



HOLY FAMILY UNIVERSITY

**Center for Academic
Enhancement**

**Northeast
Philadelphia
Campus**

**Center for Academic
Enhancement
Library 2nd Floor**

**Phone: 215-637-7700
Ext. 3326
email: cae@holyfamily.edu**

Manual for Peer Tutors: Mathematics

Thank you for agreeing to work with us as a peer tutor in the Center for Academic Enhancement. You have been chosen from the applicant pool for many reasons. You have been recommended by your instructors, and, in some cases, also by your peers; you have exhibited outstanding scholarship; and, perhaps most importantly, you have shown that you understand the process of learning -- the challenges and the rewards. You will invest much, and, hopefully, will come away with much. In order for this process of learning and tutoring to be successful, you will need knowledge and imagination and patience. As Martina Horner, President of Radcliffe College, has said, "What is important is to keep learning, to enjoy challenge, and to tolerate ambiguity. In the end there are no certain answers." Remember: no manual can address all of the questions or predict each of the circumstances you will encounter; and so, we are there to help you. We are a team.

Angela Godshall, Director

P.S. Always, retain your humor. And read on, lest we take ourselves too seriously! The following "mathematically inspired" quotes were selected by our current peer tutors to remind you to keep perspective and keep smiling!

"Natural numbers are better for your health." [unknown]

"Decimals have a point." [unknown]

"Calculus has its limits." [unknown]

And finally,

*"The union of the mathematician with the poet, fervor with measure,
passion with correctness, this surely is the ideal." William James*

Welcome to the Center for Academic Enhancement (CAE) at Holy Family University! You are about to embark on an experience that promises not only to address the educational needs of the academic community, but one that enhances your personal growth as well. It is assumed that all tutors at the Center are extremely knowledgeable in their field[s] of expertise. However, what separates the great tutors from the very good ones is not how much they know, but rather the way they communicate the subject matter to the students with whom they are working. Tutoring sessions at the Center are designed to promote collaborative learning – you will give assistance and confidence to the tutee; in turn, your own skills of communication and ability to interact meaningfully will strengthen and mature.

We will work with you in an orientation program and training sessions. Also, we will make available to you a copy of The Bedford Guide for Writing Tutors, which served as the underpinning for this manual. The general tenets of tutoring translate from one discipline to another, and so this guide for writing tutors served as a basis for all of the manuals we have produced. Our design is to make your tutoring experience as productive and rewarding as possible!

Contributors

The general procedural portions of this manual were researched and written by:

Professional Tutors

William Broderick
Irene Klosko
Dennis Millan, compiler

Peer Tutors

Lisa Cruz
Wayne Hefner
Amanda Hipwell
Lauren Seay

The sections dealing specifically with mathematics in this manual were researched and written by:

Professional Tutors

Mary Elizabeth Farrell, SSJ
Patrick Heasley

Peer Tutor

Shawna Erhard

Holy Family University
Philadelphia, Pennsylvania

August 2007

Introductory Information

The CAE's Mission Statement

The Center for Academic Enhancement at Holy Family University is committed to providing a broad complement of diverse academic support services, addressing student needs at all levels. By strengthening the skills necessary for intellectual growth and scholarly achievement, the Center seeks to enrich the academic experience of each student, to instill in each student enthusiasm for life long learning, and to uphold the University commitment to maintaining standards of academic excellence.

Tutor Training Program

The Center provides a training program for peer tutors. The intention of the program is to offer support and instruction to the tutor. We emphasize the Center's approach of working as a team; we coach the tutor, focusing on teaching technique and practices, communication skills; we strive to reinforce the University commitment to cultural diversity by providing insight into the needs of the ESL student and instilling an awareness of the dynamics of the intercultural community. In sum, it is our intent to reinforce the tutor's awareness of, understanding of, and respect for the learning needs of the University students.

Mathematics

Discipline Objectives

- To form systematic, orderly, and exact habits of student thought.
- To help instill an appreciation of the natural origin and evolutionary growth of the basic mathematical ideas.
- To provide a wide cultural and scientific background for science students for whom knowledge of mathematics is necessary.
- To give interested students a knowledge of the basic mathematics needed for more advanced study in the field.
- To introduce technology to enhances learning and empowers the student to become a better problem solver. Quoted from the **Holy Family University Cooperative Education and Internship Handbook**

Office procedures for the CAE

For non-referred students:

- The student logs into the computer dedicated to this task with the date, her/his name, the subject to be tutored in, and the tutor's name.
- Student meets with her/his tutor.
- After tutoring session, the student fills out the Evaluation form on a periodic, but regular basis.
- Student signs out on computer log with the time the tutoring session ended.
- Tutor fills out the Student Summary Sheet, noting the material that was covered and makes recommendations if applicable.

