1. Shown is the graph of $s(t)$, the position of a car as a function of time $t$.
   Position (distance) is measure in meters and time in seconds.

   (a) Is the car speeding up or slowing down? (How can you tell?)

   (b) Show how to estimate the average velocity of the car over this six-second time interval.

   (c) Show how to estimate the (instantaneous) velocity of the car at time $t = 1$.

   (d) Which is larger, $s(2)$ or $s(5)$? (How can you tell?)

   (e) Which is larger, $s'(2)$ or $s'(5)$? (How can you tell?)
2. Shown at right is the graph of a function, \( y = g(x) \).
   Note that the first 3 questions ask about \( g(x) \) itself, NOT \( g'(x) \).
   (a) For which \( x \)-values is \( g(x) \) decreasing?

   (b) For which \( x \)-values is \( g(x) \) concave down?

   (c) For which \( x \)-values is \( g(x) \) positive?

   (d) Sketch a graph of \( g'(x) \), the derivative of \( g(x) \), on the axes under the graph of \( g(x) \).
       (Make it clear where \( g' \) is positive or negative or zero, and where \( g' \) hits its maximum and minimum.)

3. Let \( f(x) = (\sin(x))^x \).
   (a) Use a **difference quotient** to estimate \( f'(1) \).

   (b) How can you check that your answer to part (3a) is (or is not) accurate to 3 decimal places?
4. Suppose you are on a roller coaster. To keep things simple, imagine that the track remains in a vertical plane. Then we can represent the track as the graph of a function \( y = f(x) \), where \( y \) measures the vertical distance above the ground in feet and \( x \) measures the horizontal distance in feet along the ground from the starting point. Show below is a picture and some data for the function \( y = f(x) \).

(a) Use the data table to estimate \( f'(35) \).

(b) What is the physical meaning of the number you just computed?

(c) Suppose the formula for \( f \) is \( f(x) = 10xe^{-0.05x} \). Use derivatives to find the EXACT value of the \( x \)-value of the maximum. (Hint: What is \( f' \) at the peak?)
5. Fill in the blanks describing the point B shown on the graph below.

\[ y = f(x) \]

(a) \( f(\underline{\hspace{2cm}}) = \underline{\hspace{2cm}} \)

(b) \( f'(\underline{\hspace{2cm}}) = \underline{\hspace{2cm}} \)

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6. Use the information in the table to compute the given quantity.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
<th>( f'(x) )</th>
<th>( g(x) )</th>
<th>( g'(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>-1</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>8</td>
<td>-1</td>
<td>3</td>
</tr>
</tbody>
</table>

(a) \( h(2) \), where \( h(x) = f(x) - g(x) \)

(b) \( h'(2) \), where \( h(x) = f(x) - g(x) \)

(c) \( p'(3) \), where \( p(x) = f(x)g(x) \)

(d) \( q'(2) \), where \( q(x) = \frac{e^{3x}}{g(x)} \)
7. The quantity \( q \) of a certain skateboard depends on the selling price, \( p \), in dollars, so we write \( q = f(p) \). You are given that \( f(140) = 15000 \) and \( f'(140) = -100 \).

(a) What does the statement \( f'(140) = -100 \) tell you about the sales of skateboards?

(b) The total revenue \( R \) earned by the sale of skateboards is given by \( R(p) = pq \). What is the value of \( R(140) \)?

(c) Compute \( R'(140) \), the derivative of \( R \).

(d) If skateboards are currently selling at \$140\), what does the sign of \( R'(140) \) tell you?
8. Suppose each of the four graphs below represents the graph of some function \( f(x) \).

For which graph(s) is each of the following statements true?

(a) \( f(x) \) is increasing.

(b) \( f'(x) \) is increasing.

(c) \( f(x) \) is concave up.

(d) The slope of \( f \) is positive.

(e) \( f(x) > 0 \).

(f) \( f'(x) > 0 \).

(g) \( f''(x) > 0 \).

(h) The slope of \( f \) is increasing.

(i) \( f'(x) < 0 \).