

***Rooted Knowledge Corporation***

[www.rootedknowledge.com](http://www.rootedknowledge.com)



A teacher may reproduce copies of the Pre-Lesson Fluency Builders, Post-Lesson Fluency Builders, and Multiplication Arrays for their classroom only. Except as permitted under the United States Copyright Act, no part of this publication may be transmitted, stored, or recorded in any form without written permission from the publisher.

Copyright © 2017 by Rooted Knowledge Corporation. All rights reserved.



# Contents

## 2 Introduction

## 3 Barriers to Success

- 3 *A Short Attention Span*
- 5 *A Conditioned Fear Response*

## 9 Research

- 9 *The National Research Council*
- 11 *Memory Development*
- 12 *Improving Retention*
- 13 *Middle School Implementation Results*

## 16 Monitoring Growth

- 16 *Pretest and Posttest*
- 17 *Potential IEP Goal*

## 18 Lesson Overview

## 19 Lessons

- 19 *Lesson 1: 4x4, 4x8, 8x8*
- 22 *Lesson 2: 3x3, 3x6, 6x6*
- 25 *Lesson 3: 3x4, 6x4*
- 28 *Lesson 4: 3x8, 6x8*
- 31 *Lesson 5: 4x7, 8x7*
- 34 *Lesson 6: 3x7, 6x7, 7x7*



## ***Introduction***

As a teacher, your greatest desire is to see your students succeed. When they succeed, you feel great. You feel good when they do well on a spelling test and happy when you hear they're doing well with other teachers. You want the best for them and feel dissatisfied when things are going in the wrong direction.

Teachers know that multiplication facts are an important part of mathematics and they want their students to succeed. Many teachers are able to improve their classes fluency through flash cards, using an online program, and even multiplication games. While these strategies will definitely increase a classes proficiency in multiplication and division facts, it doesn't always work for every student. When this happens, it's very discouraging for teachers. It becomes easy to believe some students will always struggle in math.

Teachers in these situations will find this guide particularly useful. Within this guide, you will find the directions necessary to teach both multiplication and division facts to a variety of learners. The steps are easy to follow and are proven to be effective. Because the lessons are online, you won't need to worry about gathering resources. You can find these lessons on the Rooted Knowledge website, "[www.rootedknowledge.com](http://www.rootedknowledge.com)".



## ***Barriers to Success***

Rooted Facts is able to teach Multiplication and Division facts to most people. However, there are instances where Rooted Facts, by itself, won't work. To help you address these barriers, the following are reasons that could prevent learning from occurring. With each reason you will find tips to help overcome this barrier.

### ***Reason 1 - A Short Attention Span***

A short attention span can easily affect a person's learning of math facts. When attention is lost, all learning stops until attention is regained.

#### ***What causes a Short Attention Span?***

Some causes are external (outside of a person). Examples of these external reasons include excessive noise and too many distractions. When a short attention span exists due to something external it's easier to control. For example, if there's too much noise in the room, you can do things to make it quieter, or, if there are too many distractions in the room, you can remove a few of them.



Other causes are internal (inside of a person). Common internal reasons include Attention Deficit Disorder, Executive Functioning Disorder, and Absence Seizures. When the cause of a short attention span is something internal it can be a bit more difficult to address. This entry is here to help in these situations. Within it, you will receive four tips on improving the likelihood of learning when an internal reason exists.

### *Tip 1. Verify Information is Received*

When a person with an internal cause stops paying attention it can be rather hard to notice. This is because many of those with an internal cause have become rather good at “pretending” they are paying attention even when they are not.

They aren’t trying to be rude or disrespectful when they do this. It’s really just the opposite. They know they offend most people when they don’t pay attention. They also know that they are unable to control when they do, and when they don’t, pay attention. So, they just pretend. By pretending, they can keep a good relationship with you even though they can’t always pay attention to you. Unfortunately, this also means they will miss a lot of things that you tell them. Thankfully, there are ways you can verify they receive your information.