- Tutor files the Student Summary Sheet in the file cabinet in the student's folder. If the student is new and/or does not have a folder, the tutor makes a folder for the student and files it alphabetically.
- The tutor files the Evaluation form in her/his own folder for end-of-year summary and assessment. [NOTE: There should be a folder for evaluations in *each* tutor's section of the file cabinet.]

For referred students:

- Tutor takes the Faculty Referral Form from the student or locates it from the appropriate tray if the form has been sent via mail.
- Follow the procedure, steps 1-6, above.
- Complete the Faculty Confirmation Form and forward it to the referring faculty member via campus mail after first session.
- File the Faculty Referral Form in the student's folder along with the Student Summary Sheet.

In all instances:

- Please check your mailbox and the appointment book daily.
- When a student makes an appointment, either over the telephone or in person, please be sure to get telephone number [preferably cell] where s/he can be reached in case there is a scheduling conflict. Also record the student's subject and/or tutor in the appointment book. Place your initials next to each appointment you make.
- Keep all CAE resources, for example, dictionaries and handbooks, in order; return all resources to their place after each use.
- Keep the CAE neat and orderly.
- Have respect for all students, without forming any preconceived notions based on any form of bias.
- Turn in your time sheet weekly.
- Suggest that the student be prepared, with textbook, notebook, pencil, and questions

Specifics for Math appointments:

- Remember, there is a separate math login sheet.
- There can be no more than three people signed up at a single time, all of whom must be studying the same material in the same subject for tutoring.

Please complete ALL procedural steps daily: don't let the paperwork build up!

CHAPTER 1: THE CENTER AS CREATED LEARNING SPACE

A tutor becomes a part of a large but special group who has empowered others, enabling them to attain knowledge and hone their skills. Tutoring can be a joyful task, full of excitement and challenge, but there are some basic regulations that must be followed at all times --- these are intended to establish a procedure that works to the benefit of both tutor and tutee.

- Treat all students courteously and respectfully.
- Maintain a respectful and serious attitude toward the student's work, yet be somewhat casual, informal, and relaxed. Do not put on airs or act superior to those you tutor [you may have more education or have better skills, but this does not of itself make you a better human being.]
- Be constructive and specific when evaluating the student's work. Don't leave the tutee hanging: give honest, but never nasty, feedback. Show the student exactly where s/he can improve her/his paper. Praise the areas you feel the writer did well.
- You must always work *with* the student, never do the work *for* the student. You can work out math problems that are similar to the ones that are assigned in class, but do not do the problems for the tutee. Let the tutee do the problems that have been assigned. **IT IS NEVER HELPFUL TO DO THE WORK FOR THE STUDENT!!!**
- Give substantial help at each session. The tutee must feel that s/he has benefited in some clear way from the session or s/he is not likely to return. Sometimes, the tutor needs to tread a fine line between being too helpful, i.e. doing too much work on the actual assignment and not giving enough direction or feedback [see the preceding item.]
- Help the student interpret or better understand an assignment, but the tutor must refrain from commenting negatively on the teacher, the assignment, or any comments the teacher has written on the student's work.
- To repeat: learn the procedures of the Center [listed above] and follow them. Fill out summary forms and other paperwork in a timely fashion. Don't let things slide, because you will forget later what you did with each student.

You will not always be busy, tutoring students. There are times when you will not have appointments. Tutors must take advantage of these down times, to invest effort in assessing and honing their language and tutoring skills. This can be done in a variety of ways:

- Learn as much as you can about the tutoring strategies—how different students learn, and how you, as a tutor, can get the information across to different students.
- Get familiar with the computer software. They do come in handy when you are stuck with some problems.
- Become familiar with the textbooks that are available in the Center. It will be beneficial to know how to look things up quickly when you are in a bind. No one can remember everything, but all tutors should have handbooks and valuable websites within easy access.

- Become familiar with the software that is installed on each of the Center's computers --- the software is invaluable for self- paced tutorials.
- Between tutoring sessions, think about the things that seemed to go right, which seemed to work, and those that were less effective. Keep a journal so that you can remember and refer back to the most successful sessions.

