4. How many of the following statements are true concerning the graph of $f(x)$ given below:

- $f''(x) \geq 0$ for all $x$-values between $-1$ and $1$.
- $f(x)$ has exactly two critical numbers.
- $f(x)$ has exactly one local minimum.
- $f'(x) \leq 0$ for all $x \geq 0$.

(A) 0  (B) 1  (C) 2  (D) 3  (E) 4

$\n$
\[ \Delta y = f(x + \Delta x) - f(x) \]

3. The elevation \( h \) (in feet above the ground) of a stone dropped from a height of 500 ft is modeled by the equation \( h(t) = 500 - 16t^2 \), where \( t \) is measured in seconds and air resistance is neglected. Use differentials to approximate the change in elevation over the interval \( 3 \leq t \leq 3.1 \) seconds.

\( \Delta h \approx -4.8 \) ft \( \textcircled{B} \) \( \Delta h \approx -9.6 \) ft \( (C) \Delta h \approx -118 \) ft \( (D) \Delta h \approx -846.4 \) ft \( (E) \) None of the above

\( \Delta t = 3.1 - 3 = 0.1 \)

\( \Delta h = f(t + \Delta t) - f(t) \)

\( \Delta h = f(3 + 0.1) - f(3) \)

\( \Delta h = f(3.1) - f(3) \)

\( \Delta h = 346.24 - 356 \)

\( \Delta h = -9.76 \)

\( f(3.1) = 500 - 16(3.1)^2 \)

\( = 500 - 16(9.61) \)

\( = 500 - 153.76 \)

\( = 346.24 \)

\( f(3) = 500 - 16(3)^2 \)

\( = 500 - 144 \)

\( = 356 \)
\[ f'(x) = -2x + 4 - 2e^x \rightarrow f''(x) = -2 - 2e^x = -2(1 + e^x) \]

\[ f'(0) = -2(0) + 4 - 2e^0 = 2 - 2 = 2 \]

\[ f''(0) > 0 \Rightarrow f \text{ is increasing at } x = 0 \]

6. If \( f(x) = -x^2 + 4x + 3 - 2e^x \), then how many of the following are true:

(A) The graph of the function is concave upward at \( x = 0 \).
(B) The function is increasing at \( x = 0 \) * 
(C) The function has two inflection points
(D) The function is concave downward at \( x = \ln 2 \)

(A) 0 \hspace{1cm} (B) 1 \hspace{1cm} (C) 2 \hspace{1cm} (D) 3 \hspace{1cm} (E) 4

\[ f''(x) = -2 - 2e^x \]

\[ f''(0) = -2 - 2e^0 = -2 - 2 = -4 < 0 \]

\[ f''(0) < 0 \Rightarrow f \text{ is concave down at } x = 0 \]

\[ f''(\ln(2)) = -2 - 2e^{\ln(2)} = -2 - 2(2) = -2 - 4 = -6 < 0 \]

\[ f''(\ln(2)) < 0 \Rightarrow f \text{ is concave down at } x = \ln 2 \]