Math 220 – Test 1 Information – Sections AL1 and AL2 with Bob Murphy

The test will be given during your lecture period on Wednesday (February 13, 2019). No books, notes, scratch paper, calculators or other electronic devices are allowed. Bring a Student ID.

It may be helpful to look at

- [https://faculty.math.illinois.edu/~murphyrf/teaching/M220-S2019/](https://faculty.math.illinois.edu/~murphyrf/teaching/M220-S2019/) – Trigonometry worksheet, quizzes 1, 2 and 3, and Daily Assignments for a summary of each lecture
- [https://compass2g.illinois.edu/](https://compass2g.illinois.edu/) – Homework solutions
- [https://faculty.math.illinois.edu/~murphyrf/teaching/M220/](https://faculty.math.illinois.edu/~murphyrf/teaching/M220/) – Tests and quizzes in my previous MATH 220 courses

**Section 1.1 (Four Ways to Represent a Function)**
- Read points off a graph. Know the meaning of function, piece-wise defined function, increasing, decreasing, domain, range, even, odd. Know equations for lines and circles. Sketch graphs of basic functions.
- See #4, 7, 8, 25, 34, 41, 47, 51, 54, 71, 73, 77.

**Section 1.2 (Mathematical Models: A Catalog of Essential Functions)**
- Know lines, slope, vertical intercept, horizontal intercept, word problems. Understand tables of linear functions.
- See #7, 12, 18, 20.

**Section 1.3 (New Functions from Old Functions)**
- Sketch graphs of basic functions. Shift graphs left, right, up, down. Stretch and shrink graphs horizontally or vertically. Reflect graphs about x-axis or y-axis. Understand composition of functions (including domain).
- See #3, 8, 10, 12, 14, 15, 18, 19, 33, 35, 37, 40, 43, 45.

**Section 1.4 (Exponential Functions)**
- Work with exponents and exponential functions. Understand tables of exponential functions.
- See #2, 4, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 25, 30, 32, 37

**Section 1.5 (Inverse Functions and Logarithms)**
- Know the definition of one-to-one. Know the horizontal line test. Obtain formulas, graphs, etc. for $f^{-1}(x)$ given information about $f(x)$. Know properties (graphical, numerical, etc.) of inverse functions including ln($x$), arcsin($x$), arccos($x$) and arctan($x$).
- See #5, 7, 9, 10, 15, 17, 19, 21, 22, 23, 24, 25, 26, 35, 36, 37, 38, 39, 40, 41, 51, 52, 53, 54, 57, 58, 63, 64, 65, 66, 68, 70, 71.

**Section 2.1 (The Tangent and Velocity Problems)**
- Be able to find instantaneous velocity as a limit.
- See #5.
• Section 2.2 (The Limit of a Function)
  – Understand infinite limits and vertical asymptotes. Understand limits from graphs, piecewise-defined functions, table of values.
  – See #4, 7, 8, 11, 15, 17, 23, 24, 25, 31, 33, 34, 35, 42, 45, 47.

• Section 2.3 (Calculating Limits Using the Limit Laws)
  – Be able to state and use the Squeeze Theorem. Know algebraic techniques (factoring, multiplying by conjugate, getting common denominator, etc.) for finding limits.
  – See #11, 13, 15, 17, 18, 20, 25, 26, 37, 39.

• Section 2.5 (Continuity)
  – Know the definition of continuity. Be able to state and use the Intermediate Value Theorem.
  – See #20, 45, 51, 53, 55.

• Section 2.6 (Limits at Infinity; Horizontal Asymptotes)
  – Understand limits at infinity and horizontal asymptotes. Knowing graphs helps. Factoring out the denominator’s dominant term from both the numerator and denominator sometimes helps. This is equivalent to multiplying both the numerator and denominator by the reciprocal of the denominator’s dominant term.
  – See #8, 15, 16, 21, 24, 27, 31, 32, 35, 47, 49.

• Section 2.7 (Derivatives and Rates of Change)
  – Know the definition of a derivative at a point using limits. Understand the use of the derivative in answering questions about slope, rate of change, tangent line, position and velocity.
  – See #5, 6, 7, 8, 9, 10, 13, 14, 31, 32, 33, 34, 35, 36.

• Section 2.8 (The Derivative as a Function)
  – Know the definition of the derivative function. You will definitely have one question on the test where you have to use this definition to obtain a derivative formula. Know that differentiability implies continuity. Given the graph of a function, be able to sketch a graph of its derivative.
  – See #4, 5, 6, 12, 16, 17, 18, 21, 23, 25, 27, 29.

• Trigonometry
  – Know the unit circle definitions of \( \sin(x) \) and \( \cos(x) \). Know the definitions of \( \tan(x) \), \( \cot(x) \), \( \sec(x) \), \( \csc(x) \) in terms of \( \sin(x) \) and \( \cos(x) \). Graph all six trigonometric functions along with shifted versions using the techniques of section 1.3. Evaluate trigonometric functions at special angles. Know right triangle trigonometry in terms of the hypotenuse, opposite, and adjacent sides. Know these identities: \( \sin^2(x) + \cos^2(x) = 1 \), \( \tan^2(x) + 1 = \sec^2(x) \), \( \cot^2(x) + 1 = \csc^2(x) \), \( \sin(2x) = 2 \sin(x) \cos(x) \), \( \cos(2x) = \cos^2(x) - \sin^2(x) \). Evaluate quantities such as \( \cos(\theta + \pi/2) \), \( \sin(\pi - \theta) \), etc.
  – See the trigonometry worksheet and #29, 30, 35, 36, 37, 38, 65, 67 from Appendix D.