# Worksheet 7
## GRAPHING USING CALCULUS - PART I
## FINDING RELATIVE MAXIMA USING CALCULUS - PART I
DR. M. P. M. M. MCLOUGHLIN
FALL 2011

Let the universe be $U = \mathbb{R} \times \mathbb{R}$ (the plane).

For each write **D. N. E.** for does not exist if an answer does not exist and explain why it does not exist.

Exercise 7.1: Let $f : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that $f(x) = x^4 - x^3$.
Find the critical value(s), all the relative maxima and relative minima, and find where $f$ is increasing or where $f$ is decreasing.

Exercise 7.2: Let $g : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that $g(x) = x^4 + x^3$.
Find the critical value(s), all the relative maxima and relative minima, and find where $g$ is increasing or where $g$ is decreasing.

Exercise 7.3: Let $h : D \longrightarrow \mathbb{R}$ be a well defined function such that $h(x) = x^4 + x^3$ where $D = [0, \infty)$.
Find the critical value(s), all the relative maxima and relative minima, and find where $h$ is increasing or where $h$ is decreasing.

Exercise 7.4: Let $j : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that $j(x) = \sqrt[3]{x}$. Find the critical value(s), all the relative maxima and relative minima, and find where $j$ is increasing or where $j$ is decreasing.

Exercise 7.5: Let $k : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that $k(x) = \sqrt[3]{x^2}$.
Find the critical value(s), all the relative maxima and relative minima, and find where $k$ is increasing or where $k$ is decreasing.

Exercise 7.6: Let $k : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that $k(x) = \cosh x$.
Find the critical value(s), all the relative maxima and relative minima, and find where $k$ is increasing or where $k$ is decreasing. If you forgot the definition of the hyerbolic cosine that is fine - look it up because you need it to compleat this problem.

Exercise 7.7*: Let $p : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that $p(x) = \frac{1}{4} \cdot x^4 - \frac{1}{3} \cdot x^3 - \frac{5}{2} \cdot x^2 - 3 \cdot x$.
Find the critical value(s), all the relative maxima and relative minima, and find where $p$ is increasing or where $p$ is decreasing.

Exercise 7.8*: Let $q : [-1, 1] \longrightarrow \mathbb{R}$ be a well defined function such that

$$q(x) = \frac{1}{4} \cdot x^4 - \frac{1}{3} \cdot x^3 - \frac{5}{2} \cdot x^2 - 3 \cdot x$$

Find the critical value(s), all the relative maxima and relative minima, and find where $q$ is increasing or where $q$ is decreasing.

Exercise 7.9*: Let $b : \mathbb{R} \longrightarrow \mathbb{R}$ be a well defined function such that

$$b(x) = \frac{1}{4} \cdot x^4 - \frac{2}{3} \cdot x^3 - \frac{5}{2} \cdot x^2 + 6 \cdot x$$

Find the critical value(s), all the relative maxima and relative minima, and find where $b$ is increasing or where $b$ is decreasing.

Note: * designates a challenging problem ('hard').