Sections 2.3 and 2.4
Interpretations of the Derivative and The Second Derivative

1. Suppose $C(r)$ is the total cost of paying off a car loan borrowed at an annual interest rate of $r\%$. What are the units of $C'(r)$, what is the practical meaning of it, and what is its sign?

2. The quantity $Q$ (mg) of nicotine in the body $t$ minutes after a cigarette is smoked is given by $Q = f(t)$.
   
   (a) Interpret the statements $f(20) = 0.36$ and $f'(20) = -0.002$ in terms of nicotine. What are the units of the numbers 20, 0.36, and -0.002?

   (b) Use the information given in part (a) to estimate $f(21)$ and $f(30)$. Which estimate is most reliable?

3. The graph of a function $f(x)$ is shown in the figure below. In the table, indicate whether $f$, $f'$, $f''$ at each marked point is positive, negative, or zero.

   ![Graph of a function](image)

<table>
<thead>
<tr>
<th>Point</th>
<th>$f$</th>
<th>$f'$</th>
<th>$f''$</th>
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</thead>
<tbody>
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<td>A</td>
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4. A company’s revenue from car sales, \( C \) (in thousands of dollars), is a function of advertising expenditure, \( a \) (in thousands of dollars). So \( C = f(a) \).

(a) What does the company hope is true about the sign of \( f' \)? Explain.

(b) What does the statement \( f'(100) = 2 \) mean in practical terms? How about \( f'(100) = 0.5 \)?

(c) Suppose the company plans to spend about $100,000 on advertising. If \( f'(100) = 2 \), should the company spend more or less than $100,000? What if \( f'(100) = 0.5 \)?

5. Let \( f(T) \) be the time, in minutes, that it takes for an oven to heat up to \( T^o \) F.

(a) What are the units of \( f'(T) \)?
(b) What is the sign of \( f'(T) \)?
(c) Interpret the statement \( f(300) = 10 \).

(d) Interpret the statement \( f'(300) = 0.1 \).