



Rocket Math[®]

Directions

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Rocket Math[®]

Teacher Directions: Prologue

There are a lot of things that are REALLY hard to do. Take, for example, brain surgery...REALLY hard...dealing with a two-year-old child...H-A-R-D. (Writing copy for directions to math facts programs...we just found out...REALLY quite hard.) However, getting students to be fluent with math facts using a smart program (You are holding one in your hands!)...not so hard. Just stick with us through these directions and you will be amazed! We kinda even promise.

So, you've gone and bought this program to help you teach math facts to students. If you haven't been to one of our trainings you'll need to read through these directions. If you went to a training and you think you have missed or forgotten some of the details, you are probably right. In that case, you may need to read through these directions. Also, we think they are sort of fun to read. We had fun writing them. The 74 family members that we inflicted them upon told us that they were good. We know they were our family, but they are usually brutally honest. So see? You have three good reasons to read these directions. On the next page is the table of contents (organized as FAQs) in case you want to skip to a specific question you want answered. That is OK, BUT (BIG BUT) we think you should read and understand all of the directions. They are all important in order to help your students master their math facts. Besides, we worked really hard on them. But after you have read the directions, started organizing this, and then realize you've forgotten something, we're hoping the FAQs will help you find the information quicker.



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What is the overview of how Rocket Math® runs?

Please, please, please DO NOT attempt to run the program after reading only this overview. It would not be a good thing. Someone could get hurt. OK, so not really, but it really isn't a good idea. Trust us on this one!

Start with initial assessments

1. Administer the one-minute Writing Speed Test.
2. Use the Goal sheet to select goals for each student based on writing speed.
3. Begin the whole class at Set A or administer the Placement Probes.

Set in Place the daily routine

1. Each student has the lettered sheet on which they're working.
2. Each student has an answer key packet.
3. Students practice in pairs for two to three minutes each.
 - a) Student says the facts and the answers around the outside of the sheet.
 - b) Partner with answer key fixes up hesitations and errors.
 - c) After two to three minutes the students switch roles.
4. Students record their goal for the one-minute timing test inside the box.
5. One-minute timing test inside the box is administered to the whole class.
6. All students record the date for this try on the Rocket Chart.
7. Students who pass — meet or beat their goal (previous high score):
 - a) Turn in test sheet to the teacher for checking
 - b) Move on to a new practice/test sheet the next day
 - c) Are recognized in some way
8. Student who do not pass:
 - a) Take home the current sheet for homework practice
 - b) Work on the same practice/test sheet again the next day.

Routine for weekly two-minute timing

1. Administer the same two-minute timing to all students working in an operation.
2. Teacher times for two minutes
3. Students correct each others' two-minute timings.
4. Teacher monitors students charting their scores on the Individual Student Graph.
5. Teacher recognizes anyone who beats their previous best score.



What is automaticity with math facts?

Automaticity is the third stage of learning. (Buckle up. We need to review a bit of Ed. Theory here. Ed who? No, Education Theory. Don't worry, it won't be painful and it is really quite smart and interesting.) First we learn facts to the level of accuracy — we can do them correctly if we take our time and concentrate. Next, if we continue practicing, we can develop fluency. Then we can go quickly without making mistakes. Finally, after fluency, if we keep practicing we can develop automaticity. Automaticity is when we can go quickly without errors and without much conscious attention. We can perform other tasks at the same time and still perform quickly and accurately. Automaticity with math facts means we can answer any math fact instantly and without having to stop and think about it. In fact, one good description of automaticity is that it is “obligatory” — you can't help but do it. Students who are

automatic in decoding can't help but read a word if you hold it up in front of them. Similarly students who are automatic with their math facts can't help but think of the answer to a math fact when they say the problem to themselves. (See, that didn't hurt much huh?)

Why is automaticity in math facts important?

Automaticity with math facts is important because the whole point of learning math facts is to use them in the service of higher and more complex math problems. We want students to be thinking about the complex process, the problem-solving or the multi-step algorithm they are learning — not having to stop and ponder the answer to simple math facts. (Taking off their shoes and socks to count toes is a good indication that perhaps automaticity is not present!) So not only do we want them accurate and fast (fluent) but we also want them to be thinking about other things at the same time (automaticity). One characteristic of students who lack automaticity in math facts is that their math work is full of simple, easy-to-fix errors. We used to call these “careless errors.” But these errors stem from not knowing math facts to automaticity — the student can either focus on getting the facts correct or on getting the procedures correct — but cannot focus on both at the same time. So helping students learn math facts to automaticity will improve their ability to learn and retain higher order math skills—because they won't be distracted by trying to remember math facts.



Just what do I have to copy?

The first question most teachers ask us is about what they have to copy, so we'll deal with that first. And no, the copyright police will not come and get you. These are blackline masters and you may copy them forever. You must copy three things which you need to staple into or onto each child's folder (yes, a folder for each child!). So you have to copy enough for your class.

1. **The Rocket Chart,**
2. **The Goal Sheet,** and
3. **The Individual Student Graph**

You also have to copy but keep it loose in the folder:

4. **The Writing Speed Test**

You may need to copy one other thing to put into everyone's folder, if you plan to use it:

5. **The Placement Probes** for the operation you are starting. How you decide when to use the Placement Probes and when not to can be found in the section on "Why would I want to give the Placement Probes?" (How is that for clear?))

The first four things are found at the end of these teacher directions. The fifth thing (the Placement Probes) are found at the start of each operation.



Just what do I have to set up?

You have a week or two to get this ready, but don't put it off. You get to go to the office supply store. Yeah! We know teachers' affinity for those. We love them too!

You are also going to need to have files (hanging files are highly recommended...yes we know your school does not stock these, ours didn't either!) for each set (marked by letters) and each progress monitoring test (marked by numbers) in the operation with which you are starting. OK, we can hear you asking, "But how do I know which operation to begin with?" We'll get to that in just a bit. If you can't wait, just jump ahead to the section entitled, "What operation do I begin with?"

THE MATH FACTS CRATE

You're going to need a place to put your hanging files, probably one of those plastic crates (and no your school doesn't stock these, ours didn't either...). *[If the office supply store is not a fun option for you we do sell a crate and hanging files on the rocketmath.com website to be shipped to you.]* If you teach a grade over second, you're going to want to have the files somewhere the students can get to them easily—so they can get their own replacement sheets. (Scary thought: you may end up having more than one of these as your students move on to other operations!) In your crate you'll need a hanging file for each set of facts (marked by letters) and each progress monitoring test (AKA "The two-minute test") (marked by numbers).



