Introduction to Study Team Strategies

CLASSROOM METHODOLOGIES

The College Preparatory Mathematics Program (CPM) recommends a varied instructional program. Small group work done in study teams is one part of the program. In fact, a major reason for developing the CPM program was to provide some flexibility in how students could learn mathematics and thus meet the needs of a greater number of students. There should be opportunities in every CPM classroom for small group, large group, and individual work and instruction. Work with the whole class should include setting the context, direct instruction when there is a general need for it--usually after students have explored an idea or have done the developmental investigations in the text--and summarizing.

Because traditional classrooms have generally focused only on whole-class and individual instruction, what looks different about CPM is the time spent working in teams. Since this format is new for many teachers, learning how to do it well is emphasized in our teacher workshops. We concentrate on that component because it is the place where most teachers have had the least experience and have the most to learn.

Working in student study teams is one way to engage more students in discussing and doing mathematical problems. In most lessons there are problems specifically designed to be worked on by students in study teams. Others are meant to be done individually. The teams serve as a resource to explore investigations together, stimulate intellectual discourse, check work, and discuss and resolve differences for problems that are done individually. The teams also allow the teacher to make more individual contact with students and to know their strengths and weaknesses better. In the case of more advanced students, the teacher has the opportunity to ask them more challenging questions to extend them beyond what other students may be doing.

Working in teams is often new to students as well. They need to learn how to work with their peers, and CPM teacher workshops address this issue in detail. Students are usually most successful when they approach team participation with an open mind to see what works well for them and to learn what does not work so well. The team time offers students more opportunities to articulate their ideas, ask questions, clarify ideas, and bring closure to the investigations that guide them to the concepts and skills in each lesson and in the course.

Some Ideas About Using Study Teams

The daily activities in this course will require much more work in study teams and much less introduction and explanation of ideas by the teacher. Study team interaction is an integral part of the learning process. As Tom Sallee and Carol Meyer Waters recommend in *Make It Simpler*, the study team setting has many advantages for both the teacher and the student. From the teaching perspective, study teams of four can reduce the number of students in the class from thirty-six to nine. Moreover, since members of the study team respond to routine inquiries, **more of the teacher's time can be spent dealing with questions of substance.** The students benefit because they have the continuous presence of three others to whom they can explain their ideas and ask questions. They get the opportunity to teach and to refine their ideas, questions, and approaches in the security of a small study team. They become more willing to try because there is less to risk in a study team of four than in a whole-class setting. Research has shown that the most effective way to consolidate learning and enhance retention is to explain what you think you know to someone else.

This course contains fewer problems than a traditional course, but many problems should be done in more depth, especially those that include a written reflection by the student. Students need time to consider different ways of looking at a problem so that they can truly understand its underlying structure. They also need to understand and appreciate that there are often several ways to solve a problem. In some cases, they need to see why one particular approach may work better than another. Their quality of thinking may be improved in several ways, including focused discussions within the study teams, students' presentations to the whole class, and students and the teacher modeling good thinking by "thinking out loud" to the team or the whole class.

When using study teams, **the role traditionally assumed by teachers must change**. The teacher must give up the central role of "sage on the stage" and really become a "guide on the side," allowing students to explore problems and gradually construct their own understandings. This means that students first find ways to express ideas in language that makes sense to them, gradually refine their work, and eventually reach accepted language for these mathematical ideas. To do this **students need to explain to each other**, and **listen to each other**. Sometimes their solutions will not work, but our goal is to have them find this out for themselves. On the other hand, **teacher-led discussions are essential to summarize results of study team activities and tie together big ideas after the students have had a chance to work on the pieces.** These guided discussions should be conducted in an open, accepting way with the purpose of helping the students make connections to see where and how the pieces of information fit together.

To ensure optimum interaction, we recommend pairs (student partners) or study teams of four students. In these situations, there is always an open line of communication. In the case of study teams of four, if Student #1 and Student #2 are discussing a problem solving exercise, Students #3 and #4 still have the opportunity to discuss the activity with each other. They may choose not to, but the opportunity is available. In study teams of three, if two people are talking the third person may be isolated or shut out.

Study teams work best when team members have their desks in close proximity. For pairs, this means that the two desks are either placed touching each other, either side-by-side or facing each other. For teams of four, all four desks should be touching (or nearly touching) and oriented so that all four team members can easily see each others' faces. Depending on the teacher and school facilities, the desks (or tables) may remain arranged in pairs or fours, or the teacher may have students move their desks from rows into tight configurations for study team work, then back into rows again. Note the operative word "tight." If the team members are too far apart, when they want to confer with teammates they either have to get out of their seats or shout. Both of these behaviors are distracting to the rest of the class. The alternative is perhaps more detrimental to the success of a CPM class: it is so much bother to try to work with teammates that study team members give up and try to work alone, if they work at all. To avoid this scenario, teachers need to get their students to form tight-knit study teams so they will have someone nearby to talk with about math.

It is equally important to have the study team configurations well-spaced throughout the classroom. There needs to be enough space between teams for the teacher to freely circulate about the classroom. This space also provides something of a buffer zone between study teams so that a conversation in one team does not interfere with a neighboring team's work.

The two most common configurations for study teams of four are formed by either having pairs of students from adjacent rows (say Row 1 Students #1 and #2, and Row 2 Students #1 and #2) turn their desks 90° to face the aisle between their rows and lift-slide so the table tops are touching, or by

having one pair (say Students #1 in Rows 1 and 2) turn-lift-slide and one pair simply lift-slide so they share a common work surface. ("Lifting and sliding" is less destructive to floors and nerves than "dragging.") For classrooms furnished with desk-chairs, some teachers prefer a spiral arrangement where the front of one desk touches the left side of the next.

While it is not particularly difficult to get students to physically move their desks into study team configurations, it does take practice at first. Teachers who are fairly expert at using study teams report that it is not enough to show their students how to configure their teams the first few days of school--they must keep insisting that the desks be arranged as they have shown them. This insistence may be in the form of verbal reminders, or the teacher may help study team members push their desks together (perhaps while checking homework or taking care of other business), or help clustered study teams separate from each other. The time and effort a teacher spends during the first month of school pays off throughout the year.

An efficient way to make a transition into a study team arrangement is to say, "When I give the signal, quickly and quietly stand up, and lift and turn your desks to form your study team." Be sure to let the students know what you mean by "quickly" (15 seconds is ample) and what level of noise is acceptable (how "quietly") right from the start. Once students get to know the routine, they can, on your signal, make the transition from rows to study teams in three to five seconds.

Early in the semester it is most efficient to randomly assign students to study teams. Some methods that work for us include: dealing a deck of cards, finding the four parts of a puzzle that fit together, finding the two pieces of a broken crayon that match, or a "snake dance" where rows or columns move as a whole to a new position. Seating should be for a definite period of time, two to three weeks or the duration of one unit, maximum. Later on during the course, you may want to choose your study teams to ensure a mixture of abilities, particularly if you are doing team grading of any activities. Another way to sort students is to hand back unit tests in study teams of four, announcing names as you lay the tests on each table or set of desks.

Guidelines for Working in Study Teams

One of your first tasks will be to share your expectations for behavior when the students are working in study teams. We suggest the following guidelines for students.[1]

1. **You are responsible for your own behavior**.
   Disturbances are going to occur whether in rows or study teams, but the seating should not be an excuse. Basically this is a translation of the rule, "No student has the right to interfere with another student's right to learn."

2. **You must try to help anyone in your study team who asks.**
   This is one of the more difficult ideas for competitive students to accept.[2] However, explaining something to someone else is one of the best ways to assure that s/he understands the idea as well as being a means to deepening understanding and increasing long-term retention of it.

[1] These guidelines are based on those suggested by Carol Meyer Waters and Tom Sallee in *Make It Simpler*, Addison-Wesley 1983.

[2] Give them Henry Pollack's example: When an industry such as AT&T looks for a young mathematician or scientist to hire, they want to know how well he or she can work with a group. If someone brilliant works best in isolation they will let him or her do that and then buy the results later. There is no point in paying someone for time they would spend on their own anyway.

3. **Only when ALL study team members have the SAME question may you ask the teacher for help.**
   You will probably have as much difficulty following this as the students do. You must break the habit of directly answering a question when asked. Instead, say, "Does everyone in the study team want the question answered?" At this point your goal is still to help students to answer their own question (see additional remarks about this issue under "Teacher Roles"). Often your response should be a question rather than a statement.

4. **You must use study team voices.**
   The volume of the students' voices should remain reasonable within the hearing of their study team only. You will need to develop signals to indicate the end of team discussion, such as turning the lights out, clapping, ringing a bell, or raising a hand.

Student Roles for Interaction in Study Teams

Effective CPM classrooms will be noisy but not loud. Study teams will "hum" when someone in each team takes on each of the roles below. Ideally, students will move in and out of various roles during the course of the lesson unless you specifically assign these roles as recommended in the "Connections" textbook.

Resource Manager: • Gets necessary materials and supplies for the team and makes sure that the team cleans up at the end of the period. • Manages non-material resources for the team, seeking input from each member. • Calls the teacher over when the whole team has a question.	**Facilitator:** • Helps their team get started by having someone read the task aloud. • Makes sure each person understands the task and knows how to get started. • Makes sure everyone can explain the team's answer.
Recorder/Reporter: • Shares team's results with the class. • Serves as a liaison with the teacher during a 'Huddle.' • Makes sure each team member records the work. • Organizes the team presentation and assigns the parts for the presentation.	**Task Manager:** • Keeps the team focused and on task discussing math. • Intervenes if anyone is off task. • Articulates the reasons behind the math statements that the team makes by repeating what the team is saying.

