Math 130 – Final Exam Study Guide

Fall 2011, David Beydler

Final Exam

- Date: Monday, December 12, 7:30pm-10:00pm in 61-3319 (Building 61, Room 3319)
- Will focus on sections covered in Chapter 2, 3, 4, 5, and 7, as well as 1.6 and 1.7.
- No calculators (this includes cell phones), notes, or books.
- Don't forget that the **fourth batch of homework is due at the test**! This includes the following sections: 7.1-7.5

I'll provide you with the following formulas:

- (2.1) Distance formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- (2.1) Midpoint formula: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
- (4.2) Compound interest: $A = P\left(1 + \frac{r}{n}\right)^{tn}$
- (4.2) Continuous compound interest: $A = Pe^{rt}$
- (4.4) Change-of-Base Theorem: $\log_a x = \frac{\log_b x}{\log_b a}$
- (7.1) $\sum_{i=1}^{n} i = 1 + 2 + \cdots + n = \frac{n(n+1)}{2}$
- (7.1) $\sum_{i=1}^{n} i^2 = 1^2 + 2^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$
- (7.1) $\sum_{i=1}^{n} i^3 = 1^3 + 2^3 + \cdots + n^3 = \frac{n^2(n+1)^2}{4}$
- (7.2) $a_n = a_1 + (n-1)d$ and $S_n = \frac{n}{2}(a_1 + a_n)$
- (7.2) $a_n = a_1 r^{n-1}$ and $S_n = \frac{a_1(1-r^n)}{1-r}$ (where $r \neq 1$) and $S_\infty = \frac{a_1}{1-r}$ (if $-1 < r < 1$)
- (7.4) $(x+y)^n = x^n + \binom{n}{1}x^{n-1}y + \binom{n}{2}x^{n-2}y^2 + \cdots + \binom{n}{r}x^{n-r}y^r + \cdots + \binom{n}{n-1}xy^{n-1} + y^n$

Here are <u>some</u> of the formulas you'll want to know:

- (1.4) Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- (2.2) Center-radius form for circles: $(x-h)^2 + (y-k)^2 = r^2$
- (2.4, 2.5) Lines
  - Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$
  - Standard form: $Ax + By = C$
  - Slope-intercept form: $y = mx + b$
  - Point-slope form: $y - y_1 = m(x - x_1)$
  - Horizontal lines: $y = b$, Vertical lines: $x = a$
  - parallel ↔ same slope (also two vertical lines are parallel)
  - perpendicular ↔ slopes are negative reciprocals (also, vertical and horizontal lines are perpendicular)
- (2.7) $f(x) + c$ translates up, $f(x) - c$ translates down
  $f(x - c)$ translates right, $f(x + c)$ translates left

$cf(x)$ stretches vertically (if $c > 1$), or shrinks vertically (if $0 < c < 1$)
$f(cx)$ stretches horizontally (if $0 < c < 1$), or shrink horizontally (if $c > 1$)
$-f(x)$ reflects about x-axis
$f(-x)$ reflects about y-axis

- (2.7) $f(x)$ is even if $f(-x) = f(x)$
  $f(x)$ is odd if $f(-x) = -f(x)$
- (2.8) $(f \pm g)(x) = f(x) \pm g(x)$
  $(fg)(x) = f(x)g(x)$
  $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$ for $g(x) \neq 0$
  $(g \circ f)(x) = g(f(x))$
- (3.1) Vertex formula: $-\frac{b}{2a}$
- (3.2) Remainder Theorem: If polynomial $f(x)$ divided by $x - k$, remainder is $f(k)$
- (3.3) Factor Theorem: $x - k$ is factor if and only if $f(k) = 0$
- (3.3) Rational Zeros Theorem: Rational zeros are always a factor of constant term over a factor of leading coefficient.
- (3.3) Conjugate Zeros Theorem: Complex zeros come in conjugate pairs ($a + bi$, $a - bi$).
- (3.3) Descartes' Rule of Signs:
  # of positive real zeros is either the # of variations in sign of f(x), or is less than that by an even #
  # of negative real zeros is either the # of variations in sign of f(-x), or is less than that by an even #
- (4.1) One-to-one: if $a \neq b$, then $f(a) \neq f(b)$. (Or, if $f(a) = f(b)$, then $a = b$.)
- (4.1) $f(x)$ and $g(x)$ inverse functions if both one-to-one, $f\big(g(x)\big) = x$, $g\big(f(x)\big) = x$
- (4.3) $\log_a xy = \log_a x + \log_a y$, $\log_a \frac{x}{y} = \log_a x - \log_a y$, $\log_a x^r = r \log_a x$
- (4.3) $a^{\log_a x} = x$, $\log_a a^x = x$
- (4.4) $\ln x = \log_e x$, $\log x = \log_{10} x$
- (7.1) $\sum_{i=1}^{n} c = nc$
- (7.1) $\sum_{i=1}^{n} ca_i = c \sum_{i=1}^{n} a_i$
- (7.1) $\sum_{i=1}^{n} (a_i \pm b_i) = \sum_{i=1}^{n} a_i \pm \sum_{i=1}^{n} b_i$
- (7.4) $n! = n(n-1)(n-2) \ldots (3)(2)(1)$ and $0! = 1$
- (7.4) ${}_nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$

Extra Credit!

- If you write up the answers to all of the review exercises (see separate handout), and hand them in at the test, you can earn up to 1% extra credit towards your overall grade (depending on neatness and completeness)!