Information about the Math 120R Final Exam
Spring 2012

Procedures

- The final exam is on Monday, May 7th, from 8 – 10am. Do not be late. You will not be given additional time if you arrive after 8:00am. We recommend that you arrive 15 minutes early, maybe 20 minutes earlier if your teacher has multiple sections.
- If you will be using testing accommodations through DRC, you should arrive 15 minutes early to the testing room at the DRC.
- Bring your calculator (TI 89 calculators and symbolic manipulators are not permitted). You will not be allowed to borrow or share a calculator, or use your cell phone during the exam. The calculator should have exponential and logarithmic functions. Spare batteries are advised. The only two programs acceptable are QUADRATIC and EVALUATE. All others must be deleted.
- Bring a picture ID.
- The final exam is not given in your usual classroom. The location of the final exam can be found at http://math.arizona.edu/academics/courseinfo/common
- Several sections will be in the same room, students in **each section** (not just by instructor) will need to sit together. Listen to your instructor about where to sit, especially if s/he has more than one section. You will sit every other seat. Additional directions will be given at the test site.
- All cell phones and electronic devices such as PDAs must be **turned off** during the exam. Vibrate or silence mode is not allowed. If the device goes off it could be constituted as cheating.
- All hats must be removed or turned around; the bill must not be facing forwards.
- You will not be allowed to leave the exam room until 9:00 am.
- If you are finished with the exam before 9:00 am, you can turn in your test but you may not pull out any other material or listening devices.
- No formula sheet or notes are allowed on the exam.

About the exam

- You will be given a short answer and a multiple choice exam booklet. In addition, you will receive an answer sheet in order to record your answers for the multiple choice questions.
- There will be 7-8 short answer (some multi-part) questions and 22-25 multiple choice questions on the final exam. The point values for each short answer problem will vary.
- No partial credit will be given for multiple choice questions. If you don't know an answer, do not leave it blank, take a guess. Circle your answer on the exam and fill in the circle on the answer sheet that will be provided.
- Topics covered: Algebra skills, functions: constant, linear, quadratics, polynomials, rational, exponential, logarithmic, and trigonometric functions. The exam will use the Rule of 4: formulas, graphs, tables and words.
- Except where noted, you must show all work to get credit. Your final answer must also follow from your work (even if your answer is correct). Showing your work includes but is not limited to the interpretation of the question asked.
- Always include appropriate units in your answers. Always give exact answers unless stated to round to a number of decimal places. Interest rates and percentages must be a %.
- Graph must show understanding (label and values). If asked to draw a graph, this means, along with the function, to label the axes with appropriate titles and relevant values and a title appropriate for the problem
- You need to know the following geometry formulas: area of a circle, rectangle and triangle, circumference of a circle and perimeter of a rectangle and triangle; volume and surface area of a rectangular box, and the Pythagorean Theorem.

- Any function type can appear on the exam: polynomial, rational, exponential, logarithmic, trigonometric (all six), inverse trigonometric [(arcsin(x), arccos(x),arctan(x)], absolute value, piecewise, and equations with parameters.
- You need to be able to make practical interpretations and geometric interpretations for expressions and equations.
- You need to know terminology such as difference quotient, average rate of change, maximum, minimum, and asymptotes.
- The Final Exam Study guide was designed to provide additional problems for practice. Although the questions on the guide are not samples from actual exam questions, they do cover the topics, vocabulary and concepts relevant to the exam.
- You need to know the trigonometric values of the special angles. For example: we expect you to write $\cos(\frac{5\pi}{4})$ as $-\frac{\sqrt{2}}{2}$ or $-\frac{1}{\sqrt{2}}$.
- The following formulas will be provided on the final exam.