*Technique – Probing Questions* – Most techniques used to verify that information has been received puts them on the spot. When this happens, and they can’t answer the question you asked, they will most likely shut down (for more information on this, refer to Tip 2- Keep Things Positive). Thankfully, probing questions are less likely to do this. Probing questions are questions you can ask that won’t create offense. It’s best to ask these



questions indirectly. You can ask these questions in a variety of ways. For example, rather than asking a question to a single student, you could ask the entire class. You could also follow a direction with an immediate opportunity to practice.

### *Tip 2. Keep Things Positive*

Many professionals have mentioned that those with a short attention span can easily be discouraged. To prevent this, it's best to keep things positive. One way of keeping things positive is through positive reinforcement.

Technique – Provide Positive Reinforcement – Positive reinforcement is a behavioral technique which focuses on the positive outcomes rather than the negative ones. A good rule of thumb when using positive reinforcement is to provide 5 positive comments to every 1 negative.

## Reason 2 - A Conditioned Fear Response

### *What is a Conditioned Fear Response?*

A conditioned fear response is how your body reacts to things that caused pain in the past. For example, let's say you went on a few dates, but each time you did, you had a bad experience. This could cause a conditioned fear response to develop. Because of those bad experiences you are now less likely to want to go on dates in the future.



Now let's take it a step further. Let's say you finally decide to get back out there and begin dating again. You go on your date, but unfortunately, it's just another bad experience. Sadly, you're now less likely to go on dates than you were before. This is because the higher the frequency of these bad experiences, the higher your fear becomes.

A conditioned fear response can also develop due to the intensity of pain. For example, let's say you go on just one date, but during this date you have a really bad experience. This really bad experience can also cause a conditioned fear response to develop.

### *How Does This Affect Learning Math Facts?*

A conditioned fear response can also develop while learning math facts. For example, let's say Jim is a student in a fourth grade class. Every day Jim's class practices their multiplication and division facts. They use a variety of tools to practice, including flashcards and worksheets.

Jim notices that his entire class is getting better, except for him. When using worksheets, Jim notices that he is always the last person to finish. When using flashcards, Jim sees everyone else is able to answer those questions he just can't figure out. Now, every time the class is about to practice, Jim begins to feel anxious. Sadly, Jim can't just leave class whenever practice begins, so instead, he just shuts down.



### *Tip 1. Create a Feeling of Safety*

When a fear develops, it will often attach to more than one thing. Many times, a fear will associate with lots of things. For an example, let's look back at Jim. We already know that Jim developed a conditioned fear response to math facts, but math facts weren't the only thing there when this fear developed. There were also the flash cards that were used, the worksheets that were used, the students and teacher that were present, the desk he was sitting at, the time of day his class practiced, etc, etc, etc... Any of these factors may now contribute to his fear.

If we could, we would want to address as many of these factors as possible. Unfortunately, it's really hard to know what all of these things are. Most of the time, a student's fear will develop in a place you weren't a part of. In addition, It would also be extremely time consuming. Fortunately, there are still options.

*Technique – Keep things as consistent as possible* – One option is to keep things as consistent as possible. Consistency can do a lot of things. For one, when an environment is consistent it feels safe, and places that feel safe are easier to work in. Because of this, it becomes a lot easier to get over any fear that might come up. Many times, fears will go away just because they are naturally exposed over and over again in a safe environment.



## *Tip 2. Weaken the Fear*

Sometimes a fear may be too strong to go away just through consistent exposure in a safe environment. If this happens, it's often best to use a technique that will slowly remove it.

*Technique – Use Systematic Desensitization* – Systematic desensitization is a powerful technique that has been used for decades to address phobias. Systematic desensitization slowly removes a fear by systematically increasing a stimulus in a way that doesn't decrease a person's feeling of safety.

Systematic desensitization is most often used in clinical settings, but you can easily apply these methods to learning environments. The first key is to only provide material that can lead to success. For example, when using math worksheets, it's best to use worksheets that will allow success to occur. If the student does not yet know  $8 \times 7 = 56$ , it is best to leave this off the worksheet.

The second key is to provide a manageable piece of whatever they are afraid of and systematically increase it. For example, if you are using multiplication worksheets, you could start with a smaller number of problems (such as 16 problems). Once the student shows they can successfully complete 16 problems, you would increase the number of questions (such as 30 problems). Once they can complete 30 problems without fear, you would increase it again. These incremental increases will continue until the student has reached the average number of problems for his grade level.