Teacher Roles During Study Team Work

YOUR JOB AS THE TEACHER IS TO CIRCULATE AMONG THE STUDY TEAMS. The CPM texts are designed to guide the students to discover and consolidate the concepts and skills in the course. The texts have summary points and examples, but these are usually placed after students have had time to explore and think about an idea for themselves. A major part of your role as teacher is the constant assessment of the needs of individuals, study teams, and the entire class. Move from team to team, listening. (You can often get a more accurate assessment of how a study team is functioning by listening to a team you are not looking at or currently working with.) When a team asks a question, your first response should be to help determine what the students need: often they simply need to be directed to ask members of the team for help, to read the problem or to take note of a particular direction in the problem. If everyone in the team has a question that requires more than a referral, your first effort should be to ask them a question or two that they can answer that will help them resolve the question they asked. Often a series of leading questions, a suggestion to review an idea that will help in the solution, or a discussion of what they know so far will get them moving forward. Sometimes their question may simply need to be answered, especially if it is for clarifications that we would not expect them to work through on their own. **Note:** Using CPM textbooks effectively DOES NOT prohibit you from answering questions! It does mean that, as much as possible, you try to have students think and answer questions for themselves.

You are also assessing the general progress of the class on the assignment. Sometimes you will need to stop the class for a few seconds to clarify a point of confusion that has emerged in two or three teams, such as a question in the text that is not worded as well as it might be. Other times you may decide that one or more teams should share their results with the class. You are also making mental (or written) notes about what you observe for the purposes of clarification or summary at the end of class or to start the next day.

Notice that the role of facilitator is active and demanding. You will need to make dozens of decisions about how to intervene (or not to do so!) each class period. There is ample opportunity to use direct instruction, but you will do so when it is appropriate and in a prescription manner, based on the observed needs of your students rather than the assumed needs that underlie the traditional shotgun lecture that presumes the teacher knows what everyone needs to hear. You still have the opportunity to ask questions and share your experience and wisdom, but you do so in a much more personalized setting with an individual or members of a team. T**eachers certainly do teach in a CPM classroom!**

When joining a study team, come in at their eye-level. Sit on a student chair, kneel on the floor, or for short stops, squat. Do not lean over. Leaning over makes you the boss not the catalyst; besides, some of us have learned the hard way that it is not good for our backs.

We have found two rules of thumb that, while initially may be difficult to follow, are also very important in developing students' independence and responsibility for their own thinking:

1. Never carry or grab a writing implement.
2. Usually respond with a question.

If you cannot write or draw you can concentrate on getting the students to understand well enough to write or draw what is needed themselves. If you do not tell them what to do, but ask them questions instead, they will have to do most of the thinking. The hard part, what makes these two rules difficult

to follow, is time. But remember you can leave the study team with a leading question, go to another team, and come back later, so you do not have to spend the time telling anyone how to do the whole problem. If a study team seems to be missing one of the roles mentioned above, join the team and assume the missing role. However, do not stay too long; the idea is for a team member to take over when you leave.

For the first few weeks after you start using study teams, begin most contacts with this question:

DOES EVERYONE HAVE THE SAME QUESTION?

Even (especially) if the question is as simple as "What did you tell us to do?" refer it back to the study team unless and until you are convinced that you need to answer their question. You, and especially the students who like to get your attention, will find it HARD at the beginning. But being firm and consistent at the beginning will give you better study team dynamics later in the year. However, be sensitive to even some of the mundane questions. Sometimes the students may not understand what the book says; they are not just being lazy. Maybe a study team was legitimately distracted when you said something. Common sense should always dictate responses, not adherence to a rule for the sake of the rule.

IN PARTICULAR, **like all absolute statements, there are exceptions. You do not want to create an adversarial relationship with students or the image that "the teacher doesn't teach" by refusing all questions. You will know your students' needs best. If one student needs to have three or four questions answered so that you can leave her/him with a question that can be answered, fine. For another student, you might answer very few questions. Our caution here is that you not take the emphasis on students answering their own questions so literally that you never answer a question! Likewise, CPM does not discourage direct teaching; it suggests, however, that it be purposeful and focused as discussed above. Thus, telling students or parents that CPM prohibits you from answering questions or explaining anything is a gross mis-statement of the preceding guidelines.**

It takes time and effort at the beginning of the school year to get study teams to work effectively, but the effort pays off later. As the year goes on you will find in roving the classroom that students are asking better questions and that they are doing some work even after getting stuck. They are helping each other on the routine problems and only asking for help on the hard parts. If you are truly successful, in March you could be circulating and listening and finding your students are all busy. They do not seem to need you because you have helped them become good, self-reliant problem solvers.

Six Ideas to Keep in Mind when Using Study Teams

G1. When/Why to use pairs or teams.
G2. Getting groups started – assigning teams, physical arrangements.
G3. Getting students to move into (and out of) teams quickly and quietly.
G4. Getting students to depend on each other – team building, discipline in groups.
G5. Questioning techniques – whole class and teams.
G6. What does a good group look like?

From the Student Texts:
Much of your class time will be spent working with your fellow students in study teams of two or four. Study teams are the first source of support for learning in this course. Read the guidelines for study teams in the box below, as well as the paragraph that follows.

Record the names of the members of your study team on your paper. Then copy these four guidelines into your notebook.

GUIDELINES FOR STUDY TEAMS

1) Each member of the team is responsible for his or her own behavior.

2) Each member of the team must be willing to help any other team member who asks for help.

3) You should only ask the teacher for help when all team members have the same question.

4) Use your team voice.

Often, a problem will direct you to share the work within your study team. This does not mean one person does all the work and then tells the rest of the team members the answers. Decide how to divide the labor, then share each individual's work to help solve the problem. Your team can verify whether your solutions are reasonable and provide an opportunity for all of you to discuss different ways to solve the same problem.

Effective Study Teams

The following ideas should be kept in mind to help study teams become effective: Basic Elements that Make Teams Successful, and Strategies that Help Teams Work Well Together

BASIC ELEMENTS OF COOPERATIVE LEARNING

* Positive Interdependence
* Face-To-Face Interaction
* Individual Accountability
* Interpersonal and Small Team Skills
* Team Processing

* POSITIVE INTERDEPENDENCE *

Positive interdependence is essential to successful cooperative work. It creates a situation in which they "sink or swim" together. For an individual student to succeed, the other members of the team must also be successful. There is mutual caring based on a shared identity, common goals and the belief that "none of us is a smart as all of us together!"

Types of Positive Interdependence

1. Goal Interdependence - setting a team goal so members are responsible for each other's learning and success as well as their own.

2. Outside Enemy Interdependence - placing teams in competition with each other so team members feel interdependent in their efforts to beat the other teams.

3. Reward and Recognition Interdependence - giving rewards and recognition equally to all team members for completing a task successfully shows them that their efforts are appreciated.

4. Resource Interdependence - providing each member with a part of the information, resources, or materials needed for a task so members' resources must be combined for the team to achieve its goal.

5. Task Interdependence - creating a division of labor so that a member's part must be completed before the next member can complete his/her responsibilities.

6. Role Interdependence - assigning complementary and interconnected roles to different team members that specify the responsibilities that the team needs in order to complete its task.

7. Identity Interdependence - asking teams to choose a name, make a flag, choose a motto or song.

8. Environmental Interdependence - binding team members together by their physical environment, for example, assigning a table or putting chairs or desks together.

STRATEGIES FOR CREATING POSITIVE INTERDEPENDENCE

Goal Set a team goal:

Each member scores 90% or higher on the next test.
The team average is 90% or higher.
The total score for the team is at least 300.
All members complete their homework for 1 day, week,...
Each member does better on the next quiz than on the last one.
All members agree on one answer and each one must be able to explain the work.
The team prepares one paper signed by all members.

Outside Enemy Set a team goal:

Beat the highest team average from last week.
Beat the total class score made on the last test.
Beat last week's record for homework completed.

Reward and Recognition Everyone is rewarded or no one is.

Give bonus points that are added to all members' scores when everyone in the team meets the criterion.
Give nonacademic rewards (see list under Recognition, Privileges, and Rewards)
Give praise, round of applause, standing ovation.

Resource

Give each team one pencil, ruler, calculator, etc. Use the jigsaw strategy so each student has a part of the necessary information.

Role

Assign or ask team members to assign team roles. For example: reader, recorder, encourager, checker, timekeeper, observer, traveler, summarizer, materials handier, reporter, facilitator, praiser, paraphraser, etc.

* FACE-TO-FACE INTERACTION *

Cooperative learning requires face-to-face interaction among students so that they can promote each other's learning and success. Such positive interaction has a number of effects.

Students are encouraged to explain how to solve problems, discuss concepts, ask questions, explain what they know to others, and discuss how the present learning is connected with past learning. They can influence each other's thinking, provide help and assistance, and give important feedback concerning each other's performance. Social support and interpersonal rewards increase. Opportunities are there to pressure less motivated team members to achieve.

It is the face-to-face interaction involved in working together that allows students to get to know each other as individuals, and this forms the basis for caring.

To obtain meaningful face-to-face interaction:

The size of the teams needs to be small (2 to 4 members). The smaller the team, the greater the perception that one's participation and efforts are needed. As the team size increases, however, the amount of pressure peers may put on their less motivated members also increases.

Team members need to sit close enough so that they can make eye contact easily, hear, be heard, and see what's going on.

* INDIVIDUAL ACCOUNTABILITY *

Cooperative learning teams are successful only when every member has learned the material or has helped with and understood the assignment. It is important to emphasize and evaluate individual learning so team members can appropriately support and help one another.

Strategies

Give individual tests or quizzes
Collect a paper from each student
Collect one team paper signed by all members
Collect one paper at random
Call on one person to explain the team's work during or after the task
Monitor team work carefully
Assign an in-team observer to monitor team participation
Assign each student a team role
Ask students to demonstrate on the blackboard
Conduct random interviews with teams regarding content and/or participation
Make video or audio tapes of teams working
Ask teams to do peer and self evaluations
Have students initial the items they completed on a worksheet
Use similar assignments - team works together on an assignment then each member is given a similar assignment to complete individually
Use "learning" tests - practice tests team members write test and pass to another team; one person is test taker, partner is researcher and helper, then switch roles

* SOCIAL SKILLS *
(INTERPERSONAL AND SMALL GROUP SKILLS)

Social skills are the skills necessary for successful cooperative work. All students need to develop skill in communicating, building and maintaining trust, providing leadership, making decisions, and managing conflict. We need to teach these skills directly and provide opportunities and motivation for using them.

