MATH 4111 HOMEWORK ASSIGNMENT 1
DUE Thursday, September 8

INSTRUCTOR'S HOMEWORK POLICIES: TRY HARD TO HAND IN ASSIGNMENTS IN CLASS ON THE INDICATED DUE DATE OR, IF YOU'RE UNABLE TO ATTEND CLASS, TO GIVE YOUR COMPLETED ASSIGNMENT TO A FRIEND TO HAND IN. PAPERS SLIPPED UNDER MY OFFICE DOOR WITHIN AN HOUR OR TWO AFTER CLASS ON THE DUE DATE HAVE GOOD ODDS OF GETTING INTO THE GRADER'S HANDS AND BEING GRADED. IN THE EVENT OF A SPECIAL PROBLEM (ILLNESS, ETC.), CONTACT ME BY E-MAIL. UNLESS I'VE MADE A SPECIAL ALLOWANCE, PAPERS RECEIVED AFTER I'VE PASSED ON ALL OTHER PAPERS TO THE GRADER (USUALLY DONE BY MID AFTERNOON ON THE DUE DATE) WILL NOT BE CAREFULLY GRADED AND WILL RECEIVE LITTLE OR NO CREDIT. NEVER PUT ANY PAPERS IN MY MAILSLOT SINCE I CHECK IT ONLY SPORADICALLY.

IT'S PERFECTLY O.K. TO ASK FOR A HINT DURING OFFICE HOURS. I'LL USUALLY BE QUITE "GENEROUS" WITH HINTS AND MAY COME CLOSE TO COMPLETING THE PROBLEM. REMEMBER THAT IT'S ALSO IT'S PERFECTLY O.K. TO DISCUSS PROBLEMS WITH OTHER STUDENTS IN THE CLASS AS LONG AS YOU INDIVIDUALLY WRITE OUT YOUR OWN SOLUTIONS AND WRITE THE NAMES OF YOUR COLLABORATORS ON THE TOP OF YOUR FIRST PAGE (SEE ACADEMIC INTEGRITY SECTION). THERE'S NO DEDUCTION AT ALL FOR SUCH IDENTIFYING NOTES BUT THERE MIGHT BE A DEDUCTION WHEN IT'S CLEAR THERE HAS BEEN COLLABORATION BUT NO NOTES APPEAR. AS MENTIONED IN THE ACADEMIC INTEGRITY STATEMENT
FOR THIS COURSE, THE BIG “NO-NO” IS SUBMISSION OF SOLUTIONS FROM AN “ASK THE EXPERT” WEBSITE; THIS IS PLAGIARISM AND MAY RESULT IN A SEVERE PENALTY ASSESSED BY THE ACADEMIC INTEGRITY COMMITTEE.

ASSIGNMENT #1. DUE THURSDAY, SEPTEMBER 8

(i) Read Chapter 1 in Rosenlicht's book, the Notes on Sets and Set Theory posted on the course website, and get started on reading Chapter 2.

(ii) Do the following problems from Chapter 1 (pages 12-13): 4 and 5 (all parts), 7(b), (c), (e), (f), 8, and 9.

(iii) Use mathematical induction to prove that, for each positive integer $n$, the sum of the third powers (cubes) of the first $k$ positive integers is $\left[\frac{k(k+1)}{2}\right]^2$. Thus, for $k = 3$, $1 + 8 + 27 = 36 = 6^2$ with $6 = \frac{3(4)}{2}$. Done efficiently, the induction proof takes only a few lines.

(iv) Use mathematical induction to prove the binomial theorem (look it up if you’ve forgotten the statement). Then use the binomial theorem to prove the trinomial theorem for expansion of the $n^{th}$ power of a sum $a+b+c$ by a sum of products of powers of $a$, $b$, and $c$ with certain “trinomial” coefficients all involving $n!$ in the numerator and appropriate products of three factorials in the denominators.

(v) For extra credit, hypothesize a statement of a general multinomial theorem for expansion of the $n^{th}$ power of a sum of $m$ variables and go on to prove your hypothesis either by induction on $m$ for each fixed $n$ or induction on $n$ for each fixed $m$ (one way is much easier than the other!)