

Universal Access

Introduction

This course is a challenging curriculum that provides the opportunity for all students to meet or exceed expected state and local standards. The program is especially effective in teaching students of varied abilities and backgrounds.

CPM Educational Program originated as an Eisenhower-funded curriculum project to write and support classroom materials that would provide access to mathematics for a broad range of students. As such, this course incorporates strategies and creates problems that are accessible to most learners. In particular, the use of research-based student study teams provides support for students who may need various kinds of assistance with reading, alternate explanations, and guided learning.

Lessons and problems are constructed to offer visual representations of many ideas and use manipulatives and models to support learning when appropriate. Study teams also encourage mathematical discourse. In addition to asking questions, students also are able to articulate their developing understanding of ideas, listen to how other students see them, and shape their understanding and mastery with the help of their team's support. Teachers are able to give individual attention to the needs of each student because they have the opportunity to observe their work and interact with them during each lesson.

The program's instructional materials provide context-rich problems to introduce students to concepts. Problems are grounded in situations that are familiar and understandable to the student. The instructional program supports learning by helping students to use higher order thinking strategies and to develop problem solving strategies. Because mastery is best achieved over time, practice of basic skills and major concepts is spaced throughout the curriculum. Students have several opportunities to learn an idea or skill before mastery is expected. Closure activities at the end of each day's lesson and at the end of the chapter provide students with opportunities to summarize their learning and to deepen their mathematical understanding.

Alignment of Instruction with Assessment

This course uses assessment to help move students toward mastery of required standards and course objectives. The assessment program uses multiple ways to assess student learning and to identify the topics misunderstood by students. It provides the teacher with assessment data from the following different perspectives:

- **Individual tests** assess students' ability to solve mathematical problems, their level of skill mastery, and their conceptual understanding. Classroom teachers carefully design tests using the test bank, balancing new topics with previously taught material.
- **Team tests** allow teachers to assess not only mathematical knowledge, but also the thinking processes and solution methods used by the students. Teachers design team tests using problems that assess larger ideas, that require higher order thinking skills, and often cover more than one concept or topic in a single problem.
- **Participation quizzes** provide information about the quality of the work being done in the structured learning teams. The assessment data generated is designed to give students feedback about how well they are working together to support their learning and suggest ways to do so more effectively.
- **Student presentations**, done either individually or in study teams, provide opportunities for students to talk about their mathematical learning, to share insights and thus deepen their mathematical understanding.
- **Math portfolios** allow students to display their mathematical learning, understanding, and skills. They provide valuable information about a student's learning and growth over time.

The teacher's edition is organized to help with the monitoring of student learning and to align assessment with instruction. Each chapter provides the teacher with an **overview** of the chapter, giving a big-picture look at expected student learning. "**Where Is This Going?**" provides connections to related learning in other chapters. It shows the teacher how present learning is connected to work in other chapters. The **lesson objectives and core problems** that develop the course objectives are clearly stated. The **lesson plan** describes the thinking strategies that will be used in the lesson. An extensive **assessment handbook** provides help with how to use the assessment program to guide instruction, including how to design appropriate tests and how to use alternative forms of assessment. Especially helpful are the **assessment plans** for each chapter.

These plans lay out where, when, and what type of assessments to give to students and the important skills and mathematical content to assess.

Successful Diagnostic Teaching

It is important to identify the cause of difficulties that prevent some students from making appropriate progress towards mastery of the course objectives and standards, and to provide remedies to correct these problems. The course assessment program provides a screening test to verify student placement at the beginning of the year, as well as identify previous topics that may need additional work. During the course, the emphasis of each lesson can be adjusted to challenge more advanced learners and to support students who need more work with the fundamental skills and core ideas. Many of the teaching strategies for modifying instruction have been built into the this course and into the teacher's edition in the chapter lesson plans and assessments, as well as in the general notes in the front of the teacher edition.

