

### Free response with Squeeze Theorem

#### AP Calculus

It's important to NOT BE INTIMIDATED when you look at a free response question. You have learned everything that will come up....so look beyond the confusing notation and say, "I can do this!" First do the parts that you can answer and answer those and then wade into the more confusing parts and see what you can figure out!

Functions  $f$ ,  $g$ , and  $h$  are twice-differentiable functions with  $g(2) = h(2) = 4$ . The line  $y = 4 + \frac{2}{3}(x - 2)$  is tangent to both the graph of  $g$  at  $x = 2$  and the graph of  $h$  at  $x = 2$ .

(a) Find  $h'(2)$ .

(b) Let  $a$  be the function given by  $a(x) = 3x^3h(x)$ . Write an expression for  $a'(x)$ . Find  $a'(2)$ .

(c) The function  $h$  satisfies  $h(x) = \frac{x^2 - 4}{1 - (f(x))^3}$  for  $x \neq 2$ . It is known that  $\lim_{x \rightarrow 2} h(x)$  can be evaluated using

L'Hospital's Rule. Use  $\lim_{x \rightarrow 2} h(x)$  to find  $f(2)$  and  $f'(2)$ . Show the work that leads to your answers.

(d) It is known that  $g(x) \leq h(x)$  for  $1 < x < 3$ . Let  $k$  be a function satisfying  $g(x) \leq k(x) \leq h(x)$  for  $1 < x < 3$ . Is  $k$  continuous at  $x = 2$ ? Justify your answer.