

Introduction

General Description

The PRAXIS Mathematics: Content Knowledge test (test code 0061, Mathematics CK) is designed to assess the mathematical knowledge and skills that an entry-level teacher of secondary school mathematics needs to possess. As listed in the *Mathematics: Content Knowledge (0061) Test at a Glance* (www.ets.org/Media/Tests/PRAXIS/pdf/0061.pdf), the test addresses five broad areas:

- I. Algebra and Number Theory
- II. Measurement, Geometry, and Trigonometry
- III. Functions and Calculus
- IV. Data Analysis, Statistics, and Probability
- V. Matrix Algebra and Discrete Mathematics

The test consists of 50 multiple-choice questions. Each multiple-choice question contains four response options. You record your answer choice in the separate answer booklet by filling in the space corresponding to **A**, **B**, **C**, or **D**. No penalty is imposed for wrong answers (you merely score a zero for that test question). The test booklet provides a mathematics reference sheet containing information organized under three labels: NOTATION, DEFINITIONS, and FORMULAS. You are given two hours to complete the test.

Calculator Requirements

You are required to bring a graphing calculator to use while taking the Mathematics CK. The calculator that you bring must be capable of the following:

- producing the graph of a function within an arbitrary viewing window
- finding the zeros of a function
- computing a numeric derivative of a function
- computing a numeric integral of a function

Calculator memories will *not* be cleared by the test administrator prior to the start of the examination.

You are NOT allowed to bring computers, including powerbooks and portable/handheld computers, calculators with QWERTY keyboards (for example, TI-92 PLUS, Voyage 200), cell-phone calculators, or electronic writing pads or other pen-input/stylus-driven devices.

Format of the Test

According to the *Mathematics: Content Knowledge (0061) Test at a Glance* (see “General Description,” earlier in this chapter for the Internet address), the content categories for the test and approximate number of questions and percentage of the test for each content category are as follows:

Format of the Test

Content Category	Approximate Number of Questions	Approximate Percent of Test
Algebra and Number Theory	8	16%
Measurement	3	6%
Geometry	5	10%
Trigonometry	4	8%
Functions	8	16%
Calculus	6	12%
Data Analysis and Statistics	5–6	10–12%
Probability	2–3	4–6%
Matrix Algebra	4–5	8–10%
Discrete Mathematics	3–4	6–8%

In addition to mathematical knowledge and skills, the PRAXIS Mathematics CK assesses five process categories: Problem Solving, Reasoning and Proof, Connections, Representation, and Use of Technology. These process categories refer to the ways through which mathematical knowledge is acquired and used. The first four process categories are adopted from the National Council of Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics* (2000) process standards and are as described here:

Problem Solving (<http://standards.nctm.org/document/chapter3/prob.htm>)

- Build new mathematical knowledge through problem solving.
- Solve problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.

Reasoning and Proof (<http://standards.nctm.org/document/chapter3/reas.htm>)

- Make and investigate mathematical conjectures.
- Develop and evaluate mathematical arguments and proofs.
- Select and use various types of reasoning and methods of proof.

Connections (<http://standards.nctm.org/document/chapter3/conn.htm>)

- Recognize and use connections among mathematical ideas.
- Understand how mathematical ideas interconnect and build on one another.
- Recognize and apply mathematics in contexts outside of mathematics.

Representation (<http://standards.nctm.org/document/chapter3/rep.htm>)

- Create and use representations to organize, record, and communicate mathematical ideas.
- Select, apply, and translate among mathematical representations to solve problems.
- Use representations to model and interpret physical, social, and mathematical phenomena.

The description of the fifth process category as given in the *Mathematics: Content Knowledge (0061) Test at a Glance* is as follows:

Use of Technology

- Use technology appropriately as a tool for problem solving.
- Use technology as an aid to understanding mathematical ideas.

The process categories are integrated into the content questions. This circumstance means that you will not be asked explicit questions about the process categories, but rather you will be expected to use one or more of the processes in answering questions on the test.

