

Developing Automaticity with Multiplication Facts in a Fourth Grade Classroom

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### Abstract

This action research study was conducted to investigate the effect math centers might have on students' ability to memorize single digit multiplication facts. Participants in the study included three female and two male students ( $n=5$ ). Students practiced single digit multiplication facts 0 through 9 using various activities in math centers. The activities included computer games, card and dice games, worksheets, flash cards, and timed tests. Students' progress was monitored through a pre/post test, daily one-minute timed test, and weekly two-minute timed tests. Findings indicated that implementing multiplication fact review through the use of math centers did slightly increase fact fluency among the five participants.

## Developing Automaticity with Multiplication Facts in a Fourth Grade Classroom

At the present time, I teach Math, Science, and Social Studies to forty-two fourth grade students at a rural elementary school in central Illinois. I previously taught third grade for four years. Five years ago, the district I work for adopted the Everyday Mathematics series published by the Wright Group. The main focus of the math series is teaching students' problem solving strategies. It focuses very little on teaching students basic multiplication facts and developing their fluency and automaticity with basic math facts.

I have noticed over the past five years that my students' ability to automatically recall basic math facts such as addition and multiplication has significantly declined. This has been a great concern of mine because I believe it will affect their future math performance as the math concepts become more difficult and in depth. Students are spending too much time thinking about and trying to solve basic multiplication facts; for example, they are using multiplication charts and counting on their fingers to solve basic facts. I decided to openly discuss the issue with fellow third and fourth grade teachers to find out if they were having similar concerns regarding the students' lack of automaticity with basic multiplication facts. I discovered the other teachers did share similar concerns about the students' inability to automatically recall basic facts. I began to ponder my concerns and questioned whether daily practice would enhance a students' ability to learn and memorize basic multiplication facts. I believe daily practice with basic multiplication facts using various methods will enhance and increase the students' ability to automatically recall basic multiplication facts.

The purpose of this study is to investigate the effect math centers might have on students' ability to memorize single digit multiplication facts. In order to do this, I conducted math centers for five weeks in my classroom. The math centers consisted of activities that allowed students to

practice and enhance the learning of basic multiplication facts; they also completed a daily one-minute timed test, and a weekly two-minute timed test. The research question that guided this study was: What are the effects of implementing math centers in a fourth grade classroom to facilitate the memorization of multiplication facts?

### Literature Review

#### Cognitive Ability and Anxiety

Memorizing and understanding basic multiplication facts is essential to a student's continued growth in math. Proper training and repetitive practice must occur to ensure a student's success in building fluency and automaticity with math facts. According to Baroody, Bajwa and Eiland (2009), instant recall of basic math facts involves learning the facts in a constructive and meaningful manner. They concluded one should be able to make connections between the math expression and its response. In fact, Caron (2007) affirmed that when automaticity is developed with math facts, it frees up working memory, allowing students to perform more advanced problem solving tasks. He further stated that students need to have a deeper knowledge and comprehension of the multiplication process so they can determine when, where, and how to utilize the facts (Caron, 2007). Baroody et al. (2009) supported Caron's claim that memorizing basic facts is imperative for future success with advanced math courses. Students are not taught basic math facts and are not given the opportunity to practice repeatedly over a long period of time; therefore, they may face obstacles when it comes to building fluency and automaticity. Caron (2009) acknowledged that students who fail to memorize basic math facts for several years may begin to avoid the task altogether. Over time, this may cause students to develop an anxiety towards the math concept, which could negatively affect and decrease their working memory (Ashcroft and Kirk, 2001). Woodward (2006) also insisted that students might

experience a cognitive overload if they are not able to mentally retrieve multiplication facts quickly and accurately. Both Baroody et al. (2009) and Caron (2007) concluded that fluency and memorization of math facts are developed through meaningful long-term engagements with number sense.

### **Instructional Strategies**

Effective instruction is an important aspect of building students fluency and automaticity with multiplication and other math facts. Phillips (2003) stressed the main factor of effective and productive instruction is daily routine. For that reason, she insisted that an educator provide the same sequence of activities each time he or she works with students. Bystrom (2010) completed an action research study following the same reasoning, that daily instruction should be provided using various activities or methods.

Phillips methods consisted of the following sequence of activities: “a warm up, automaticity check, numbers in context, strategy instruction, games, and practice at home” (Phillips, 2003 p. 359). She insisted that math fact fluency is a task that is multifaceted and a student’s fact fluency will appear and develop if flexible teaching strategies are employed. In fact, students’ speed and accuracy can increase due to strong instructional strategies that occur on a routine basis. Phillips (2003) acknowledged that developing a student’s number sense through routine activities allows a student to achieve an understanding of basic math facts. She stressed that it would be more productive and meaningful rather than just using pencil and paper worksheets, timed tests, and flash cards to instruct students.

Bystrom (2010) employed a daily fact review with her fourth grade students by using a variety of strategies. The strategies included timed multiplication tests, games, and flash cards. She introduced a daily fact activity to allow a warm up or anticipatory set for students. She

stressed that students eventually became bored with flash cards, which may take away from their effectiveness in building fluency and automaticity. One activity she found successful with students was through the use of technology. She found that Smartboard activities allowed for differentiation in which students can work at their own speeds. She reiterated that learning became enjoyable when students completed activities through online websites and by playing hands-on games. In fact, the five target students showed some growth and increase in fluency rates.

Mason (2006) also found a relationship between establishing a strong daily routine and an increase with students' automaticity levels. Daily and weekly routines were developed by the author and followed most of the time; they involved practice and timed multiplication tests through the use of Dr. Don Crawford's "Mastery Math Facts Program". Even though Mason (2006) only provided drill practice for students in her class, she did find an increase in their ability to recite multiplication facts fluently and accurately.

### **Automaticity and Fluency**

Crawford (2003) and Loewenberg-Ball et al. (2005) defined automaticity as the ability to quickly and accurately answer basic math facts without consciously thinking about them. According to Crawford (2003) students need continued practice to develop fluency, which over time leads to an achievement of automaticity. He stated multiplication facts become a priority to memorize starting at the fourth grade level because knowledge of basic multiplication facts are needed to solve other math problems such as fractions, division, and multiple digit multiplication (Crawford, 2003). Woodward (2006) also indicated that automaticity with math facts is important to mathematical success and achievement over time.

