Review for Test 2: Sections 1.7, 2.1 – 2.6

ONLY non-CAS calculators will be allowed on the exam. You may not share a calculator with other students during the exam so be sure to bring your own.

Assigned problems:
page 58: 17, 19 (also review the 5 problems from the worksheet on continuity)
page 62: 47 (explain why it is discontinuous at x = 1, -1 using the formal definition of continuity)
page 67: 67

page 109: 1, 3, 5, 7, 9, 11, 13, 15, 17, 25, 27, 33ab, 35, 36, 37, 43

page 113: 3, 9, 12, (true), 14, (true), 16 (true), 23, 24 (True), 25, 26 (True), 27.
(Also review the worksheet on differentiability)

Concepts
Continuity (1.7)

- Determine points of discontinuity of a function from its graph or formula

- Know the FORMAL definition of continuity (3 parts) and be able to explain why a function is discontinuous at a point in terms of this definition.

- Given a piecewise-defined function, determine the value of a parameter in order to make the function continuous.

Derivatives (2.1 – 2.5)
Given a function in any form, i.e. as a formula, as a graph, as a table of data or as a description of an application:

- Approximate the value of the derivative at a point, x = a, given
    - a graph (find or estimate the slope of the tangent line at a point)
    - a table of data (know how to find the BEST estimate)

- Find the derivative (i.e. find the exact value) at a point, x = a, or as a formula for any x-value, using the limit definition.

  Note: "find the derivative using the limit definition" is equivalent to "find the derivative algebraically" or "find the derivative using difference quotients" or "find a formula for the derivative."

  All of these require that you use analytic techniques, meaning setting up the limit for f', then evaluating the limit algebraically. You shouldn't use your calculator on any part of this sort of problem…all the computation should be done using algebra.

- Interpret the derivative in practical terms, as a rate of change. Include units as part of the interpretation.

- Sketch the graph of f', given the graph of the original function, *f*.

  Key points: $f'(x)=0$ at any point where *f* levels out.
    - $f'(x)>0$ on intervals where *f* is increasing
    - $f'(x)<0$ on intervals where *f* is decreasing
    - $f'(x)$ will be at a max or min value at a <u>point of inflection</u> of *f*

In general, know the relationship between the value (sign +, - or 0) of $f'(x)$ and the graph of f

- Sketch the graph of f'', given the graph of the original function, *f*.

  Key points: .

  - on intervals where *f* is concave up
  - on intervals where *f* is concave down
  - $f''(x) = 0$ when f is linear
  - f has a point of inflection when $f''(x) = 0$ AND *f* changes in concavity. Note: In logic, an "AND" statement requires that both conditions be satisfied for the statement to be true!)

  In general, know the relationship between the value (sign +, - or 0) of $f''(x)$ and the graph of f

- Know the relationship between the second derivative, acceleration of a particle and the graph of the particle's distance with respect to time.

Differentiability

- Given the graph of a function, determine points at which the function is not differentiable. Be able to explain WHY the function is not differentiable at these points,
  - in terms of "abrupt change in slope", "vertical tangent line", "point of discontinuity of the original function".
  - In terms of the limit (which creates the derivative) not existing (be able to show work demonstrating that the limit doesn't exist)

- Given a piecewise-defined function (given algebraically), be able to graph and determine points at which the function is not differentiable.

- Given an absolute value function, be able to rewrite it in piecewise form and identify the point of non-differentiability.