The Role of the Mathematics CK in Teacher Certification

The Mathematics CK is one of the PRAXIS II Series subject assessment tests designed by the Educational Testing Service (ETS). The PRAXIS II tests are part of a national teacher assessment program and are used as part of the certification or licensing requirements in about 80 percent of the states. This means that you can transfer your score on the Mathematics CK from state to state for those states that use the PRAXIS II subject assessment tests.

If your state has selected the Mathematics CK to assess secondary teacher candidates' mathematical knowledge and skills, then this *CliffsTestPrep* book will be invaluable in helping you achieve the passing score for your state. Test scores needed to obtain certification vary from state to state because each state sets its own passing score. ETS maintains a listing by state of links to test requirements for those states that require the PRAXIS II subject assessment tests for certification at www.ets.org/praxis/prxstate.html. ETS also publishes the most recent information it has regarding passing score requirements in a pamphlet titled *Understanding Your Praxis Scores*, which you can download at <http://www.ets.org/Media/Tests/PRAXIS/pdf/09706PRAXIS.pdf>. The following is a list of states that require the Mathematics CK along with the current (in 2006) score needed to obtain certification in each state:

Alabama—118	Kentucky—125	Ohio—139
Alaska—146	Louisiana—125	Oregon—138
Arkansas—116	Maine—126	Pennsylvania—136
Colorado—156	Maryland—141	South Carolina—131
Connecticut—137	Minnesota—125	South Dakota—124
Delaware—121	Mississippi—123	Tennessee—136
District of Columbia—141	Missouri—137	Utah—138
Georgia—136	Nevada—144	Vermont—141
Hawaii—136	New Hampshire—127	Virginia—147
Idaho—119	New Jersey—137	Washington—134
Indiana—136	North Carolina—*	West Virginia—133
Kansas—137	North Dakota—139	Wisconsin—135

* Test required - check with state.

Questions Commonly Asked About the Mathematics CK

Q. What is the Mathematics CK?

A. The Mathematics CK is a PRAXIS II Series subject assessment test. Currently, it is used by 36 states as part of their teacher certification/licensure requirements.

Q. Who administers the Mathematics CK?

A. The Mathematics CK is administered by the Educational Testing Service (ETS).

Q. When and where is the Mathematics CK given?

A. Currently, PRAXIS Series tests, including the Mathematics CK, are administered six times a year (usually in September, November, January, March, April, June, and August) at locations throughout the United States. You can find information on test dates, site locations, fees, registration procedures, and policies in the current *The Praxis Series Information and Registration Bulletin*, which you can download at <http://www.ets.org/Media/Tests/PRAXIS/pdf/01361.pdf>.

Q. How do I register to take to the test?

A. You can register online using a credit card at the PRAXIS Web site (www.ets.org/praxis) from 7 A.M. to 10 P.M. (Eastern Time), Monday through Friday; or you can register by mail by downloading the registration form available on the PRAXIS Web site and then mailing the completed form to ETS-The Praxis Series, Box 382065, Pittsburgh, PA 15251-8065.

Q. Are special testing arrangements available?

A. If you have a disabling condition (visual, physical, hearing, or so on), special testing arrangements and test materials can be made available for you. Complete the registration form and follow the instructions at www.ets.org/praxis/prxdsabl.html.

If you are unable to take the test on Saturdays because of your religious convictions or because of duties as a member of the U.S. armed forces, you can request a Monday testing day by following the instructions in the *Registration Bulletin*. A copy of your military duties or a letter from your clergy on the clergy's letterhead, verifying the religious basis for your request, must be included with your registration application.

If your primary language is not English, you can request extended testing time by following the instructions in the *Registration Bulletin*.

You should write your name, social security number, and phone number on all correspondence to ensure proper handling of your documentation. Don't forget to make copies of everything before you mail it.

Q. May I change my registration if I need to?

A. Yes, you may change tests, test sites, or transfer registration to a later test date by completing the appropriate forms, which you can download from the PRAXIS Web site (www.ets.org/praxis). For test and center changes, the form must be received by the late registration deadline. For test date changes, the form must be received within two weeks after your original test date. The current fee (in 2006) for this service is \$40.