Get The Crate Started Now



Q: How many copies should I put into each folder?

A: At least enough for your whole class. Plan on keeping 25 or 30 copies in each file, so you'll always be ready for the program to run. Don't make too much more than that, as you don't know how many times your students will need to repeat each set, so you can't predict how many they will need. Plus, the office will get mad at you for running two hundred copies of 30 sheets (and using up a whole box of paper—6,000 pages or 12 reams!...We speak from experience. Our schools got mad at us!)



What operation do I begin with?

Here is our basic recommendation:

Grade 1	Addition
Grade 2	Addition , then when addition is fluent—subtraction
Grade 3	Multiplication
Grade 4 and up	Multiplication , then when it is fluent—division.

Yes, even for those poor kids who are still adding and subtracting on their fingers in the upper grades!

Why? See below in “Why do multiplication facts have priority in 4th grade and up?”

Please don't start children on subtraction facts until you are certain that addition facts have been mastered. Use the placement tests to see whether or not they are fluent with addition, or where to begin in addition. “What's fluent?” you ask. See the section entitled “What is fluent performance on math facts?” Sorry you asked? Then after they are fluent with addition, and you know they are fluent, you can begin with subtraction.

Why? The two operations of addition and subtraction are very similar—being just the reverse of each other. Because of their similarity, a person trying to memorize some subtraction facts before the addition facts have been firmly committed to memory, will experience *proactive* and *retroactive* inhibition. Those are fancy psychological terms for confusion—but a special kind of confusion. “There are special kinds of confusion?” you ask. Why, yes there are. This special kind of confusion occurs whenever a person begins to try to learn something that is too similar to something the person is still in the process of learning. The new information conflicts with the recently-not-quite learned information and vice versa and...VIOLA ... confusion!

Please don't start children with division facts (this may sound familiar!) until you are certain that multiplication facts have been mastered. Yep... confusion! Use the placement tests to see whether or not they are fluent with multiplication, or where they should begin memorizing multiplication facts. Then, after they are fluent with multiplication, and you know they are fluent, you can begin with division. The reasons are the same as for addition and subtraction above.

When are students ready to begin fact memorization in an operation?

When they “understand the concept” of the operation. “And how does one know that?” you might be asking. Well, we're going to tell you. Drum roll, please.

Children “understand” an operation when they are able to compute or figure out any fact in the operation. They can use their fingers to figure out the addition and subtraction facts. Or they can use successive addition to figure out the multiplication facts. Or they can use manipulative and get the right answer. Or they can draw lines, or horses, or dots, or cookies (we've seen it all) and get the answer. Somehow, some way, given any fact in the operation, and unlimited time, the child can figure out the answer. Then the child is ready to begin memorizing.



What if I prefer to teach in fact families? Is that wrong?

Fact families are sets of facts that are all related such as $2+3$, $3+2$, $5-3$, and $5-2$. Teaching in fact families is absolutely not a problem, and certainly not wrong. However, these materials are set up to teach operations separately. You'd need different worksheets than you have and a different sequence for memorization. These won't help you. Find a fact practice program that practices by families — preferably one that teaches only one family at a time.

Why do multiplication facts have priority in fourth grade and up?

Are we sure? Yes, we're sure. "But," you say, "my students are still counting addition and subtraction on their fingers." We know. And we are still sure — fourth grade and up — multiplication.

Why? Once children are in fourth grade it is critical that teachers make sure they memorize multiplication facts — primarily because you can't be sure of how much help they will get later to learn the math facts. Sadly, the students may only learn one operation to fluency. If so, multiplication facts have priority over addition and subtraction. Besides complex multiplication and division, the multiplication facts are needed for success in fractions and ratios. Students have to immediately see the relationships between numbers in order to understand topics like equivalent fractions, reducing fractions, combining unlike fractions, as well as ratios. Let's be honest here...those are the things that state tests LOVE to ask about.

If you have the students for long enough (at least one year) you may find that they finish and have mastered both multiplication and division facts. Then you can go back and have them learn addition and subtraction facts as well. Don't get us wrong — we know that addition and subtraction facts are VERY IMPORTANT — it's just that multiplication is MORE IMPORTANT.



How fast is fast enough in answering math facts problems?

Given a problem that the student reads either silently or orally, after reading the problem, the answer should come nearly instantly — less than a one second delay. (If you know something well, you don't have to stop and think about it. For example, if someone asks you your name, you can answer without any delay. Same thing here.) In a one-minute timing of math facts, fluent performance is answering **40 problems per minute**. This is true for answering orally (just saying the answers, not the problems and the answers). Children who are fluent can say the answers to 40 fact problems in one minute. This is also true for answering in writing — if the students can write fast enough to write the answers to 40 problems in a minute. See below for an exception for students who can write faster than is needed to answer 40 problems in a minute.

What about students who can't write the answers to 40 problems per minute?

This is a great question. We are very very impressed and glad you asked!

For less than fluent writers *their goal is to write as many answers as they can write in one minute*. See the information about the Writing Speed Test for details of how their goal would be adjusted down from 40 problems per minute. Their goal will be to answer as fast as their little fingers can write! We do not want children to be hesitant, or have to stop to figure out math facts. We want them automatic, with as little thought required as possible. We definitely do not want them counting on their fingers. Allow us to repeat ourselves here...**NO FINGER COUNTING!**



What has to be ready for me to start?

You need to have a folder for every student. On the front of the folder you'll have stapled the Rocket Chart — that's how you'll keep track of what lettered set each student is practicing. On the inside left you'll have stapled their Goal Sheet — so you know how many problems they have to answer in one minute to pass. And on the inside right you'll have the Individual Student Graph for progress monitoring — so you know if they are getting better at answering math facts in that operation. In each child's folder you'll have the Writing Speed Test, ready for them to take. If you choose to use it, you will also have the Placement Probes — which are found at the start of each operation. (Remember, if you just can't wait to find out how that works, you can skip ahead to the section entitled, "Why would I want to give the Placement Probes?").