Loewenberg-Ball et al. (2005) maintained that students must have a solid foundation of knowledge in math to be able to function successfully in the world today. They insisted basic math facts such as multiplication are needed in a variety of math procedures; therefore, they deemed it necessary to have students practice repeatedly over time so fluency and automaticity are achieved (Loewenberg-Ball et al., 2005).

## **Conclusion**

Basic multiplication facts, ranging from zero through nine are an integral part of mathematics. They are needed to solve more difficult math problems involving division, fractions, perimeter, area and so much more. Students may face many obstacles in the future while learning more challenging math concepts, especially if they are struggling to solve basic multiplication facts. Since automaticity and fluency in multiplication have such an impact on students' future math success, I want to create an opportunity in my classroom for students to learn and practice basic multiplication facts in a meaningful and entertaining manner. By providing repetitive practice with basic multiplication facts through daily math centers, it is my hope that students will achieve an increase in fluency and automaticity.

## **Methods and Results**

This action research study was conducted in a fourth grade classroom in a rural central Illinois elementary school for five weeks from the beginning of February to March 2013. Qualitative and quantitative data was collected and analyzed during this action research project. A convenience sample was used to determine the participants in this study.

## **Participants**

Currently, the school district where I am employed requires students to take the Quarterly Discovery Math Assessment four times a year. Participants in this study were selected using the

January 2013 Discovery Math Assessment results from my twenty-four fourth grade students (Appendix A). Participants were selected who were considered at risk and scored in the Level 2 (40 to 60% correct) section. This convenience sample included five male and female students between the ages of eight and ten. One student in the study has an IEP.

### **Data Collection Strategies**

Three instruments were used over the course of five weeks to collect data for this study. Each instrument used in this study provided data to help determine if practicing single digit multiplication facts in math centers affected the student's ability to memorize multiplication facts.

**Multiplication Pre-Test/Post-Test** A multiplication pre-test retrieved from Multiplication.com was conducted prior to the implementation of math centers (Appendix B). The pre-test determined what students knew prior to the teaching of multiplication facts. At the conclusion of the study, the same multiplication test (retrieved from Multiplication.com), with questions reordered, was conducted to determine students' growth.

**Math Centers** Math centers were conducted for approximately 30 minutes a day in my classroom. All students took part in the math centers. Some math center activities included the following performed by all students: multiplication games on the computer from Multiplication.com website, practice of multiplication facts using flash cards with a partner, practice of multiplication facts by playing card and dice games with a partner, and completing basic multiplication worksheets independently. The math centers activities allowed students to practice and enhance the learning of basic multiplication facts.

**One-Minute Timed Test** Several times a week students completed a 40-question multiplication test (Crawford, 2003) located at the bottom of the practice sheet (Appendix C).

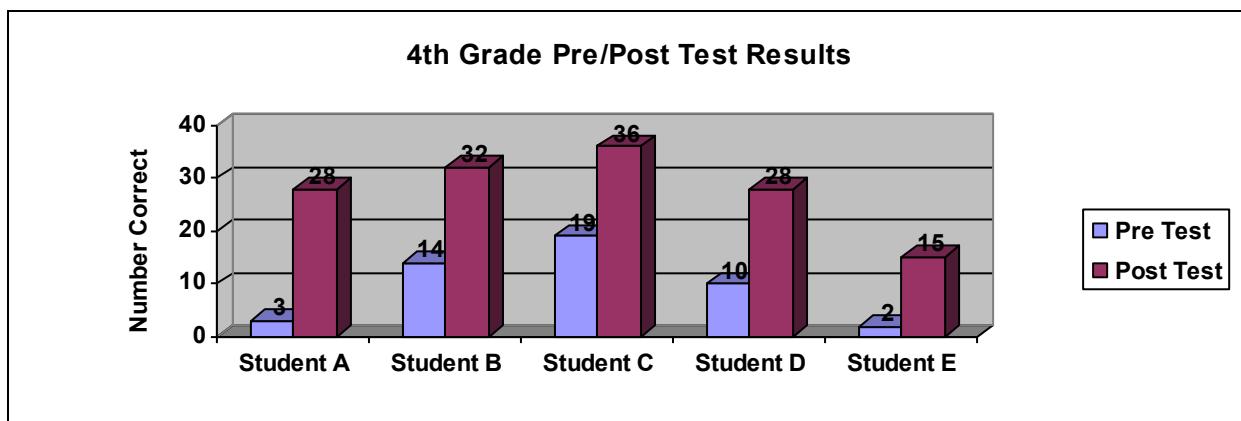
They completed the practice portion for three minutes prior to taking the test. The test determined how many multiplication facts they successfully memorized thus far.

**Weekly Two-Minute Timed Test** Students' progress was monitored once a week using different 2-minute timed tests (Crawford, 2003) with 80 random multiplication facts 0 through 9 (Appendix D). The weekly test determined how many multiplication facts students memorized throughout this study.

**Teacher Journal/Student Artifacts** A teacher journal was kept throughout this study. Information about the math center activities was included, as well as observation notes of students' interactions while they engaged in math centers. I also kept samples of student artifacts that were completed in the math centers throughout the 5-week study. Some samples included: worksheets (Appendices E and F), game record sheets from card and dice games (Appendix G), and one-minute timed tests (Appendix H) and two-minute weekly timed tests (Appendix I).

