

## **CHAPTER 4: APPLICATIONS OF DIFFERENTIATION**

### **Section 4.1: Maximum and Minimum Values**

- absolute maximum (global maximum) and maximum value
- absolute minimum and minimum value
- extreme values
- local maximum (relative maximum)
- local minimum
- the extreme value theorem
- Fermat's theorem
- critical number
- if  $f$  has a local maximum or minimum at  $c$ , then  $c$  is a critical number of  $f$
- the closed interval method
- endpoints of an interval cannot be local maximums/minimums
- use your graphing calculator to estimate the maximums and minimums of a function

### **Section 4.2: The Mean Value Theorem**

- Rolle's theorem
- example 2 page 215
- the mean value theorem
  - understand this theorem graphically
  - be able to apply this theorem to different types of problems

### **Section 4.3: How Derivatives Affect the Shape of a Graph**

- increasing/decreasing test
  - show proper justification
    - set up a table with clearly labeled columns
    - interpret the table and explain your answers
- the first derivative test
  - show proper justification
    - set up a table with clearly labeled columns
    - interpret the table and explain your answers
      - **MUST** say that the derivative changes sign
        - local max at  $c$ : derivative changes from positive to negative at  $c$
        - local min at  $c$ : derivative changes from negative to positive at  $c$
- concave upward
- concave downward
- concavity test
  - show proper justification
    - set up a table with clearly labeled columns
    - interpret the table and explain your answers
- inflection point
  - show proper justification
- the second derivative test
  - remember we typically used the first derivative test because it always gives us information

#### **Section 4.4: Limits at Infinity; Horizontal Asymptotes**

- horizontal asymptote
  - show proper justification
- be able to evaluate limits of rational functions
- vertical asymptote
  - show proper justification

#### **Section 4.5: Summary of Curve Sketching**

- domain
- intercepts
- symmetry
  - even function
  - odd function
  - periodic function
- asymptotes
  - horizontal asymptotes
  - vertical asymptotes
  - slant asymptotes
- intervals of increase or decrease
- local maximum and minimum values
- concavity and points of inflection
- sketch the curve putting together all of the above aspects of the curve
- slant asymptotes
  - know when a rational function has a slant asymptote
  - be able to find the slant asymptote showing the appropriate division and limit

#### **Section 4.6: Graphing with Calculus *and* Calculators**

- be able to use your calculator to help you with the above aspects of graphing
  - your calculator should only aid you
    - you still need calculus to support your answers
- families of functions

#### **Section 4.7: Optimization Problems**

- use the step-by-step process to be able to solve optimization problems
- first derivative test for absolute extreme values

#### **Section 4.9: Antiderivatives**

- antiderivative
- theorem I on page 275 – general solution of an antiderivative has an arbitrary constant
- be able to find antiderivatives
  - don't forget to simplify functions before trying to find the antiderivative
- be able to find particular/specific solutions if you are given additional information
- rectilinear motion