Name: ______________________________ **QUIZ 2** **MATH 200**

January 25, 2022

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

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

$$\lim_{x\to 2} \frac{\sqrt{x^2+12}^{\,2} + 4\sqrt{x^2+12} - 4\sqrt{x^2+12} - 4^2}{(x-2)\left(\sqrt{x^2+12}+4\right)} = \lim_{x\to 2} \frac{\sqrt{x^2+12}^{\,2} - 4^2}{(x-2)\left(\sqrt{x^2+12}+4\right)} =$$

$$\lim_{x\to 2} \frac{x^2+12-16}{(x-2)\left(\sqrt{x^2+12}+4\right)} = \lim_{x\to 2} \frac{x^2-4}{(x-2)\left(\sqrt{x^2+12}+4\right)} = \lim_{x\to 2} \frac{(x-2)(x+2)}{(x-2)\left(\sqrt{x^2+12}+4\right)} =$$

$$\lim_{x\to 2} \frac{x+2}{\sqrt{x^2+12}+4} = \frac{2+2}{\sqrt{2^2+12}+4} = \frac{4}{\sqrt{16}+4} = \frac{4}{8} = \boxed{\frac{1}{2}}$$

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 $|2-x| = -(2-x)$

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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 $|1-x| = -(1-x)$