## Results

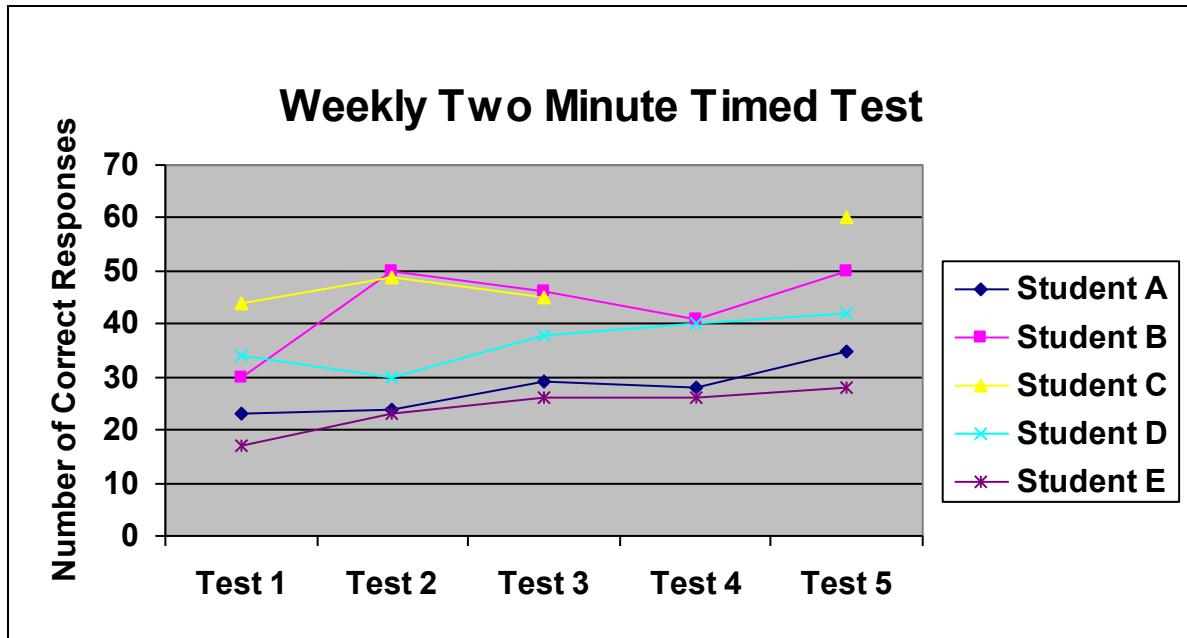
The main goal of this action research project was to determine if daily practice with basic multiplication facts in math centers had an effect on students' ability to memorize basic math facts. Students were administered a pre/post test, daily one-minute timed tests, and two-minute weekly timed tests. Students used multiplication charts, calculators, and counting on their fingers to solve basic multiplication facts prior to the onset of this study; they relied on the tools immensely.



*Figure 1.* Results of Pre/Post test administered prior to the implementation and at the conclusion of math centers.

Students were given three minutes to complete the 36 question pre-test and post-test. The pre and post tests contained the same questions; however, they were reordered. Four participants scored below 50 percent of the questions correct on the pre-test, while student C scored slightly above 50 percent. At the conclusion of the study, the scores of the five participants did slightly increase from their previous scores. Throughout the study, it was emphasized to students that they were working to increase their individual scores since each student worked at different rates of speed. Student A's performance rate increased 70 percent from the pre to the post test. Student

B and D had a rate increase of 50 percent. Student C had a 47 percent increase in his/her score and Student E increased by 36 percent. Each participant achieved an increased percentage of growth by the end of this study. Some participants' scores increased more than those of others.



*Figure 2 Results of two minute timed test administered weekly*

The data from the two-minute timed tests varied with each student. Once again each participant worked at different rates of speed; therefore, the number of correct responses varied among students. I analyzed individual scores to determine if students were continuing to show growth on a weekly basis. Student A, B, and C's scores varied throughout each week. Their scores would increase, decrease, and increase again throughout this study. Student D's score decreased between test 1 and 2; however, it did faintly increase continuously during test 3, 4, and 5. Student E appeared to be the only one to show slight continuous growth throughout the testing with the exception of scoring the same number of correct responses on test 3 and test 4.

I was also interested in comparing test 1 with test 5 since test 1 occurred at the beginning of this study and test 5 occurred near the end of it. All participants received a higher score on test 5 compared to that of test 1. The following participants achieved an increase on the two-minute timed test when week 1 was compared with week 5: Student A increased by 15 percent; Student B, 25 percent, Student C, 20 percent; Student D, 10 percent, and Student E, 14 percent.

<b><i>One Minute Timed Test</i></b>							
<b><i>Record of Passed Tests</i></b>							
	Test G	Test H	Test I	Test J	Test K	Test L	Test M
Student A	9	4					
Student B	2	4	1	1	1	3	1
Student C	7	1	1	1	1	1	1
Student D	4	2	2	2	2		
Student E	9	4					

*Table 1* Results of one minute timed test administered 3 to 4 times a week

The 1 minute timed test contained 40 questions that were administered to students at least 3 to 4 times a week. The test allowed students an opportunity to practice 40 multiplication facts 0 through 9 for 3 minutes prior to the test. Students were allowed to move on to the next test level if they received a score of 35 or higher. This meant they would be given more facts with increased difficulty at each level. If they did not pass, this indicated they may be having difficulties with the facts and may need additional practice; therefore, they took the same test the next day. I used a total of 17 levels throughout this study that were administered to students. The tests were labeled G through M. Each student worked at their own level and pace; as a result,

some students passed more levels than others. The levels contained facts 0 through 9; however, as the levels increased the combination of multiplication facts became more difficult. For example, Test K contained facts such as: 3x9, 4x9, 5x9, 6x9, 7x9, and 8x9.

Throughout this five week study all five participants passed Tests G. As the levels became more difficult fewer participants showed progress. Three participants passed levels H, I, J, and K. Student E was working on Test H at the end of this study and achieved a score of 28 out of 40. Two participants passed on to level L. While 2 participants passed on to level M by the end of the 5 week study.

Students B, C, and D progressed through higher levels at a faster pace than the other two participants. Student C had to attempt Test G seven times but once the participant became familiar with the process he/ she passed Test H through M after one attempt. Student A successfully passed Test G and H. This particular student worked meticulously and carefully and had to be reminded it was a timed test for speed and accuracy. Student E also passed test G and was working towards passing Test H. The participant receives IEP services for math and suspected auditory processing disability; this may have impacted the test scores.

Based on the results from this action research study, I believe the students' ability to automatically recall basic multiplication facts was enhanced and did slightly increase. I feel like daily practice with basic multiplication facts through various engaging activities; such as, computer games, dice and card games, and independent practice enhanced their ability to recall the basic facts. The one-minute timed test, two-minute timed test, and pre/post test results showed students' recall of basic multiplication facts increased, even though the increase was small, it was still an increase.