## **Research**

### **The National Research Council**

In 2001, the National Research Council, which is the principal operating agency of the National Academy of Sciences, released the findings of an eighteen month mathematics based study. The purpose was to synthesize research on pre-kindergarten through eighth-grade mathematics learning to find what it means to be successful in mathematics and, based on these findings, provide research-based recommendations for teaching, teacher education, and curriculum development.

This study identified five crucial components each student needs to use while learning in order to develop mathematical proficiency. These components are conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Rooted Facts was developed with these components.

Conceptual Understanding occurs when a learner understands the mathematical concept being taught and the relationships the concept has. Rooted Facts breaks the principles of multiplication into smaller, learner-friendly chunks. This significantly increases a learner's opportunity to know, and understand, the why behind a multiplication fact. This also helps learners recognize the relationships multiplication facts have with each other, which further increases knowledge acquisition.



Procedural Fluency is an individual's ability to carry out mathematical procedures, such as multiplication, quickly, accurately, and efficiently. Not only does Rooted Facts improve student fluency after the use of the program, but learners also increase their procedural fluency during its use as students begin to recognize the various relationships between multiplication facts.

Strategic Competence occurs when a learner is able to identify, create, and use different strategies to reach an answer to a mathematical problem. Because Rooted Facts teaches students various chunking techniques to identify the correct answer to a multiplication or division problem, the student also develops a variety of strategies to identify answers.

Adaptive Reasoning is an individual's ability to reason why their chosen answer is correct. Rooted Facts is designed to have this ability develop naturally. For the first four lessons, as students follow the teacher's direct instruction, students automatically develop a deeper understanding of their taught multiplication and division facts. On the final lesson, lesson five, students are given the opportunity to investigate, explore and discuss all the multiplication items presented on the final Multiplication Guide. By providing this opportunity on the final lesson, this decreases the chance of student misconceptions so when these ideas are presented there is a much higher chance of student success.

Productive Disposition is a person's ability to see themselves as capable of solving mathematical concepts. Because this product was developed in a way that increases the likelihood of any student being able to learn the multiplication facts, regardless of perceived



disability, Rooted Facts can improve any student's belief in their ability to solve problems using mathematics.

### *Memory Development*

Memories are the most essential component of learning. Memories store information for us and allow us to recall this information when necessary. In order to develop a memory the brain first uses its sensory functions (such as sight, hearing, speech and touch) to gather information. The brain then analyzes this information through other functions of the brain (including language and reasoning) to organize the information and determine its usefulness. If this information is deemed useful it can then be transferred and stored in our long-term memory.

By focusing on the formation of memories we become better equipped to provide effective instruction. When a teaching method engages multiple functions of the brain (including sight, hearing, speech, touch, language and reasoning) there is an increased chance learning will occur.

Rooted Facts is a teaching technique developed to teach both multiplication and division. Rooted Facts utilizes each of these functions of the brain (sight, hearing, speech, touch, language and reasoning) during instruction to improve the likelihood memories will develop.

## Improving Retention



Memories are the most essential component of learning. Memories store information for us and allow us to recall this information when necessary..

Once a memory is developed it can then be strengthened. When a memory is strengthened it becomes easier to retrieve and lasts for longer periods of time. Memories can be strengthened through recency (how recently the information has been used), frequency (how frequently the information is used), and memory connections (the amount of connections to other memories).

By focusing on the strengthening of memories we become better equipped to provide effective instruction. When a teaching method incorporates recency, frequency, and connections to other memories there is an increased chance of longer retention and quicker retrieval.

Rooted Facts is a teaching technique developed to teach both multiplication and division. Rooted Facts utilizes each of these concepts (recency, frequency, and memory connections) during instruction to improve the likelihood memories will be retained.



## Middle School

### Rooted Facts Implementation Results

The Rooted Facts technique was utilized with middle school students at an alternative school in Arizona. The use of this technique began on 01/17/2017 and ended on 01/24/2017. The implementation consisted of 5 sessions, one session per day. Each session lasted approximately 30 minutes. This document details these results.