Steps in Teaching Social Skills;

1. Help students see the need for the skill.

2. Help students understand what the skill is and when to use it.

3. Set up regular opportunities for students to practice the skill.

4. Ask students to process their use of the skill and provide feedback on how well they are doing.

5. Have students continue practicing the skill until its use becomes automatic and routine.

* TEAM PROCESSING *

Team processing means giving students both the time and the procedures for analyzing their team work. It involves looking at how they are completing their assigned task and how well they are using the necessary social skills. Processing helps all team members be successful and maintains good working relationships within the team. Processing also involves receiving feedback from the teacher and/or student observers.

Types of Processing

1. Analysis - Students look at the team experience just completed to analyze what helped and what didn't in completing their assigned task. The focus is on "I," "you," or "we."

2. Application - Students look at what they learned from the team experience that could be applied in other situations to help them make connections between classroom cooperation and cooperative experiences in the rest of their lives.

3. Goal Setting - Students choose a specific social skill to work on in their next cooperative team activity. The focus can be on goals for individual team members or for the team as a whole.

Strategies for Processing

1. Discussion - whole class or individual team
2. Written - individual or team
3. Signals

SPARC - Getting Teams to Work Together-**A Five-Finger Check List**

Here are five things YOU can do to get your CPM class off to a good start.
After each period, do a quick mental check on how well each of these guidelines worked.

Start promptly. Teams get organized quickly, quietly, and tightly so that students can begin working right away.
Be firm and consistent all year in insisting that the desks be tightly configured so that all team members can make eye contact with and talk to (and hear) each other with walking space left between adjacent teams. Expect students to arrange their desks and have materials out and ready for use within 20-40 seconds of your signal. It takes practice to "quickly and quietly" make the transition from a seating arrangement for individuals to one for teams, and vice versa, but the time spent practicing at the beginning of the year is well worth it. After at most a few minutes of socializing, teams should begin working on mathematics.

Peer support. Team members consult each other *before* consulting you.
*Students are used to having teachers transmit information, **not** facilitate thinking. It takes time for them to learn to work together, to trust and support each other, and to feel comfortable as generators of knowledge. Although you may empathize with their frustrations and find it difficult yourself to follow this team guideline, do it! It takes at least two months for student to accept this responsibility, but your early diligence will payoff for the rest of the year.*

Assignments. All students should attempt to do the assignment each day.
Be especially vigilant at the beginning of the year that your students develop a sense of responsibility and make a serious attempt to do their assigned work every day. You will probably need to grade the work daily for some period of time. You will also need to guard against "covering" yesterday's assignment for students before they begin the day's lesson; otherwise, you foster dependence on you.

Respond to team. You address your responses to the whole team, not just the individual who voices the question.
One of the most effective ways to facilitate cooperative team work is to address responses or questions to the entire team. One way to do this is to stand opposite the student who has a hand raised, and try to make eye contact with each team member while you talk. If all team members are not listening because they do not all share the same question, get them talking to each other.

Circulate. You visit all teams regularly, not just those with raised hands.
*Your circulation pattern about the classroom should include pauses to make sure **all** teams are talking about mathematics. You should make contact, even if it is only a quick "Any problems?" at least three times every period. While it is important to respond to teams who have questions, waving hands should not determine your circulation pattern. Acknowledge raised hands by making eye contact with team members, or by saying, "I'll be right with you" and then continue your classroom "cruise." Get back to the team whose raised hands you acknowledged within one or two minutes. If your interactions with the teams is solely reactive – responding to signals for help – you will reinforce the students' dependence on you and undermine your goal of fostering student-centered learning.*

Study Team Strategy Cards

A Summary of the strategies

General Study Team Work - Teacher Check List ▪ **S**tart promptly ▪ **P**eer support expected within each team ▪ **A**ssignments due each day ▪ **R**espond to group rather than individuals ▪ **C**irculate. Circulate. Circulate.	**Jigsaw 1 (Team as part of the class)** ▪ Each study team is assigned a different part of a larger topic/task. ▪ The team researches and discusses the topic/task. ▪ The team determines how to organize and present the information. ▪ Each study team presents its part to the whole class.
Jigsaw 2 (Within a team) ▪ Each study team member is assigned a different part of a task/topic. ▪ Each member researches/learns about the task/topic (possibly with others with same topic). ▪ Each member then presents the information to the others in his/her study team.	**Pairs Check~(Rally Coach)** ▪ Each pair has one paper and pencil. ▪ Student #1 writes what Student #2 explains OR Student #1 does the first problem while Student #2 only watches, listens and asks questions. ▪ Then roles are reversed for the second problem. ▪ Then each pair checks their work with the other study team pair. ▪ Continue on to the next pair of problems.
Numbered Heads ▪ Students number off in study team. ▪ The team is given a problem to solve. ▪ When the team finishes, use random numbers (1-4) to ask questions or have team members share the solution process. ▪ The numbers can also be used to assign roles.	**Teammates Consult (Pencils in the Middle)** ▪ All pencils and calculators are set aside. ▪ Students read the problem or question. ▪ Give students individual think/work time. ▪ The problem is discussed by the team for clarity. ▪ Possible strategies are shared. ▪ Teacher gives okay for pencils to be picked up and written work to

	begin.
Reciprocal Teaching ▪ In pairs, Person A pretends that Person B was absent and explains a concept. ▪ Switch roles and continue.	**Dyad** ▪ Each person is given equal time to talk. ▪ The listener does not talk, it isn't a conversation. ▪ Confidentiality is maintained. ▪ Maintain eye contact and good body language.

Huddle ▪ One person from each team (teacher's choice) is called to the front of the room. ▪ Teacher gives a piece of information, checks for understanding.... ▪ Student goes back to team to share.	**Swapmeet** ▪ When a group task is partially finished, one pair from each team rotates to the next team. ▪ Pairs from the two teams share ideas, solutions, thinking... ▪ Pairs return to their original teams and share what they learned.
Whip-Around ▪ Topic or question is presented. ▪ Participants randomly have an opportunity to say something briefly about it. ▪ Everyone does not have to comment but are encouraged to do so.	**Participation Quiz** ▪ Pick a group worthy task. ▪ Tell students which norm you are focusing on. ▪ Show teams how you are keeping track (overhead, posters, chalkboard). ▪ Record comments while students are working. ▪ Debrief (Do not need to record everything).

Carousel ~(Around the World/Station Rotation) ▪ Write a different problem/topic/question on large poster sheets hung on the walls or on each table. ▪ Each team is given a different colored marker. ▪ Each team goes to a different poster, discusses the topic and decides what to write. ▪ Teams rotate to all of the posters, adding to what was written by previous teams (have a time limit). ▪ When done, each team does a "gallery walk." ▪ A large group discussion/debrief can be held.	**Fortune Cookie** ▪ Choose 5-6 questions and put in an envelope. ▪ Each team receives an envelope. ▪ One person draws a question, and makes one statement about the topic, then passes it on. ▪ The next person adds their statement or responds to the previous statement. ▪ When everyone has responded to the first statement, another person draws from the envelope and repeats the process.
Think (Ink) Pair Share~(Timed Pair Share) ▪ Teacher poses a question/problem.	**Silent Debate** ▪ Student pairs: One is "pro", the other "con."

▪ Without pencils, students think for 1-2 minute. ▪ (Students may then use pencil to begin working...without talking to partner). ▪ Students then share their thinking and answer(s) with their partner. ▪ Pairs then may share with larger group.	▪ Each pair has one pencil and one sheet of paper. ▪ A topic is given, the pro goes first. ▪ The pro makes a supportive statement in writing. ▪ The con reads the statement and then writes a comment against the topic. ▪ The process repeats 3-4 times.

Hot Potato~(Round Table) ▪ Every team has one sheet of paper and each student has a different colored pencil. ▪ A problem is given to the group. ▪ Person 1 writes the first step of the solution process, explaining aloud, and passes the paper on to Person 2. ▪ Person 2 makes any corrections and adds the next step, explaining aloud, and passes the paper on. ▪ Process continues until the problem is competed.	**Listening Post** ▪ Students #1 and #2 work on a math problem aloud in their team. ▪ Student #3 listens to the discussion and can ask clarifying math questions. ▪ Student #4 only records what is discussed and verbalized (looks for attitudes) and may not talk. ▪ After 15 minutes, work stops and student #4 shares notes and observations. ▪ A variation is Students #1, #2, and #3 work and #4 observes and then shares.
Index Card Carousel ▪ Have the participants write one thing that they really need help with in their classroom - management, homework, getting kids to work, etc. ▪ The card gets passed around with the other participants offering suggestions on how to solve the problem.	**Station Rotation** ▪ Have 1-2 more stations than the number of student groups. ▪ Place a sheet of review problems (4-6) at each station. (Good idea to use a sheet protector) ▪ Have a blank answer sheet at each station for each group. (Good idea to have the exact number of spaces needed to answer the questions at each station. All of the spaces are in numerical order even though the group may not solve them in that order. This will make it easier to grade the papers, if you elect to do so.) ▪ The students work the problems as a group when they finish they turn in the station paper to the teacher and move to the next available station.

Hot Seat	I Have...., Who Has....
▪ One chair/desk per team is set up in the front of the room. ▪ Using Numbered Heads, Person #1 from each team comes to the front of the room and sits. ▪ Teacher gives everyone a problem to work on in a specified amount of time. ▪ Teams can talk, but not the individuals in front. ▪ Check individual and team answers; two points for correct individual answers and 1 point for correct team answers. ▪ Person #2 from each team is up next and repeat.	▪ Each student has one card with problem and an answer to a different problem. ▪ Student 1 asks "Who has..." and states the problem. ▪ The person with the solution says "I have ...." and states the answer. ▪ The responding student then poses his problem and the student with the answer on his card responds. ▪ The process continues until all the questions and responses have been given.
Give One – Get One ▪ Record three ideas to share related to a certain topic. ▪ Circulate and share ideas; for every idea given they receive one in return and record these on a piece of paper – including the name of the author. ▪ Begin group sharing by inviting a volunteer to share one idea received citing the author. The named person then continues the sharing process.	

GIVE ONE – GET ONE

This is an activity to use when getting people to share a lot of ideas or suggestions. An idea for adults could be to share ideas for correcting homework. For students you could ask the students to write three ideas for being successful in class.