★☆☆☆ **Stop & Make Folders Now** ★☆☆☆

Now the papers are ready, but **you** are *not ready* — because you haven't read the rest of the directions thoroughly. Just take a moment here to recognize how much fun you have had reading these directions up to this point. Imagine what fun lies ahead! Hmm... You still need to learn about what you need to do and more importantly why you need to do it.

The **students** aren't ready because they need to learn how to participate in the program. They need to learn how to work as partners, how to practice the math facts with a partner and how to give corrective feedback to their partner. Just as important: the children need to learn why cheating isn't smart and why and how they will want to practice at home too. And we want you to know how to do all this in a very smart way. (So, if you were hoping you were almost done reading these directions, *you're not*. You may want to go get a fresh cup of coffee or a sandwich. We've got a ways to go!)



Why do I have to give a Writing Speed Test?

We have found that many children are not able to write the answers to 40 problems in one minute. They can orally say the answers to that many problems, but they can't write that fast. In grades one and two it may be nothing more than an "inexperienced little hands" problem. In other grades handwriting speed is dependent on other variables.

When they learn their facts, but cannot pass a test, due to slow writing, we see much weeping, gnashing of teeth and pulling of hair. (And that's just the teacher.) Suffice it to say, it's not a pretty sight. So we want to establish goals for all students that are no faster than they can write. To do that we have to find out how fast they can write. That's why we have to give the Writing Speed Test.

How do I give the Writing Speed Test?

You might want to find a copy of the Writing Speed Test to look at while reading this section. It is located at the end of these Teacher Directions. Go ahead. We'll wait for you. (We are drumming our fingers on our desk.) Ready? OK.

The children are going to write in each box the number they see up in the corner of the box. They look at the number and write it. That's just how fast they should be with the math facts — just look at the fact and write the answer without hesitation. However many boxes they can write the numbers for in one minute determines the number of problems they can be expected to write the answers for in one minute. This sets their goal. Whew! That was hard to write! We are OK. Keep reading.

When you give the test, make sure all students are situated with their papers out, names on them and their pencil at the ready. Tell students to hold their pencil up (yes, in the air!) when they are ready. (This is a really cool technique to use for all timings. If students are holding their pencils at the ready and in the air, nobody can be cheating by starting early. Also, in this way you can look out over the masses and easily tell when everyone is set and ready to go.) The directions for the Writing Speed Test are on the test sheet. Read these aloud. Do not allow any students to start ahead of time as this will invalidate their score. Have the students write in the boxes as fast as they can for one minute. Then they can put the tests back into their folders, and turn in their folders. You will be taking the information from the test and putting it onto the Goal Sheet.



What do I do with the Goal Sheet?

If you recall from the section “What has to be ready for me to start?” we mentioned stapling a Goal Sheet inside each child’s folder (on the left). We also mentioned that you can find that Goal Sheet at the end of these directions. Don’t remember that? It’s OK, we just told you again. Take a peek at a Goal Sheet while we explain its purpose and use. If you don’t already have copies of the Goal Sheet stapled into each kid’s folder—stop right now and do that. Now? Yes, now!

★★★ Stop & Make Folders Now ★★★

It would be really great if we didn’t have to say that again!

What is the purpose of the Goal Sheet? Its purpose is to keep track of each child’s goal for passing the One-Minute Daily Test. Their goal is to write the answers to math facts as fast as they can — without any hesitation. The number of numerals they can write in one minute is the upper limit on their performance — so we set that as the goal. The Goal Sheet also tells you what the goal is for each student for two other purposes, (1) the Placement Probes and (2) the annual goals, but we’ll talk about those later. Just don’t lose those Goal Sheets.

Once you have their Writing Speed Test in hand, you can see how many boxes they filled in in one minute. Circle that entire row. The second column from the right labeled “One-Minute Daily Test” gives you their goal for the One-Minute Daily Test. (You may have noticed that it is the same as the number of boxes filled. Don’t tell anyone, as we would like this to appear as complicated, esoteric, and sophisticated as possible.) Please write that on the line for “One-Minute Daily Test” — the line located at the bottom of the Goal Sheet. Then each day, when students take the “One-Minute Daily Test,” as long they meet or beat their goal, they pass that set. Some kids will have a lower goal than others, but each child passes when he/she meets or beats their individualized goal. Cool, huh? We think so too.



What do I do about the students who are very fast writers?

Please note: *There is a special exception for students who are such fast writers that they have goals OVER 40 in a minute. On the bottom of the Goal Sheet, please notice the exception for fast writers. Students who have goals over 40 should try to meet those goals, but only for up to six days. As long as they are answering over 40 problems per minute without errors, they should be passed after six days. It is nice for those who can write faster to have higher goals, but we don't want it to slow them down too much.*

What do I do about the students who are very slow writers?

Students who copied fewer than 18 boxes in the Writing Speed Test may not have understood the task and should be re-tested and more closely monitored. If, in fact, they are not capable of writing any quicker they need to learn how to write numerals faster before they begin this **Rocket Math®**. Students who write this slowly (fewer than 18 boxes in one minute) may not be able to complete enough problems in the time allowed to benefit from the practice; nor will they be able to really demonstrate fluency in memorizing the facts. These students should be placed in *Rocket Writing for Numerals* to structure their practice in writing the numerals 0-9 until they are fluent. This program uses the same daily routine of practice as the **Rocket Math®** program, where students practice for a few minutes and then take a timed test. Later, you can retest them on the Writing Speed Test and place them into **Rocket Math®**.

Do their goals ever go up as they get faster at writing numerals?

Yes. The number you circled is only the starting point. As children write faster and do more on a "One-Minute Daily Test," cross out their old goal and make their new record score their goal.

For example: Think of a child, Joe, who has a goal of 28. One day Joe writes the answers to 30 problems in one minute. Now we know Joe can write faster than 28 and so his goal goes up to 30. Joe passes today, and tomorrow he has to do just as well, write the answers to 30 problems, to pass the next sheet. Get it? If you don't, read this paragraph again. It really does make sense.

Each time students demonstrate the ability to write the answers to more facts in one minute, their goal goes up accordingly. This can be very motivating for students. Celebrate with students as they improve.