A wide variety of mathematical representations, such as **graphs, charts, and ratio and function tables**, are embedded in the curriculum materials. These allow students to visually represent mathematics in the problems they are solving. Two types of **Math Notes** appear throughout the text: **Methods and Meaning** notes consolidate core content, and **Looking Deeper** notes provide extensions. Regular **Learning Log** entries allow students to reflect on their learning and consolidate their mathematical understanding. They can be used to monitor student learning and to make adjustments to the instructional process. Several lessons in the course employ the use of **graphing technology**.

The instructional program has been designed to develop student mathematics skills and conceptual understanding over time. Using research-based **spaced practice**, a skill or concept is introduced in a chapter, where it is initially practiced, then appears again in succeeding chapters as direct practice as well as embedded practice to work toward solutions of more complex problems. This strategy gives students more than one opportunity to learn and achieve mastery of the concepts and skills. Spaced practice provides ongoing assessment opportunities to measure the progress students are making towards mastery of the content standards.

Review and Preview, the homework portion of each lesson, recognizes that students need ongoing practice and review with previous learning. Some problems practice the material from the day's lesson. Other problems continue practice with and the development and extension of skills and concepts previously introduced. Some problems provide pre-teaching activities for later topics. Other problems provide enrichment and extensions to challenge students.

Students have access to the online tutorial site www.hotmath.com. CPM pays for a national user's license so that teachers, students and parents have free access to the site from any computer with Internet access. All of the problems in the student text are available at this web site. The **Review and Preview** problems posted there include hints and complete solutions. The Hotmath site is a true tutorial resource. Students see the development of solutions to the problems and can choose their degree of interaction with the solutions. In some cases they may only need the hints to complete a problem. In others, the step-by-step solution teaches them how to solve the problem. In short, Hotmath is structured much like what a teacher would do in the classroom. The site also provides an entry point for parents to get involved with their child's learning.

Support of Students Making Normal Progress

Students who are adequately prepared for this course should make good progress toward mastery of the course objectives and standards. Ideally, students will achieve mastery by completing the lessons and homework in the text. However, the authors of this course recognize that students may encounter temporary or minor difficulties as they work through the curriculum. Mastery is not required or expected at the first exposure to the new learning. Students benefit from learning and practicing a math skill at **spaced intervals** rather than all at once. Students remember ideas longer and understand them better when they have a chance to revisit concepts over a longer period of time. See the research that supports *spaced learning* as well as *problem-based lessons* and *study*

teams in the “Research and Reports” section of this Teacher Edition or posted at www.cpm.org/teachers/research.htm under “CPM Research Base.”

Working within the environment of a **structured, teacher-supported study team** greatly enhances students' ability to deal with any difficulties that might arise. A structured study team environment allows students the opportunity to test their ideas and solve problems in an intellectually safe learning environment. The teacher, through targeted direct instruction and the use of effective questioning techniques, provides support for student learning while helping students work through the lesson's problem set.

It is recommended that teachers use this course with students who are making normal progress by employing the following strategies:

- Move them through the course at the recommended pace and sequence. This ensures that, in addition to the new learning, students also practice and review previous learning, and that they will complete the course.
- Use structured study teams. Monitor the level of student participation by using team test and participation quiz results, and especially personal interaction observations while circulating among the study teams.
- Monitor student progress toward mastery of the course objectives and standards and identify areas of weakness by using the assessment resources and by interacting with students in their study teams.
- Require students to talk about the mathematics they are learning. This works best in the context of study teams and oral presentations.
- Teach the study team strategies. Role-play expected dialogue and behaviors using problems from student assignments, as well as the team role resources in the lesson plans.
- Use direct instruction based on student needs. Teachers should determine what needs to be addressed to the entire class or when to intervene during a lesson from their observations of and interaction with the study teams as they work on the lesson's core problems (hence the previous reference to “targeted” direct instruction). Also use assessment information from student work, team tests, and participation quizzes to pinpoint topics that need clarification.
- Check to see if students are having difficulty reading the problems. Use the list of reading suggestions at the end of this section as needed.