### **Findings and Implications**

At the beginning of the study, I had been very concerned with the low pre-test scores. In fact, two participants completed less than three basic multiplication questions within a three minute time span. I wondered why some participants did not answer very many questions. The reasons that I can think of were that they may have been nervous, concerned with the time, or were unsure how to answer the facts without their multiplication charts and other math tools they have relied so heavily upon. When the post-test was compared with the pre-test, participant scores varied. Some participants showed a more significant growth while others only showed a slight growth. This was due to each student progressing at a different rate. In fact, the highest participant growth rate was 70 percent while the lowest growth rate was 36 percent.

Student scores on the two-minute timed tests varied, the highest growth rate between week 1 and week 5 was 25 percent. The lowest growth rate was 10 percent. The growth rate percentages were lower on the two-minute timed test than they were on the pre and post test. I feel this is due to the fact the students were given more time to complete the post test. As I observed students working on the timed test, it appeared to take some students more time to begin answering the facts. The extra minute on the pre-test seemed to make a difference for those students who took more time answering the facts or who were more meticulous with their work.

I noted in my teacher journal that students were thoroughly enjoying the math centers. They looked forward to being in their group and practicing multiplication facts. They were self motivated and immediately moved from group to group during the math centers. They worked on tasks independently without being reminded and worked well as partners when necessary. They would ask me about the math centers almost daily and expressed their enjoyment of the activities. The one activity students commented on was the computer games and working with

partners practicing with flashcards. The students thought the Internet games were engaging and exciting. This was the most popular math center among most students. I was surprised that students enjoyed the flashcards as much as they did. I felt it would become redundant and students would be bored. They enjoyed testing one another on their basic math facts. I began to notice as students' fluency with multiplication facts increased their confidence increased as well. As they passed the leveled tests they would comment and show their excitement for achieving the goal. If they did not pass to the next level, they would begin practicing and would not give up.

Some students did not seem familiar with the timed tests, they were taking their time answering the facts. Early in the study, I informed the students the goal of the test was to answer as many questions as they could, as quickly as they could. It seemed to be hard for students to accomplish this task quickly because they are used to being told to write neatly and carefully. I feel this may have impacted some test scores. I did not observe any negative effects on students during this study. The students knew they were working on their goals individually and did not compare themselves with other students. I did not witness them being hard on themselves; however, I did not know how they were feeling inside about their progress.

### **Limitations**

There were a few limitations to this study even though students appeared to be positively impacted due to the practice. First of all, time was a major factor. This study took place over the course of five weeks during the winter months and ISAT testing. We did experience three snow days, which did impact our ability to practice on those days. Also, we had to reduce our time and activities in the centers during ISAT week because we had to keep the noise level down. Next, there was a small population of student data analyzed during the research study ( $n=5$ ), which in

turn limits the generalization of test results. Lastly, the participants in the study were established based on the results of the January 2013 Discovery Assessment in math. Participants were selected who were considered at risk scoring in the Level 2 (40 to 60% correct) section. Results may have varied if participants were selected from a different level or if additional participant data was analyzed.

### **Reflection and Action Plan**

#### **Reflection**

This research study was meaningful and important to me as an educator. I still firmly believe that students need daily practice with basic multiplication facts to increase and enhance their ability to memorize them. The way a person becomes better or more skilled at something is through practice, so it just makes sense that multiplication facts should be practiced as well.

I believe students enjoyed the variety of activities in the math centers; it seemed to break up the monotony of our daily math routine. I agree with Phillips (2003) and Bystrom (2010) that daily routine and the same sequence of activities provides effective instruction to assist in building students' fluency and automaticity with multiplication facts. During this study, students were provided with various activities on a daily basis and this kept them engaged in practice.

If I were to carry out this study again, I would like to start at the beginning of the school year. Also, I would prefer to collect data for a longer period of time, five weeks made it challenging to observe and record actual growth. It would be beneficial to have students practice multiplication fluency and automaticity for an entire semester. I would also prefer to extend this study to provide practice at home. I believe it is important to have parents and guardians involved in the education process.

### Action Plan

I discovered that students enjoyed practicing basic multiplication facts through a variety of activities in math centers; in fact, they looked forward to it everyday. The data illustrated the five participants' scores in this study did slightly increase. For this reason, I would like to incorporate multiplication fact practice in the daily schedule next year. With time limitations being a factor, I thought Response to Intervention period might provide the perfect opportunity for practice. The only disadvantage is not all students will be able to partake in the centers. During the next school year I am teaching a self-contained class and will have my class the entire day. I will be teaching six subjects instead of the three I teach now. For this reason, I will continue to reflect further and look at my schedule to envision where I can incorporate the activities.

I intend to have the following activities as part of the practice centers: computer games, dice and card games, and flash card practice. I am not sure if I will continue utilizing the worksheets as part of the centers, it may become part of the homework portion of the study. The practice and timed tests will be incorporated at the beginning of the year and I will continue to monitor students' progress on a weekly basis. The one thing I would like to do differently next year, is to have the students track their one-minute timed test progress on a graph sheet. I believe this will give students a sense of ownership regarding their progress and may encourage them to work harder to achieve personal goals.

This action research study and results from it will be shared with faculty members in my school building. I will present the findings to my principal, assistant principal, my co-teacher, and fellow fourth grade teachers. I would also like to share the results with other educators in the

building because I believe the information would be useful to them as well. They may be facing similar issues in the younger grade levels with automaticity of addition and subtraction facts.

The thought of conducting this research study made me extremely nervous because it took me out of my comfort zone. I did not see myself as a researcher. Upon completion of the study, I realized moving out of my comfort zone made me a better educator. I am constantly searching for ways to improve my teaching practice so my students receive the best education I can provide. I took away so much from this experience and will continue to utilize what I learned about myself and my students in future endeavors.