Without a doubt, tutors are at different stages and levels of knowledge and ability. As you get students coming in on a regular basis, you will get to know them more and more. The common denominator among all tutors, regardless of their level of expertise and knowledge, is the love and enthusiasm for mathematics, and the patience and willingness to transfer some of this knowledge and enthusiasm to the students they tutor.

CHAPTER 2: THE TUTORING SESSION

A common misconception students have about coming to a tutoring center is that only poor students need the kind of help that a center provides. A student with this kind of thinking will come feeling inferior. The CAE must make it a priority to change such a view. One excellent way of doing this is by training tutors to manifest behavior that does not label the student as a weak mathematician. The ideas that the student is always in control of her/his math skills, and that practice and effort are rewarded, must always be reinforced.

The way in which the tutor interacts with the tutee will either encourage or discourage her/him. The following guidelines will help evoke a positive response from the students.

As You Begin the Tutoring Session

- Help make the student feel comfortable:
 1. Introduce yourself.
 2. Be friendly.
 3. Be interested.
- Sit next to the student, not across from her/him.
- Be enthusiastic and upbeat, have a positive tone of voice.
- Smile.
- Always be friendly, respectful, and patient.
- Create a comfortable environment for yourself and for the student.
- Most importantly, always remain calm and collected; as a tutor, you must always be a calming influence.

Pre-requisites for the student:

- Always have the student bring something to work with—a book, a paper, a handout, etc.
- Check if the tutee has a clear understanding of the assignments that he/she brings to you.
- Have her/him bring a syllabus for the particular class in which he/she is encountering difficulty.

During the Tutoring Session

- Try to limit sessions to a half hour or one hour, depending on the time needed. Going over this time period can often be too much for any student to absorb at one time, and can decrease the productivity of the session.
- Ask to see the requirements of the assignment.
- Ask if there are any particular questions the student has about the assignment.
- Establish two-way conversation; interaction between the tutor and student is ideal for tutoring sessions.
- Talk about experiences that the student can relate to.
- Actively listen and respond to the student.

1. Use appropriate posture and eye contact.
 2. If something is confusing, ask the student to clarify what he/she is trying to say. Example: “Can you tell me more about...?”
 3. Use “I” statements to place the burden of understanding upon you rather than on the writer. Example: “I’m a little confused about...”
- If you, as a tutor, do not remember a definition that the tutee is learning, ask the student if s/he knows it before looking it up in the chapter.
 - Let the student make his/her own corrections. Guide the student. Always have the student hold the pencil, and make all corrections.
 - Try to identify problems in the student’s work and explain how to correct these problems —constructive criticism is a good thing!
 - Always keep reference math books and handouts nearby.

Things to avoid when tutoring:

- *Never* discuss grades or criticize the student’s professor(s).
- Try not to evaluate the student’s work; this is the teacher’s job.
- **This can’t be repeated enough: don’t do the work for the student.**

At the End of the Tutoring Session

If the tutoring time is almost over, or if another appointment is scheduled immediately following the session, let the student know when there is only five or ten minutes left.

This way, the remaining time can be used to end the session beneficially, and not hurriedly. Some possibilities include:

- Allow the student to finish what he/she is currently working on.
- Discuss what the student may do next or what may take place during the next session.
- Answer any last questions the student may have.
- Have the student fill out an evaluation form.

After the Tutoring Session

- Fill out the Student Summary Sheet.
- Make a folder for the student if one is not already on file. Place the Student Summary Sheet in this folder.

You may find the links on the CAE website useful during your tutoring experience.

CHAPTER 3: MATHEMATICS COURSES ADDRESSED IN THE CENTER

Tutoring can be requested in any of the following Mathematics courses; for assistance in math courses other than these, the student will typically be referred to the instructor :

*Note: the course descriptions are taken from the University catalog; courses indicated with an * are major level courses and are typically handled by the professional tutors.*

Introduction to College Mathematics (Math 106)

This course is designed to develop skills in the basic concepts of arithmetic in a lecture/laboratory setting (ALEKS).

Introduction to College Algebra (Math 107)

This course is designed specifically for those students who need to develop a proficiency in algebraic skills that are essential for subsequent Math courses. Topics include: operations with signed numbers, solving equations and inequalities, the arithmetic of polynomials, factoring polynomials, rational functions, graphing exponents, and radicals.

