

# FREE THROWS: A 7<sup>th</sup> Grade Unit

## TEACHER'S GUIDE

### Correlation to NCTM Curriculum Focal Points and Connections to the Focal Points for Grade 7

**(CFP) Number and Operations and Algebra and Geometry: Developing an understanding of and applying proportionality, including similarity.**

**Students extend their work with ratios to develop an understanding of proportionality that they apply to solve single and multistep problems in numerous contexts. They use ratio and proportionality to solve a wide variety of percent problems, including problems involving discounts, interest, taxes, tips and percent increase or decrease.** They also solve problems about similar objects (including figures) by using scale factors that relate corresponding lengths of the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and identify the unit rate as the slope of the related line. They distinguish proportional relationships ( $y/x=k$ , or  $y=kx$ ) from other relationships, including inverse proportionality ( $xy=k$ , or  $y=k/x$ ).



**It is essential that these focal points be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.**

Bold print in the description of the focal point identifies the topic addressed in the unit.

### WARM UP

Shaq made 60% of his basketball free throws. He made twelve free throws. How many free throws did he attempt?

### Warm Up Suggestions

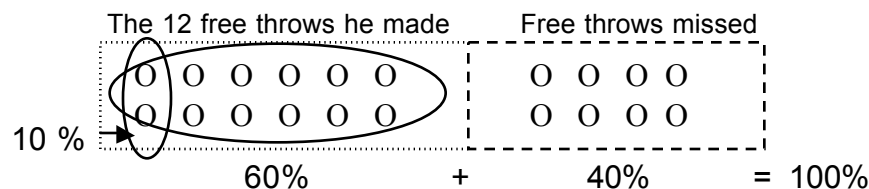
Ask students to:

- Talk about the vocabulary of basketball (free throws, making, attempting).
- Solve an easier question: "What if he attempted ten free throws, how many would he make?"
- Come up with visual representations of 60% of the free throws.

*(Suggestions continue...)*

### A Solution

If 60% were made, then 40% were missed.



12 free throws made + 8 shots missed = 20 free throws attempted

## Teacher's Guide: Grade 7

Each unit is correlated to the NCTM Curriculum Focal Points and/or the Connections to the Focal Points.

Each unit includes one or more Warm Up Problems, a Problem Solving Task and one or more Extension Problems.

This resource encourages visual solutions.

Possible solutions are included when one answer is appropriate.

## PROBLEM SOLVING TASK

Claire has only missed eight free throws all season. If she makes her next six free throws in a row, she will make exactly 75%.

Create a visual representation of this situation and/or write an algebraic expression to help you find out how many free throws she has **made** so far, not counting the next six.

Show your work and explain your thinking.

### Problem Solving Task Suggestions

If the students are not yet comfortable with algebraic expressions, change the task to ask for mathematical expressions.

Ask students to:

- Discuss with a partner possible ways to begin to work on this problem. Then share ideas with the class.
- Let students work independently or in pairs to solve the problem.

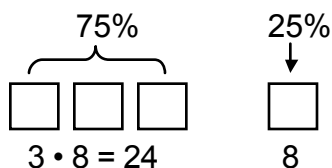
Visit groups during work time to observe and ask questions that draw out student reasoning. However, be careful to avoid verbal and non-verbal responses that would discourage independent student reasoning and that would direct students to the teacher's way of thinking. Look for different approaches. Suggested questions to **promote student thinking** (for use when students have trouble entering into the task) include: "What did you do first to begin to solve this? If Claire makes 75% of her shots, what percent did she miss? How many total free throws has Claire attempted? Were you able to make and use a visual?"

When the class is finished:

- Ask students with visual methods to share first, and those with abstract methods to share last, in order to help all students understand the work.

*(Suggestions continue...)*

#### A Solution



The eight free throws missed will be 25% of the total. Eight is 25% of 32, so her total attempted shots were 32. Since 32 is the total and she missed eight of them, she has **made** 24 shots. The 24 shots include the last six, so not counting those six would be 24-6, or 18 shots made.

### Teacher's Guide: Grade 7 (continued)

Pages have been reduced in size and/or combined for this sample folder.

Each unit includes blackline masters of each problem with permission for one classroom teacher to make copies for his/her students.

Teaching suggestions frequently include sample questions that can help guide students toward discovering new ways to make sense of a problem.

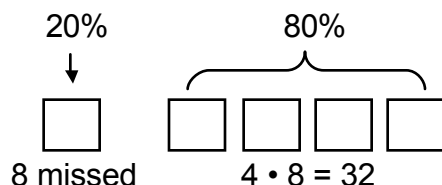
## EXTENSION 1

Assuming Claire made the six free-throws in the Problem Solving Task, how many **more** free throws in a row will Claire need to make to bring her percentage up to 80%?

### Extension 1 Suggestions

All Extensions refer to the answer from the Problem Solving Task.

#### A Solution



Claire made 24 in the Problem Solving Task.

$$32 - 24 = 8$$

She needs **8 more free throws** in a row to reach 80%.

## EXTENSION 2

Assume that Claire is now at 80%, having only missed 8 free throws. What will her new percentage be if Claire makes her next 10 free throws in a row?

### Extension 2 Suggestions

Continue asking students to solve the task using both visual and abstract (numerical) methods. (Suggestions continue...)