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## Appendix A

**Discovery Student Skill Report**  
 EDUCATION

School: ARLAND D WILLIAMS ELEM SCH

**Test C** of ABCD (21 students)

Teacher: Marsha Steele

Class: Math (virtual class)

Grade: Grade 4

Subject: Mathematics

School Year: 2012-2013

Generated: April 12, 2013

## Proficiency by Subject

Level 1 (0-11 correct) Level 2 (12-16 correct) Level 3 (17-21 correct) Level 4 (22-34 correct) 

determined by # correct

	Operations	Base Ten	Fractions	Meas. & Data	Geometry	
	Lvl 2	Lvl 3	Lvl 1	Lvl 1	Lvl 2	Lvl 1 11
	Lvl 2	Lvl 4	Lvl 2	Lvl 2	Lvl 2	Lvl 2 16
	Lvl 4	Lvl 4	Lvl 4	Lvl 2	Lvl 4	Lvl 4 26
	Lvl 1	Lvl 3	Lvl 2	Lvl 1	Lvl 2	Lvl 1 10
	Lvl 3	Lvl 4	Lvl 1	Lvl 3	Lvl 2	Lvl 2 13
	Lvl 4	Lvl 4	Lvl 2	Lvl 3	Lvl 3	Lvl 3 21
	Lvl 3	Lvl 4	Lvl 1	Lvl 3	Lvl 3	Lvl 3 17
	Lvl 2	Lvl 4	Lvl 1	Lvl 1	Lvl 4	Lvl 2 14
	Lvl 3	Lvl 3	Lvl 1	Lvl 1	Lvl 3	Lvl 2 12
	Lvl 1	Lvl 4	Lvl 3	Lvl 4	Lvl 2	Lvl 3 20
	Lvl 2	Lvl 3	Lvl 2	Lvl 3	Lvl 2	Lvl 2 14
	Lvl 3	Lvl 4	Lvl 4	Lvl 4	Lvl 4	Lvl 3 21
	Lvl 4	Lvl 4	Lvl 4	Lvl 4	Lvl 4	Lvl 4 25
	Lvl 3	Lvl 4	Lvl 4	Lvl 1	Lvl 2	Lvl 2 16
	Lvl 4	Lvl 4	Lvl 1	Lvl 4	Lvl 2	Lvl 3 18
	Lvl 3	Lvl 4	Lvl 1	Lvl 1	Lvl 3	Lvl 2 16
	Lvl 2	Lvl 3	Lvl 1	Lvl 2	Lvl 2	Lvl 1 11
	Lvl 1	Lvl 3	Lvl 1	Lvl 1	Lvl 1	Lvl 1 5
	Lvl 1	Lvl 3	Lvl 1	Lvl 1	Lvl 3	Lvl 2 12
	Lvl 1	Lvl 3	Lvl 1	Lvl 1	Lvl 4	Lvl 2 12
	Lvl 1	Lvl 2	Lvl 1	Lvl 1	Lvl 4	Lvl 1 10

## Appendix B

**Quick Quiz**

Name \_\_\_\_\_

**START**Correct \_\_\_\_ Incorrect \_\_\_\_ Time \_\_\_\_\_  
Date \_\_\_\_\_

Click START to begin taking the quiz. After you have entered an answer, click Enter to continue to the next question.

Click FINISHED when you have completed the quiz.

$$\begin{array}{r} 1 \quad 3 \quad 2 \quad 4 \quad 3 \quad 4 \quad 9 \quad 5 \quad 5 \quad 6 \quad 5 \quad 7 \quad 8 \quad 8 \quad 2 \quad 9 \quad 3 \\ \times 2 \quad \underline{\hspace{1cm}} \quad \times 2 \quad \underline{\hspace{1cm}} \quad \times 3 \quad \underline{\hspace{1cm}} \quad \times 6 \quad \underline{\hspace{1cm}} \quad \times 5 \quad \underline{\hspace{1cm}} \quad \times 3 \quad \underline{\hspace{1cm}} \quad \times 2 \quad \underline{\hspace{1cm}} \quad \times 2 \quad \underline{\hspace{1cm}} \quad \times 3 \end{array}$$

$$\begin{array}{r} 10 \quad 11 \quad 12 \quad 13 \quad 14 \quad 15 \quad 16 \quad 17 \quad 18 \quad 19 \quad 20 \quad 21 \quad 22 \quad 23 \quad 24 \quad 25 \quad 26 \quad 27 \quad 28 \\ 6 \quad 7 \quad 6 \quad 7 \quad 6 \quad 9 \quad 4 \quad 5 \quad 9 \quad 6 \quad 8 \quad 4 \quad 8 \quad 7 \quad 5 \quad 8 \quad 7 \quad 8 \quad 6 \\ \times 2 \quad \underline{\hspace{1cm}} \quad \times 4 \quad \underline{\hspace{1cm}} \quad \times 3 \quad \underline{\hspace{1cm}} \quad \times 3 \quad \underline{\hspace{1cm}} \quad \times 4 \quad \underline{\hspace{1cm}} \quad \times 3 \quad \underline{\hspace{1cm}} \quad \times 4 \quad \underline{\hspace{1cm}} \quad \times 5 \quad \underline{\hspace{1cm}} \quad \times 4 \quad \underline{\hspace{1cm}} \quad \times 2 \end{array}$$

$$\begin{array}{r} 19 \quad 20 \quad 21 \quad 22 \quad 23 \quad 24 \quad 25 \quad 26 \quad 27 \quad 28 \quad 29 \quad 30 \quad 31 \quad 32 \quad 33 \quad 34 \quad 35 \quad 36 \\ 6 \quad 8 \quad 9 \quad 8 \quad 7 \quad 7 \quad 8 \quad 5 \quad 7 \quad 6 \quad 5 \quad 2 \quad 5 \quad 8 \quad 7 \quad 2 \quad 9 \\ \times 5 \quad \underline{\hspace{1cm}} \quad \times 3 \quad \underline{\hspace{1cm}} \quad \times 4 \quad \underline{\hspace{1cm}} \quad \times 8 \quad \underline{\hspace{1cm}} \quad \times 6 \quad \underline{\hspace{1cm}} \quad \times 7 \quad \underline{\hspace{1cm}} \quad \times 2 \quad \underline{\hspace{1cm}} \quad \times 5 \quad \underline{\hspace{1cm}} \quad \times 4 \end{array}$$

$$\begin{array}{r} 28 \quad 29 \quad 30 \quad 31 \quad 32 \quad 33 \quad 34 \quad 35 \quad 36 \\ 6 \quad 8 \quad 5 \quad 9 \quad 9 \quad 9 \quad 8 \quad 7 \quad 9 \\ \times 6 \quad \underline{\hspace{1cm}} \quad \times 2 \quad \underline{\hspace{1cm}} \quad \times 5 \quad \underline{\hspace{1cm}} \quad \times 7 \quad \underline{\hspace{1cm}} \quad \times 2 \quad \underline{\hspace{1cm}} \quad \times 9 \end{array}$$

**FINISHED****Print this Quiz**Visit [www.multiplication.com](http://www.multiplication.com) for more quizzes, worksheets, activities, and games.

