

6. [6 points] Let  $L(x)$  be the linear approximation and  $Q(x)$  be the quadratic approximation to the function  $d(x)$  near  $x = 1$ . Suppose that  $d'(x)$ ,  $d''(x)$  and  $d'''(x)$  are defined for all real numbers. Let  $Q(x) = 7(x - 1)^2 - 8(x - 1) + 3$ . Find the *exact* value of the following quantities. If there is not enough information to answer the question, write “NI”.

$$d(0) = \text{NI} \quad d'(1) = -8 \quad d''(1) = 14$$

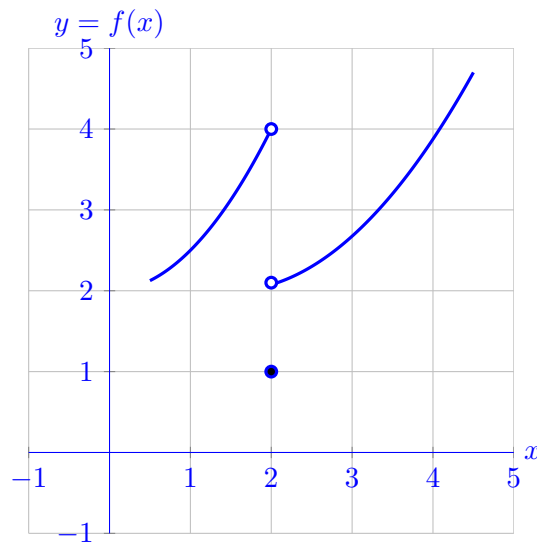
*Solution:*

$$L'(2) = -8 \quad Q'''(1) = 0 \quad d'''(1) = \text{NI}$$

7. [5 points] Sketch graphs of functions  $f(x)$  and  $g(x)$  satisfying the conditions below, or circle NO SUCH FUNCTION EXISTS. You do not need to explain your answer.

A function  $f(x)$  defined on the interval  $(0, 4)$  that satisfies:

- i)  $f'(x) > 0$  for all  $x \neq 2$ .
- ii)  $x = 2$  is a global minimum.

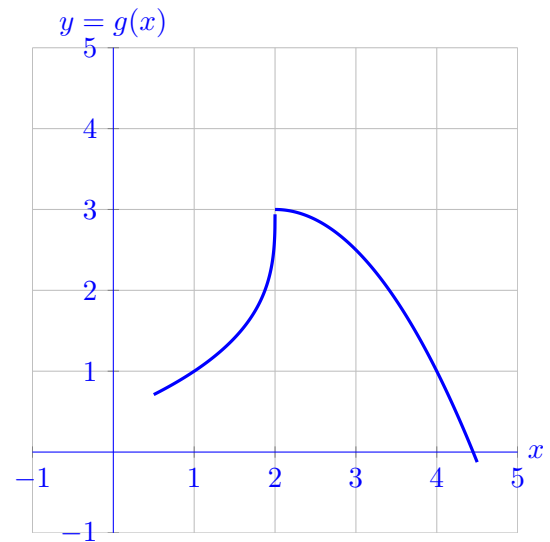


or

NO SUCH FUNCTION EXISTS

A continuous function  $g(x)$  defined on the interval  $(0, 4)$  that satisfies:

- i)  $\lim_{x \rightarrow 2^-} g'(x) = \infty$ .
- ii)  $\lim_{x \rightarrow 2^+} g'(x) = 0$ .



or

NO SUCH FUNCTION EXISTS

*Solution:*