Math 130 Learning Objectives

Chapter 1

- Understand and use interval notation and inequalities to describe sets of real numbers.
- Understand and use commutative, distributive and associative properties.
- Evaluate real number expressions with +, -, *, ***/,*** exponents, radicals, and absolute value without a calculator (show your work).
- Use scientific notation.
- Use laws and properties of exponents to simplify expressions.
- Simplify radical and rational expressions.
- Rationalize the numerator or denominator.
- Operations with polynomials: +, -, *, squaring and cubing, and factor (including sum and difference of cubes and 4 term polynomials using grouping)
- Solve equations and inequalities (answer using interval notation) both by hand (show your work, give an exact answer). Example: $x = \sqrt{2}$ is an exact answer; $x \approx 1.414$ is a decimal approximate correct to 3 decimal places ... $\sqrt{2} \neq 1.414$. Types: linear, quadratic (know the quadratic formula and how to simplify the answer), rational, radical, absolute value, and factorable polynomial. Check answers when necessary.
- Express the domain of an expression using interval notation
- Plot points and find the distance between two points, the midpoint, the slope and the equation of the line passing through the points.
- Graph simple equations by hand, find intercepts and discuss symmetry. Know the tests for symmetry.
- Equations of lines: know slope-intercept, point-slope, and general forms. Be able to graph the line and find the equation of a line perpendicular or parallel to a given line through a given point. Use linear equations to solve simple word problems.
- Circles: recognize the equation of circle and put in standard form by completing the square. Graph. Given information about a circle, graph and find the equation.

<u>Some Representative Study Problems:</u>

Chapter 1 Review, p. 125: 28, 44, 58, 62, 64, 76, 89, 91, 99, 116, 126
Chapter 1 Test, p. 128 1 - 8, 11-21

Chapter 2

- Know and understand the definition of "function." Be able to recognize a graph or equation which describes *y* as a function of *x*.
- Evaluate functions at real numbers and simple algebraic expressions. Simplify a difference quotient $\frac{f(a+h) - f(a)}{h}$ for a given function, *f(x).*
- Express the domain of a function in interval notation.
- Sketch the (complete) graph of simple functions by hand. Use the graph to find the range of the function.
- Evaluate and sketch the graph of piecewise defined functions.
- Transformations of graphs: understand and describe how to use vertical and horizontal shifting, reflecting and stretching/shrinking, in the correct order, to transform the graph of a standard function (see page 159 of text for list). Graph transformed function by hand. Given the graph of a function, $y = f(x)$, sketch the graph of its transformation, such as $y = 2f(3x) + 4$ or $y = -f(x+7) - 13$ or similar expression.
- Combine two functions to make a new function using +, -, *, ***/,*** or composition of functions. Give the domain in interval notation.
- Be able to recognize the graph or equation of a function that is one-to-one and sketch its graph. Restrict the domain of a function to make it one-to-one.
- Find the formula and domain and range of the inverse of a one-to-one function.

Chapter 3

- Graph polynomial functions by hand using transformations of power functions or factoring to find the intercepts. Show all intercepts and proper end behavior.
- Divide polynomials using long division. Find the quotient and remainder functions. Synthetic division is optional (not required on midterms or final exam).
- Given a zero of a polynomial, use the factor theorem to factor the polynomial and find all zeros. Given the zeros of a polynomial, write the formula for the function.
- Sketch the graph of a rational function. Find the domain and range, all intercepts, and the equations of vertical and horizontal asymptotes by hand (give exact values) and display and label them on the graph.
- Slant asymptotes may appear in homework but will not be on midterms or the final exam.

<u>Some Representative Study Problems:</u>

Chapter 2 Review, p. 208: 40, 64, 75, 80, 90
Chapter 2 Test, p. 211: 1,2,6,7,8,9,10, 1l(ab)
Chapter 3 Review, p. 292: 12,27,41, 77, 79
Chapter 3 Test, p. 295: 4, 5, 12

Chapter 4

- Sketch the graph of simple exponential and logarithmic functions with transformations. Find domain, range, intercepts and asymptotes by hand and display and label on graph.
- Evaluate logarithmic expressions. Give exact values.
- Use Laws and properties of logarithms to expand expressions or combine terms into a single logarithm.
- Solve exponential and logarithmic equations. Give exact answers.

