \frac{x^2 + 12 - 16}{(x - 2)(\sqrt{x^2 + 12} + 4)} = \lim_{x \to 2} \frac{x^2 - 4}{(x - 2)(\sqrt{x^2 + 12} + 4)} = \lim_{x \to 2} \frac{(x - 2)(x + 2)}{(x - 2)(\sqrt{x^2 + 12} + 4)} = \lim_{x \to 2} \frac{x + 2}{\sqrt{x^2 + 12} + 4} = \frac{2 + 2}{\sqrt{2^2 + 12} + 4} = \frac{4}{\sqrt{16} + 4} = \frac{1}{2}$$

3.
$$\lim_{h \to 0} \frac{\frac{1}{1+h} - 1}{h} = \lim_{h \to 0} \frac{\frac{1}{1+h} - 1}{h} \cdot \frac{1+h}{1+h} = \lim_{h \to 0} \frac{1 - (1+h)}{h(1+h)} = \lim_{h \to 0} \frac{1 - 1 - h}{h(1+h)} = \lim_{h \to 0} \frac{-h}{h(1+h)} = \lim_{h \to 0} \frac{-1}{1+h} = \frac{-1}{1+0} = \boxed{-1}$$

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

Note: When 2 < x (as it is when x approaches 2 from the right), the expression 2 - x is negative, so |2 - x| = -(2 - x)



MATH 200 January 25, 2022

Directions: Find the limits. Show all steps. Simplify your answer.

1.
$$\lim_{x \to 0} \frac{5x^2 + x^3}{5x^2} = \lim_{x \to 0} \frac{x^2(5+x)}{5x^2} = \lim_{x \to 0} \frac{5+x}{5} = \frac{5+0}{5} = \boxed{1}$$

2.
$$\lim_{x \to 3} \frac{\frac{1}{x^2} - \frac{1}{9}}{x - 3} = \lim_{x \to 3} \frac{\frac{1}{x^2} - \frac{1}{9}}{x - 3} \cdot \frac{9x^2}{9x^2} = \lim_{x \to 3} \frac{9 - x^2}{(x - 3)9x^2} = \lim_{x \to 3} \frac{(3 - x)(3 + x)}{(x - 3)9x^2} = \lim_{x \to 3} \frac{-(x - 3)(3 + x)}{(x - 3)9x^2} = \lim_{x \to 3} \frac{-(3 + x)}{9x^2} = \frac{-(3 + 3)}{9 \cdot 3^2} = \frac{-6}{81} = \boxed{-\frac{2}{27}}$$

3.
$$\lim_{h \to 0} \frac{\sqrt{5+h} - \sqrt{5}}{h} = \lim_{h \to 0} \frac{\sqrt{5+h} - \sqrt{5}}{h} \cdot \frac{\sqrt{5+h} + \sqrt{5}}{\sqrt{5+h} + \sqrt{5}} = \lim_{h \to 0} \frac{\sqrt{5+h}^2 + \sqrt{5+h}\sqrt{5} - \sqrt{5}\sqrt{5+h} - \sqrt{5}^2}{h\left(\sqrt{5+h} + \sqrt{5}\right)} = \lim_{h \to 0} \frac{\sqrt{5+h}^2 - \sqrt{5}^2}{h\left(\sqrt{5+h} + \sqrt{5}\right)} = \lim_{h \to 0} \frac{5+h-5}{h\left(\sqrt{5+h} + \sqrt{5}\right)} = \lim_{h \to 0} \frac{h}{h\left(\sqrt{5+h} + \sqrt{5}\right)} = \lim_{h \to 0} \frac{1}{\sqrt{5+h} + \sqrt{5}} = \frac{1}{\sqrt{5} + \sqrt{5}} = \boxed{\frac{1}{2\sqrt{5}}}$$

4.
$$\lim_{x \to 1^{+}} \frac{|1-x|}{6x - 6x^{2}} = \lim_{x \to 1^{+}} \frac{-(1-x)}{6x - 6x^{2}} = \lim_{x \to 1^{+}} \frac{-(1-x)}{6x(1-x)} = \lim_{x \to 1^{+}} \frac{-1}{6x} = \frac{-1}{6 \cdot 1} = \boxed{-\frac{1}{6}}$$

Note: When 1 < x (as it is when x approaches 1 from the right), the expression 1 - x is negative, so |1 - x| = -(1 - x)