- Use the learning logs. Writing clarifies and organizes learning. Provide opportunities for students to share their logs. Be sure to verify and ensure their accuracy.
- Demand homework as an important part of the total program, and check homework on a daily basis. Use homework quizzes to reinforce the importance of doing homework.
- Urge students to use the www.hotmath.com link for tutorial help at school and at home.
- Refer students to the *Extra Practice* resource, either in booklet form or online at www.cpm.org/students/skillBuilders.htm for additional practice with topics as well as alternative explanations and solved examples for most skills and concepts.
- Urge parents to partner with their children in their homework. The www.hotmath.com link provides one opportunity for this to happen.
- Urge parents to use the *Parent Guide* at www.cpm.org/parents/resources.htm. The introduction to the guide gives parents a better understanding of how the program works and provides suggestions for how parents can partner with their children in the learning process. In addition, it provides explanations of concepts and skills, contains solved examples, and offers additional practice with most topics.

Support for Students Who Need Additional Help

Students may be enrolled in the course who are having more than occasional difficulty with the lessons. They can be supported within the regular classroom. Using **structured study teams** provides additional program support beyond what the teacher can provide. **Reducing the instructional load**, that is, having these students focus on the core problems of the lesson, builds in additional time to allow them to focus on the core problems in each lesson (see lesson plans). These students need to be involved in a **consistent homework program**. Tutorial programs after school provide help with homework and the time to continue the work on the day's learning. Use of **Extra Practice problems** provides students with additional practice, especially if they are tied to areas of identified weaknesses.

In addition to the previous recommendations for supporting students, tailor this course to students who need additional assistance by employing the following strategies:

- Provide the whole course for these students by focusing on the core problems of the lessons and eliminating enrichment and extension problems in the homework. Reducing the number of chapters covered is a last resort.
- Provide more instructional time. Extended days, block schedules, and after-school tutorials are possibilities.
- Use the structured study team format and team roles provided in the lesson plans. Partners or study team members can provide needed support immediately, instead of waiting for the teacher. Assigned roles will help keep students on task.
- Use the team tests and participation quizzes, along with personal observations, to monitor the participation and the work being done in the study teams. Provide remedies to ensure that all students are participating and to correct any identified weaknesses.
- Carefully reading the problems is critical. Use the suggestions at the end of this section.
- Have students use the contextual clues from the problems to make a visual representation of the problem.
- Provide resource pages where applicable to scaffold instruction.
- Have students use a spiral graph paper notebook for all their math work, both in class and at home. The notebook keeps all math assignments in one place. It provides organization that is critical to success.
- Use the *Extra Practice* resource materials for alternative explanations and additional practice with the basics for students with identified weaknesses.
- Concentrate on the review portion of the homework assignment.
- Encourage the use of www.hotmath.com to help students at home with their homework.
- Encourage parent participation with homework.

Students Who Are Unprepared for the Course

Sometimes students are placed in a class who have large deficiencies in their prior skill development and conceptual understanding of prerequisite mathematics. Overcoming these problems requires **more instructional time** than can be found in a typical class period. These students should be re-assigned to an appropriate course whenever possible.

In the event that students with substantial deficits in their preparation are assigned to this course, the strategies discussed above should be used, especially: provide additional instructional time, focus on the core problems of the lessons, and assign the practice and review problems from the homework. The team structure should use partners rather than teams of four. Regularly employ the reading strategies that follow this discussion of Universal Access. Provide each student with a copy of the *Extra Practice* booklet for this course. Have students do all of their work in a spiral graph paper notebook and check each one daily while you circulate among the pairs of students. This allows you to monitor their progress daily rather than waiting for formal assessments. Students should have on-site access to the homework tutorials at www.hotmath.com. Encourage parents to obtain and use the *Parent Guide* to assist their child.

In addition, there should be structured on-campus support for students, such as a zero period coupled with a tutor center to help students address their identified deficiencies as well as provide support for the learning in this course itself.