- Record three ideas to share related to a certain topic on separate pieces of paper or index cards.
- Circulate and share ideas; for every idea given they receive one in return and record these on a piece of paper – including the name of the author.

- Begin team sharing by inviting a volunteer to share one idea received citing the author. The named person then continues the sharing process.

JIGSAW

One cooperative learning activity asks participants to become experts in a particular area and then share their new found knowledge. There are various ways to organize the jigsaw activity, but the central concept is that teams of people are assigned or select topics that they teach to others in the workshop. The teams decide collectively and cooperatively how they are going to share what they know. This activity draws on the experience the teachers bring to or acquire at the workshop and then acknowledges and reinforces mutual responsibility for learning.

One way to acquire knowledge from a large amount of material is to break it into smaller pieces. Each team of participants becomes an expert of a part of the material and then shares their knowledge in their team. For example, if a large part of a reading assignment is broken into four parts, then each member of the team takes one part to become an expert on. Each team numbers off from 1 to 4. All the ones become expert on the same material and discuss it in one section of the room. All the twos do the same with their part, as do the threes and fours. Then they return to their original teams and each shares their information.

Ideas for using a Jigsaw in your classroom are: to have each team member learn about the different Ways of Thinking and share with their team(Connections courses); to have each team member review (Appendix of FFA 1 and 2) about a different Property of Numbers (Associative, distributive. . .) and share with their team.

Two ideas follow this page; one is about the Laws of Exponents and the other about the Law of Logs. Cooperative Logic Cards, such as the ones used in the Bicycle Race (Unit 7, Algebra Connections) and in Foundations are also Jigsaw problems.

#1

BASE, EXPONENT, AND VALUE

In the expression 2^5 , 2 is the **base**, 5 is the **exponent**, and the **value** is 32.

2^5 means $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

x^3 means $x \cdot x \cdot x$

Write each of these expressions as simply as possible using the method shown below.

Knowing that $x^3 = x \cdot x \cdot x$
then:

$$x(x^3) = x \cdot (x \cdot x \cdot x) = x^4$$

Use exponents to write each of the following expressions as simply as possible. Look for patterns as you do this with your study team. Write out the variables to show the meaning whenever necessary.

Write these out the long way, like the example.

a)	$x^2 \cdot x$	h)	$x^3 \cdot x^6$
b)	$y^2 \cdot y^5$	i)	$x^3 \cdot x^2$

Write these out using the pattern or shortcut that you found.

c)	$(x^2)(x^5)$	j)	$x^3 \cdot x^4$
d)	$x^7 \cdot x^5$	k)	$m^{13} \cdot m^{14}$
e)	$y^8 \cdot y^6$	l)	$x^{32} \cdot x^{59}$
f)	$y^7 \cdot y^4$	m)	$x^{31} \cdot x^{29}$
g)	$x^3 \cdot x^5 \cdot x^4$	n)	$y^3 \cdot y \cdot y^4$

Write the rule for multiplying exponential numbers in your own words.

#2

BASE, EXPONENT, AND VALUE

In the expression 2^5 , 2 is the **base**, 5 is the **exponent**, and the **value** is 32.

2^5 means $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

x^3 means $x \cdot x \cdot x$

Write each of these expressions as simply as possible using the method shown below.

Knowing that $x^3 = x \cdot x \cdot x$ then:

$(x^3)^4 = (x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x) = x^{12}$

Use exponents to write each of the following expressions as simply as possible. Look for patterns as you do this with your study team. Write out the variables to show the meaning whenever necessary.

Write these out the long way, like the example.

a) $(x^4)^2$		h) $(x \cdot y)^2$	
b) $(y^2)^3$		i) $(x^2 \cdot y^3)^3$	
c) $(x^5)^5$		j) $(2x)^4$	

Write these out using the pattern or shortcut that you found.

d) $(x^3)^6$		k) $(x\,y^2)^2$	
e) $(x^3)^9$		l) $(2x^2)^3$	
f) $(x^4)^5$		m) $(x^2y^2)^4$	
g) $(3^5)^4$		n) $(5^2)^4$	

Write the rule for raising exponential numbers to a power in your own words.

#3

BASE, EXPONENT, AND VALUE

In the expression 2^5 , 2 is the **base**, 5 is the **exponent**, and the **value** is 32.

2^5 means $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

x^3 means $x \cdot x \cdot x$

Use your **calculator** to write these exponential numbers as a **decimal and as a fraction.**

a) 10^{-1}	b) 10^0	c) 5^{-1}	d) 5^0
e) 2^{-1}	f) 2^0	g) 4^{-1}	h) 4^0
i) 3^{-1}	j) 3^0	k) 2^{-2}	l) 4^{-2}
m) 10^{-2}	n) 3^{-2}	o) 5^{-2}	p) 10^{-3}

e) What effect does a negative sign have when it appears in an exponent? Was this what you expected?

f) What effect does zero have when it appears as an exponent?

Write the rule for what happens to numbers whose exponents are 0 or a negative in your own words.

#4

BASE, EXPONENT, AND VALUE

In the expression 2^5 , 2 is the **base**, 5 is the **exponent**, and the **value** is 32.

2^5 means $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

x^3 means $x \cdot x \cdot x$

Use exponents to write each of the following expressions as simply as possible. Look for patterns as you do this with your study team. Write out the variables to show the meaning whenever necessary. Knowing that $y/y = 1$

$$y^3 \div y = \frac{y \cdot y \cdot y}{y} = y^2$$

Write these out the long way, like the example.

a)	$x^2 \div x$	h)	$x^3 \div x^6$
b)	$y^2 \div y^5$	i)	$x^3 \div x^2$

Write these out using the pattern or shortcut that you found.

c)	$(x^2) \div (x^5)$	j)	$x^3 \div x^4$
d)	$x^7 \div x^5$	k)	$m^{13} \div m^{14}$
e)	$y^8 \div y^6$	l)	$x^{32} \div x^{59}$
f)	$y^7 \div y^4$	m)	$x^{31} \div x^{29}$
g)	$\frac{x^3}{x^1}$	n)	$\frac{x^3}{x^3}$

Write the rule for dividing exponential numbers in your own words.

#1
Using your calculator, compare each expression in Column A with its paired expression in Column B.

Column A	> < = ?	Column B
log 30		log 5 + log 6
log 27		log 9 + log 3
log 24		log 2 + log 12
log 132		log 12 + log 11
log 45		log 9 + log 5
log 45		log 3 + log 15
log 45		log 45 + log 1

a) Write a conjecture (a statement you think is true) based on the pattern you noticed.

b) What is another way of expressing log 65?

c) Make up three more examples of your own, and check them.

#2

Using your calculator, compare the expressions in these two columns.

$>$
$<$
$=$
?

Column C	Column D
log 30	log 300 - log 10
log 27	log 81 - log 3
log 8	log 24 - log 3
log 12	log 60 - log 5
log 16	log 64 - log 4
log 16	log 80 - log 5
log 16	log 32 - log 2

a) Write a conjecture based on the pattern you noticed.

b) What is another way of expressing log 13?

c) Make up three more examples of your own, and check them.

#3
Using your calculator, compare the expressions in these two columns.

$>$
$<$
$=$
?

Column E	Column F
$\log 3^2$	$2 \log 3$
$\log 5^3$	$3 \log 5$
$\log 4^3$	$3 \log 4$
$\log 5^3$	$3 \log 5$
$\log 5^5$	$5 \log 5$
$\log 8^4$	$4 \log 8$

a) What is another way of expressing $\log a^b$? Write a conjecture.

b) What is another way of expressing log 16 using the conjecture?

c) Make up three more examples of your own, and check them.

#4
Using your calculator to find a pattern. Then write a conjecture.

$$\frac{\log 27}{\log 3}$$

`

$$\frac{\log 25}{\log 5}$$

$$\frac{\log 64}{\log 4}$$

$$\frac{\log 625}{\log 5}$$

$$\frac{\log 32}{\log 2}$$

$$\frac{\log 8}{\log 2}$$

a) What is another way of expressing the log patterns above as exponential equations or expressions? Write a conjecture.

b) What is another way of solving $a^x = b$ using the conjecture?

c) Solve the following:

$2^x = 3$

$3^x = 10$

$2^x = 7$

d) Make up three more examples of your own, and check them.

PAIRS CHECK

Pairs Check is an effective strategy to use when students are practicing a new skill or procedure. Within each team of four, students work in pairs to solve problems and then check their solutions with the other pair. Each pair has one worksheet and one pencil. Student #1 does the first problem, explaining what s/he is doing while student #2 watches, listens, asks questions, and helps when needed. Then the paper and pencil are passed to student #2 and they reverse roles for the second problem.

When the first two problems have been completed, each pair stops and checks with the other pair. If both pairs agree on the first two problems, have them circle the check mark and proceed to the next two problems. If they disagree, they review their work and figure out what went wrong.

Student #1 completes the left side of the paper and student #2 completes the right side. If you want students to complete the problems for homework, cut the page in half. The next day they can check their work and answers with the other pair in their team.

Another way to do the first part of Pairs Check is to have student #1 do the writing while student #2 does the explaining. Continue with the rest of the steps.

Once the students are familiar with the process of Pairs Check, they can set up their own worksheets or work directly from sets of problems in their text.

The reasons to use Pairs Check are many; as a pre-assessment for the topic to be taught, as a review/practice of the topic just taught, or using several concepts, as a review before a quiz or test.

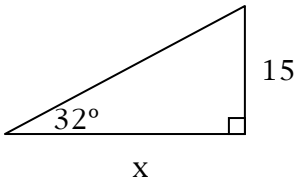
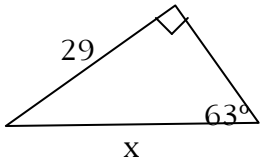
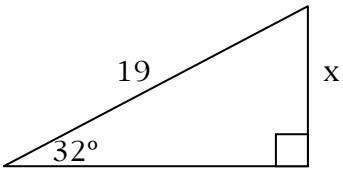
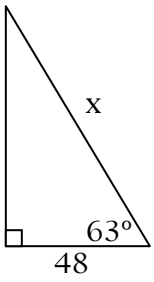
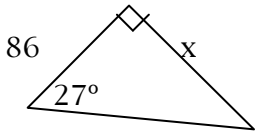
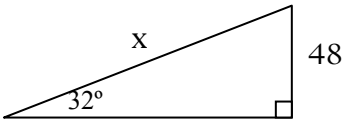
Foundations for Algebra, Year 1 has two in the book, Chapter 1, AR 48 and AR 65.