  Show all work. Use exponential and logarithmic functions to solve simple word problems.

Chapter 5

- Understand and use the unit circle. For any value of *t*, plot the terminal point for *t* in the proper quadrant and find the reference number.
- Given a terminal point *(x,y)* for *t*, find the six trigonometric exact values of *t*.
- Memorize the special exact values of the trigonometric functions, p. 378. Use them to find exact values for the other three quadrants. Know the signs of the trigonometric functions in each quadrant.
- Memorize and use the Fundamental Identities, p. 382.
- Sketch one complete period of the graphs of $f(x) = \sin x$ and $g(x) = \cos x$ and their transformations, e.g. $f(x) = a\sin k(x - b) + c$, by hand. Find the amplitude, period, and phase shift. Plot at least five exact points in one period for each graph.
- Given a sine or cosine graph, write an equation that represents the curve. Find the amplitude, period and phase shift.
- Sketch the graphs of $y = \tan x$, $y = \cot x$, $y = \sec x$, $y = \csc x$ and simple transformations of each. Find and display all intercepts and asymptotes, find the period.
- Know the definitions of arcsine, arccosine, and arctangent (inverse trigonometric functions), their graphs, and domain and range for each. Find exact values (sketch a triangle if necessary). Rewrite expressions with inverse trigonometric functions as algebraic expressions in x.

<u>Some Representative Study Problems:</u>

Chapter 4 Review, p. 353: 52,63,67, 70
Chapter 4 Test, p. 356: 1 - 6
Chapter 5 Review, p. 424: 6, 20, 26, 36, 39, 46, 49-52
Chapter 5 Test, p. 426: 1 - 8, 10,11

Chapter 6

- Convert between degree and radian measure. Given the measure of an angle, plot in standard position on the unit circle, give the reference angle.
- Know the length of a circular arc formula and the area of a circular sector formula and use them to find a missing quantity.
- Solve right triangles for missing angles or side lengths. Solve simple word problems.
- Know and use the definition of the trigonometric functions of an angle in standard position, p. 452.
- Find the exact value of trigonometric functions of special angles (0°,30°,45°,60°,90° , ...).
- Use the Fundamental identities to write one trigonometric function in terms of another, with correct sign for the given quadrant. Given one trigonometric value of θ and the quadrant, find the other 5 trigonometric values of θ.

Chapter 7

- Be able to prove a trigonometric identity. Start with one side and write it down, as is. Use known identities to transform the side, step-by-step (show all work) into the other side.
- Simplify a trigonometric expression using known identities. Write your answers using the smallest number of trigonometric functions as possible or using sine and cosine only.
- Perform a given trigonometric substitution and simplify the answer.
- Know how to use addition and subtraction formulas. These do not need to be memorized and will be provided on the final exam.
- Memorize and be able to use the double-angle formulas on p. 508. Find exact values, prove identities, and simplify expressions.
- Use the formulas for lowering powers and half-angle formulas (p. 510) to find exact values, prove identities, and simplify expressions (these will be provided on the final exam).
- Solve a simple word problem for θ.
- Solve trigonometric equations, including multiple-angle equations. Be able to find all solutions, or all solutions in [0, *21l').* Give exact value answers.
  (Exact values will be required for final exam)

<u>Some Representative Study Problems:</u>

Chapter 6 Review, p. 483: 7,9, 17,26,48
Chapter 6 Test, p. 487: 1, 2, 4 - 10, 12, 15
Chapter 7 Review, p. 530: 1, 9, 11, 33, 35,40, 54, 55, 61
Chapter 7 Test, p. 532: 1 - 4, 6, 7bcd, 9