Name: Richard

Quiz 4

MATH 200

September 3, 2024

1. $\lim_{x \to 0} \frac{x^2 - 4x + 3}{3x^2 + 12x - 15} = \frac{0^2 - 4 \cdot 0 + 3}{3 \cdot 0^2 + 12 \cdot 0 - 15} = \frac{3}{-15} = \boxed{-\frac{1}{5}}$

2. $\lim_{x \to 1} \frac{x^2 - 4x + 3}{3x^2 + 12x - 15} = \lim_{x \to 1} \frac{(x-1)(x-3)}{3(x^2+4x-5)} = \lim_{x \to 1} \frac{\cancel{(x-1)}(x-3)}{3\cancel{(x-1)}(x+5)}$

getting $\frac{0}{0}$

$= \lim_{x \to 1} \frac{(x-3)}{3(x-5)} = \frac{1-3}{3(1+5)} = \frac{-2}{3(6)} = \boxed{\frac{-1}{9}}$

3. $\lim_{x \to 5^+} \frac{x^2 - 4x + 3}{3x^2 + 12x - 15} = \lim_{x \to 5^+} \frac{x-3}{3(x+5)} = \boxed{-\infty}$

(approaching -8, (negative)

Same factoring as above

approaching 0, positive

4. $\lim_{x \to \infty} \frac{x^2 - 4x + 3}{3x^2 + 12x - 15} = \lim_{x \to \infty} \frac{x^2 - 4x + 3}{3x^2 + 12x - 15} \frac{\frac{1}{x^2}}{\frac{1}{x^2}}$

$= \lim_{x \to \infty} \frac{1 - \frac{4}{x} + \frac{3}{x^2}}{3 - \frac{12}{x} - \frac{15}{x^2}} = \frac{1 - 0 + 0}{3 - 0 - 0} = \boxed{\frac{1}{3}}$

5. $\lim_{x \to \infty} \cos\left(\frac{1}{x}\right) = \cos\left(\lim_{x \to \infty} \frac{1}{x}\right) = \cos(0) = \boxed{1}$

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1. $\lim_{x\to\infty} \frac{3x^2+12x-15}{x^2-4x+3} = \lim_{x\to\infty} \frac{3x^2+12x-15}{x^2-4x+3}\,\frac{1/x^2}{1/x^2}$

$= \lim_{x\to\infty} \frac{3+\frac{12}{x}-\frac{15}{x^2}}{1-\frac{4}{x}+\frac{3}{x^2}} = \frac{3+0-0}{1-0+0} = \boxed{3}$

2. $\lim_{x\to 0} \frac{3x^2+12x-15}{x^2-4x+3} = \frac{3\cdot 0^2+12\cdot 0-15}{0^2-4\cdot 0+3} = \frac{-15}{3} = \boxed{-5}$

3. $\lim_{x\to 1} \frac{3x^2+12x-15}{x^2-4x+3} = \lim_{x\to 1} \frac{3(x^2+4x-5)}{(x-1)(x-3)} = \lim_{x\to 1} \frac{3\cancel{(x-1)}(x+5)}{\cancel{(x-1)}(x-3)}$

getting $\frac{0}{0}$

$= \lim_{x\to 1} \frac{3(x+5)}{x-3} = \frac{3(1+5)}{-2} = \boxed{-9}$

4. $\lim_{x\to 3^+} \frac{3x^2+12x-15}{x^2-4x+3} = \lim_{x\to 3^+} \frac{3(x+5)}{x-3} = \boxed{\infty}$

approaching 24

same factoring as above

approaching 0, positive

5. $\lim_{x\to\infty} \ln\left(1+\frac{1}{x}\right) = \ln\left(\lim_{x\to\infty}\left(1+\frac{1}{x}\right)\right) = \ln(1+0)$

$= \ln(1) = \boxed{0}$