## Appendix C

*Mastering Math Facts - Multiplication* M-15 Name \_\_\_\_\_

**Set G [9x3, 3x9, 9x4, 4x9] Practice on facts through Set G**

$$\begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 2 \\ \times 1 \\ \hline 2 \end{array} \quad \begin{array}{r} 0 \\ \times 2 \\ \hline 0 \end{array} \quad \begin{array}{r} 8 \\ \times 9 \\ \hline 72 \end{array} \quad \begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array} \quad \begin{array}{r} 6 \\ \times 2 \\ \hline 12 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 9 \\ \times 2 \\ \hline 18 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 6 \\ \times 2 \\ \hline 12 \end{array} \quad \begin{array}{r} 2 \\ \times 9 \\ \hline 18 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 9 \\ \times 2 \\ \hline 18 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 7 \\ \times 2 \\ \hline 14 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 9 \\ \times 2 \\ \hline 18 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 8 \\ \times 2 \\ \hline 16 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 2 \\ \times 6 \\ \hline 12 \end{array} \quad \begin{array}{r} 2 \\ \times 9 \\ \hline 18 \end{array} \quad \begin{array}{r} 0 \\ \times 5 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 7 \\ \times 2 \\ \hline 14 \end{array} \quad \begin{array}{r} 2 \\ \times 5 \\ \hline 10 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 8 \\ \times 2 \\ \hline 16 \end{array} \quad \begin{array}{r} 2 \\ \times 9 \\ \hline 18 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 2 \\ \times 7 \\ \hline 14 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 2 \\ \times 6 \\ \hline 12 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array}$$

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**One Minute Timing on facts through Set G**

$$\begin{array}{r} 1 \\ \times 2 \\ \hline 2 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 2 \\ \times 6 \\ \hline 12 \end{array} \quad \begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array} \quad \begin{array}{r} 1 \\ \times 3 \\ \hline 3 \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 2 \\ \times 0 \\ \hline 0 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 2 \\ \times 4 \\ \hline 8 \end{array} \quad \begin{array}{r} 7 \\ \times 2 \\ \hline 14 \end{array}$$

$$\begin{array}{r} 0 \\ \times 7 \\ \hline 0 \end{array} \quad \begin{array}{r} 2 \\ \times 5 \\ \hline 10 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 2 \\ \times 9 \\ \hline 18 \end{array} \quad \begin{array}{r} 1 \\ \times 6 \\ \hline 6 \end{array} \quad \begin{array}{r} 1 \\ \times 0 \\ \hline 0 \end{array} \quad \begin{array}{r} 5 \\ \times 1 \\ \hline 5 \end{array} \quad \begin{array}{r} 1 \\ \times 7 \\ \hline 7 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 2 \\ \times 1 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 4 \\ \times 2 \\ \hline 8 \end{array} \quad \begin{array}{r} 1 \\ \times 8 \\ \hline 8 \end{array} \quad \begin{array}{r} 2 \\ \times 5 \\ \hline 10 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 6 \\ \times 1 \\ \hline 6 \end{array} \quad \begin{array}{r} 1 \\ \times 9 \\ \hline 9 \end{array} \quad \begin{array}{r} 6 \\ \times 2 \\ \hline 12 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 8 \\ \times 2 \\ \hline 16 \end{array} \quad \begin{array}{r} 2 \\ \times 2 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 7 \\ \times 2 \\ \hline 14 \end{array} \quad \begin{array}{r} 0 \\ \times 8 \\ \hline 0 \end{array} \quad \begin{array}{r} 3 \\ \times 1 \\ \hline 3 \end{array} \quad \begin{array}{r} 8 \\ \times 1 \\ \hline 8 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 5 \\ \times 1 \\ \hline 5 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 5 \\ \times 1 \\ \hline 5 \end{array} \quad \begin{array}{r} 2 \\ \times 3 \\ \hline 6 \end{array} \quad \begin{array}{r} 2 \\ \times 6 \\ \hline 12 \end{array}$$

1 minute timing goal \_\_\_\_\_

Number of problems correct \_\_\_\_\_

## Appendix D

*Mastering Math Facts - Multiplication* M-33 Name \_\_\_\_\_

Two Minute Multiplication Timing #1 (Do this weekly to see your progress)

$$\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 1 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 1 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 1 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 1 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 1 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ \times 1 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 1 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 8 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 4 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 0 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 5 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 1 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 9 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ \times 6 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 5 \\ \times 9 \\ \hline \end{array}$$

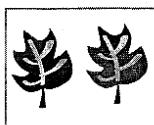
Goal \_\_\_\_\_ Number of problems correct \_\_\_\_\_

## Appendix E

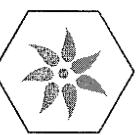
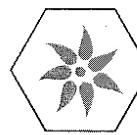


## Making Multiplication Sentences

Look at each picture below. Write both the addition and multiplication facts that illustrate each picture. The first one is done for you.



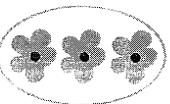
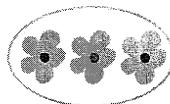
$$\underline{2 + 2 + 2}$$



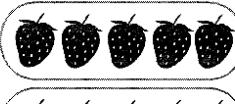
$$\underline{1 + 1 + 1 + 1}$$

$$\underline{2 \times 3 = 6}$$

$$\underline{1 \times 4 = 4}$$



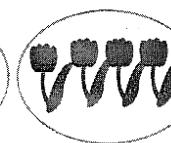
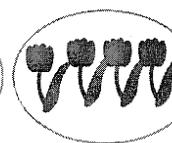
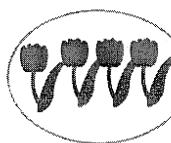
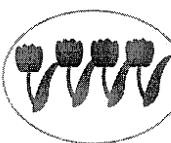
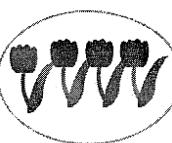
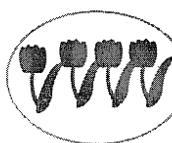
$$\underline{3 + 3 + 3}$$



$$\underline{3 \times 3 = 9}$$

$$\underline{5 + 5 + 5 + 5}$$

$$\underline{5 \times 5 = 25}$$



$$\underline{4 + 4 + 4 + 4 + 4 + 4}$$

$$\underline{4 \times 6 = 24}$$



## Appendix F

**Multiplication Boxes**

Write the answer to each multiplication fact in each square.