The primary goal of the Rooted Facts technique in an upper grade remedial setting is to provide a more efficient means in teaching multiplication and division facts to students who have been unable to become fluent in multiplication and division. The purpose of providing this information to student is to increase understanding of multiplication and division, thereby increasing the likelihood more advanced mathematical concepts can be learned.

#### Assessment and Implementation Information

To determine these scores each student was provided *RFM Pre-assessment Version 1*. *RFM Pre-assessment Version 1* is a 5 minute assessment consisting of 50 multiplication problems and 50 division problems from the 3x3, 3x4, 3x6, 3x7, 3x8, 4x4, 4x6, 4x7, 4x8, 6x6, 6x7, 6x8, 7x7, 7x8 and 8x8 fact families. These assessments were provided in a remedial setting in month six of the 2016/2017 school year.



Each student then took part in learning both multiplication and division facts using the Rooted Facts technique. The implementation consisted of 5 sessions, one session per day. Each session lasted approximately 30 minutes.

After implementation had been completed, each third grade student was provided *RFM Post-assessment Version 1*. This second assessment also consisted of 50 multiplication problems and 50 division problems from the 3x3, 3x4, 3x6, 3x7, 3x8, 4x4, 4x6, 4x7, 4x8, 6x6, 6x7, 6x8, 7x7, 7x8 and 8x8 fact families. This assessment was five minutes in length.

The results received from the second assessment were then compared to the first assessment using a bar graph. While growth was evident from each category, the highest growth occurred with scores from the lower 25%. The results are detailed below:

### **Class Average**

Class Average: 01/12/2017 - 10.25 Facts per Minute

Class Average: 01/25/2017 - 20.80 Facts per Minute

Class Average increase by Facts per Minute - 10.55 additional Facts per Minute

Class Average increase by percentage - Rise of 102.9%



### Lower 25%

Lower 25% Average 01/12/2017 - 3.85 Facts per Minute

Lower 25% Average 01/25/2017 - 16.60 Facts per Minute

Lower 25% increase by Facts per Minute - 12.75 additional Facts per Minute

Lower 25% increase by percentage - Rise of 331.2%

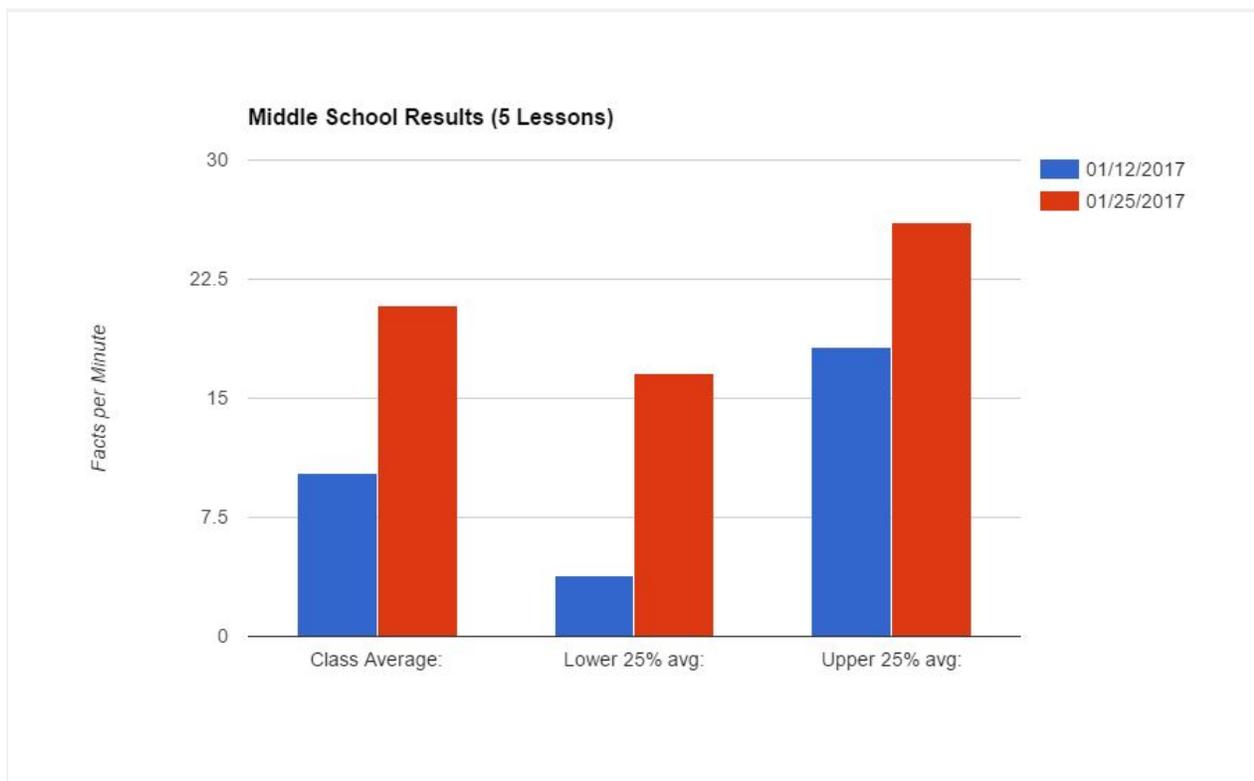
### Upper 25%

Upper 25% Average 01/12/2017 - 18.21 Facts per Minute

Upper 25% Average 01/25/2017 - 26.08 Facts per Minute

Upper 25% increase by Facts per Minute - 7.87 additional Facts per Minute

Upper 25% increase by percentage - Rise of 43.2%





# Monitoring Growth

Knowing students are learning can be a significant benefit for educators. There are two types of assessments inside this unit, short term assessments and long term assessments. The short term assessments are the post lesson fluency builders (which take place after each lesson). The long term assessments are pretests and post-tests (which can be accessed from [www.rootedknowledge.com](http://www.rootedknowledge.com)).

## **Pretests and Post Tests**

To administer a pretest or posttest, follow these steps:

1. Have students go to [www.rootedknowledge.com](http://www.rootedknowledge.com).
2. Have them click on the [learn online](#) button.
3. Have them click on the [take an assessment](#) button.
4. Provide them five minutes to complete the assessment.
5. Once five minutes have expired, have students click the “submit” button.
6. Have students who finish early click the submit button as well. This will record their true finish time.
7. Results will be displayed on each students computer. This Results Page provides correct answers and the time used.



## ***Unit Overview***

Following is a six-day unit developed to improve multiplication and division fact fluency. This unit of instruction is geared towards middle and high school students in remedial and special education math classrooms. Please see the various sections below for more details on this unit.

### **Performance Objectives**

Following are the objectives used in this unit:

#### **Objective 1 - Accuracy**

Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

#### **Objective 2 - Fluency**

Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.



## Instructional Strategies

This unit utilizes a variety of instructional strategies. Visuals are used to provide examples of work to be performed. Manipulatives are used to provide another avenue for learning to take place. A doubling strategy is used to tie facts together. Arrays are used to organize the information being learned.

## Materials and Resources

The only material needed for each student is either a computer or tablet. There are no resources needed.

## Instructional Sequence

This unit is comprised of six lessons that are 70 minutes each, a 5 minute pre assessment and a 5 minute post assessment. It is designed to be completed in six instructional days. Each lesson follows a basic sequencing over five steps: pre-instructional activities, content presentation and learner participation, assessment, and follow through activities.

The following pages will detail steps to perform six lessons. Through completion of these lessons, your class will improve automaticity of their multiplication and division facts for the 3, 4, 6, 7, and 8 fact families.

*Quick Note - Fluency builders are the glue that hold these memories in place. Not enough practice could mean not enough glue. Be sure students don't skip over them.*

## Lesson 1



*This first lesson will teach the **4x4**, **4x8**, and **8x8** fact families.*

### **Materials Needed:**

Computer or Tablet

**Time Required:** 70 minutes

### **Performance Objectives:**

Performance Objective 1: Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

Performance Objective 2: Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

### **Step 1 - Pre-Instructional Activities**

(Gagne 1 and 3 - Gain Attention and Stimulate recall of Prior Learning)

To prepare for learning of the first lesson students will be asked how doubling a single factor on a multiplication problem will change the product. This will start a discussion that will prepare the learners for the upcoming events.



(Gagne 2 - Inform Learners of Objective)

After the discussion, inform the learners of the current objective to increase abilities in multiplication and division facts by improving both accuracy and fluency.