#### A Solution

- In the Problem Solving Task, Claire made 18 free throws, and then 6 more in a row.
- In Extension 1, she scored 8 more free throws.
- In Extension 2, she scored 10 additional free throws.

$$\frac{18 + 6 + 8 + 10}{8 + 18 + 6 + 8 + 10} = \frac{42 \text{ "made"}}{50 \text{ attempted}} \quad 42 \text{ out of } 50 \text{ is } \mathbf{84\%}.$$

## EXTENSION 3

Can Claire ever get her free throw percentage to be 100% for this season? Explain why or why not.

#### A Solution

No. Her free throw percentage cannot ever be 100%, because she will always have missed eight free throws.

## Teacher's Guide: Grade 7 (continued)

Extension problems are included in each unit for students who are ready for additional challenges.

The range of difficulty, from the first Warm Up to the hardest Extension, provides appropriate challenges for students of diverse skill levels.

## H.2 FREE THROWS Rubric

### **3-Point Response (Proficient)**

The response shows a clear understanding of percentages and their connection to part/whole (in this case: the number of free throws made divided by the number of free throws shot). Using a drawing and/or an equation leads to discovering that Claire has already made 18 free throws this season. The representations connect the ideas so the reader sees why the drawing (and/or equation) leads to 18 free throws.

### **2-Point Response (Partially Effective)**

The response may show a partial understanding of percentages when set in the context of free throws made divided by the number of free throws shot. The implementation of the justifiable method to solve the task may be only partially effective. The representations may not connect one idea to the next or to the solution of 18 free throws.

### **1-Point Response (Limited)**

The response may show a limited understanding of free throws made divided by the number of free throws shot producing the shooting percentage, or an ineffective or mathematically unjustifiable method is used. The representations may not connect the pieces of the solution to the task or to the solution of 18 free throws.

### **0-Point Response (Insufficient)**

The work is irrelevant, completely inaccurate, missing, or no more than a restatement of the problem.

### **Teacher's Guide: Grade 7 (continued)**

An individual rubric has been developed for each Problem Solving Task.

Our rubrics emphasize Understanding, Reasoning and Communication, which are promoted by the NCTM Curriculum Focal Points.

Our score of 3 is Proficient.

## H.2 FREE THROWS

### Sample and Scored Commentary

#### Sample (S/T) 2: Score 2

Although the response includes an appropriate equation from the proportion to represent the situation, there is nothing to convince the reader what the “ $x = 18$ ” tells us. The reader must infer that “18” indicates the total number of free throws made during the season. Although two parts of the equation are labeled, the work is not effectively explained.

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Sample (S/T) # 2

T/PK1

Claire has only missed eight free throws all season. If she makes her next six free throws in a row, she will make exactly 75%.

Create a visual representation of this situation and/or write an algebraic expression to help you find out how many free throws she has **made** so far, not counting the next six.

Show your work and explain your thinking.

will be shooting  
↓  
 $\frac{6+x}{8+6+x} = 75\%$

missed

will be shooting  
↓  
 $\frac{6+x}{14+x} = \frac{3}{4}$

Math

will be shooting  
↓  
if makes 6 throws

$$\frac{6+x}{8+6+x} = \frac{3}{4} \rightarrow$$
$$\frac{6+x}{14+x} = \frac{3}{4} \rightarrow 24+4x = 42+3x$$
$$x = 18$$

### Teacher's Guide: Grade 7 (continued)

Each Problem Solving Task has several samples of student work with scored commentaries based on an individual rubric.

The samples, commentaries and individual rubrics assist teachers in evaluating the work of their students.

The scored samples and commentaries also help students learn how to evaluate their own work on Problem Solving Tasks.

## “FIX IT!” H.2 FREE THROWS

DIRECTIONS: CHANGE OR ADD TO THE WORK BELOW TO IMPROVE THE FINAL SCORE.

Claire has only missed eight free throws all season. If she makes her next six free throws in a row, she will make exactly 75%.

Create a visual representation of this situation and/or write an algebraic expression to help you find out how many free throws she has **made** so far, not counting the next six.

Show your work and explain your thinking.

I guess and checked, I got she had already shot 18 of 26. I knew the more you make with the same amount missed the percentage is higher because  $\frac{1}{3} = .33$  and  $\frac{2}{3} = .6$  and  $\frac{3}{4} = .75$  and so on. I just started out with 32 out of 40 and that was too high so I went lower until I went too low and then I went up one more shot and I got .75 or 75%. To verify I double checked it. I got the same answer.

$$\frac{18}{26} + \frac{6}{6} = \frac{24}{32} = \frac{3}{4} = .75 = 75\%$$

### Teacher’s Guide: Grade 7 (continued)

After a class has completed a unit, the “Fix It!” activity can give students practice in revising and improving a work sample.

The job of the student in these exercises is to analyze what makes sense in the sample and what needs changing, and then to fix and complete the solution.

### TEACHER SELF-EVALUATION FORM

Check the strategies you used in this unit and note what you said or did.

WAYS TO HELP STUDENTS MAKE SENSE OF PROBLEM SOLVING	✓	WHAT I SAID OR DID
<ul style="list-style-type: none"> <li>Be aware of the mathematics embedded in each unit—Warm Up(s), Task and Extension(s)—so you can engage students in discussions that will deepen mathematical understanding.</li> </ul>		
<ul style="list-style-type: none"> <li>Encourage visualization of solutions, especially with the use of manipulatives.</li> </ul>		
<ul style="list-style-type: none"> <li>Encourage students to rely on their own and each other’s thinking.</li> </ul>		

(Form continues...)

The Teacher Self-Evaluation Form is included at the end of each unit. It can assist teachers as they learn to incorporate these instructional strategies into their daily problem-solving lessons.