Contemporary Math (Math 121)

Introduces the student to numerous mathematical topics and their applications in the modern world. The main emphasis is on developing quantitative reasoning, that is an ability to read and write mathematics, as well as on developing an appreciation for the role of mathematics in contemporary society. Topics include: graph theory, mathematical modeling, consumer mathematics, descriptive statistics, geometry, and symmetry.

Mathematics for Education Majors (Math 122)

Through lecture, discussion, and collaborative projects, students will explore some of the basic areas of mathematics including sets, logic, probability, statistics, and mathematical systems. Emphasis will be placed on problem-solving throughout the course and real world examples will be used insofar as possible

Elementary Statistics (Math 130)

Sampling distributions, point estimates, confidence intervals, hypothesis testing, nonparametric methods, contingency tables, and goodness-of-fit.

College Algebra and Trigonometry (Math 150)

Fractional equations, roots, algebraic equations and inequalities, polynomial functions, exponential and logarithmic functions, applications, introduction to trigonometric functions, applications of trigonometric functions.

***Calculus I (Math 211)**

An introduction to limits and their properties, differentiation, applications of differentiation, indefinite integration, the Fundamental Theorem of Calculus, numerical integration and applications of integration.

***Calculus II (Math 212)**

Further applications of integration, transcendental functions, methods of integration, indeterminate forms and L'Hopital's Rule, improper integrals, and infinite series.

***Calculus III (Math 213)**

Plane curves, parametric equations and polar coordinates, vectors and vector-valued functions, partial differentiation with applications, multiple

integration with applications, and vector analysis.

***Linear Algebra with Applications (Math 220)**

An introduction to the concepts and applications of linear algebra with emphasis on employing graphing calculators and MAPLE as analytic tools. Topics include matrices and systems of equations, determinants, vector spaces, linear transformations, orthogonality, eigenvalues and eigenvectors, numerical linear algebra.

***Discrete Mathematics (Math 250)**

An introduction to topics encountered in advanced mathematics courses with emphasis on mathematical notation, reasoning, and methods of proof. Topics include Logic, Methods of Proof, Set Theory, Relations, Functions, Boolean Algebra, Basic Combinatorics, and Elementary Graph Theory.

***Theory of Numbers (Math 305)**

Divisibility, prime numbers, linear congruences, continued fractions, Diophantine equations, perfect numbers, Pell's equation and public key cryptography.

***Probability (Math 308)**

Topics include basic probability and counting principles, discrete and continuous random variables, expectation, probability distributions, joint distributions, and the central limit theorem. Emphasis on problem-solving.

***Graph theory (Math 309)**

Graph Theory is a subject on the cutting edge of mathematics and has applications to such diverse subject areas as operations research, economics, chemistry, sociology, computer science, and genetics. This course will provide a thorough introduction to graph theory. Topics to be covered include; paths, cycles, trees, planar graphs, graph colorings, digraphs and applications to optimization problems.

***Modern Algebra I (Math 316)**

An introduction to the theory of Groups, Rings, and Fields. Understanding and writing mathematical proofs will be emphasized. Topics include Groups and Subgroups, Permutation Groups, Cyclic Groups, Homomorphisms and Isomorphisms, Factor Groups, Rings, Fields, and Integral Domains.

Logic (Phil 202) *A requirement for Mathematics majors*

Rules and principles of informal logic, and formalized systems of deductive logic, including syllogisms, truth-functions, and quantificational logic. Introduction to symbolic logic and formal methods of proof.

The Center for Academic Enhancement (CAE) provides nursing students with assistance in "MedMath." This skill is not a course, but a component of the syllabus of NURS 210, **Essential Elements of Nursing Practice**. The CAE offers support to students who need to be accurate in dispensing medications to patients. Proficiency requires conversion of fractions to decimals and decimals to fractions, division and multiplication of fractions and decimals, percents, and conversion of the metric system.

CHAPTER 4: THE DIFFERENT LEARNERS

Tutors work with many different kinds of learners, from traditional freshmen to returning older students, from very competent students to those who need help at every stage of the process. A tutor will inevitably face some students who will challenge her/his skills and abilities. The following are some of the most common:

- *Anxious students*
- *Academically under-prepared students*
- *ESL students*

Anxious Students

This group can be broken up into two main types: the procrastinator and the perfectionist.

- Procrastinators:

These students will leave their work until the last possible minute, and then somehow hope that by an act of God or some other miracle, the work will get done. They will show up at the Center two hours before an assignment is due, with nothing, not even the assignment or pencil, in hand, and will nevertheless expect or hope to leave with a finished product to submit. BE PATIENT!