Format

Name:	**Name:**
	√
	√

PAIRS CHECK

Do not solve. Explain to your partner which of the three trig identities you would use and why. Then set up an equation

Name:	**Name:**
	 √
	 √
	 √

PAIRS CHECK

<table>
<tr><td>Name:</td><td>Name:</td></tr>
<tr><td>Solve for x:
$2(x + 1) - 7 = 1 - 2(1 - x)$</td><td>Solve for x:
$4 - (2 - x) = x + 4$
√</td></tr>
<tr><td>Solve for x:
$2(x - 3) + x = 3(x - 2)$</td><td>Solve for x:
$4(x + 2) - x = 3(x + 3) - 1$
√</td></tr>
<tr><td>Solve for x:
$5x - 8 = 4(x - 2)$</td><td>Solve for x:
$5(x - 2) - x = 3(x - 4) + 2$
√</td></tr>
<tr><td>Write the equation for:
<table><tr><td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>-7</td><td>-5</td><td>-3</td><td>-1</td><td>1</td><td>3</td></tr></table></td><td>Write the equation for:
<table><tr><td>x</td><td>2</td><td>-1</td><td>3</td><td>1</td><td>0</td><td>-2</td></tr><tr><td>y</td><td>-4</td><td>5</td><td>-7</td><td>-1</td><td>2</td><td>8</td></tr></table>√</td></tr>
</table>

Pairs Check

Name _____ Name _____

Use tiles to solve then write the equations: $-3 + 5$	Use tiles to solve then write the equations: $4 + (-6)$ √
Use tiles to solve then write the equations: $-2 - 5$	Use tiles to solve then write the equations: √ $3 - (-2)$
Use tiles to solve then write the equations: $-3 (5)$	Use tiles to solve then write the equations: $-2 (-4)$ √

NUMBERED HEADS TOGETHER

NUMBERED HEADS TOGETHER is an effective strategy for keeping all students involved and accountable during team work.

Students number off in their teams. Then they are given a problem to solve, a question to answer, or any task to complete. The team members work together making sure that each student in the team understands what they are doing, knows the answers, and can explain the team's work.

While teams are working, you can use the numbers to ask students questions about the work their team is doing. When the teams finish, use the numbers to have teams share their answers, the process used, or any other appropriate response. Students can signal responses, explain, hold up a paper for a quick check, etc.

This is also a good way to assign team roles or have students pick up materials or turn in papers. For example, all the #3's can pick up the supplies for their team project. The #4's can report out.

Ideas for using Numbered Heads

When doing out loud reading, take turns reading by telling the teams that to go in order of the teams and the number 3's will read from each team. If there is still more to read, then the next time around, the # 2's can read, etc.

TEAMMATES CONSULT

Teammates Consult is an effective strategy to use for problem solving and concept development situations. Students begin by putting all pencils and calculators in the center of the table. One student reads the problem or question to the team or each student reads it individually. Then they discuss the problem, making sure that each team member understands the information given and what they are asked to do. Possible strategies and answers are also discussed and explored.

When each student in the team understands the problem and has a strategy for solving it, all the students pick up their pencils and write out their solution. It is best for the teacher to signal to the class when they may pick up their pencils. The teacher can determine when to do this by walking around the room, listening to the team discussions, and questioning team members. Students may then compare their work with others in their team or share it with the class. Numbered Heads can be used for determining who will read the problem, who will answer the questions, and who will share the solution with the class. Individual student papers can be collected for evaluation.

This strategy is best used on the big problems in the chapter/unit.

GUIDELINES FOR DYADS

- Each Person is given equal time to talk.
- The listener does not interpret, paraphrase, analyze, give advice, interrupt or break in with a personal story.
- Confidentiality is maintained.
- The participants are to maintain eye contact and appropriate body language.

Dyads can be used in many ways. The first day of school is an opportunity for students to get some of their excitement out. They pair up and have each person take their turn talking about "How it feels to be back in school." Triads can be used if necessary.

If there has been an action that concerns many students the dyad is an opportunity for students to express their concern about it in a safe way.

If there is concern about a math topic or test or project that is due, this would be a chance for the students each to be able to talk about it.

RECIPROCAL TEACHING

Have students seated in pairs facing the front of the room. One student is A, the other is B. After a small amount of material has been presented (teacher, video, reading, etc.) ask student A to suppose that her partner B just arrived and, therefore, missed the information presented. A's task is to teach the material to B. While A is teaching, listen to as many pairs as possible to make sure what they are teaching is correct and to identify questions and points of difficulty.
As more information is presented continue having the pairs teach, but reverse the role each time.

This is an activity that can be done at any time during the class period to check for understanding. At the beginning of the period, students could be asked to explain a concept or definition from the previous day or week. It would serve to remind them of what they had just learned. Or this might be a way to introduce the topic of the day by remembering some of the parts leading up to the concept that had been learned in previous units. Done in the middle of class reciprocal teaching could be used to check the comprehension of what is being learned in that day's lesson. This is also one way to summarize topics at the end of class.

Ideas:
Foundations – works with Measures of Central Tendency. Have person A describe *median* and person B could do *mode.* Or put data on the board and have person A show how to find the median, etc.
Geometry - has many definitions. Have person A describe *complementary angles* and person B could do *exterior angles.*
Algebra 1 - has formulas for finding perimeter and area. Have person A explain *perimeter of a quadrilateral* and person B could do *area of a triangle.*
Algebra 2 – has parent graphs. Have person A describe *exponential graphs* and person B could do *power graphs.* Or have students explain how to shift and stretch graphs as a lead in to log graphs.

CAROUSEL (Around the World)

Several small teams can brainstorm at once with this idea by Pam Robbins. Divide the participants into teams of 3-5. Topics or questions are written on large poster paper and either hung up around the room or placed one at each table. Teams gather and discuss the topic and make a decision on what to write on the chart. After 2-3 minutes the teams move on to the next topic; either the teams move physically if the charts are on the wall or the charts move physically from table to table. The teams read what the previous teams have written, have a discussion, and then add to the list.

This continues for as long as you have time. You do not have to have every team respond to every chart. Stop when you feel that the teams have exhausted most ideas. Then have a "gallery walk" where the teams can go around and read all of the charts.

Some teachers have the problems posted on each poster but the students DO NOT write on the posters. This can be done at the end of the chapter with review problems. Even though the students can sit at their desks and work on the problem this gives them the opportunity to move around.

Two other variations of a ***Carousel*** are:

Index Card Carousel

- Have the participants write one thing that they really need help with in their classroom - management, homework, getting kids to work, etc.
- The card gets passed around with the other participants offering suggestions on how to solve the problem.

Or

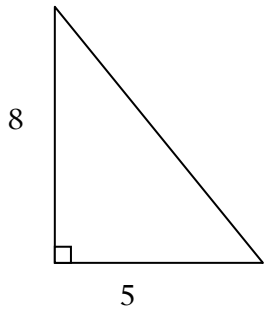
- Have the students write one thing that they really need help with in class – studying for tests, homework, keeping the toolkit/notes organized, etc.
- The card gets passed around with the other students offering suggestions on how to solve the problem.

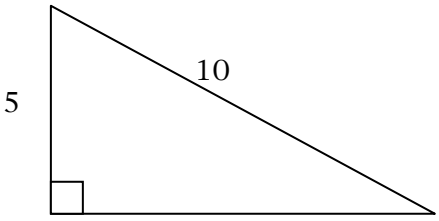
Station Rotation

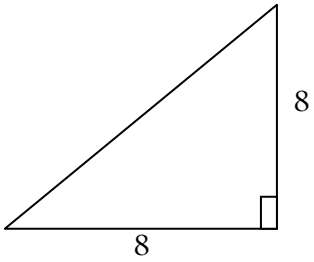
- Have 1-2 more stations than the number of student teams.
- Place a sheet of review problems (4-6) at each station. (Good idea to use a sheet protector)
- Have a blank answer sheet at each station for each team. (Good idea to have the exact number of spaces needed to answer the questions at each station. All of the spaces are in numerical order even though the team may not solve them in that order. This will make it easier to grade the papers, if you elect to do so.)
- The students work the problems as a team; when they finish they turn in the station paper to the teacher and move to the next available station.

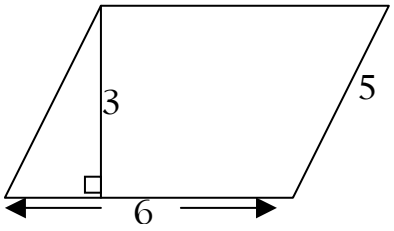
The following ideas would have each problem at a different station.