**Step 2 and 3 - Content Presentation and Learner Participation - Part 1**

(Gagne 4 and 5 - Present the Content and Provide Learning Guidance)

1. Be sure each student has their own computer or tablet. The lessons have been setup to provide individualized guidance to each learner.
2. Once each student has personal access to the internet through a computer or a tablet, have them go to [www.rootedknowledge.com](http://www.rootedknowledge.com) to begin the instruction.
3. After each student has arrived at [www.rootedknowledge.com](http://www.rootedknowledge.com), instruct them to click on “Learn Online”.
4. Next, instruct them to click on Lesson 1
5. From here, students will be guided into developing a knowledge of multiplication and division facts.
6. The instructor should observe student work and behavior to verify each student is staying on task.

**Step 4 - Assessment**

(Gagne 6 - Elicit Performance)

1. Once students have completed the lesson, they will be instructed to begin an informal assessment. This assessment will reinforce the concepts just learned.



*(Gagne 7 and 8 - Provide Feedback and Assess Performance)*

2. Observe for students who are working on this assessment and provide feedback using a 5 to 1 ratio of positive statements to negative statements.

***Step 5 - Follow-Through Activities***

*(Gagne 9 - Enhance Retention and Transfer to the Job)*

To help improve fluency on the 4x4, 4x8, and 8x8 fact families, behavioral methods of instruction should now be used. It is important to note that these instructional methods should only involve facts from the 4x4, 4x8, and 8x8 fact families. Options for these behavioral methods include flash cards, timed drills, computer games, or any other option the instructor finds useful.

## Lesson 2



*This lesson will teach the 3x3, 3x6, and 6x6 fact families.*

### **Materials Needed:**

Computer or Tablet

**Time Required:** 70 minutes

### **Performance Objectives:**

Performance Objective 1: Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

Performance Objective 2: Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

### **Step 1 - Pre-Instructional Activity**

(Gagne 1 and 3 - Gain Attention and Stimulate recall of Prior Learning)

1. Be sure each student has their own computer or tablet. The lessons have been setup to provide individualized guidance to each learner.



2. Once each student has personal access to the internet through a computer or a tablet, have them go to [rootedknowledge.com](http://rootedknowledge.com) to begin the instruction.
3. After each student has arrived at [www.rootedknowledge.com](http://www.rootedknowledge.com), instruct them to click on “Learn Online”.
4. Next, instruct them to click on Lesson 2
5. Students will start with a fluency builder to help recall information from the previous lesson.

### **Step 2 and 3 - Content Presentation and Learner Participation**

#### **(Gagne 4 and 5 - Present the Content and Provide Learning Guidance)**

1. Once the fluency builder has been completed, students will automatically begin the lesson.
2. From here, students will be guided into developing a knowledge of multiplication and division facts.
3. The instructor should observe student work and behavior to verify each student is staying on task.

### **Step 4 - Assessment**

#### **(Gagne 6 - Elicit Performance)**

1. Once students have completed the lesson, they will be instructed to begin an informal assessment. This assessment will reinforce the concepts just learned



(Gagne 7 and 8 - Provide Feedback and Assess Performance)

2. Observe for students who are working on this assessment and provide feedback using a 5 to 1 ratio of positive statements to negative statements.

**Step 5 - Follow-Through Activities**

(Gagne 9 - Enhance Retention and Transfer to the Job)

To help improve fluency on the 3x4 and 6x4 fact families, behavioral methods of instruction should now be used. It is important to note that these instructional methods should only involve facts from the 3x3, 3x6, 6x6, 4x4, 4x8, and 8x8 fact families. Options for these behavioral methods include flash cards, timed drills, computer games, or any other option the instructor finds useful.

## Lesson 3



*This lesson will teach the **3x4** and **6x4** fact families.*

### **Materials Needed:**

Computer or Tablet

**Time Required:** 70 minutes

### **Performance Objectives:**

Performance Objective 1: Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

Performance Objective 2: Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

### **Step 1 - Pre-Instructional Activity**

(Gagne 1 and 3 - Gain Attention and Stimulate recall of Prior Learning)

1. Be sure each student has their own computer or tablet. The lessons have been setup to provide individualized guidance to each learner.



