

FREE THROWS: A 7th Grade Unit

TEACHER'S GUIDE

Alignment to Washington 2008 Mathematics Standards for Grade 7

- 7.2. Core Content:** *Proportionality and similarity*
(Operations, Geometry/Measurement, Algebra)
- 7.2.B Solve single- and multi-step problems involving proportional relationships and verify the solutions.
- 7.6. Core Processes:** *Reasoning, problem solving, & communication*
7.6.A, 7.6.B, 7.6.C, 7.6.D, 7.6.E, 7.6.F, 7.6.G, 7.6.H

Vocabulary

Terms first used at Grade 7 in the MSP or in the AESD 7th Grade word list are identified in bold print.

- Rate
- Ratio
- **Proportional**

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



TO HELP STUDENTS UNDERSTAND THE PROBLEM:

Ask students to explain the problem to you in their own words and to discuss possible strategies. (7.6.A, 7.6.B, 7.6.C)



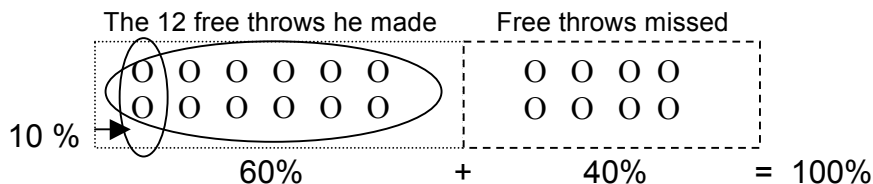
AS STUDENTS WORK:

Circulate to observe, listen to student discourse and ask questions, as needed:

- What if he attempted ten free throws, how many would he make? (if an easier problem is needed)
- How could you make a visual representation of 60%?

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

This Washington standards-based resource includes all of the 7th grade AESD and MSP terms. Instructional suggestions for vocabulary acquisition are included in Section I, Chapter C, Part 1, of this book.

Units include one or more Warm Up Problems, a Problem Solving Task and one or more Extension Problems.

Presentation slides with Virtual Manipulatives are available to accompany this unit.

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



TO HELP STUDENTS UNDERSTAND THE PROBLEM:

Ask students to explain the problem and discuss possible solution strategies. Include possible visual solutions in the discussion. (7.6.A, 7.6.B, 7.6.C)

Ask students to estimate how many free throws she has made so far.



AS STUDENTS WORK:

Circulate to observe, listen to student discourse and ask questions as needed. Select several different types of solutions for sharing later.

Watch for some common misconceptions:

- Confusing shots missed with shots made
- Thinking 8 free throws represents 75%

Questions for students who have trouble getting started:

- What does, “75% free throw “success rate” mean?
- If Claire makes 75% of her shots, what percent did she miss?
- How many total free throws has Claire attempted?
- How could you use a picture or a table to help us “see” this problem?



WHEN STUDENTS ARE FINISHED:

- Invite groups that you selected to share their work. Ask the class to evaluate solutions. (7.6.D, 7.6.E, 7.6.F, 7.6.G)
- 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.
- Ask, “Does the solution meet all the criteria of the problem?”
- Focus students’ understanding of how to use proportional relationships.

Journal: Show and explain how a visual solution to this problem relates to an algebraic or numerical solution.

Teacher’s Guide: Grade 7 (continued)

The coding (7.6.A, etc.) shows how the instructional suggestions match the WA Core Process Standards for Grade 7.

Although problems in this sample are outlined for readability, many of the BLM’s are in MSP format.

This program encourages multiple ways to find solutions. We encourage sharing the most concrete solutions first, so that all students can understand. Abstract or sophisticated solutions are shared last.

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.

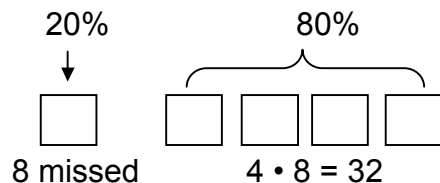


HELP STUDENTS UNDERSTAND THE PROBLEM:

Ask students to explain the problem and discuss possible solution strategies. (7.6.A, 7.6.B, 7.6.C)

Encourage students to make a visual representation as well as a numerical and/or algebraic representation of the problem.