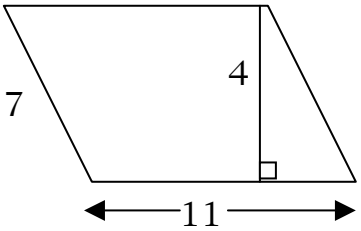
Find the areas of the following figures (find the shaded area in the last two figures):

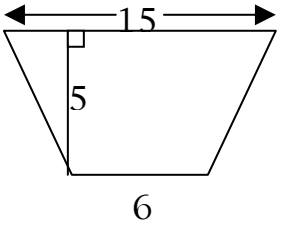


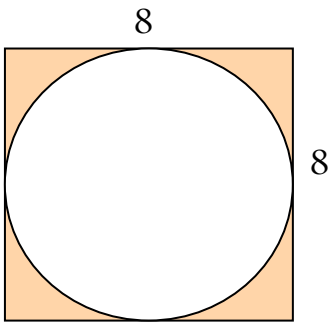


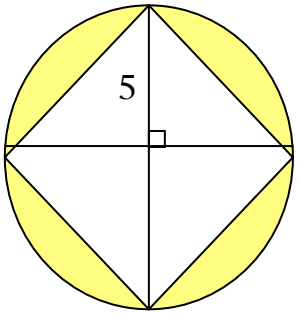


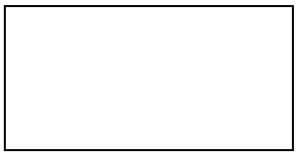
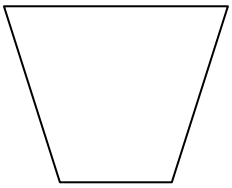
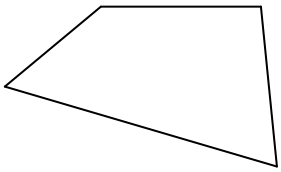
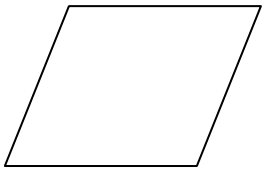


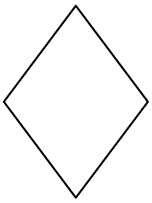
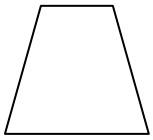
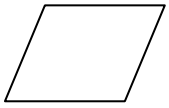








 rectangle	List the characteristics and the congruences of the rectangle.
 trapezoid	List the characteristics and the congruences of the trapezoid.
 quadrilateral	List the characteristics and the congruences of the quadrilateral.
 parallelogram	List the characteristics and the congruences of the parallelogram.

 square	List the characteristics and the congruences of the square.
 kite	List the characteristics and the congruences of the kite.
 isosceles trapezoid	List the characteristics and the congruences of the isosceles trapezoid.
 rhombus	List the characteristics and the congruences of the rhombus.

Write an example of the additive identity.	Write an example of the additive inverse.
Write an example of the multiplicative identity.	Write an example of the multiplicative invers.
Write an example of the distributive property.	Write an example of the commutative property.
Write an example of the associative property of addition.	Write an example of the associative property of multiplication.

Another idea is for Geometry: Each station could have something to Prove. Each team writes one step of the Proof.

Multi step problems work well with a Carousel, where each team adds one step to the problem. It should include a check when solving for a variable.

Fill in one piece of information for this equation:

$$2x + 3y = 6$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$2x - 3y = 12$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$5x - 4y = -6$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$2x - 4y = 12$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$6x + 3y = -18$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$4x + 3y = 0$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$4x - 5y = 6$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

Fill in one piece of information for this equation:

$$3x + y = -5$$

Put in y=mx + b form:

x-intercept:

y-intercept:

slope:

fill in 2 numbers on the table:

x	-2	-1	0	1	2	3
y						

graph the equation:

THINK, INK, PAIR, SHARE

THINK, INK, PAIR, SHARE was developed by Frank Lyman and his associates at the University of Maryland. It works well when students are involved in concept development or problem solving situations. The strategy emphasizes the importance of thinking about the situation before jumping to an answer. It gives students the opportunity to be creative and to explore different approaches.

Students work with a partner. They begin by *thinking* about a question or problem without the use of a pencil or paper (about two minutes, depending on the difficulty of the problem). Then the teacher gives the signal that they may use their pencils. At this point they still may not talk to their partner. They decide what approach to use and get an answer. Then after a period of time determined by the teacher, they *pair* up and *share* their thinking and answer with their partner. When partners have finished sharing, you may want to have each pair share within their team or have students share with the whole team.

There is also a Think-Pair-Share. This excludes writing down, after the first think, what the student was asked to think about.

This strategy could be used when beginning a Chapter Summary. Have the students Think about what concepts were covered in the chapter, then they Pair up and talk about their ideas in their team or with a partner. Finally the whole team Shares the ideas.

This strategy could be used when introducing Diamond problems, doing Mental Math or looking at reflecting on a new concept.

FORTUNE COOKIE ACTIVITY

Listed below are questions to use as 'fortunes' for this activity. There are several fortunes ideas listed. Choose 5 or 6 questions. They will need to be copied, cut apart and one set of each the questions put into envelopes. Each table gets an envelope.

The **first person** draws a piece of paper, reads it aloud and then makes one statement about it or responds to it appropriately (30 sec). After making his/her **one** statement, the next person rereads the statement and makes one statement **or** makes one comment about what the first person said. Continue the process. After each person has had his/her chance to speak, then the whole team can take part in a discussion if they still have issues to discuss. If needed, place a time limit on this open discussion. (You can tell how the discussion is going as you walk around.)

The **second person** pulls a new sheet of paper out of the envelope and the process is repeated. Everyone will have a chance to begin the discussion by drawing a "fortune."

You should model this activity the first time it is used. If you have a large team you may want to appoint a time-keeper and limit the "open" discussion to one minute. This activity also provides a good opportunity to model appropriate behavior in dealing with teams. Circulate and respond accordingly.

For each of the "fortunes" of this activity, have a poster with the scenario written across the top already made. Have each team quickly put their best response/comment **on a post-it note** to be placed on the poster. After this meeting and before the next meeting transcribe responses from post-its to the appropriate poster.

These posters should be on the walls at each subsequent meeting. Encourage people to revise, add or remove items as the year progresses. If you find you have participants that continually ask about the same issues that already have been discussed concerning teams, and the majority of the participants do feel the issue has been resolved, then you can refer the individual participants to the poster for further ideas or comments.

Note: The focus of the Fortune Cookie activity is the discussion, so do not mention the posters ahead of time, nor make it a big, time-consuming activity. It should be used to wrap up the discussion.

Fortune Cookie ideas for Teachers:

* When team members don't want to work together, I ....

* Some incentives that I use to encourage students are ....

* A homework idea that I use ...

* One of my favorite sayings in class is ...

* When many students do not understand a math concept I...

* To get students to start working when the bell rings I ...

Fortune Cookie Ideas for Students

My best advice for next year's students concerning:

* Homework is…
* Tests is…
* Working in teams is…
* Tool kits is…
* Asking for help from teachers or peers is…
* Being successful is…
* Learning Math is…
* Important Math concepts learned this year are…
* The thing I learned about myself is…

FOCUS: TEAMS

- Most students in a team seem to understand and are working on the problem. One is still trying to understand. If s/he asks for help, this helps or hinders the team's success. . . . I would say to that person . . . .
- Someone in a team sits with their body turned away from the rest of the team. This behavior may help or hinder that team. . . . I would say to that person. . . .
- Someone in a team always wants to copy a student's work. I make sure that this person is really learning from looking at another's work by. . . .
- A team has a member who's primary language is not English. Just letting them copy the work will not help them learn math or English. The specific behavior that will help this member of that team is. . . .
- Behaviors that teams display that hinder their learning are. . . .
- Specific questions that can be asked in your teams . . . .
- After helping a team, a question to ask them so you could check their understanding of what you told them is. . . . .
- When teams get stuck on some part of a problem, I. . . . .

FOCUS: Miscellaneous Pick some of the following statements that apply to the types of questions or concerns that come up with your team.

- A student transferred from a traditional Algebra classroom to a CPM class in November, I . . .
- I have a soccer player in my class who misses every Wednesday. I. . .
- A student has had strep throat and has been out for two weeks. She missed an investigation as well as class work. I . . .
- Mastery over time is a concept that many parents find hard to comprehend. I . . .
- You could spend a lot of time grading CPM papers. I . . .
- A colleague says that you cannot cover content if you don't lecture. I reply. . .

Math specific topics

Something that I know about integers is. . .

When scaling axis . . .

What I like about working in teams . . .

One of the measures of central tendency is _____ . To find it you . . .

When I get stuck on a homework problem I . . .

Something I know about a _____(specific kind) triangle is . . .

To find the slope of a line I . . .

One step used when solving a Guess and Check problem is . . .

Something that I know about probability is . . .

One of the Properties of Arithmetic Operations is _____ and it means that . . .

One of the things you need to do when graphing equations (linear and non-linear) is . . .

Something I learned from this chapter is _____ Explain what it is.

Something I still need to work on is _____ Explain what you don't understand.

My strength in math is . . .

HOT POTATO

Every team needs one paper and one pencil or one paper and a different color of pencil for each team member.

The first person writes down the first step, simplification, or answer while explaining their thinking out loud. The next person corrects the first person's work, if necessary, and then puts the next step down, while explaining their thinking out loud. The third team member corrects anything that is incorrect and then does their writing and explaining. And so on, until the problem is completed and checked.

At the end you could have the students each sign off that they understand and agree with everything that was written down.

$$2\,(x - 3) + 4x - (x + 1) = 3x + 5\,(2x - 3) - 2$$

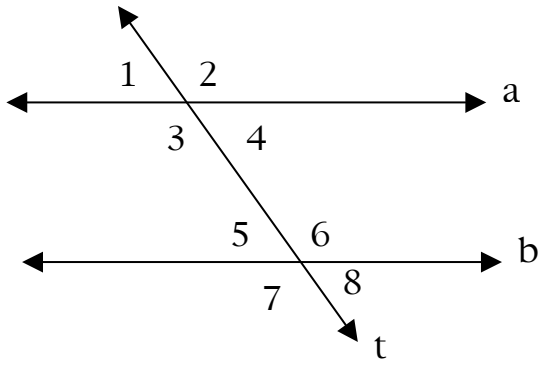
HOT POTATO

Every team needs one paper and one pencil or one paper and a different color of pencil for each team member.

The first person writes down the first step, simplification, or answer while explaining their thinking out loud. The next person corrects the first person's work, if necessary, and then puts the next step down, while explaining their thinking out loud. The third team member corrects anything that is incorrect and then does their writing and explaining. And so on, until the problem is completed and checked.

At the end you could have the students each sign off that they understand and agree with everything that was written down.

Based on the information given, determine whether line *a* is parallel to line *b*, while completing the table below.



	Name the special relationship for this pair of angles	**Is *a* // *b* ?**
a) m ∠1 = m ∠5		
b) m ∠3 = m ∠6		
c) m ∠5 = m ∠8		
d) ∠4 and ∠6 are right angles.		
e) m ∠1 = m ∠7		
f) m ∠3 = m ∠5		
g) m ∠2 = m ∠7		

HOT POTATO

Every team needs one paper and one pencil or one paper and a different color of pencil for each team member.