2. Once each student has personal access to the internet through a computer or a tablet, have them go to [rootedknowledge.com](http://rootedknowledge.com) to begin the instruction.
3. After each student has arrived at [www.rootedknowledge.com](http://www.rootedknowledge.com), instruct them to click on “Learn Online”.
4. Next, instruct them to click on Lesson 3.
5. Students will start with a fluency builder to help recall information from the previous lesson.

### **Step 2 and 3 - Content Presentation and Learner Participation**

#### **(Gagne 4 and 5 - Present the Content and Provide Learning Guidance)**

1. Once the fluency builder has been completed, students will automatically begin the lesson.
2. From here, students will be guided into developing a knowledge of multiplication and division facts.
3. The instructor should observe student work and behavior to verify each student is staying on task.

### **Step 4 - Assessment**

#### **(Gagne 6 - Elicit Performance)**

1. Once students have completed the lesson, they will be instructed to begin an informal assessment. This assessment will reinforce the concepts just learned



(Gagne 7 and 8 - Provide Feedback and Assess Performance)

2. Observe for students who are working on this assessment and provide feedback using a 5 to 1 ratio of positive statements to negative statements.

**Step 5 - Follow-Through Activities**

(Gagne 9 - Enhance Retention and Transfer to the Job)

To help improve fluency on the 3x3, 3x6, and 6x6 fact families, behavioral methods of instruction should now be used. It is important to note that these instructional methods should only involve facts from the 3x4, 6x4, 3x3, 3x6, 6x6, 4x4, 4x8, and 8x8 fact families. Options for these behavioral methods include flash cards, timed drills, computer games, or any other option the instructor finds useful.

## Lesson 4



*This lesson will teach the **3x8** and **6x8** fact families.*

### **Materials Needed:**

Computer or Tablet

**Time Required:** 70 minutes

### **Performance Objectives:**

Performance Objective 1: Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

Performance Objective 2: Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

### **Step 1 - Pre-Instructional Activity**

(Gagne 1 and 3 - Gain Attention and Stimulate recall of Prior Learning)

1. Be sure each student has their own computer or tablet. The lessons have been setup to provide individualized guidance to each learner.



2. Once each student has personal access to the internet through a computer or a tablet, have them go to [www.rootedknowledge.com](http://www.rootedknowledge.com) to begin the instruction.
3. After each student has arrived at [www.rootedknowledge.com](http://www.rootedknowledge.com), instruct them to click on “Learn Online”.
4. Next, instruct them to click on Lesson 4
5. Students will start with a fluency builder to help recall information from the previous lesson.

### **Step 2 and 3 - Content Presentation and Learner Participation**

#### **(Gagne 4 and 5 - Present the Content and Provide Learning Guidance)**

1. Once the fluency builder has been completed, students will automatically begin the lesson.
2. From here, students will be guided into developing a knowledge of multiplication and division facts.
3. The instructor should observe student work and behavior to verify each student is staying on task.

### **Step 4 - Assessment**

#### **(Gagne 6 - Elicit Performance)**

1. Once students have completed the lesson, they will be instructed to begin an informal assessment. This assessment will reinforce the concepts just learned



(Gagne 7 and 8 - Provide Feedback and Assess Performance)

2. Observe for students who are working on this assessment and provide feedback using a 5 to 1 ratio of positive statements to negative statements.

**Step 5 - Follow-Through Activities**

(Gagne 9 - Enhance Retention and Transfer to the Job)

To help improve fluency on the 3x8 and 6x8 fact families, behavioral methods of instruction should now be used. It is important to note that these instructional methods should only involve facts from the 3x4, 6x4, 3x3, 3x6, 6x6, 4x4, 4x8, and 8x8 fact families. Options for these behavioral methods include flash cards, timed drills, computer games, or any other option the instructor finds useful.

## Lesson 5



*This lesson will teach the **7x4** and **7x8** fact families.*

### **Materials Needed:**

Computer or Tablet

**Time Required:** 70 minutes

### **Performance Objectives:**

Performance Objective 1: Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

Performance Objective 2: Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

### **Step 1 - Pre-Instructional Activity**

(Gagne 1 and 3 - Gain Attention and Stimulate recall of Prior Learning)

1. Be sure each student has their own computer or tablet. The lessons have been setup to provide individualized guidance to each learner.



