

## **Handout: Graphing Strategy**

**General Idea:** Start with simplest, least sophisticated analysis, and proceed to more sophisticated. If a step is not easy, then skip that step.

### **Step 1. Analyze $f(x)$ .**

- Find the  $y$ -intercept
- Find the  $x$ -intercepts.
- Does the graph of  $f(x)$  have any symmetry or any periodicity?
- What is the domain of  $f(x)$ ? Where is  $f(x)$  continuous?
- Determine location of any vertical asymptotes.
- Make a sign chart for  $f$  and use it to determine where  $f$  is positive, negative, or zero.
- Determine the end-behavior (Are there horizontal asymptotes? Or do the ends of the graph go up or down?) by finding  $\lim_{x \rightarrow \infty} f(x)$  and  $\lim_{x \rightarrow -\infty} f(x)$ . (May require L'Hospital's Rule!)

### **Step 2. Analyze $f'(x)$ .**

- Find  $f'(x)$ , factor it, and then find the partition numbers for  $f'(x)$ .
- Construct a sign chart for  $f'(x)$  and use it to determine the  $x$  coordinates where graph of  $f$  has a horizontal tangent line, the intervals on which  $f$  is increasing and decreasing, and the  $x$  coordinates of all local maxima and minima.
- Find the  $y$  coordinates of all local maxima and minima.

### **Step 3. Analyze $f''(x)$ .**

- Find  $f''(x)$ , factor it, and then find the partition numbers for  $f''(x)$ .
- Construct a sign chart for  $f''(x)$  and use it to determine the intervals on which  $f$  is concave up and concave down, and to find the  $x$  coordinates of all inflection points.
- Find the  $y$  coordinates of all inflection points.

### **Step 4: Sketch the graph of $f$ .**

- Draw any asymptotes as dotted lines, and label them with their line equations.
- Plot the axis intercepts, local maxima and minima, and inflection points, and label them with their  $(x, y)$  coordinates.
- Using the other information from steps 1, 2, and 3, draw the graph.