The first person writes down the first step, simplification, or answer while explaining their thinking out loud. The next person corrects the first person's work, if necessary, and then puts the next step down, while explaining their thinking out loud. The third team member corrects anything that is incorrect and then does their writing and explaining. And so on, until the problem is completed and checked.

At the end you could have the students each sign off that they understand and agree with everything that was written down.

Sketch the graph of the following equation showing at least 3 key points:

$$y = x^2 + 2x - 8$$

y-intercept

x-intercept

vertex

equation

sketch

LISTENING POST

In a team of four students, two of them, A and B, are the "mathematicians" who vocalize their thinking as they work together on a problem they have selected from the sheet of "listening problems." Solving the problem is not the main focus of the "mathematicians;" rather, they concentrate on vocalizing their thoughts as they work toward a solution.

Another person, C, listens to the "mathematicians" as they work and asks for clarification when needed. As an active listener, C seeks to understand the "mathematicians'" thinking.

The fourth team member, D, silently observes A, B, and C, and records what happens. A silent observer, D may only take notes about what goes on, and may not join in or interfere in any way.

After five minutes, the work stops and the team processes what occurred for 15 minutes: First, C explains what A and B were talking about and doing; then A and B respond to C's interpretation; and lastly, D shares notes and observations.

After processing one round, roles are rotated among team members and the process starts again, with the new "mathematicians" selecting a new problem. The exercise continues until all team members have played and processed each role.

This could be done with Guess and Check problems, proportions, solving for x, graphing, trigonometric functions, and so on. Just use the problems from the classwork section.

SILENT DEBATE

This is very similar to an oral debate except that it is *silent.* The students pair up and the teacher assigns one person to take the pro side and the other takes the con side. They do not get to choose. The pro goes first. Each pair has one paper and one pencil between them.

A topic is given to the students. The pro writes it down and then makes a statement, *in writing,* in support of the topic. Then the con reads the statement and responds to the statement or makes a comment against the topic. This goes on, back and forth, until everyone has had 3-4 chances to respond. This is great to improve the writing/communication skills of students.

Some topics:
After the first pair/team test use -

Team tests are a valid assessment.

Other ideas:

Guess and Check is the best way to solve word problems.
Calculators should be allowed on all tests.
There is only one way to do. . . .
Fractions are important.
Toolkits/notes are important for learning.

SWAPMEET

When students are working on a Big Problem, sometimes it is well worth the time to have them share their ideas or hear other team's ideas without having a whole class discussion. One way to do this is through a Swapmeet. Partway through a problem, have two people from each team rotate to a new team. They can then share what they have been working on, what strategies they have tried and what questions they still have. After each pair shares with one team, they return to their original team. Then they share what was learned from other teams and continue to work.

HUDDLE

If you want to check on the progress of the teams, give additional information or ask for a consensus on something to do with the problem everyone is working on, you could call a "huddle." Have one person from each team come to a meeting (at the front of the room or just outside the door). You give that person the information and they return to the team and share it. This is a great way to give status to a low status team member. It gives them something important to share with the team. It is also a way to communicate with all the teams without having to call the whole class together.

HOT SEAT

Because individual accountability is so important, a Hot Seat is a good way to emphasize this. After the teams have been working on a set of problems, have one member from each team come to the front of the classroom to work individually. A problem (similar to the ones they have been working on) is put on the overhead with a 2 minute time limit. The team members left in their team, work quietly together to solve the problem. The team member in the front works without talking, independently, on the same problem. At the end of 2 minutes, the teacher checks the solutions. Two points are awarded to each team if the individual member at the front gets it correct. One point is awarded to each team if the team gets the solution. Continue with a new team member going to the front.

WHIPAROUND

Close a teacher workshop with a final element that elicits an emotional reaction to leave the participants with a powerful feeling about the workshop itself and with good feelings about implementing CPM. One idea is the Whiparound. It allows each person to have a final comment. Whiparounds work best with everyone sitting in a circle, but does not have to be set up that way. The Teacher Leader puts out a topic or question and the participants make a brief comment about it. They could go in order around the circle or anyone could talk. Everyone does not have to make a comment, but they are encouraged to do so.

The following are possible items to use as a lead in to the Whiparound:

- Name a math term that we have learned about in this chapter and define it.
- What is the best thing about math class?
- Which topic in the chapter do you really feel that you understand?
- Name an action that you are going to take as a result of this workshop.
- What suggestions do you have for next year's math students (workshop attendees)?
- What was the biggest AHA! that you had in this chapter (workshop)?
- Name the most practical idea that you picked up.
- What will be the easiest thing about CPM to implement in your classroom?
- What are your feelings as this workshop series ends?

Below is another variation of a ***Whiparound*** called 'I have, who has…'

Algebra Whiparound or "I have, Who has?"

I have x = 3 Who has x + 9 = 4?	I have x = -5 Who has x - 2 = 3?
I have x = 5 Who has x + 2 = 10?	I have x = 8 Who has 2x + 1 = 9?
I have x = 4 Who has 2x - 3 = x - 3?	I have x = 0 Who has 3x - 2 = 1?
I have x = 1 Who has 2x + 7 = -x - 2?	I have x = -3 Who has 2x - 4 = x - 2?
I have x = 2 Who has 3x + 4 = 2x + 2?	I have x = -2 Who has 3x - 10 = x + 4?

I have x = 7 Who has 2x + 1 = -1?	I have x = -1 Who has x - 1 = 2x - 11?
I have x = 10 Who has 3x - 3 = 2x + 3?	I have x = 6 Who has 3x + 5 = x - 3?
I have x = -4 Who has 2x + 1 = 2x - 1?	I have x = Ø Who has x + 4 = 7?

Geometry Whiparound

*** I have Octagon. Who has the general term for a polygon with four sides?**	**I have Quadrilateral. Who has a triangle with an angle greater than 90°?**
I have Obtuse Triangle. Who has a special rectangle with all sides of equal length?	**I have Square. Who has a special parallelogram with 4 right angles?**
I have Rectangle. Who has a quadrilateral with only one pair of parallel sides?	**I have Trapezoid. Who has a triangle with no equal sides?**
I have Scalene Triangle. Who has the opposite angles where two lines meet?	**I have Vertical Angles. Who has a triangle with all sides equal?**
I have Equilateral Triangle. Who has a triangle with two equal sides?	**I have Isosceles Triangle. Who has a four sided polygon where all sides are equal?**
I have Rhombus. Who has a polygon with six sides?	**I have Hexagon. Who has two angles that add up to 90°?**
I have Complementary Angles. Who has a triangle with one angle of 90°?	**I have Right Triangle. Who has a polygon with five sides?**
I have Pentagon. Who has an angle greater than 90°?	**I have Obtuse Angle. Who has an angle less than 90°?**
I have Acute Angle. Who has an angle equal to 180°?	**I have Straight Angle. Who has a line that connects two vertices in a polygon but is NOT a side?**
I have Diagonal. Who has a distance around a figure?	**I have Perimeter. Who has figures that have the same size and shape?**

I have Congruent. **Who has** **a closed two-dimensional (flat) figure with 3 or more sides?**	**I have Polygon.** **Who has** **a quadrilateral with both pairs of opposite sides parallel?**
I have Parallelogram. **Who has** **a polygon with all sides and all angles equal?**	**I have Regular Polygon.** **Who has** **an angle of 90°?**
I have Right Angle. **Who has** **a triangle with all angles less than 90°?**	**I have Acute Triangle.** **Who has** **2 or more lines on your paper that would never meet no matter how far they were extended?**
I have Parallel Lines. **Who has** **a 'corner,' the point where 2 sides of a polygon meet?**	**I have Vertex.** **Who has** **lines that form a right angle when they meet?**
I have **Perpendicular lines.** **Who has** **two angles that add up to 180°?**	**I have Supplementary Angles.** **Who has** **A polygon with eight sides?**

PARTICIPATION QUIZ

Teaching students to work effectively in study teams must be done explicitly and routinely. Even in classes that function well, teamwork can periodically break down. When a particular lesson is especially challenging, students may not realize that their best teamwork skills are required for success. To help with these struggles, teachers developed a structure known as a Participation Quiz.

What is a Participation Quiz?

In a Team Test, good teamwork is essential for success, but students are assessed mostly or solely on the quality of their mathematics. In a Participation Quiz, the quality of the teamwork on any given task is documented and assessed directly by the teacher, rather than the mathematical content. As students work together, the teacher watches and listens and records observations on a transparency or the board. Below is an example of what this record might look like:

- Quick start! Facilitator reading
- All four reading quietly – Make sure you immediately discuss!
- "Does everyone understand the question?"
- Talking outside team – Task Manager needs to deal with it.
- Great team question
- "What if we…"
- Making statements but without reasons –
- Explaining in the middle of the table – all 4 Tell WHY! leaning in to see and discuss.
- All four working but in pairs – be sure everyone understands and agrees. because ___..."
- "I think the graph is saying that ___
- One person blasting ahead
- "Wait, explain that again."
- All four sticking together: "Are we all ready for the next question?"

As you can see from the sample notes, a Participation Quiz documents the language, behavior, and even body language teams use as they work on a task. For classes implementing team roles (Facilitator, Task Manager, Recorder Reporter and Resource Manager), it documents successful use of these roles. This documentation gives teams real-time feedback on the teacher's expectations and how teams are doing. (For more information on Team Roles, please refer to the "Study Teams" section of the "Connections" Teacher Edition.)

When should I use a Participation Quiz?

There are at least three scenarios in which teachers have found a Participation Quiz to be useful:

- At the start of a course, to begin teaching students about high-quality teamwork. Some teachers use a Participation Quiz on the very first day of class to set the tone. In the first week of a course, it is helpful to spotlight one or two key teamwork behaviors to emphasize in a Participation Quiz (such as students not talking outside the team, or Resource Managers calling the teacher over only for team questions), along with the kinds of talk that we might expect to hear from a team that is doing this well. The teacher might say, "Today's problem is interesting and challenging, like many of the lessons we will work with in this class. If you were working on this problem alone, you might think it is too hard. Luckily, you have your teammates to share ideas with. I want to give you credit for doing a great job of working together, so today's problem is going to be a Participation Quiz. I am going to

record what I see and hear that I think will help you and your team to be successful. In particular, I want to make sure that, Resource Managers, you only call me over for questions that your entire team has discussed fully already. I also want to see that no one talks outside their team – if someone slips, I need
to hear the Task Managers doing their job."