Planning for Special Needs Students

Many students with learning disabilities are mainstreamed in regular math classes. This course provides them with equal access to all the course objectives and standards through using effective teaching strategies, many of which are embedded in the curriculum materials. The classroom teacher is part of a team of professionals that work with special needs students, helping them to master the course objectives. **Resource teachers and resource aides** play a major role in the learning process. To better equip them, CPM provides access to the same workshop training that regular classroom teachers receive for this course. The purpose is to provide all team members with the **same curricular understanding**, how the materials can be used to meet the needs of Special Needs Students, and the recommended teaching strategies to use when working with these students.

The classroom teacher needs to have a clear understanding of a student's needs when designing an academic program for Special Needs Students. A student's **504 accommodation plan** or **IEP** (Individual Education Plan) provides information about the student's disability and their strongest learning modality. Teachers should use this information to help make the proper adjustments to the curriculum and to choose the most effective teaching strategies.

It is recommended that teachers tailor the course to special needs students by applying the following strategies:

- Have students work with a partner rather than in a team of four. This provides a less distracting and safer learning environment where they can feel free to collaborate with their partner.
- Use the study team strategies that match a student's best learning modality.
- Provide connections to prior learning whenever possible.
- Have each student read the problem. Help them read and unlock the problem and find the important contextual clues needed to solve the problem. Use the reading suggestions at the end of this section.
- Use concrete materials and physical movement whenever possible.
- Help students build a visual representation of the problem. Create additional resource pages to provide scaffolding for complex problems.
- Have students focus on the core instructional program. This includes the core problem in class and the review problems for homework.
- Use selected problems from the *Extra Practice* resource to provide additional practice, as well as alternative explanations and solved examples as needed.
- Have students use a spiral graph paper notebook for all work, both in class and at home. Special needs students need a very organized approach to learning.
- Use their math support period to provide needed help for new mathematical learning and to jump-start their homework.
- Use www.hotmath.com to provide support at school and at home.
- Provide *Parent Guides* to help parents become partners in their children's education.

Sequential or Simultaneous Instruction for English Learners

Teachers are challenged by the complexity of teaching mathematical concepts while at the same time teaching a new language. As mathematical achievement varies among English language learners, it is important to use available assessment information, such as their CELDT scores, to provide **correct placements** for these students. Narrowing the range of achievement in a classroom helps the teacher better meet the needs of English language learners. CPM teachers report that the reading requirements of this course help these students develop their English language skills. Collaborate with the language arts teachers whenever possible.

It is important to get English language learners involved in their learning quickly. They need a safe environment where they feel free to talk about the math and to ask questions. This can be achieved by grouping students into **structured study teams**.

While adding strategies to help these students learn English, the teacher focus on core problems in the classroom, include review problems in homework assignments, provide tutorials, and direct students and parents to the Website www.hotmath.com. The teacher should use language acquisition strategies to help high level English language learners make the transition to English, while at the same time helping them to build and use effective strategies that allow them to make the connections from what they are learning to their prior mathematical learning. Additional suggestions to support literacy follow page 16 of this section.

It is recommended that teachers tailor this course to English language learners by applying the following strategies:

- Use structured study teams to provide the optimal learning environment. Start with study partners and move into study teams when students feel secure and comfortable with their learning environment.
- Develop a good working relationship with students by moving among study partners and interacting with them as described in the lesson plans and study team notes in the front of the teacher binder.
- Be careful about giving answers too quickly. Instead, use effective questioning techniques to challenge students to answer their own questions.
- Provide instruction in English. Use their native language to clarify and enhance key concepts and skills. Ask students if they know the word(s) in their native language and have them write and discuss these words with the rest of the class as a way to establish the meaning of English word(s).