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.

$$\frac{18 + 6 + 8 + 10}{8 + 18 + 6 + 8 + 10} = \frac{42 \text{ "made"}}{50 \text{ attempted}}$$

42 out of 50 is **84%**.

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.

Possible solutions are included when one answer is appropriate.

H.6 FREE THROWS Rubric	
Level	
4 Beyond Proficient	In addition to the requirements for a 3, the student shows “in-depth inferences and applications that go beyond what was taught.” Advanced understanding may be shown in connections, generalizations not required by the task, higher order approaches to the task, insightful methodology, or other ways.
3 Proficient	<p>The response has “no major errors or omissions” and shows that the student:</p> <ul style="list-style-type: none"> • Works with ratios to solve problems involving a variety of proportional relationships... including the connection to part/whole (in this case: the number of free throws made divided by the number of free throws shot); and • Can solve (single- and) multi-step problems involving proportional relationships and verify the solutions.
2 Partially Effective	<p>The response shows “no major errors or omissions regarding the simpler details and processes” and indicates that the student:</p> <ul style="list-style-type: none"> • Is at least partially effective when working with percentages; and • At least partially understands the proportional relationship in the free throw problem situation. <p>However, the work shows “major errors or omissions regarding the more complex ideas and processes.” The response may have computation errors and/or labeling errors and may be only partially accurate.</p>
1 Limited	<p>The response shows that the student demonstrates a limited understanding of some of the simpler details and processes of the task.</p> <p><i>Note: In your classroom, score a 1 if a student, with help, shows “partial understanding of some of the simpler details and some of the more complex ideas and processes.”</i></p>

**Teacher’s
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(continued)**

An individual rubric has been developed for each Problem Solving Task, modeled on the Washington ESD/Marzano-style rubrics.

Line(s) in bold are quoted from the WA 2008 Mathematics Standards.

* All quotes and many ideas are from WA ESD/Marzano rubrics. Retrieved from <http://www.esd112.org/marzano/>
Line(s) in bold are taken directly from the WA 2008 Mathematics Standards.

H.2 FREE THROWS

Sample and Scored Commentary

Sample (S) 2: Score “almost a 3”

The response has “no major errors or omissions”. Although it uses an appropriate equation from the proportion to represent the situation, the reader must infer that “ $x = 18$ ” indicates the total number of free throws made during the season. Although two parts of the equation are labeled, this response would be improved by clear labeling of the answer and at least brief explanations or labels of the work.

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.

$$\begin{array}{l}
 \begin{array}{l} \text{will be shooting} \\ \downarrow \\ \frac{6+x}{8+6+x} = 75\% \end{array} \quad \begin{array}{l} \text{Math} \\ \text{will be shooting} \\ \downarrow \\ \text{if makes 6 throws} \end{array} \\
 \text{missed } \frac{6+x}{8+6+x} = 75\% \rightarrow \frac{6+x}{8+6+x} = \frac{3}{4} \rightarrow \\
 \begin{array}{l} \text{will be shooting} \\ \downarrow \\ \frac{6+x}{14+x} = \frac{3}{4} \end{array} \rightarrow 24+4x = 42+3x \\
 x = 18
 \end{array}$$

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 $\frac{18}{26} = .6$ and $\frac{24}{32} = .75$ and so on. I just started out with 32 out of 40 and that was 28 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"> 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. 	<input type="checkbox"/>	
<ul style="list-style-type: none"> Encourage visualization of solutions, especially with the use of manipulatives. 	<input type="checkbox"/>	
<ul style="list-style-type: none"> Encourage students to rely on their own and each other’s thinking. 	<input type="checkbox"/>	

(Form continues...)

The Teacher Self-Evaluation included in each unit can assist teachers as they incorporate these instructional strategies into their daily problem-solving lessons.