However, you can postpone raising the goals if you have reason to believe that the student will not be able to write that fast again. Keep an eye on that student and raise their goals to match their writing speed when they are ready. Raising the goals is important to do eventually — so that children are not allowed to pass sets of facts on which they are hesitant. If a child has low goals, but actually can write much faster, then the child could be hesitant on some of the facts and still meet their goals. This results in students back where you started — not automatic. Children who pass several sets of facts in which they are hesitant, will reach a point where the number of facts on which they are hesitant are too many to learn. Then they become stuck and can't and won't progress up the Rocket Chart. Then, guess who's crying? Yep...the teacher...No, we're kidding. Students don't like to "hit the wall." It is great that they want to succeed. Just be sure that you are monitoring the goals. Make sure they are as high as they should be at all times and you will prevent the aforementioned wall hitting situation.

Please note: *Don't forget the exception on the Goal Sheet for students with goals over 40. Students who have goals over 40 should try to meet those goals, but only for up to six days. As long as they are over 40 without errors, they should be passed after six days.*



Why would I want to give the Placement Probes?

You want to give the Placement Probes if you think there is a chance that some of your students have already memorized some of the facts in the operation in which you are about to have them start. For example, a second grade teacher might suspect (or hope!) that some of her students have learned some of the addition facts in first grade. She wants them fluent on all the addition facts before beginning them on subtraction. (That doesn't ring a bell? Go back and read the section, "*When are students ready to begin fact memorization in an operation?*") If some of the children have memorized some of the addition facts already, they can skip some of the sets of addition facts. After the teacher finishes doing her "happy dance," she/he will realize that this will save time and allow the students to move along faster. The teacher would want to use the Placement Probes to see who can skip some sets of facts.

These placement tests are optional however. The alternative is to have all your students start at the beginning with Set A. We would not recommend using the "placement" test in situations where few of the students have had opportunities to practice memorization of math facts, or to practice memorization of the facts within the operation in which you are beginning. Starting children at the beginning of the operation will not slow them down much. When children already know some facts, they will usually pass those sheets on the first try. Children who are moving along, passing one sheet a day, soon find themselves on sheets that require some study.

For example, a first grade teacher beginning math facts memorization for the first time would not need to use the Placement Probes because those students are completely new to the idea of memorizing math facts. So you want to give the Placement Probes if you think some students may **not** need to start at the beginning of the operation — and you are in a hurry to move them along. Students who are not tested and start at the beginning of an operation in which they know some of the facts will master each sheet in a day and quickly move up to the set on which they need to work. So if you can afford a few days it would be a good idea to skip the Placement Probes and start all your students at the beginning. We have done it both ways and we recommend this strategy if possible.

How do I use the Placement Probes?

Each of the Placement Probes is a mini-test (15 seconds in length...Yes, you read that right. 15 seconds!) of a part of each operation. The Placement Probes for each operation can be found at the beginning of each operation. There are four probes for each operation. This means that each operation has only four places in which you can start the students.

The Placement Probes will help you place students beyond the beginning of the sequence of facts. This would be a good thing, no? Students who do not pass the first test in an operation would begin at Set A in the beginning of the operation. For each mini-test that a student passes the student is able to skip practicing those sets.

It is especially imperative that students do not begin writing on the placement tests until you say "Go" and that they discontinue writing answers immediately upon "Stop." (We believe this is true of ALL timings, but especially the placement test timings.) If you cannot get your students to abide by the starting and stopping times, the scores will be useless and the placement will be incorrect. If you have this problem (students starting early or continuing to mark answers after time is up) then these students (or all students) will need to either start at Set A, or be tested in small groups where compliance with the time restraints can be assured.

Because the tests are so short, there is not much time for frustration. Therefore it is OK to have everyone try all parts and then score them later. *You could have students exchange papers and grade them in class if you are feeling especially lucky that day.*



What is passing for a Placement Probe?

If your next question is “What is passing for a Placement Probe?” you are definitely smart! The criteria are easy to remember if you keep in mind the point of the Placement Probes. For each Placement Probe you’re trying to see if a child is so good at those facts that he or she really has no need to even practice them. So they have to be really good and really fast! For example, you would not want to pass any student who skipped any problems in the Placement Probe—because that indicates they don’t know that fact easily. They really ought to have a bit more practice. And of course, if there are ANY errors in that set, the student does not pass the set and begins at the beginning of that set.

So, no skipping and no errors allowed. What else? Oh yeah, the students have to write answers as fast their little fingers can write. The students have to meet or beat their goal (established on the Writing Speed Test) for the Placement Probe.

What is the student’s goal for a Placement Probe? You have to go back to the Goal Sheet that you completed after the children did the Writing Speed Test. You found the number of boxes each child filled in during the test and you circled that row. Then you stapled the Goal Sheet into that child’s personal **Rocket Math®** folder. If this hasn’t happened yet, you’ll have to give the Writing Speed Test and complete the Goal Sheet before you can evaluate the Placement Probes.

★★★ **Stop & Put In Goal Sheets** ★★★

Now check the second column from the left on the Goal Sheet. You will find the 15-second Placement Probe goals, based on the student’s individual writing speed. On each child’s Goal Sheet, a certain row is circled or highlighted based on the number of boxes that child filled in during the Writing Speed Test. So the goal for that student’s Placement Probe is the number in the Placement Probe column in the row that is circled. Nice, huh? We think so too.

A student who meets his/her goal for a 15-second timing on each part (Sets A– F, G– L, etc.) passes that portion of the sequence. They are assumed to have memorized those facts fluently.

Even if you choose to start all students at Set A, you would still need to have students complete the Writing Speed Test. That information is still needed in order to set appropriate goals for the timings, but everyone could start instruction together on the same set.

WARNING!

Be aware of any students who do not pass a timing within the first week. Such students should either be moved back to a lower part of the sequence or have a re-test of their writing speed and their goals adjusted if warranted.



Are the practice facts going around the outside different from the test?

The practice facts around the outside of sheets are designed to provide practice which is concentrated on the most recently introduced facts. This is smart and makes sense, right? Learners need more practice on the newer material. This practice should take place for about two to three minutes for each student.

The first four facts on the top row of the outside practice area are the four “new” facts that are being introduced on this page. Students should be able to figure out the correct answer to the “new” facts before beginning practice. Tell students, “If you have a new sheet today, before you begin practice you **MUST** figure out the answer to the four facts at the top of the page!” The practice facts function the same way as practice with flashcards.



How should the students practice with each other?