Addition and subtraction formula for sine:

$$\sin(s+t) = \sin s \cos t + \cos s \sin t$$

$$\sin(s-t) = \sin s \cos t - \cos s \sin t$$

Addition and subtraction formula for cosine:

$$\cos(s+t) = \cos s \cos t - \sin s \sin t$$

$$\cos(s-t) = \cos s \cos t + \cos s \sin t$$

Double Angle formula for sine: $\sin(2\theta) = 2\sin\theta\cos\theta$

Double Angle formula for cosine: $\cos(2\theta) = \cos^2\theta - \sin^2\theta$

Compound Interest (n times a year): $A(t) = P\left(1+\frac{r}{n}\right)^{nt}$

Compound Interest (continuously)/Exponential Growth and Decay Model:

$$A(t) = Pe^{rt}$$

Note: No question involving the addition, subtraction, or double angle Formula for tangent will appear on the final exam.

Math 120R – Topics by Section

Section 1.4

- Domains of fractional expressions
- Simplifying fractional expressions $(+,-,\times,\div)$ (also negative exponents)
- Rationalizing the numerator/denominator

Section 1.5

- Isolating a variable in an equation
- Completing the square
- Quadratic formula
- Using the sign of the discriminant to determine the number of solutions to a quadratic equation
- Solving different types of equations (quadratic type, square roots, absolute values)

Section 1.6

- Setting up mathematical models
- Know area and perimeter formulas for rectangle, square, and circle; know the formula distance = rate x time; know Pythagorean Theorem

Section 1.7

- Solving basic inequalities
- Solving "complex" inequalities (set unequal to 0 and find key numbers)
- Solving inequalities with absolute values

Section 1.8

- Determining the distance between 2 points
- Determining the midpoint of the line segment between 2 points
- Determine the equation of a circle in standard form
- Determining if equations/graphs exhibit any of the 3 types of symmetry (*x*-axis, *y*-axis, or origin)

Section 1.9

- Find appropriate viewing window for any function
- Use calculator to approximate features on graph (turning points, zeros, maximum, minimum, intersection)

Section 1.10

- Determining the slope between 2 points (in context when appropriate)
- Determining the equation of a line (including horizontal and vertical lines)
- Determining equations of parallel or perpendicular lines

Section 1.11

- Determining direct, inverse, and joint variation equations.
- Determining constants of proportionality.

Section 2.1

- Determining whether an equation or table represents a function
- Evaluating a piecewise-defined function
- Evaluating functions for algebraic expressions

Section 2.2

- Determining whether a graph represents a function (vertical line test)
- Determining domain/range from a graph
- Know the basic functions discussed on page 166 of the text
- Graphing piecewise-defined functions

Section 2.3

- Determining the open intervals where a function is increasing/decreasing/constant
- Determine the approximate values of turning points
- Calculating the average rate of change (perhaps in a context)
- Difference quotients and average velocity are average rate of change calculations

Section 2.4

- Transformations for functions (symbolic, tables, graphs, verbal)
    - Vertical/Horizontal expanding and compressing
    - Reflecting over the x- or y-axis
    - Shifting up/down and left/right
- Even and Odd functions

Section 2.5

- Quadratic functions
- Determining the vertex (applications also)
- Local Max/Min

Section 2.6

- Modeling with functions (set up equations for application problems)
- Determine optimal values (max/min)

Section 2.7

- Add/Subtract/Multiply/Divide functions
- Determine domains when adding/subtracting/multiplying/dividing functions
- Composition of functions (symbolic, tables, graphs)
- Determine domains when composing functions
- Decomposition of functions

Section 2.8

- Show that a function is 1–1 (algebraically and/or graphically)
- Verify algebraically that 2 functions are inverses
- Determine the inverse of a function (symbolically, tables, graphs)
- Restricting the domain of a function to ins the inverse (quadratics)
- Interpret the meaning of an inverse function in application problems

Section 3.1

- Identify whether a formula/graph represents a polynomial function
- Determine the end behavior of a polynomial
- Leading term property for determining end behavior of a polynomial
- Multiplicity of zeros
- Graphing polynomial functions

Section 3.2

- Long division of polynomials
- Synthetic division of polynomials
- Remainder Theorem
- Factor Theorem

Section 3.6

- Determining any vertical, horizontal, and/or slant asymptotes for rational functions
- Determining any holes in the graph of rational functions
- Determining any intercepts for rational functions
- Determining the domain of rational functions
- Determining the complete graph of rational functions (label asymptotes, holes, and intercepts)
- Behavior of rational functions near asymptotes

