INSTRUCTIONS: Show all steps in the solution. Use the indicated tests to determine where the given functions are increasing/decreasing, concave up/down, or where the critical points.

1. Determine what the critical points are for the following functions.
   (a) \( y = x^2 + 4x - 1 \)
   (b) \( y = -x^2 + 7 \)
   (c) \( y = 2x^3 - 3x^2 - 12x + 1 \)
   (d) \( f(x) = \frac{1}{4}x^4 + \frac{2}{3}x^3 - 1 \)
   (e) \( f(x) = x^4 - x^3 \)
   (f) \( g(x) = x^6 - x^4 \)
   (g) \( h(x) = \sin(x) \)
   (h) \( y = e^x \)
   (i) \( y = -\cos(x) - \sin(x) \)
   (j) \( y = \frac{(x + 1)^2}{1 + x^2} \)

2. Determine the intervals on which the following functions are increasing and decreasing.
   (a) \( y = x^2 + 3x - 1 \)
   (b) \( y = 4x - 5 \)
   (c) \( y = \frac{1}{3}x^3 - 5x^2 + 24x \)
   (d) \( y = x^4 + \frac{4}{3}x^3 - 12x^2 \)
   (e) \( f(x) = x^3 + x - 2 \)
   (f) \( g(x) = \sqrt{x - 3} \)
   (g) \( h(x) = \frac{1}{x^2 + 1} \)

3. Use the First Derivative Test to classify the critical points of the following functions.
   (a) \( y = -3x^2 \)
   (b) \( y = x^3 \)
   (c) \( y = x^3 - 3x^2 + 3x - 1 \)
   (d) \( y = x^3 - 3x^2 \)
   (e) \( y = 4x - 5x^{4/5} \)
   (f) \( y = \frac{x^2}{4 - x^2} \)
   (g) \( y = \sqrt{25 - x^2} \)

4. Use the Second Derivative Test to classify the critical points of the following functions.
   (a) \( y = x^2 + x + 1 \)
   (b) \( f(x) = x^3 - \frac{20x^3}{3} \)
   (c) \( y = x^4 - 4x^3 + 10 \)
   (d) \( y = e^{x^2} \)
   (e) \( y = e^{-x^2} \)