Q. What is the fee for the test?

A. The current fee (in 2006) for regular registration is \$75. The fee for late registration is an additional \$40 charge.

Q. What should I bring to the test site?

A. After you mail in your registration form, you should receive an admission ticket by one week before your scheduled test date. If you have not received your admission ticket by this time or if you have lost your admission ticket, call ETS at 1-800-772-9476. If you register online, you must print your admission ticket. Your admission ticket will include your name, the tests you are registered to take, the test date, the test site address, and the reporting time. Check the information on your admission ticket to make sure that it is correct. You will not be allowed to make changes at the test site.

The day of the test, you should bring your admission ticket, a valid form of photo and signature identification (for example, driver's license or military identification), your graphing calculator, several sharpened Number 2 soft lead

pencils, a good eraser, a blue or black ink pen, and a watch to help pace yourself during the exam. Mechanical pencils cannot be used. No personal items such as handbags, cell phones, or study materials or other aids will be permitted in the testing room.

Q. Is the Mathematics CK divided into timed sections?

A. No, you have two hours to complete the 50 multiple-choice test items. You may work through the questions at your own pace as long as you stay within the two-hour timeframe.

Q. What is the passing score?

A. The passing score varies from state to state. Check with your preparation institution regarding the passing score in your state.

Q. When will I get my score report?

A. Your score report will be mailed approximately four weeks after the test administration date.

Q. How should I prepare?

A. Using this test prep book is your best preparation. This study guide gives you insights, reviews, and strategies for the question types. Some universities offer preparation programs to assist you in attaining a passing score. Check with them for further information.

Q. How do I get more information about the Mathematics CK?

A. Check the PRAXIS Web site (www.ets.org/praxis). If new information on the Mathematics CK becomes available, it will be posted on this site.

Q. What is the ETS Recognition of Excellence Award (ROE)?

A. This award is a way ETS recognizes test takers who demonstrate a high level of proficiency on any of 11 Praxis II tests. For the Mathematics CK, achieving a score of 165 or higher will earn you the ROE. You will receive a congratulatory letter and recognition certificate from ETS acknowledging your high score on the test. In addition, the award will be noted on your score report, and summary award data will be included on reports sent to institutions of higher education and state agencies.

How to Use This *CliffsTestPrep* Book

When you read through the list of content categories that are assessed on the Mathematics CK, you may feel overwhelmed by the task of preparing for the test. Here are some suggestions for developing an effective study program using this book.

1. To help you organize and budget your time, set up a specific schedule of study sessions. Try to set aside approximately two hours for each session. If you complete one session per day (including weekends), it should take you about three to four weeks to work your way through the review and practice material provided in this book.

If your test date is coming up soon, you may need to lengthen your study time per day or skip sections that cover topics that you feel you already know fairly well. Nonetheless, be cautious about deciding to skip sections. You could find yourself struggling through material that would be easier to master if previous sections had been reviewed first. This caution is particularly important with regard to math topics, which are usually highly dependent on previously learned skills.

2. Choose a place for studying that is free of distractions and undue noise, so that you can concentrate. Make sure that you have adequate lighting and a room temperature that is comfortable—not too warm or too cold. Be sure that you have an ample supply of water to keep your brain hydrated, and you might also want to have some light snacks available. To improve mental alertness, choose snacks that are high in protein and low in carbohydrates (for example, nuts). Try to have all the necessary study aids (paper, pen, note cards, and so on) within easy reach, so that you don't have to interrupt your studying to go get something you need. Ask friends not to call you during your study time.