- Perfectionists:

Such students are in many ways the opposite of procrastinators: they usually get their work done well ahead of the due date—but then they agonize over every detail. These students are good to work with since their work is usually finished with almost no errors. However, sometimes their perfectionism can be taxing on the tutor since the constant questioning and second guessing may challenge every bit of knowledge and patience within the tutor's reach. BE PATIENT!

Academically Under-prepared Students:

Another type of student is the academically under-prepared student. This student comes to the Center with an array of learning challenges, and often other related issues such as poor time management skills, weak study skills, family and work-related problems, etc. There is no one answer for best planning to help the underprepared learner; each student and situation needs individualized assessing.

This student's work will not be "fixed" in one or two sessions. Therefore, an honest appraisal is the best in this situation.

ESL Students

ESL students can be classified according to their fluency and knowledge of the English language into beginning, low intermediate, intermediate, and proficient. Many of the same problems that occur with the under-prepared native student can be seen in the ESL student.

- In addition to language usage issues, there can also be some cultural issues that can cause difficulties in communication and understanding. As usual, the tutor needs to provide assistance and be kind and helpful without doing the work for the student.
- With ESL students, it is important for the tutor to remember that some writing and language problems, although persistent, may not be all that serious. Yet many of these students are extremely intelligent and quite articulate in English in most other ways. Therefore, the tutor should try to get the material across to the student as best as possible.

CHAPTER 5: THE USE OF TECHNOLOGY IN TUTORING

Technology has changed academia in so many different aspects. Computers have made learning easier. Cable TV has allowed some universities to maintain their own TV stations. Online libraries and data-bases have allowed easier access to information. Works can now be turned in and correspondences exchanged through email. Classes are given online. The way a tutoring center conducts its business has also been affected; computers and online tutoring are changing the way tutorials are being conducted.

Some pointers for computer-based tutoring:

- Keep the student in control of the computer and the problems. Sit behind the student as he/she sits in front of the keyboard and monitor. You may not enter any data.
- Use the bold, underline, and font color commands in highlighting problematic /weak sections.
- Point out weaknesses, errors, inconsistencies with an explanation of why they are better revised. But never make corrections for the student.
- Have some scrap paper available, so the students can write the work down to help them better understand the process and the answer.

Using internet sources:

The internet has become the primary research tool for a number of students; and many math students will be writing abstracts/papers using this resource. Indeed, it is a very rich source of information because it is very easy to upload data. However, this ease has resulted in some problems, since just about anyone can upload any information without the information [statistics, facts, figures, etc.] being checked for integrity. It has become the responsibility of the internet user to evaluate the source s/he comes across, and see if it is a credible and accurate source. The following questions may serve as guides on how to evaluate internet sources.

- Website owners/sponsors
 1. Is the author's name provided?
 2. Is s/he an authority in the field?
 3. Do other sources say good things about her/him?
 4. Does s/he appear to be knowledgeable on the topic?
- Determine the organization which owns the website
 1. Does this group have the authority to talk on this topic?
 2. Is it respected in its field?
- URL (To a certain degree, the web address reveals some information on the site's credibility)
 1. .edu – educational institution
 2. .gov – government agency
 3. .mil – military
 4. .org – non-profit organization
 5. .com & .net – commercial establishment
- Determine how often updates are implemented

- Accuracy and Bias
 1. Does the source include its bibliography and does it offer links to the entries?
 2. Can you verify information through another source?
 3. Does the site offer factual information for opposing views?
 4. Is the author known to be a staunch supporter of a cause?
 5. Does s/he allow her/his emotions to become entangled with logic?
 6. Does the site include the date of publication, posting, or the last update?

Some good mathematic websites to visit!

- BoxerMath (www.boxermath.com)
- Calculators On-Line Center (www-sci.lib.uci.edu/HSG/RefCalculators.html)
- ENC Online (www.enc.org)
- ExploreMath.com (www.exploremath.com)
- Hotmath (www.hotmath.com)
- Math.com (www.math.com)
- Math Forum @ Drexel (www.mathforum.org)
- Math Goodies (www.mathgoodies.com)
- NCTM Illuminations (www.illuminations.nctm.org)

Also, whenever appropriate, use the self-paced software in mathematics that we have installed on every computer in the Center. However, this is not to replace, but rather to supplement working sessions with a tutor. You will receive training in the software programs.

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“Mathematics is a more powerful instrument of knowledge than any other that has been bequeathed to us by human agency.”

Descartes