• During the course, at times when the class seems to need a vivid reminder of what great teamwork looks, sounds, and feels like – a reminder of just how much students can learn from talking and working very well together. Sometimes, for example, a class might be slow to get started working. Announcing a Participation Quiz in which the teacher will focus on getting off to a quick start is one way to help students tune up their teamwork. For example, the teacher might say, "I've noticed that teams have been struggling to get going lately, and this slow start has meant that your conversations have not been as useful or focused as I think they need to be for you all to learn the mathematics deeply. So let's make today's lesson a Participation Quiz. I will be watching and listening for two things: Facilitators, I want you to make sure that tables are clear of everything except the materials your team will need, and that you are all reading today's problem together. Also, Task Managers, I need to hear you challenging your teammates to give reasons for their ideas."

• For a lesson that is mathematically complex enough that students' best teamwork skills are essential for success. Many lessons within CPM "Connections" courses have significant opportunities for depth if students strive for connections, justification, and multiple representations. Simply stating this at the beginning of the class may not be enough to help teams recognize how important it is that they push for depth. By structuring the lesson as a Participation Quiz, the teacher can help students remember what it will take to be fully successful. For example, the teacher might introduce a lesson by saying, "Today's lesson is very challenging – it has a lot of complex mathematics that will help you make sense of the big ideas of this chapter. You will need your very best teamwork skills to make sense of all the math you need to learn, so today's lesson will be a Participation Quiz. I want to hear two things: I will be listening for teams that give reasons for the ideas they discover, and I will be looking for teams that make sense of their ideas using both algebra tiles and symbols."

How do I know what to record on a Participation Quiz transparency?

The purpose of Participation Quiz notes is to give students feedback about how well they are working together in a manner that supports their learning. In general, the more specific the feedback is, the better students are able to use it as a guide. Direct quotes are especially valuable, as are specific behaviors that you expect to observe. Simply writing "Great teamwork!" or "Excellent facilitation!" does not help students (especially those in other teams) realize what specific behaviors are valuable.

Because space is usually limited, it is helpful to develop some shorthand (such as RM for Resource Manager or TOT for talking outside the team) and to only record some portions of direct quotes ("What if we…" or "I think it's … because …").

Depending on class size, some teachers remain at the overhead, taking notes as they observe teams from there. Others circulate and listen, taking notes on a clipboard. Either way, it is important that observation notes remain as visible to students as possible.

Some teachers prefer to record only positive feedback, others record positive and negative (perhaps using different colors), and some use a "strengths and questions" format. You are encouraged to find the format that works best for your students.

It is common for students to "overact" at first, deliberately saying and doing things that they think the teacher wants to hear. This is not necessarily a bad thing, particularly if the team responds to the overacting with the kind of teamwork desired. Over time, this tendency will diminish.

Finally, it is very important to leave enough time to debrief the Participation Quiz notes with the class. It is useful if the notes about each team help the teacher tell a story – tell why the team was successful (or not).

How do I evaluate Participation Quizzes?

In general, your evaluation of a Participation Quiz should be based on the quality of teams' interactions. It is often helpful to write a previously agreed upon symbol (for example an up or down arrow) for each team in the middle of a Participation Quiz, so that students can see how they are doing.

One way to factor the mathematics into a Participation Quiz evaluation is to require teams to call the teacher over at strategic points to explain or justify an answer. Typically, the teacher will choose one team member at random to explain on behalf of the entire team, then evaluate the entire team based on that member's ability to explain and answer follow up questions.

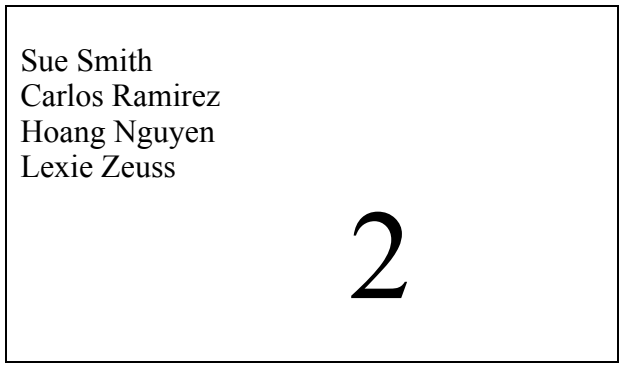
Participation Quizzes do not need to be factored into a student's grade. Teachers should use them to help facilitate the learning process for the class as a whole and for individual students.

During Participation Quizzes you could make brief notes about what individual students do in their teams and their strengths and weaknesses as learners. These notes about individual students should be kept separate from those that the students see. You could then use this information, especially as patterns emerge over time, to help students become better learners. It can also be powerful information during parent conferences to give insights into students as developing learners that goes beyond their knowledge of the course content.

The Card Game

Ratianale:
At various times during the school year students need additional motivation to stay on task. It is sometimes OK to allow brief periods of off-task; however, one of the principal duties of the classroom teacher is to find ways to increase the time the students spend on task, doing the work you want them to do. I have found that extra credit, even a few points, makes a great motivator.

Each study team is given a 3" X 5" card, with the number 2 written on it. Students are told to write all the names of study team member on the card. The teacher announces that we are "playing the card game" today. S/he says that s/he will evaluate each team at least four times. If the team is on task, doing the assigned class work, and working as a team then the number is crossed out and the next higher number is written on the card; e.g. a 2 is changed to a 3 or a 3 to a 4. If the team is working on math, but either not working as a team (i.e. one person is doing his or her own work) or working on the wrong math (i.e. doing homework problems before completing class work) then the number is simply left as it was. If one or more team members are off task (i.e. talking about sports, doing English homework, etc.) then the number is crossed out and the next lower number is written on the card: i.e. a 3 is changed to a 2 or a 2 is changed to a 1. The limits are 0 and 4: i.e. a 4 cannot be changed to a higher number and a 0 cannot be changed to a negative number. At the end of the class period the cards are collected and each team member gets a number of extra credit points equal to the number on the card.



Problems:
Sometimes the students get used to the game and simply don't feel motivated unless they are "playing the card game." When that happens it is useful to use a variation of the game:

The Invisible Card Game

The game is played exactly like the card game except that the students do not see the cards. The teacher may keep notes on a scratch pad, use a PDA, or just remember which teams deserve various numbers of points. Students often ask "can we play the card game today?" The teacher may respond with "maybe we are."

Grouping Strategies for Study Teams

Grouping methods should be purposeful, effective and fast, not always random.

Before students or teachers arrive, pull out the correct number of cards from a standard deck of playing cards. Make sure you have included all four suits of each value and that there is one card for each person. Then, as people enter the room have them draw a card. All twos form a team, all threes, fours, etc.

Use the "Matching Like Solutions Activity." You will need a 3x5 card for each participant. On each card write a different linear equation. Participants will form a team with others whose card has a matching slope. You could do the same thing with matches being coordinates of the line or y-intercepts.

As participants enter the room, have them draw tickets, colored cubes, cuisenaire rods, pattern blocks, marbles,....

Have them line up around the room (without talking!) by birthday (month/day), distance from workshop or school, distance from place of birth, shoe size,.... Then pull off four people at a time to make the new teams. Once teams are assembled, have them do a quick introduction to each other.

As participants enter the room, have them take a different colored sheet of paper. (Nothing fancy here, scratch paper will work. Just try to get as many different colors as the number of teams you will need.) Regroup by having people with the same colored paper form a team. Have them do a brief introduction.

Have them line up around the room by the number of months they have used (or been involved with) CPM materials or experience using graphing calculators or study teams. Then pull off two people at a time from each end to make a team of two experienced people with two less experienced people.

Cartoon or Escher drawing. Cut each cartoon into 4 pieces (these will last longer if they are laminated after they are cut). Teachers team by completing a cartoon strip.

Participants choice or Teacher Leader presorts. Have the participants fill out information cards and use them to presort. Try to get them to sit with new members.

Count off from 1 to N, could be in a different language. 1) Form pairs by partnering addends of N+1. 2) Ask participants to divide their number by X (X=number of teams needed). Team up by <u>remainders.</u>

Divide each table of four into quadrants. Participants move to a new team, but same quadrant.

For the chapter when you are going to do the Coordinate/Algebra/Function Walk, place the coordinate grid in the classroom and figure out the points for each desk/seat. Write each coordinate on index cards. The participants find their seat by location of their point.

Get Creative. Try to make the sorting related to activities or ideas you are going to use that day. Like using the Linear Equation sort when the Chapter focuses on linear equations.

Grouping Ideas for Algebra 2

General ideas to form teams: Use cards, cubes, count off. Line up by age, height, shoe size, birth date (without talking!); alpha by college, name or birthday; numerically by number of years teaching, teaching CPM, or out of college.

Yarn, by lengths or colors. Pre sharpened pencils, 4 of each size.

Have cards with a sequence of numbers. Form teams by same common differences or same ratios.
i.e., 2,4,6,8... -5,-3,-1,1... 3,5,7,9... all have differences of 2

Have phrases where multipliers are equal.
i.e. 30% discount, a decrease of 30%, multiplier of 0.7, a loss of 30%

Families of graphs. Put the parent graph on the table. Everyone gets a family graph to match to the parent.

Fraction buster equations. Cards match up by same common denominator.

Polynomial Equations or Imaginary numbers. Each table ends up with one complete set; i, -i, 1, -1.
(i.e., i^{23}, i^{141}, i^{99}. . . . .)

Give students degree and radian measures which they have to match up to make a team.

The table has a card with a right triangle and one other angle measure. Participants are given trig values to match up with correct triangle. Use inverse functions also.
i.e., Angle=36°. Cards have tan x = .727, sin x = .588, cos x = .809

Different colors of ice cream cones or colored paper cut like scoops of ice cream.

Equations for conics, sets of data whose mean equals number on the table...