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MATH-101 **Term-131** **IN-Class-QUIZ-3**

1) Let $y = g(x) = x^2 - \frac{1}{x}$. Use limits to find the instantaneous rate of change of y with respect to x at $x = 1$.

Inst. rate of change $= g'(1)$

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

$$= \lim_{h\to 0} \frac{(1+h)^3 - 1}{h(1+h)} = \lim_{h\to 0} \frac{h^3+3h^2+3h+1-1}{h(1+h)}$$

$$= \lim_{h\to 0} \frac{\cancel{h}(h^2+3h+3)}{\cancel{h}(1+h)} = \frac{0+0+3}{1+0} = 3$$

2) For what values of a, b, and c is $f(x)$ continuous on the closed interval $[2, 4]$.

$$f(x) = \begin{cases} c & \text{if} \quad x = 2 \\ ax - b & \text{if} \quad 2 < x < 3 \\ 2 & \text{if} \quad x = 3 \\ \frac{a}{3}x + b & \text{if} \quad 3 < x \le 4 \end{cases}$$

For $f(x)$ to be cont. on $[2,4]$ we need:

(*) $f(x)$ cont. at $x=3$

(*) $f(x)$ cont. from right at end point $x=2$

This means:

(1) $\lim_{x\to 3^+} f(x) = 2 \to a+b=2$

(2) $\lim_{x\to 3^-} f(x) = 2 \to 3a-b=2$

$\Rightarrow \boxed{a=1,\ b=1}$

(3) $\lim_{x\to 2^+} f(x) = c \to 2a-b=c \Rightarrow \boxed{c=1}$