1. [10 points]
A portion of the graph of the function \( j(x) \), whose domain is \((-3, \infty)\), is shown to the right. Note that:

- \( j(x) \) is linear on \((-3, -1]\) and on \((-1, 3]\).
- On the interval \([3, \infty)\), the function \( j(x) \) is given by the formula \(-\sqrt{x-3}\).

For parts a.–c., find the exact values, or write NEI if there is not enough information to do so, or write DNE if the value does not exist. Your answers should not include the letter \( j \) but you do not need to simplify. Show work.

a. [2 points] Find \( j'(4) \).

Solution: On \([3, \infty)\), \( j(x) = -(x - 3)^{1/2} \) so \( j'(x) = -\frac{1}{2}(x - 3)^{-1/2} \) and Using the chain rule,

\[ \left[-\sqrt{x-3}\right]' = -\frac{1}{2}(x - 3)^{-1/2} \]

so

\[ j'(4) = -\frac{1}{2}(4 - 3)^{-1/2} = -\frac{1}{2} \]

Answer: \( j'(4) = -\frac{1}{2} \)

b. [3 points] Let \( A(x) = \frac{x}{j(x)} \). Find \( A'(1) \).

Solution: Using the quotient rule,

\[ A'(x) = \frac{j(x) - xj'(x)}{[j(x)]^2} \]

\[ A'(1) = \frac{j(1) - j'(1)}{[j(1)]^2} = \frac{\frac{1}{2} - \left(-\frac{1}{4}\right)}{\left(\frac{1}{2}\right)^2} = 3 \]

Answer: \( A'(1) = 3 \)

c. [3 points] Let \( B(x) = 2^j(x) \). Find \( B'(-2) \).

Solution: Using the chain rule,

\[ B'(x) = \ln(2)2^j(x)j'(x) \]

\[ B'(-2) = \ln(2)2^{j(-2)}j'(-2) \]

\[ = \ln(2)2^{4(-2)} = -32\ln(2) \]

Answer: \( B'(-2) = -32\ln(2) \)

d. [2 points] On which of the following intervals does \( j(x) \) satisfy the hypotheses of the Mean Value Theorem? Circle all correct answers. You do not need to show work for this part.

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