- One student has a copy of the PRACTICE answer key and functions as the checker while the practicing student has the problems without answers. The practicing student *reads the problems aloud and says the answers aloud*. It is critical for students to say the problems aloud before saying the answer so the whole thing, problem and answer, are memorized together. We want students to have said the whole problem and answer together so often that when they say the problem to themselves the answer pops into mind, unbidden. (Unbidden? Yes, unbidden. We just kinda like that word and since we are writing this, we get to use it.)
- A master PRACTICE answer key is provided—be sure to copy it on a distinctive color of paper to assist in classroom monitoring. The distinctive color is important for teacher monitoring. If you are ready to begin testing and you see hot pink paper on a desk, you know someone has answers in front of him/her. When you make these distinctively colored (there, I said it again) copies, be sure to copy all of the answer sheets needed for a given operation and staple them into a booklet format...one for each student who is working in that operation. For some reason (we actually know the reason) teachers always want to find a way to put the answer keys permanently into the students' folders. DON'T. Students need to be able to hold these in their hot little hands, outside of their folders. Then answer keys will be the same regardless of the set of facts on which a student is working. So students working on multiplication will have the answers to ALL the practice sets for multiplication. This allows students from different levels to work together without having to hunt up different answer keys.
- The checker watches the PRACTICE answer key and listens for hesitations or mistakes. If the practicing student hesitates even slightly before saying the answer, the checker should immediately do the correction procedure, explained below. (Let's stop here. This is critical. Critical, we tell ya. This correcting hesitations thing is sooooo important. We mean **really important**. You can probably guess why. We need students to be able to say the answer to these problems without missing a beat — not even half a beat. So students must be taught that there is no hesitation allowed. Really.) Of course, if the practicing student makes a mistake, the checker should do the correction procedure.
- **The correction procedure has three steps:**
 - 1) The checker interrupts and immediately gives the correct answer.
 - 2) The checker asks the practicing student to repeat the fact and the correct answer at least once and maybe twice or three times. (We vote for three times in a row.)
 - 3) The checker has the practicing student backup three problems and begin again from there. If there is still any hesitation or an error, the correction procedure is repeated. Here are two scenarios:

Scenario One

Student A: "Five times four is eighteen."

Checker: "Five time fours is twenty. You say it."

Student A: "Five times four is twenty. Five times four is twenty. Five times four is twenty."

Checker: "Yes! Back up three problems."

Student A: (Goes back three problems and continues on their merry way.)



Scenario Two

Student A: "Five times four is ... uhh...twenty."

Checker: "Five times four is twenty. You say it."

Student A: "Five times four is twenty. Five times four is twenty. Five times four is twenty."

Checker: "Yes! Back up three problems."

Student A: (Goes back three problems and continues on their merry [there is a lot of merriment in this program.] way.)

- This correction procedure is the key to two important aspects of practice. One, it ensures that students are reminded of the correct answers so they can retrieve them from memory rather than having to figure them out. (We know they can do that, but they will never develop fluency if they continue to have to "figure out" facts.) Two, this correction procedure focuses extra practice on any facts that are still weak.
- **Please Note:** If a hesitation or error is made on one of the first three problems on the sheet, the checker should still have the student back up three problems. This should not be a problem because the practice problems go in a never-ending circle around the outside of the sheet. Aha...the purpose for the circle reveals itself!
- Each student practices a minimum of two minutes. The teacher is timing this practice with a stopwatch... no, for real, time it! After a couple of weeks of good "on-task" behavior you can "reluctantly" allow more time, say two and a half minutes. Later, if students stay on task you can allow them up to about three minutes each. Make 'em beg! If you play your cards right (be dramatic), you can get your students to beg you for more time to practice their math facts. We kid you not. We've seen it all over the country...really!
- After the first student practices, students switch roles and the second student practices for the same amount of time. It is more important to keep to a set amount of time than for students to all finish once around.

It is not necessary for students to be on the same set or even on the same operation, as long as answer keys are provided for all checkers. If students have the answer packet that goes with the operation they are practicing and their partner is on a different operation, they simply hand their answer packet to their partner to use for checking. We know what you are thinking. Yes, we realize that "simply handing" something between students is often fraught with danger. We were teachers too. All of the parts of the practice procedure will need to be practiced with close teacher monitoring several (hundreds of) times prior to beginning the program. Not really "hundreds," but if you want this to go smoothly, as with anything in your classroom, you will need to TEACH and PRACTICE the procedural component of this program to near mastery. Keep reading. We will tell you HOW to do this practice. (We are VERY directive.)

- The practicing student should say both the problem and the answer **every time**. This is important because we all remember in verbal chains.
- Saying the facts in a consistent direction helps learn the reverses such as $3 + 6 = 9$ and $6 + 3 = 9$.
- To help kids with A.D.D. (and their friends) the teacher can make practice into a sprint-like task. "If you can finish once around the outside, start a new lap at the top and raise your fist in celebration!" Recognize these students as they start a second "lap" either with their name on the board or oral recognition — "Jeremy's the first one to get to his second lap. Oh, look at that, Mary and Susie are both on their second laps. Stop everyone, time is up. Now switch roles and raise your hand when you and your partner are ready to begin practicing."



How do I get my students to practice math facts the right way?

Here's how to teach students how to do this kind of practice—and get them to comply with the procedures as well.

- Model how to do this in front of the whole class.
- Put the correction procedures on an overhead or poster and go over them verbally.
- Explain what a “hesitation” is. (It is two or more seconds of nothingness before saying the answer to a fact. Students don't have to count two seconds. They just need to know what it “feels” like. You will model the heck out of that later. Keep reading.)
- At first you should be the checker with a student from the class making pretend mistakes, and you tell students the three steps to the correction procedure as you model it.
- Next, you take the student role and call on students to be the checker. Make both hesitations and answer errors. Make sure the student corrects with all three steps of the correction. If they don't do part of it, prompt it until they do, then give more hesitations or mistakes for that student to get to demonstrate the correction procedure the right way.
- Once a student has demonstrated the right procedure for corrections, move on to another student.

