

Name: Key

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There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. [8 points] Use the limit definition (given below) of the derivative to find the derivative of

$$f(x) = \frac{3}{x} + 5.$$

Show all your work clearly, step by step, using correct notation. No credit will be awarded for a solution that does not use the definition below.

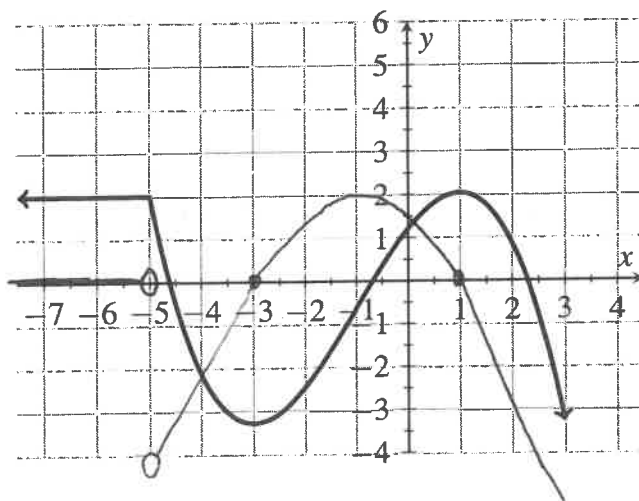
$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{\frac{3}{x+h} + 5 - \left(\frac{3}{x} + 5\right)}{h} = \lim_{h \rightarrow 0} \frac{\frac{3}{x+h} - \frac{3}{x} + \cancel{5} - \cancel{5}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\frac{3x}{(x+h)x} - \frac{3(x+h)}{(x+h)x}}{h} = \lim_{h \rightarrow 0} \frac{\cancel{3x} - \cancel{3x} - 3h}{(x+h)x} \cdot \frac{1}{h} = \lim_{h \rightarrow 0} \frac{-3h}{(x+h)xh}$$

$$= \lim_{h \rightarrow 0} \frac{-3}{(x+h)x} = \frac{-3}{(x+0)x} = \boxed{\frac{-3}{x^2}}$$

2. [5 points] The function  $y = H(x)$  is graphed below. Sketch the graph of  $H'(x)$  on the same set of axes.



3. [12 points] For each function below, find its derivative. You may use any method you like. You do not have to simplify your answer.

a.  $f(x) = x^6 + 7x^3 - x^{-3}$

$$f'(x) = 6x^5 + 21x^2 + 3x^{-4}$$

b.  $g(x) = \sqrt{x}(3x - 4x^3) = 3x^{3/2} - 4x^{7/2}$

$$g'(x) = \frac{9}{2}x^{1/2} - 14x^{5/2}$$

c.  $h(x) = x^3 \sin(x) + \cos\left(\frac{\pi}{3}\right)$  ↙ constant

$$h'(x) = 3x^2 \sin x + x^3 \cos x + 0$$

d.  $G(x) = \frac{\cos(x) + x + 14}{x^2}$

$$G'(x) = \frac{(-\sin x + 1) \cdot x^2 - (\cos x + x + 14) \cdot 2x}{(x^2)^2}$$