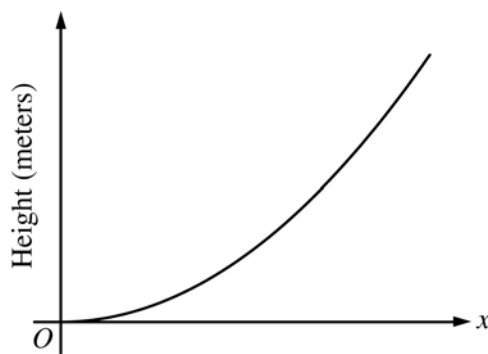


**2006 AP<sup>®</sup> CALCULUS AB FREE-RESPONSE QUESTIONS (Form B)**



3. The figure above is the graph of a function of  $x$ , which models the height of a skateboard ramp. The function meets the following requirements.
- (i) At  $x = 0$ , the value of the function is 0, and the slope of the graph of the function is 0.
  - (ii) At  $x = 4$ , the value of the function is 1, and the slope of the graph of the function is 1.
  - (iii) Between  $x = 0$  and  $x = 4$ , the function is increasing.
- (a) Let  $f(x) = ax^2$ , where  $a$  is a nonzero constant. Show that it is not possible to find a value for  $a$  so that  $f$  meets requirement (ii) above.
- (b) Let  $g(x) = cx^3 - \frac{x^2}{16}$ , where  $c$  is a nonzero constant. Find the value of  $c$  so that  $g$  meets requirement (ii) above. Show the work that leads to your answer.
- (c) Using the function  $g$  and your value of  $c$  from part (b), show that  $g$  does not meet requirement (iii) above.
- (d) Let  $h(x) = \frac{x^n}{k}$ , where  $k$  is a nonzero constant and  $n$  is a positive integer. Find the values of  $k$  and  $n$  so that  $h$  meets requirement (ii) above. Show that  $h$  also meets requirements (i) and (iii) above.
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**WRITE ALL WORK IN THE EXAM BOOKLET.**

**END OF PART A OF SECTION II**