Keep this up for the usual five to seven minutes allotted for math facts, moving from child to child having them demonstrate the correction procedure. Don't begin the program of students working with students yet. If you do this kind of modeling for a few minutes a day for several days, students will begin to ask you if they can start doing the practice now. OK. Here comes something really cool. Ready? Try telling them that doing practice “the right way” is really “hard” and you're not sure they can do it “the right way” yet. Continue modeling for a few minutes a day for a few more days—not letting students actually start practicing. (Think, “Keep Away.” You know how badly kids want the ball when they play that game? Same deal here. There are actually few things as satisfying to a teacher as having students ask you to “LET” them do work. Ya gotta love that!) By the time you actually “allow” them to practice—they'll be so anxious to prove to you that they know how to do practice “the right way” that no one will even consider doing it any other way. So around day three of practice it might look something like this:

Teacher: *“Let's do the pretend practice again.”*

Student Z: *“Umm, Mrs. Smith, can we please do this on our own? We know how to do it.”*

Teacher: *“Well, I know some college kids who can't do this right. It's really hard. I'm not sure that we are ready. Let's practice a few more days.”*

If you do this for two more days after the students start asking to work without your model, you will see something like you have never seen from your students before. It is a thing of beauty actually.



How can I manage with students at many different levels?

One great thing about **Rocket Math**® is that it follows the same daily routine. Once you establish the daily routine, it will go smoothly and quickly each day. Everyone is doing the same type of activity, even if they are on different sheets. Your job is to establish exactly how to do every part of the activity and help students practice until it becomes routine. The routine goes something like this.

Everyday students get out their **Rocket Math**® folders and pull out the practice sheet for that day. (You will develop a procedure for this.) Of course, you have already stuffed their folders with exactly the right sheet so they don't have to run around trying to find a copy of Set G or whatever they are supposed to be working on. (You will develop a procedure for this.) They move to get with their partner to practice. (You will develop a procedure for this.) Of course, you have already established partners and where they will work. When you say "'B' partners start first today!" they all know who is the "A" partner and who is the "B" partner and they begin practicing immediately. They all say each fact and the answer around the outside as fast as they can go. Their partners correct every hesitation or error. They practice for two minutes until the timer goes off. Then the partners switch roles. The student who was answering takes his partner's answer key and assumes the role of checker. When you say "'A" partners begin, everyone does and another two minutes of practice ensues. Then when the timer goes off at the end of two minutes, you say "Pencils up! We're ready for our timing." Within seconds every pencil is up—poised for the timed test. You say "Begin" and students start writing answers to math facts as quickly as possible on the test which lies inside the practice circle of the sheet. After one minute you say "Time!" and a bunch of children cheer spontaneously because they passed their timing. You collect the folders quickly (Guess what you develop for this?*) and it is all over in minutes.



How do I establish the daily routine so it runs smoothly?

First of all, see the section of these directions entitled, “How do I get my students to practice the right way?” You are going to need to teach your students how to do each part of the daily routine—beginning with how to practice and correct hesitations and ending with the distribution and collection of folders. You are also going to have to be sure you check their papers, fill their folders and keep the crate full of sheets of **Rocket Math**®. The bad news is that you’ll have to organize this all yourself. The good news is that once this is organized and taught as a routine, it will be the best part of the day for both you and the students. We know that this “organization and teaching of the routines” sounds like a no-brainer, but this where we see things go amiss (and awry and asunder too!). When teachers don’t have things set up and organized, don’t have

procedures and routines in place, don’t overtly/directly teach these routines and don’t PRACTICE the routines with their students, it is like watching a car crash. There is nothing one can do to help right then.

You know it could have been prevented. Usually, the damage is repairable. The “fix” is...go back and organize the materials, develop procedures and routines and P-R-A-C-T-I-C-E the routines with the students until they have mastered them.

**You guessed it, a routine procedure!*



How do I know when students are ready to move on to the next set of facts?

After the students practice you give the One-Minute Daily Test — the box in the center of the page. The one-minute timing each day is a little test. If a student passes the “test” he/she has successfully memorized all the facts given so far. Passing means he/she is ready to be given more facts by moving on to the next practice sheet.

If a student does NOT pass the “test” he/she needs more time to practice the facts given so far and should NOT move on to the next practice sheet. A student who does not pass needs to work on the same sheet again tomorrow because he/she did not meet his/her goal. See the section of these directions called, “Shouldn’t my students be practicing math facts at home for homework?”

What does it take for a student to pass a set of facts?

Passing is meeting or exceeding the student’s individualized goal with no errors. We recommend not allowing any errors. It will impact perhaps one out of ten “passes” that would have an error. We know it is simply a result of answering a little too fast, but it is simpler, cleaner and better to have the student re-do that set.

The goal for each student was initially established on the Goal Sheet. If a student exceeds that goal on any timing, the new “high score” becomes the goal. An exception should be made if you have reason to think the student may not be able to keep up that rate. In that case, wait until the student shows the ability to meet the new higher goal on two or three sets in a row before increasing the goal. The student should meet or beat their goal (their previous best) in order to pass.

If students stop before the end of the 1 minute timing to avoid having their goal move upwards, move it up at least one problem anyway. Or you could have the student stay after class with you and do the test again while you watch to make sure they don’t stop. Starting the program out by recognizing students whose goals have gone up is the best way to keep students moving ahead.

What does it take for a student to pass an operation?

Students pass an operation, such as addition or multiplication, when they complete Set Z in the operation. Working through the 26 levels of an operation is enough practice. The last set or sets of each operation are mixed facts and so ensure that the whole operation has been mastered. The two minute timings are meant as a means to monitor progress, but are not to be used as “final” or “exit” exam where students have to meet a certain level to pass the operation. Getting through Set Z is enough.



Shouldn't my students be practicing math facts for homework?

Homework is highly recommended—after students have learned how to practice. Any day that a student does not pass a set, we recommend requiring the student to take home the sheet they did not pass and practice the facts around the outside to improve their speed. At-home practice should be orally reciting the facts and the answers in the same manner as outlined in paired oral practice above. Once students have learned how to do that practice at school, they should be ready to show someone at home how to help them in the same way. Very few minutes a day are all that would be required to make a big difference in student success. A sample parent letter, explaining the way to practice and the reasons for practicing can be found at the end of the Teacher Directions.



How do I conduct the One-Minute Daily Test?

After the practice time, the One-Minute Daily Test should be conducted, either immediately or after a delay. If there is a delay it will be harder for students to pass, but they will know their facts better when they do pass. It is also possible to do two practice sessions at different times during the day, but still do only one test per day. Each student should enter their goal at the bottom of their practice sheet before beginning the timing.

