1. [10 points]
A portion of the graph of a function \( g(x) \) is shown to the right, along with some values of an invertible, differentiable function \( h(x) \) and its derivative \( h'(x) \) below. Note that:

- \( g(x) \) is linear on \([3, 5]\);
- \( g(x) \) has a vertical asymptote at \( x = -1 \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h(x) )</td>
<td>-1</td>
<td>(-e^{-1} )</td>
<td>0</td>
<td>( \sqrt{2} )</td>
<td>( e )</td>
</tr>
<tr>
<td>( h'(x) )</td>
<td>2</td>
<td>1</td>
<td>( \pi )</td>
<td>5</td>
<td>( \sqrt{3} )</td>
</tr>
</tbody>
</table>

a. [2 points] Let \( M(x) = x^2h(x) \). Find \( M'(-2) \).

\[ \text{Solution:} \quad \text{By the Product Rule, } M'(x) = 2xh(x) + x^2h'(x), \text{ so} \]
\[ M'(-2) = -4h(-2) + 4h'(-2) = (-4)(-1) + 4(2) = 12. \]

\[ \text{Answer: } M'(-2) = 12 \]

b. [2 points] Let \( K(x) = \frac{g(x)}{h(x)} \). Find \( K'(4) \).

\[ \text{Solution:} \quad \text{Using the Quotient Rule,} \]
\[ K'(4) = \frac{g'(4)h(4) - g(4)h'(4)}{h(4)^2} = \frac{(-1)(\sqrt{2}) - (1)(5)}{2} = \frac{-\sqrt{2} - 5}{2}. \]

\[ \text{Answer: } K'(4) = \frac{-\sqrt{2} - 5}{2} \]

c. [2 points] Find \( (h^{-1})'(0) \).

\[ \text{Solution:} \quad \text{Using the rule for the derivative of an inverse function,} \]
\[ (h^{-1})'(0) = \frac{1}{h'(h^{-1}(0))} = \frac{1}{h'(2)} = \frac{1}{\pi}. \]

\[ \text{Answer: } (h^{-1})'(0) = \frac{1}{\pi} \]

d. [2 points] On which of the following intervals does \( g(x) \) satisfy the hypotheses of the Mean Value Theorem? Circle all correct answers.

\([-3, -1] \quad [0, 2] \quad [1, 3] \quad [2, 4] \quad \text{NONE OF THESE} \]

e. [2 points] On which of the following intervals does \( g(x) \) satisfy the conclusion of the Mean Value Theorem? Circle all correct answers.

\([-3, -1] \quad [0, 2] \quad [1, 3] \quad [2, 5] \quad \text{NONE OF THESE} \]