- If the answer is less than 30, color the square yellow.
- If the answer is 30 or greater, color the square light blue.

$9 \times 3 =$	$3 \times 5 =$	$4 \times 7 =$	$1 \times 9 =$	$8 \times 3 =$	$2 \times 4 =$	$3 \times 8 =$	$2 \times 2 =$	$7 \times 3 =$
27	15	28	9	24	8	24	4	21
$4 \times 4 =$	$9 \times 9 =$	$7 \times 8 =$	$8 \times 8 =$	$7 \times 7 =$	$6 \times 5 =$	$6 \times 7 =$	$7 \times 9 =$	$3 \times 5 =$
16	81	56	64	49	35	42	63	15
$6 \times 3 =$	$4 \times 8 =$	$3 \times 7 =$	$3 \times 8 =$	$4 \times 9 =$	$4 \times 7 =$	$2 \times 7 =$	$8 \times 4 =$	$4 \times 5 =$
18	32	21	24	36	28	14	32	20
$3 \times 3 =$	$9 \times 8 =$	$5 \times 3 =$	$5 \times 4 =$	$7 \times 6 =$	$2 \times 8 =$	$3 \times 7 =$	$6 \times 5 =$	$3 \times 6 =$
9	72	15	20	42	16	21	30	18
$2 \times 1 =$	$5 \times 6 =$	$4 \times 9 =$	$8 \times 4 =$	$5 \times 6 =$	$8 \times 9 =$	$8 \times 8 =$	$9 \times 9 =$	$5 \times 3 =$
2	30	36	32	30	72	64	81	15
$5 \times 3 =$	$9 \times 7 =$	$3 \times 3 =$	$6 \times 7 =$	$8 \times 9 =$	$9 \times 4 =$	$3 \times 9 =$	$8 \times 4 =$	$9 \times 0 =$
15	63	9	42	72	36	27	32	0
$4 \times 3 =$	$9 \times 8 =$	$2 \times 8 =$	$8 \times 7 =$	$9 \times 8 =$	$7 \times 9 =$	$1 \times 3 =$	$9 \times 7 =$	$2 \times 6 =$
12	72	16	56	72	63	3	63	12
$2 \times 2 =$	$5 \times 7 =$	$0 \times 8 =$	$7 \times 4 =$	$5 \times 3 =$	$3 \times 4 =$	$4 \times 4 =$	$7 \times 6 =$	$2 \times 2 =$
4	35	0	28	15	12	16	42	4
$6 \times 2 =$	$6 \times 7 =$	$8 \times 7 =$	$9 \times 7 =$	$8 \times 8 =$	$8 \times 9 =$	$9 \times 7 =$	$5 \times 6 =$	$3 \times 3 =$
12	42	56	63	64	72	63	30	9
$7 \times 2 =$	$3 \times 9 =$	$0 \times 1 =$	$5 \times 2 =$	$8 \times 2 =$	$7 \times 0 =$	$3 \times 5 =$	$4 \times 7 =$	$4 \times 4 =$
14	27	0	10	16	0	15	28	16

## Appendix G

**Top-It Record Sheet**

Play a round of *Top-It*. Record your number sentence and your opponent's number sentence. Write  $>$ ,  $<$ , or  $=$  to compare the number sentences.

Round	Player 1	$>$ , $<$ , $=$	Player 2
<b>Sample</b>	$4 + 6 = 10$	$<$	$8 + 3 = 11$
<b>1</b>	$0 \times 1 = 0$	$<$	$2 \times 1 = 2$
<b>2</b>	$3 \times 10 = 30$	$>$	$2 \times 3 = 6$
<b>3</b>	$8 \times 0 = 0$	$<$	$1 \times 3 = 3$
<b>4</b>	<del><math>6 \times 5 = 35</math></del>	$>$	$4 \times 4 = 16$
<b>5</b>	$6 \times 0 = 0$	$<$	$5 \times 7 = 35$

**Baseball Multiplication Game Mat**

**Hitting Table**  
1-to-6 Facts

1 to 9	Out
10 to 19	Single (1 base)
20 to 29	Double (2 bases)
30 to 35	Triple (3 bases)
36	Home Run (4 bases)

Inning	1	2	3	Total
Team 1 Outs	1 1 1	1 1 1		6
Runs	1 1 1	1		5
Team 2 Outs	1 1 1	1 1 1		6
Runs	X X X	X X X		0

## Appendix H

Mastering Math Facts - Multiplication M-17 Name \_\_\_\_\_

## Set I [9x6, 6x9, 4x4] Practice on facts through Set I

$$\begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array} \quad \begin{array}{r} 2 \\ \times 4 \\ \hline 8 \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 9 \\ \times 5 \\ \hline 45 \end{array} \quad \begin{array}{r} 3 \\ \times 0 \\ \hline 0 \end{array} \quad \begin{array}{r} 4 \\ \times 4 \\ \hline 16 \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline 12 \end{array} \quad \begin{array}{r} 8 \\ \times 1 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 7 \\ \times 2 \\ \hline 14 \end{array} \quad \begin{array}{r} 5 \\ \times 9 \\ \hline 45 \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline 12 \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 9 \\ \times 5 \\ \hline 45 \end{array} \quad \begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array} \quad \begin{array}{r} 4 \\ \times 4 \\ \hline 16 \end{array}$$

$$\begin{array}{r} 4 \\ \times 4 \\ \hline 16 \end{array} \quad \begin{array}{r} 2 \\ \times 3 \\ \hline 6 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 3 \\ \times 1 \\ \hline 27 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 5 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 9 \\ \times 2 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 5 \\ \times 9 \\ \hline 45 \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline 12 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 9 \\ \times 5 \\ \hline 45 \end{array} \quad \begin{array}{r} 4 \\ \times 4 \\ \hline 16 \end{array} \quad \begin{array}{r} 3 \\ \times 1 \\ \hline 3 \end{array}$$