Have students hold their pencils up in the air when they are ready to start. Wait until all the pencils are in the air before you say to begin. If your clock has a second hand visible to all the children, you can tell them they may begin when the second hand reaches the 12—that way all eyes are on the clock rather than on their paper. You time while students write. At the end, collect the folders (along with the test papers) of *only* those children who claimed to have passed. You will have to check the tests for accuracy—but only the papers of the students who claim to have passed. If they know they did not pass (because they didn't complete enough problems to have passed...after all, they know their goal) then you don't have to check their paper until they do. (Yipppeee!!!)

Typically teachers hand back the folders the next day with the next set of pages to practice on, unless the student did not actually pass.

All students will need a new practice sheet for the following day. Students who passed their timings get the next set of facts in alphabetic sequence and students who did not pass get a clean copy of the same letter as before.

There are various ways to handle the distribution of sheets. At a minimum, you will need to create a set of lettered file folders so that the appropriate sheets can be organized and accessed. Remember the crate? Children can learn to get the next sheet on their own some time during the day. Often we see teachers have kids get the appropriate sheet on their way into the room in the morning. This becomes part of the morning routine. For students in Middle or High School, students can retrieve the appropriate sheet on their way into math class. Cooperative groups could send a representative up to collect sheets for the group. If you have some adult help, that person could put the appropriate sheets in each child's folder. You might also have a student monitor do that.

Beacuse most students will take a few tries before completing sheets you might reduce the traffic going to the files by having students collect 4, 5 or 6 copies of the page the first time. You could have 4-6 copies of the same set stapled together. Then if a student does not pass the one-minute timing they would not have to go to the crate to get a sheet. They would just turn to the next, clean copy. If students don't use all of them, the clean sheets are still usable by another student. *Remove the staple and recycle!* You can do the same thing if you must fill the folders.



How do I keep track of which set each student should be practicing?

That's where the Rocket Chart comes in! I bet you thought we had forgotten about the Rocket Chart you stapled on the front of each student's folder. We didn't. We have this down to a science. Every part is needed and there is no fluff! We are essentially "anti-fluff." OK. We came clean on that one. Now the world knows!

The Rocket Chart for recording progress is included at the end of these directions. Either before or after each timing, when the student "tries" to pass the timing, he or she should enter the date of that try on the Rocket Chart for the set they are working on. This chart should have been stapled on the front side of their **Rocket Math®** folder. (Ha! You thought we were done nagging you about the folders? You were wrong... Sorry.) Please be aware that no one should go past six "tries" without intervention from you. See the section on "What do I do about students who are stuck?"

Whenever any student passes their One-Minute Daily Test they will color in the appropriate square on the Rocket Chart. When a student has passed, the next day the student will begin practice on the next practice sheet. To help increase motivation, be sure to enthusiastically give some special recognition to students who pass their One-Minute Daily Test. Check out the certificates at the end of these directions. We made 'em ourselves and if we thought that you ignored them, we would be so bummed. Find some way to give extra recognition for students' hard work. Having a school administrator come in to distribute these certificates to elementary students is a good idea. Kids love that. This recognition is often more important to the children in the upper elementary grades where they have already struggled for some time. They need a little extra motivation.



What do I do about students who are stuck and don't pass in six tries?

Something is wrong if any student cannot pass a sheet within the six tries shown on the Rocket Chart. Do not allow this condition to persist. Intervene with one of the ideas below.

- If the student has never passed a timing, perhaps the child can't really write that fast. Try testing the student orally with the student telling you the answers. In oral testing the student says only the answers—not the whole problem. If the student can orally answer at least 40 facts in one minute, then the student is satisfactorily fluent with those facts. The handwriting goals must be too high. Reset his/her goals at the previous best and let the student move on to the next set.
- The most frequent reason a student does not progress is because the student does not practice the right way. In other words he/she avoids saying the problems out loud or skips the correction procedure when they are hesitant. Or they will simply go on after a hesitation or error rather than going back three problems and trying again to see if they are faster now. The remedy is for the teacher to practice with these students as recommended and see if that makes a difference. It often does. Let us tell you: This is typically the “magic bullet.” It is fascinating really. Carrying out the practice procedure as we have written it is VERY powerful. We wouldn't lie to you. If the teacher practicing with these students does help, arrange to see that they practice the right way consistently during peer practice. You may have to change partners or watch over them daily until they start practicing the right way. Consider increasing motivation through more rewards and recognition to keep students practicing the right way.
- The student may not be trying because he/she is unmotivated. Watch to see if the student is doing practice correctly or giving the test their best effort. **Most often this is a result of failing to succeed rather than a cause.** (That's really a very important understanding for you to have, so we're going to say it again!) Lack of student motivation is most often a **result** of failing to progress rather than a **cause**. Consider practicing with the student. Think about ways to increase student motivation, including use of student achievement awards and social recognition for success.
- Watch to see that the student is “on-task” throughout the timing. Some students fail to realize that looking up around the room during a timing will slow them down so much they won't pass. (Really, we kid you not. We've seen kids who stopped to check the clock several times during a one minute timing be surprised that they didn't pass!) If a student really cannot stay on task for 60 seconds, you might try cutting the goal and the time in half—give a 30-second timing with a goal cut in half as well. That may do the trick. It is often necessary to point out to younger students that erasing takes too long. Have you ever watched a second grader erase something? One could grow old waiting. Point out to students that perhaps putting a line through a mistake and writing the correct answer would save time.
- If practicing with a student the right way doesn't make a big difference, then the student may be stuck because he/she is “in over his/her head.” The student has officially passed several sets without completely mastering them. This should not happen if students always have to meet or beat their previous best—but sometimes it happens anyway. A sign that this has happened is that they have several facts in the set with which they are hesitant. You can tell just by watching over their shoulder as they complete a timing—there will be hesitation on several of the facts.
- The basic remedy for kids who are stuck is to back up in the alphabet until you find a letter they *can* pass. You can either test back all at once or have the student move back one letter a day until they do pass after one day's practice. Get them a new Rocket Chart to start over. Once you find out where the student is successful, make sure their goals are as fast as they can write—that you're not letting them pass even



though they are hesitant on some facts. If you announce a policy of “six tries and then you have to move back” and you announce this policy ahead of time, fewer students will get to six tries without passing! Being proactive is the key here. It is important to cover all of your bases prior to bad things happening. It is much better to pre-correct for something than to have to go back and re-teach a procedure or try to introduce one when a student is upset and losing motivation.