- Make comparisons to clarify meaning. For example, compare kilograms with pounds, and compare meters with yards.
- Link vocabulary to cognates. This reduces the number of words to learn by drawing on prior knowledge.
- Turn some lessons into silent lessons where a brief presentation for the whole class is done without speaking, using only pantomime, drawings, gestures and a few written directions and examples. This completely levels the playing field for a day and helps language learners become equal players in completing the lesson.
- Require that students read problems, either individually, with their partner, or their team.
- Arrange some teams so that students who speak primarily their first language are working with students who have stronger bilingual skills as well as with students who speak only English.
- Urge students to talk and collaborate on problems.
- Assign the text-rich problems. These are better for English language learners than algorithmic problems. Help students to use contextual clues, pictures, diagrams, and graphics to unlock problems.
- Help students learn to represent problems in a visual form to build concrete understanding.
- Use students' number sense to your advantage. For example, ask, "Will the answer be a large number, a small number, or a fraction?"
- Use pair sharing for practice exercises, where partners alternate. One student does the first problem while talking aloud about what s/he is doing and the other follows along with what the first is writing, stopping him/her if there is an error. Then they switch roles for the next problem. They do not have to speak the same language because they are following the written problem.
- Scaffold instruction as much as possible. Use prepared resource pages and create additional ones for scaffolding as appropriate.
- Require English language learners to write about their math learning in their own language. This organizes and clarifies what they have learned. The Learning Log problems provide this opportunity regularly.
- Provide after-school tutoring, a supportive place to work on homework, and a place where they can come with questions.

Differentiation in Pacing and Complexity; Advanced Learners

This course provides a challenging mathematics program for all students that leads to mastery of the course objectives and standards. Since students do not learn at the same pace or in the same way, strategies built into the course provide for differentiation of instruction. One important aspect of differentiation is pacing.

In classes with at-grade-level students, teachers should follow the pacing in the Teacher edition. Students who are performing below grade level or who begin to struggle in the course benefit from **more instructional time** by concentrating on the core problems. Doing so slows the pace of the lesson to allow students to learn the new material without falling behind the pace necessary to complete the course. The **core problems** are clearly marked in each day's lesson plan. These problems teach sub-skills and the conceptual understanding needed to progress towards mastery of the course objectives. The workload is shortened by eliminating some of the other problems, specifically enrichment and extension problems. The homework program can be slowed in the same way by **concentrating on the practice and review** problems. The practice problems reinforce key learning and, coupled with the use of the Hotmath homework tutorial resource, help eliminate the need to review problems during the regular class period.

Advanced learners will be able to complete the core problems at a pace that will leave time for them to complete the enrichment and extension problems built into the latter part of lessons. Likewise, they will be able to complete all of the homework problems and benefit from the challenges and extensions included there. Advanced students will also benefit from the richness of the problems in the text. They will often be able to develop considerable depth in their work with concepts. The closure activities will provide contexts to express this depth and demonstrate connections to other topics.

This course was written to serve students of various abilities. The lessons offer advanced students the opportunity to explore ideas in depth and develop their problem-solving skills. The authors believe that, other than truly exceptional students (assuming that they are not simply misplaced), advanced learners will benefit from the richness of the course rather than “speeding up” to skim through topics. In this course, higher-level thinking strategies are an important part of the learning process. Each daily lesson targets a thinking strategy. The idea-rich mathematical problems provide opportunities for all students to practice and use these higher-level thinking strategies, especially advanced learners.

Nevertheless, if students have backgrounds or abilities that make taking this course for a year unnecessary, the text can be adapted to accelerate the pace. The use of GATE classes, advanced placement classes, and honors classes ensure that advanced students are placed in the most challenging academic programs possible. In these settings, teachers can combine lessons by focusing on the core problems and tailoring practice to the level appropriate for their students. Care must be taken to monitor the level of mastery, ensuring that students are mastering the content standards. Teachers should strike a balance between the speed of the pacing and the opportunity for these students to benefit from the learning strategies and challenges that are built into the course.

Grouping as an Aid to Instruction

This course supports the use of **structured study teams** to help establish a safe and active learning environment for all types of learners in several ways. First, structured study teams provide small learning communities within the classroom where students who might otherwise remain anonymous in a large class context can safely ask questions of and discuss the mathematics with their peers and the teacher. Second, these study teams foster active participation in the lesson by creating roles for each member of the team so that each student has tasks to perform. Third, research has shown that the most effective way to consolidate learning and enhance retention is for students to explain what they think they know to someone else. The study team setting provides opportunities for mathematical discourse: students talk about the mathematics, share ideas and strategies, ask meaningful questions, receive support, and articulate their thinking. Finally, partners and study teams provide a useful way for teachers to **assess** individual progress and to adjust the curriculum as needed.

