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Instructions: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. Find the derivative of the following functions.
(Do NOT bother to simplify your answers!)

(a) $g(x) = \frac{4x^3 - 2x^2 + x}{x^2 - 9}$ (4pt)

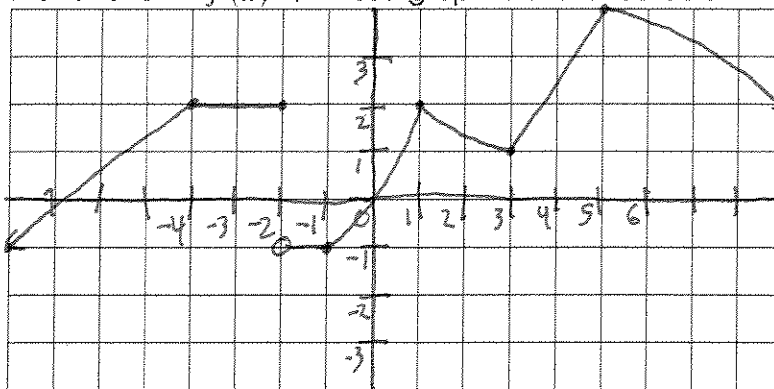
$$\frac{(x^2 - 9)(12x^2 - 4x + 1) - (4x^3 - 2x^2 + x)(2x)}{(x^2 - 9)^2}$$

Answer 1(a): _____

(b) $y = (5x^{-2} + 3x)(2x^4 - 7x)$ (4pt)

Answer 1(b): $(5x^{-2} + 3x)(8x^3 - 7) + (2x^4 - 7x)(-10x^{-3} + 3)$

2. Consider the function $f(x)$, whose graph is sketched below.



- (a) What is the average rate of change in $f(x)$ on the interval $-1 \leq x \leq 1$?

$$\frac{2 - (-1)}{1 - (-1)} = \frac{3}{2}$$

Answer 2(a): $\frac{3}{2}$ (1pt)

- (b) Estimate $f'(4)$.

Answer 2(b): $\frac{3}{2}$ (1pt)

- (c) Where on the interval $-3 \leq x \leq 5$ is $f(x)$ discontinuous?

Answer 2(c): $x = -2$ (1pt)

- (d) Where on the interval $-3 \leq x \leq 5$ does the derivative not exist?

Answer 2(d): $x = -2, -1, 1, 3, 5$ (2pt)

- (e) Where on the interval $-3 \leq x \leq 5$ is $f'(x) = 0$?

Answer 2(e): $[-3, -2], (-2, -1)$ (2pt)

Note: $[-4, -2], (-2, -1)$ would receive full points as well.