

1. Let  $f(x) = x^3 - 9x$  for all  $x \in \mathbb{R}$ . Find the
  - (a) Zeros of  $f, f', f''$ .
  - (b) Identify regions where:  $f$  is positive;  $f'$  is positive; and  $f''$  is positive.
  - (c) Identify: Critical points ; inflection points; regions where the graph is concave up and down
  - (d) Draw a rough-sketch of graph of  $f$
  
2. Let  $f(x) = x^4 - 25x^2 + 144$  for all  $x \in \mathbb{R}$ . Find the
  - (a) Zeros of  $f, f', f''$ .
  - (b) Identify regions where:  $f$  is positive;  $f'$  is positive; and  $f''$  is positive.
  - (c) Identify: Critical points ; inflection points; regions where the graph is concave up and down
  - (d) Identify  $\lim_{x \rightarrow \infty} f(x)$  and  $\lim_{x \rightarrow -\infty} f(x)$
  - (e) Draw a rough-sketch of graph of  $f$
  
3. Let  $f(x) = \begin{cases} \frac{x}{(x+3)(x-5)} & x \in \mathbb{R} \setminus \{-3, 5\} \\ 0 & x \in \{-3, 5\} \end{cases}$  Find the
  - (a) Identify  $\lim_{n \rightarrow \infty} f(-3 + \frac{1}{n})$ ,  $\lim_{n \rightarrow \infty} f(-3 - \frac{1}{n})$ ,  $\lim_{n \rightarrow \infty} f(5 + \frac{1}{n})$ ,  $\lim_{n \rightarrow \infty} f(5 - \frac{1}{n})$
  - (b) Identify the domain of  $f'$  and  $f''$
  - (c) Zeros of  $f, f', f''$ .
  - (d) Identify regions where:  $f$  is positive;  $f'$  is positive; and  $f''$  is positive.
  - (e) Identify: Critical points ; inflection points; regions where the graph is concave up and down
  - (f) Identify  $\lim_{x \rightarrow \infty} f(x)$  and  $\lim_{x \rightarrow -\infty} f(x)$
  - (g) Draw a rough-sketch of graph of  $f$