3. Take Practice Test 1 before you begin your study program to help you discover your strengths and weaknesses. Read the answer explanations for all the questions, not just the ones you missed, because you may have gotten some of your correct answers by guessing. Make a list of the content categories with which you had the most problems. Plan your study program so that you can concentrate first on content categories that your Practice Test 1 results indicate are weak areas for you. For instance, if you did very well in algebra and number theory, but poorly in geometry, then you should begin your Mathematics CK preparation with the geometry section.
4. Carefully study the review of the exam areas in Part II of this book to refresh your memory about the key ideas for each of the content categories, being sure to concentrate as you go through the material. Don't let yourself be diverted by extraneous thoughts or outside distractions. Monitor yourself by making a check mark on a separate sheet of paper when your concentration wanders. Work on reducing the number of check marks you record each study session. Take notes as you study, using your own words to express ideas.
5. Make flashcards to aid you in memorizing key ideas and keep them with you at all times. When you have spare moments of time, take out the flash cards and go over the information you've recorded on them.
6. Set aside certain days to review material you have already studied. This strategy will allow you to reinforce what you have learned and identify topics you may need to restudy.
7. Take several brief two- to three-minute breaks during your study sessions to give your mind time to absorb the review material you just read. According to brain research, you remember the first part and last part of something you've read more easily than you remember the middle part. Taking several breaks will allow you to create more beginnings and endings to maximize the amount of material you remember. It's best not to leave your study area during a break. Try stretching, closing your eyes for a few minutes, or getting a quick drink or snack.
8. When you complete your review, take Practice Test 2. Use a timer and take the test under the same conditions you expect for the actual test, being sure to adhere to the two-hour time limit for the test. When you finish taking the test, as you did for Practice Test 1, carefully study the answer explanations for *all* the questions. Then, go back and review again any topics in which you performed unsatisfactorily.
9. When you complete your second review, take Practice Test 3 under the same conditions you expect for the actual test, adhering to the two-hour time limit. When you finish taking the test, carefully study the answer explanations for *all* the questions and do additional study, if needed.
10. Organize a study group, if possible. A good way of learning and reinforcing the material is to discuss it with others. If possible, set up a regular time to study with one or more classmates or friends. Take turns explaining how to work the problems to each other. This strategy will help you to clarify your own understanding of the problems and, at the same time, help you discover new insights in how to approach various problems.

After completing your study program, you should find yourself prepared and confident to achieve a passing score on the Mathematics CK.

How to Prepare for the Day of the Test

There are several things you can do to prepare yourself for the day of the test.

1. Know where the test center is located and how to get there.
2. Make dependable arrangements to get to the test center in plenty of time and know where to park if you plan to go by car.
3. Keep all the materials you will need to bring to the test center—especially, your admission ticket and identification—in a secure place, so that you easily find them on the day of the test.
4. Go to bed in time to get a good night's rest. Avoid taking nonprescription drugs or alcohol as the use of these products may impair your mental faculties on test day.
5. On the day of the test, plan to get to the testing center early.
6. Dress in comfortable clothing and wear comfortable shoes. Even if it is warm outside, wear layers of clothing that can be removed or put on, depending on the temperature in the test center.
7. Eat a light meal. Select foods that you have found usually give you the most energy and stamina.

8. Drink plenty of water to make sure that your brain remains hydrated during the test for optimal thinking.
9. Be sure to put fresh batteries in your calculator just before you leave to go to the testing center.
10. Make a copy of this list and post it in a strategic location. Check over it before you leave for the testing center.

Test-Taking Strategies for the Mathematics CK

Here are some general test-taking strategies to help maximize your score on the test:

1. When you receive the test, take several deep, slow breaths, exhaling slowly while mentally visualizing yourself performing successfully on the test before you begin. Do not get upset if you feel nervous. Most of the people taking the test with you will be experiencing some measure of anxiety.
2. During the test, follow all the directions, including the oral directions of the test administrator and the written directions in the test booklet. If you do not understand something in the directions, ask the test administrator for clarification.
3. Move through the test at a steady pace. The test consists of 50 multiple-choice items. As you begin the test, skim through the booklet to find question 25, mark this question as an approximate halfway point. When you get to question 25, check your watch to see how much time has passed. If more than one hour has gone by, you will need to pick up the pace. Otherwise, continue to work as rapidly as you can without being careless, *but do not rush*.
4. Try to answer the questions in order. Skipping around can waste time and might cause mistakes on your answer sheet. However, if a question is taking too much of your time, place a large check mark next to it in the test booklet (*not* on the answer booklet), mark your best guess in the answer booklet, and move on.
5. Read each question entirely. Skimming to save time can cause you to misread a question or miss important information.
6. Write in the test booklet. Mark on diagrams, draw figures, underline or circle key words or phrases, and do scratch work in the test booklet. Remember, however, to mark your answer choice in the separate answer booklet. Answers marked only in the test booklet are not scored.
7. Don't read too much into a question. For instance, don't presume a geometric figure is drawn accurately or to scale.
8. Refer to the notation, definitions, and formulas provided with the test as often as you need to. *Always* double-check every formula after you write it down.
9. Use your calculator, but use it wisely. Keep in mind that graphing calculators are powerful tools, but they can make errors. See the discussion about graphing calculators that follows this section.
10. Be sure you are answering the *right question*. Circle or underline what you are being asked to find to help you stay focused on it.
11. Read all the answer choices before you select an answer. You might find an answer that immediately strikes you as correct, but this determination might have occurred because you jumped to a false conclusion or made an incorrect assumption.
12. Eliminate as many wrong choices as you can. Estimate the answer to help you decide which answers are unreasonable.
13. Change an answer only if you have a good reason to do so. Be sure to completely erase the old answer choice before marking the new one.
14. If you are trying to recall information during the test, close your eyes and try to visualize yourself in your study place. This may trigger your memory.
15. Remain calm during the test. If you find yourself getting anxious, stop and take several deep, slow breaths and exhale slowly, while mentally visualizing yourself in a peaceful place, to help you relax. Do not be upset if the student next to you finishes, gets up, and leaves before you do. Keep your mind focused on the task at hand—completing your exam. Trust yourself. You should not expect to know the correct response to every question on the exam. Think only of doing your personal best.

16. Record your answers in the answer booklet carefully. The test is scored electronically, so it is critical that you mark your answer booklet accurately. As you go through the test questions, circle the letters of your answer choices in the test booklet. Then mark those answers in the answer booklet in bunches of 5 to 10 (until the last minutes of the time allotted, when you should start marking answers one by one).
17. Before turning in your answer booklet, be sure you have marked an answer for every test question. You are not penalized for a wrong answer (you merely score a zero for that test question), so even if you have no clue about the correct answer, make a guess. Also, erase any stray marks in the answer booklet and brush off any loose eraser dust.
18. As you work through the practice tests provided in this book, consciously use the strategies suggested in this section as preparation for the actual Mathematics CK. Try to reach the point that the strategies are automatic for you.

Graphing Calculators and the Mathematics CK

Since you are required to bring a graphing calculator to use when you take the Mathematics CK, you should have your calculator on hand and use it, when needed, to work problems in the review material and practice tests in this book. Select a calculator that you will feel comfortable using. Don't purchase a high-powered calculator that will require an investment of your time to learn while you are preparing for the test.

A word of caution: Graphing calculators are very powerful tools, but you should be aware that they can make errors!

One situation in which errors might occur is when the calculator is finding the roots or zeros of a high-degree polynomial (for example, a polynomial of degree eight). The algorithm that the calculator uses to find the roots of the polynomial forces the calculator to round numbers to a certain number of decimal places before the final result is obtained, thus yielding inaccurate answers.

Another situation in which errors commonly occur is when the calculator is drawing the graph of a function. Your choice of viewing window dimensions can give results that are visually very misleading. For instance, you can be led to believe that a function has only two zeros when, in fact, it has three zeros. Changing the dimensions for the viewing window can clear up the problem in most cases; however, not every time. Most notably, for most graphing calculators, the graph of $y = \sin(1/x)$ at values near $x = \text{zero}$ will never be correct no matter what window dimensions you select.

The point of this discussion is to make you aware that such mistakes can happen. Therefore, you should use your mathematical expertise to evaluate all your calculator's answers for reliability and accuracy.

You will benefit greatly from this *CliffsTestPrep* book. By using the recommendations in this chapter as you complete your study program, you will be prepared to walk into the testing room with confidence. Good luck on the test and on your new career as a mathematics teacher!