Section 4.1

- Properties of exponential functions (domain, range, intercepts, asymptotes, graphs)
- Determine a formula for an exponential function given a graph or table
- Use $A = P(1+\frac{r}{n})^{nt}$ and $A = Pe^{rt}$ formulas
- Solve exponential application problems

Section 4.2

- Properties of logarithmic functions (domain, range, intercepts, asymptotes, graphs)
- Determine a formula for a logarithmic function given a graph or table
- Be able to convert between exponential and logarithmic forms for equations
- Determine the inverse of an exponential and/or logarithmic function
- Understand common logs and natural logs as logarithms with special bases

Section 4.3

- Use the laws of logarithms to write a logarithmic expression as the sum/difference of logs

$$\log_a(AB) = \log_a(A) + \log_a(B)$$

$$\log_a(\frac{A}{B}) = \log_a(A) - \log_a(B)$$

$$\log_a(A^C) = C \cdot \log_a(A)$$

- Change of base

Section 4.4

- Solving exponential equations
- Solving logarithmic equations (check answers)
- Solving exponential and logarithmic application problems

Section 4.5

- Solving exponential and logarithmic application problems

Section 5.1

- Determining points on a unit circle
- Determining terminal points on a unit circle given a "special" value of *t*
- Determining the reference number for a given value of *t*

Section 5.2

- Determining the 6 trigonometric function values of "special" values of *t*
- Know the sign of the 6 trigonometric functions in each quadrant
- Calculate trigonometric function values for values of *t* that have a "special" reference number (ex. $t = \frac{7\pi}{4}$, $t = -\frac{11\pi}{6}$, etc.)
- Trigonometric identities: Reciprocal and Pythagorean
- Even-Odd Properties
- Solving for values of the 6 trigonometric functions given some information

Section 5.3

- Graphing sine and cosine functions (amplitude, period, horizontal and vertical shifts)

Section 5.4

- Graphing tangent, cotangent, secant, and cosecant functions (period, horizontal and vertical shifts)

Section 5.5

- Modeling simple and damped harmonic motion
- Determining amplitude, period, and frequency for simple harmonic motion
- Given formula for damped harmonic motion $y = ke^{-ct}\sin\omega t$ or $y = ke^{-ct}\cos\omega t$

Section 6.1

- Convert between degrees and radians
- Determine whether angles are coterminal
- Length of a circular arc $s = r\theta$ (formula not given - angle in radians)

- Area of a sector $A = \frac{1}{2} r^2 \theta$ (formula not given - angle in radians)
- Angular speed $\omega = \frac{\theta}{t}$ and linear speed $v = \frac{s}{t}$ Note: $v = r\omega$

Section 6.2

- Know exact measurements for trigonometric ratios for "special angles"
- Determine trigonometric ratios for sides in a right triangle
- Application problems involving right triangles, line of sight

Section 6.3

- Determining reference angles
- Calculating trigonometric values for "special" reference angles
- Recall identities
- Signs of trigonometric functions in each quadrant
- Determining values of 6 trigonometric functions given some information
- Write each trig function in terms of another

Section 7.1

- Simplify trigonometric expressions
- Verifying trigonometric identities

Section 7.2

- Know addition and subtraction formulas for sine, cosine, and tangent.

Section 7.3

- Know double angle identities

$$\sin 2x = 2\sin x \cos x$$

$$\cos 2x = \cos^2 x - \sin^2 x$$

$$\cos 2x = 2\cos^2 x - 1$$

$$\cos 2x = 1 - 2\sin^2 x$$

$$\tan 2x = \frac{2\tan x}{1 - \tan^2 x} = \frac{\sin 2x}{\cos 2x}$$

Section 7.4

- Know restrictions for sin, cos, & tan in order to get arcsin, arccos, & arctan
- Know domain/range, graphs, asymptotes of each
- Evaluating trig and inverse trig function values exactly for "special" angles/numbers

Section 7.5

- Solving trigonometric equations on a finite or infinite interval