2. Once each student has personal access to the internet through a computer or a tablet, have them go to [rootedknowledge.com](http://rootedknowledge.com) to begin the instruction.
3. After each student has arrived at [www.rootedknowledge.com](http://www.rootedknowledge.com), instruct them to click on “Learn Online”.
4. Next, instruct them to click on Lesson 5
5. Students will start with a fluency builder to help recall information from the previous lesson.

### **Step 2 and 3 - Content Presentation and Learner Participation**

#### **(Gagne 4 and 5 - Present the Content and Provide Learning Guidance)**

1. Once the fluency builder has been completed, students will automatically begin the lesson.
2. From here, students will be guided into developing a knowledge of multiplication and division facts.
3. The instructor should observe student work and behavior to verify each student is staying on task.

### **Step 4 - Assessment**

#### **(Gagne 6 - Elicit Performance)**

1. Once students have completed the lesson, they will be instructed to begin an informal assessment. This assessment will reinforce the concepts just learned



(Gagne 7 and 8 - Provide Feedback and Assess Performance)

2. Observe for students who are working on this assessment and provide feedback using a 5 to 1 ratio of positive statements to negative statements.

**Step 5 - Follow-Through Activities**

(Gagne 9 - Enhance Retention and Transfer to the Job)

To help improve fluency on the 7x4 and 7x8 fact families, behavioral methods of instruction should now be used. It is important to note that these instructional methods should only involve facts from the 7x4, 7x8, 3x4, 6x4, 3x3, 3x6, 6x6, 4x4, 4x8, and 8x8 fact families. Options for these behavioral methods include flash cards, timed drills, computer games, or any other option the instructor finds useful.

## Lesson 6



*This lesson will teach the 6x7 and 7x7 fact families.*

### **Materials Needed:**

Computer or Tablet

**Time Required:** 70 minutes

### **Performance Objectives:**

Performance Objective 1: Students will be able to answer 90 out of 100 questions correctly when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

Performance Objective 2: Students will be able to show appropriate fluency by answering multiplication and division fact questions with a speed of at least 20 facts per minute when given a 5 minute timed assessment of 100 multiplication and division facts from the 3, 4, 6, 7 and 8 fact families.

### **Step 1 - Pre-Instructional Activity**

(Gagne 1 and 3 - Gain Attention and Stimulate recall of Prior Learning)

1. Be sure each student has their own computer or tablet. The lessons have been setup to provide individualized guidance to each learner.



2. Once each student has personal access to the internet through a computer or a tablet, have them go to [rootedknowledge.com](http://rootedknowledge.com) to begin the instruction.
3. After each student has arrived at [www.rootedknowledge.com](http://www.rootedknowledge.com), instruct them to click on “Learn Online”.
4. Next, instruct them to click on Lesson 6
5. Students will start with a fluency builder to help recall information from the previous lesson.

### **Step 2 and 3 - Content Presentation and Learner Participation**

#### **(Gagne 4 and 5 - Present the Content and Provide Learning Guidance)**

1. Once the fluency builder has been completed, students will automatically begin the lesson.
2. From here, students will be guided into developing a knowledge of multiplication and division facts.
3. The instructor should observe student work and behavior to verify each student is staying on task.

### **Step 4 - Assessment**

#### **(Gagne 6 - Elicit Performance)**

1. Once students have completed the lesson, they will be instructed to begin an informal assessment. This assessment will reinforce the concepts just learned



(Gagne 7 and 8 - Provide Feedback and Assess Performance)

2. Observe for students who are working on this assessment and provide feedback using a 5 to 1 ratio of positive statements to negative statements.

**Step 5 - Follow-Through Activities**

(Gagne 9 - Enhance Retention and Transfer to the Job)

To help improve fluency on the 6x7 and 7x7 fact families, behavioral methods of instruction should now be used. It is important to note that these instructional methods should only involve facts from the 6x7, 7x7, 7x4, 7x8, 3x4, 6x4, 3x3, 3x6, 6x6, 4x4, 4x8, and 8x8 fact families. Options for these behavioral methods include flash cards, timed drills, computer games, or any other option the instructor finds useful.