This course helps students solve challenging, idea-rich algebraic problems. Success is dependent on their ability to read and understand problems. Structured study teams play an important role in **improving reading and understanding**. It is essential that students **learn to read math problems**. They must find the contextual clues that allow them to solve problems. Support for this to happen stems not only from teachers but also from students' partners and study team members. Additional suggestions follow on pages 15-16.

Strategies for effective structured study teams have to be taught. The **teacher edition** explains how to use the student text and resource materials with study teams, and it describes the role of teacher interaction and intervention with them. See the “Study Team” tab in the front of the teacher binder for a general discussion about how to use them. Each lesson plan provides specific information for using study teams with it.

Conclusion

The diversity of students in many classrooms presents significant challenges to teachers. This course provides a standards-based curriculum that teachers can effectively adjust to make it accessible to all students. Contextually-rich problems (“problem-based learning”) are the heart of the course. Mathematical skills and conceptual understanding are developed in a “team learning” structure using “spaced practice,” providing students with the opportunity to master the course objectives and standards over time.

Effective teaching strategies are used to carry out the program, and many of these strategies are embedded in program materials.

In a standards-based classroom, the design of instruction demands dynamic, carefully constructed, mathematically sound lessons devised by groups of teachers pooling their expertise in helping children to learn.

This course was designed, written, revised, and tested by groups of teachers who pooled their expertise to create effective lessons. It provides access to students of widely varied backgrounds, including students experiencing difficulties in mathematics, special needs students, English language learners, and advanced learners. It assures universal access to high-quality curriculum and instruction so that all students have the opportunity to meet or exceed the expected state and local standards.

Suggestions for Assisting Students with Reading

Below are suggestions to use with students who need assistance with reading. Several of these strategies may be used as regular strategies with all learners to begin lessons. Most of them may be used in the study team format as well as with the entire class. For many of these suggestions, it is important that students not have a pen or pencil in their hand while they read unless the strategy asks them to make notes while they are reading.

- Have the students read to themselves and then ask different students to state one thing that was important in the reading. Ask several different students for input.
- After the students read the problem, have them write down notes from what they learned or what was important. They could also write a question about what they still need to know or do not understand.
- After the students read, summarize what was read and ask questions about what is expected from the problem.
- Have students take turns reading and stop after each section of reading and summarize it.
- As the students read to themselves, have them mark key pieces of information. Some teachers have them use different marks, such as check marks, squares, and circles for related pieces of information. Underlining or highlighting the question/task is another part of this process.
- Make an audio recording of longer word problems so that students can listen to it as many times as needed.
- Make sure all pencils are out of the students' hands and all eyes are in the book. If anyone is doing something else, stop them until everyone is ready. As they read a sentence, go over any words they do not understand. Give them a slip of paper, have them write down the word and put it on a word wall. You could have one word wall poster for math terms and another one for non-math terms. This will also help the students in other content areas.
- Give each student or study team a word from the day's lesson. Have teams form sentences that use each word. This can also be used as part of a closure activity for a lesson or chapter. You can use the concept cards from the closure section.

- Assign one person from each team to be the reader for their team that day. This ensures that every problem is being read aloud and that teams are reading all of the directions.
- Assign one person from each team to be the reader for their team that day and one person in the team to summarize what the other person reads. This ensures that every problem is being read aloud and that students are rephrasing directions in their own words.
- Have one student in the class read the problem. All other students should write down (or highlight) the key words in the problem as the student reads. Have students share (either as a full class or within their teams) which words they marked and why.
- Have the recorder/reporter keep a list of key words that their team identifies during the course of a lesson. At the end of class create a word wall or some sort of master list of that day's key vocabulary words and ideas.
- When there is a question for which there are multiple ways to respond, have each team write their approach on a white board and then place the whiteboards in front of the classroom. Discuss each idea/approach/explanation.