The derivatives for different functions are indicated below. For each indicate:

- the critical points of \( f \);
- the intervals upon which \( f \) is increasing or decreasing;
- the local maxima and local minima of \( f(x) \).

1. \[ f'(x) = (x + 2)(x - 1). \]

Solution. A sign chart for the derivative indicates that \( 0 < f'(x) \) whenever, \( x \in (-\infty, -2) \cup (1, \infty) \). Meanwhile \( f'(x) < 0 \) for \( x \in (-2, 1) \). Thus \( f(x) \) is increasing on \( x \in (-\infty, -2) \cup (1, \infty) \), and \( f(x) \) is decreasing for \( x \in (-2, 1) \). The critical point \( x = -2 \) yields a local Maximum. The critical point \( x = 1 \) yields a local minimum.

2. \[ f'(x) = (x + 5)(x + 1)(x - 7). \]

Solution. A sign chart for the derivative indicates that \( f'(x) < 0 \) whenever, \( x \in (-\infty, -5) \cup (-1, 7) \). Meanwhile \( 0 < f'(x) \) for \( x \in (-5, -1) \cup (7, \infty) \). Thus \( f(x) \) is increasing on \( x \in (-5, -1) \cup (7, \infty) \), and \( f(x) \) is decreasing for \( x \in (-\infty, -5) \cup (-1, 7) \). The critical point \( x = -1 \) yields a local Maximum. The critical points \( x = -5 \) and \( x = 7 \) yield local minima.

3. \[ f'(x) = (x - 1)e^{-x}. \]

Solution. First observe that \( 0 < e^{-x} \) for all \( x \in \mathbb{R} \). So we only have to look at the signs for the factor \( (x - 1) \). The point \( x = 1 \) is a critical point that is a local minimum. The function \( f(x) \) is decreasing for \( x < 1 \), and the function \( f(x) \) is increasing for \( 1 < x \).
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