WARNING!

(Yep, another warning. We are being proactive too!) Do not reduce the criterion to pass each sheet, as that will make it increasingly difficult for the students! They will not be learning each small set as well as they need to and you'll be adding more facts faster than they can handle. The cumulative task will get more and more difficult. Only reduce the criterion if the student simply cannot write that fast—otherwise, they can learn all the facts to the same speed as they learned the first set.



How do I monitor students' progress?

You monitor progress by the two-minute timings. You can find the two-minute timings at the end of each operation. Once a week or once every two weeks (I, of course, suggest every week.) have your students do a two-minute timing of all the facts. (I made the tests so that a good many of the entire world of facts for the given operation are represented. You do not have to figure this out. I wouldn't wish that on you. It was a lot of work to get it just right.) The purpose of these two minute timings is to see if students are improving in their knowledge of the facts. (These timings don't really teach, they just help you monitor progress.) On days when you do a two minute timing, do NOT do the regular practice sheets. (Even I, Dr. Overdo, wouldn't do that.)

Each time the students complete a two-minute timing, they will graph their results on their Individual Student Graph. They graph the number of problems they answered correctly in two minutes. You have to label the vertical axis individually for each student AFTER they complete their first two minute timing. You set the starting point based on the student's first timing. Set the starting point at the nearest ten below the student's score on the student's first two minute timing. For example if the first two minute timing is 37, set the starting line at 30. If the first two minute timing is 14, set the starting line at 10.

As students progress through the program and learn more facts that they know instantaneously, they will be able to answer more within two minutes. In the beginning they will only "know" a few of the facts and will have to figure out as many as they can in two minutes. Eventually some students will instantaneously "know" so many facts that they can answer about 40 per minute, or 80 in two minutes—but only if they can write that quickly. There are enough spaces on the graph for each week in school. Have the students color in the bar with the date closest to the date they took the test.



**How do I prepare for monitoring progress through the
two-minute timings?**

You made the folders that we told you to make, right? You made enough copies of the Individual Student Graph for each student in your class? And you stapled the blank graphs inside each student's folder? Good. Whew, you had us worried there for a second!

There are five two-minute timings (cleverly numbered one through five). Remember, we told you that they were at the end of the operation. Why are there five you ask? Well, we gave you five so you can switch it up and keep students from getting too familiar with the order of the problems. All five tests have exactly the same problems — just in a different order. Make enough copies of one of the five for your whole class. Now you are ready!



How do I give the two-minute progress monitoring tests?

Before you begin, have students look on their Individual Student Graphs and see what their previous best was. Have them write that down as their goal — to meet or beat their previous best. The first day their goal is to do some!

Students should be reminded repeatedly that their goal is simply to improve. You may tell students, “Everyone starts out in different places and we do not want you to compare yourself to anyone else. Just work to get better yourself. Your goal is to meet or beat your previous highest score.” It is good to be overt about this.

It might look something like this:

Teacher: “Students, open to your graph for two-minute timings. Put your finger on the number of facts that you answered correctly last week. Your job today is to try to beat that goal. Even if you only get one more correct this week than you got last week, you will have improved. Everybody, if you get one more than you got last week, will you have done a good job?”

Students “Yes!”

Rinse and repeat. (You may have to do this every week. It is important to keep students motivated on these two-minute timings.) Remind them that they are being tested on some facts that they haven’t even practiced yet, so this is hard and if they beat last week’s score, it is a big, huge, monstrous deal!

Whenever any student beats their previous high score recognize them in some manner and make sure they graph their results.

You can have all students do the same number timing, e.g., Timing 3. This will facilitate correcting their timings as well as refilling their folders. Do not provide a practice time, simply have students get ready by putting their pencils in the air and begin. You time while students write.

Please note: *Students who must answer orally can be paired. One student checks by looking at the answers while the other says the answers. The students then switch roles, while you conduct a second timing for the oral students, the others are correcting.*

At the end of the timing have students exchange papers to correct the timings. If you have students in different operations you will have to copy off the answer keys so that students can correct each other’s timings using their copy of the answer key. If everyone is on the same operation, then you can have them exchange papers and correct after the timing. (A great way to correct is to have the students read all the problems and say the correct answer together. That will give extra practice! Don’t try this if you were at an especially good party the night before or if you have a headache for another reason. Trust us.)

When students have finished correcting, they should enter the date and record their score (the number of problems they answered correctly) on their Individual Student Graph. Then they get to color in the bar up to the level they have achieved. This coloring activity is their reward—don’t skimp on it. This graph should have been stapled on the front side of each student’s folder back when folders were constructed. Steady yourself. Here comes another reminder to recognize the students who beat their previous best! Make sure that this is a big deal for students and worth striving for.



What is the sequence in which the facts are introduced?

Within each operation there is a sequence for introducing and learning the facts. The actual sequence is included on the following pages. *The sequence differs from the usual sequence for several reasons:*

- 1) Facts are introduced at a rate of two facts and their reverses per sheet so that students do not have too many to learn at one time. Most students who fail to learn math facts have been introduced to the facts at too fast a rate. When facts are introduced too quickly, students begin to confuse new facts with previously introduced material. That is another time when proactive and retroactive inhibition develops. Then the student has that special kind of confusion which causes it all to become a blur. Students are confusing new facts with old facts, and fail to learn anymore.
- 2) Some of the “more difficult” facts are introduced about midway during the sequence so that students can get more practice with these facts. Research seems to indicate that the “more difficult” facts are only harder because they are learned late in the sequence and students have more facts with which to become confused.

Conclusion

Well. That’s that. We wanted to write more, but we have told you everything we know about math facts. We have rewritten these directions so many times that we could line all the birdcages in the country. (Don’t worry, we recycled!) We wanted to be really sure that the program was useable—that you use it and that kids benefit, and that perhaps we could change the world. OK. We probably won’t win the Nobel Peace Prize, but we do remain cautiously optimistic. We had this other thought too. What if George Lucas picked up the film rights and...never mind. Use this program as directed. That’s all we can ask. If you teach this program the way we intended and you teach with passion, you WILL change lives. Dramatic? Not really. Now go teach those kids!