## One Minute Timing on facts through Set I

$$\begin{array}{r} 4 \\ \times 2 \\ \hline 8 \end{array} \quad \begin{array}{r} 1 \\ \times 1 \\ \hline 1 \end{array} \quad \begin{array}{r} 1 \\ \times 4 \\ \hline 4 \end{array} \quad \begin{array}{r} 4 \\ \times 4 \\ \hline 16 \end{array} \quad \begin{array}{r} 1 \\ \times 8 \\ \hline 8 \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline 12 \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array} \quad \begin{array}{r} 1 \\ \times 5 \\ \hline 5 \end{array} \quad \begin{array}{r} 6 \\ \times 2 \\ \hline 12 \end{array}$$

$$\begin{array}{r} 2 \\ \times 3 \\ \hline 6 \end{array} \quad \begin{array}{r} 9 \\ \times 3 \\ \hline 27 \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array} \quad \begin{array}{r} 0 \\ \times 5 \\ \hline 0 \end{array} \quad \begin{array}{r} 5 \\ \times 9 \\ \hline 45 \end{array} \quad \begin{array}{r} 2 \\ \times 4 \\ \hline 8 \end{array} \quad \begin{array}{r} 7 \\ \times 2 \\ \hline 14 \end{array} \quad \begin{array}{r} 1 \\ \times 2 \\ \hline 2 \end{array} \quad \begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 2 \\ \times 2 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 4 \\ \times 9 \\ \hline 36 \end{array} \quad \begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array} \quad \begin{array}{r} 1 \\ \times 9 \\ \hline 9 \end{array} \quad \begin{array}{r} 4 \\ \times 4 \\ \hline 16 \end{array} \quad \begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline 12 \end{array} \quad \begin{array}{r} 8 \\ \times 1 \\ \hline 8 \end{array} \quad \begin{array}{r} 8 \\ \times 2 \\ \hline 16 \end{array} \quad \begin{array}{r} 3 \\ \times 3 \\ \hline 9 \end{array} \quad \begin{array}{r} 1 \\ \times 2 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 4 \\ \times 1 \\ \hline 4 \end{array} \quad \begin{array}{r} 2 \\ \times 6 \\ \hline 12 \end{array} \quad \begin{array}{r} 9 \\ \times 1 \\ \hline 9 \end{array} \quad \begin{array}{r} 9 \\ \times 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 1 \\ \times 7 \\ \hline 7 \end{array} \quad \begin{array}{r} 3 \\ \times 1 \\ \hline 3 \end{array} \quad \begin{array}{r} 3 \\ \times 9 \\ \hline 27 \end{array} \quad \begin{array}{r} 6 \\ \times 9 \\ \hline 54 \end{array} \quad \begin{array}{r} 2 \\ \times 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 0 \\ \times 2 \\ \hline 0 \end{array}$$

1 minute timing goal 40 Number of problems correct 37

## Appendix I

Mastering Math Facts - Multiplication M-37 Name \_\_\_\_\_

Two Minute Multiplication Timing #5 (Do this weekly to see your progress)

$\frac{2}{\times 5}$	$\frac{5}{\times 7}$	$\frac{4}{\times 6}$	$\frac{5}{\times 5}$	$\frac{0}{\times 3}$	$\frac{3}{\times 7}$	$\frac{0}{\times 5}$	$\frac{9}{\times 2}$	$\frac{7}{\times 8}$	$\frac{3}{\times 9}$
10	35	24	25	3	21	5	18	36	27
$\frac{7}{\times 5}$	$\frac{5}{\times 2}$	$\frac{5}{\times 1}$	$\frac{0}{\times 4}$	$\frac{9}{\times 1}$	$\frac{6}{\times 2}$	$\frac{9}{\times 8}$	$\frac{8}{\times 2}$	$\frac{4}{\times 9}$	$\frac{4}{\times 3}$
35	10	5	4	9	12	72	16	36	12
$\frac{5}{\times 6}$	$\frac{8}{\times 7}$	$\frac{4}{\times 2}$	$\frac{0}{\times 8}$	$\frac{8}{\times 5}$	$\frac{8}{\times 7}$	$\frac{4}{\times 4}$	$\frac{7}{\times 3}$	$\frac{0}{\times 7}$	$\frac{6}{\times 9}$
30	56	8	0	40	56	16	21	7	54
$\frac{6}{\times 5}$	$\frac{0}{\times 5}$	$\frac{3}{\times 8}$	$\frac{6}{\times 1}$	$\frac{5}{\times 9}$	$\frac{7}{\times 2}$	$\frac{8}{\times 4}$	$\frac{3}{\times 4}$	$\frac{8}{\times 6}$	$\frac{9}{\times 6}$
30	0	24	6	45	14	32	12	48	54
$\frac{2}{\times 7}$	$\frac{5}{\times 4}$	$\frac{7}{\times 6}$	$\frac{9}{\times 9}$	$\frac{7}{\times 1}$	$\frac{4}{\times 8}$	$\frac{3}{\times 3}$	$\frac{6}{\times 7}$	$\frac{9}{\times 5}$	$\frac{8}{\times 3}$
14	20	42	81	7	32	9	42	45	24
$\frac{8}{\times 1}$	$\frac{0}{\times 9}$	$\frac{2}{\times 4}$	$\frac{2}{\times 8}$	$\frac{9}{\times 7}$	$\frac{5}{\times 8}$	$\frac{6}{\times 6}$	$\frac{8}{\times 8}$	$\frac{4}{\times 5}$	$\frac{3}{\times 6}$
8	0	8	16	63	40	36	64	20	18
$\frac{7}{\times 7}$	$\frac{4}{\times 1}$	$\frac{2}{\times 9}$	$\frac{0}{\times 6}$	$\frac{3}{\times 1}$	$\frac{9}{\times 3}$	$\frac{8}{\times 9}$	$\frac{6}{\times 8}$	$\frac{6}{\times 4}$	$\frac{4}{\times 7}$
49	4	18	6	1	3	9	8	4	7
$\frac{7}{\times 4}$	$\frac{6}{\times 3}$	$\frac{2}{\times 6}$	$\frac{5}{\times 3}$	$\frac{5}{\times 9}$	$\frac{2}{\times 2}$	$\frac{2}{\times 1}$	$\frac{3}{\times 5}$	$\frac{9}{\times 4}$	$\frac{7}{\times 9}$

Goal \_\_\_\_\_ Number of problems correct \_\_\_\_\_

