1. Find the leading term and use it to determine the long-term behavior of each polynomial function.

   (a) $f(x) = x^3 + 2x - 1$ x^3, $f(x) \to \infty$ as $x \to \infty$, $f(x) \to -\infty$ as $x \to -\infty$

   (b) $f(x) = -x^2 + 4$ $-x^2$, $f(x) \to -\infty$ as $x \to \pm\infty$

   (c) $f(x) = -(x+2)^2(x-1)(x-3)^2$ $-x^5$, $f(x) \to -\infty$ as $x \to \infty$, $f(x) \to \infty$ as $x \to -\infty$

   (d) $f(x) = (x^2 + 2x - 1)^2(3x - 5)^4$ $81x^8$, $f(x) \to \infty$ as $x \to \pm\infty$

2. Find all roots and their degrees. Describe the behavior of the graph at each root.

   (a) $g(x) = (x+1)(x-2)^2(x-4)$ $x = -1, \text{deg } 1,\ x = 1, \text{deg } 2,\ x = 4 \text{ deg } 1$

   (b) $g(x) = (2x-1)(x+6)^4$ $x = \frac{1}{2}, \text{deg } 1,\ x = -6, \text{deg } 4$

   (c) $g(x) = (x^2 - 5x + 6)(x^2 - 16)$ $x = 3, \text{deg } 1,\ x = 2, \text{deg } 1,\ x = 4 \text{ deg } 1,\ x = -4 \text{ deg } 1$

   (d) $g(x) = (x^2 + 1)(x^2 - 9)^2$ $x = -3, \text{deg } 2,\ x = 3, \text{deg } 2$

3. Give the degree of each polynomial function. At most how many turning points does each graph have?

   (a) $h(x) = x(x+7)(x-2)(x-5)$ Degree 4. At most 3 turning points

   (b) $h(x) = (x-5)^2(x+3)^3$ Degree 5. At most 4 turning points

   (c) $h(x) = (x^3 + 2x - 1)^2$ Degree 6. At most 5 turning points

   (d) $h(x) = x^2(3x+4)^2(x^2 - 3x + 1)^3$ Degree 10. At most 9 turning points

4. Sketch the graph of each polynomial function. Label all roots with their degrees and mark all intercepts. The graph must be smooth and continuous.

   (a) $f(x) = x(x-1)(x-3)(x-5)$

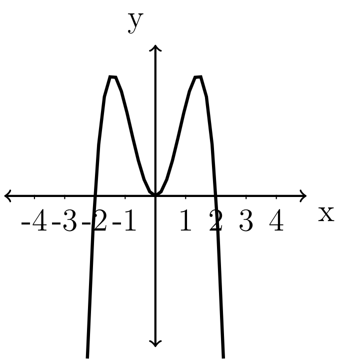
   (b) $f(x) = -(x-2)^2(x+1)^3$

   (c) $f(x) = (x^2 + 4x + 3)^2$

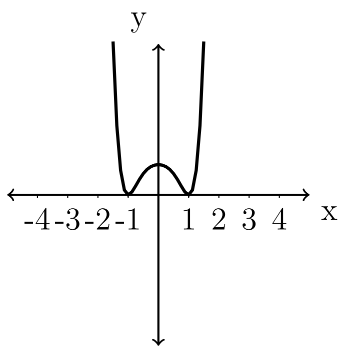
   (d) $f(x) = (x-1)^2(x^2 + 4x + 4)(3 - x)$

5. *Working backwards.* Find a possible polynomial function for each graph with the given degree. The y-axis is left intentionally without scale.

   (a) degree 4



   Possible solution: $f(x) = -x^2(x+2)(x-2)$



(b) degree 6

Possible solution: $f(x) = (x+1)^4(x-1)^2$