# ***Nana's Lemonade***

By Dan Meyer
http://www.101qs.com/3043

## Instructor Notes

By Trey Cox

### What is a Three Act Task?

- If you are unfamiliar with Dan Meyer's Three Act Tasks or would like to watch a good overview of how they can be effectively implemented in your classroom, be sure to watch this Youtube video: Three Act Tasks .
- A very good blog produced by Dan Meyer includes valuable information. On the blog he explains his philosophy of the Three Act Task as well as answers questions from classroom teachers can be found at: dy/dan.
- You can find an Excel spreadsheet of Three Act Tasks created or inspired by Dan Meyer can be found here . It includes over 70 lessons you can access from the spreadsheet. Most of the tasks do not include fully fleshed out lessons. That is the goal of the Teacher Notes and Student Handouts that I have created and posted on the AMP Network for your use.

### Overview of Lesson:

In a brief video, students are confronted with the situation of a person squeezing a lemon slice into a small cup of water. Then a "big gulp" cup is placed next to the smaller, lemon filled cup. By asking the question, "How many lemon wedges do you need to add for the same lemony taste?" students will begin to experiment and mathematically determine the answer.

This lesson includes the following documents (find on the AMP Network or on the Dan Meyer website):

- Student Activity
- Instructor Guide

### Common Core Standard(s) Addressed:

CCSS.Math.Content.6.NS.A.1
Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

CCSS.Math.Content.6.RP.A.1
Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

CCSS.Math.Content.6.RP.A.2
Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship.

CCSS.Math.Content.6.RP.A.3
Use ratio and rate reasoning to solve real-world and mathematical problems.

# Nana's Lemonade - Student Activity

By Trey Cox

Act One:
Watch: "Drinking Lemon Water" Video:

On your own (without any help from other students):

1) Guess how many 1/8ths of a lemon (a wedge) should be used to make the large glass of water taste the same. Explain how you chose your guess. Write down one guess that you know will be too large but is still reasonable (e.g. don't write "a billion") and one guess you know will be too small but is still reasonable (e.g. don't write "0"). How do you this guess is too large?

Act Two:
Team up with at least one other student and brainstorm an answer to the following question:

2) What additional information would you like to have so you can try to answer the questions "How many 1/8ths of a lemon (a wedge) should be used to make the large glass of water taste the same?" **Don't actually try to provide a numerical answer** – just state the information you think would be necessary to do so. (And you may **not** just say "keep putting in lemons and keep tasting the water.")

3) Using the additional information you have been provided with regarding the glasses of water – answer the following questions:
    a. How many 1/8ths of a lemon will need to be squeezed into the larger cup to make it taste the same as the smaller cup of water?

Act Three:
Watch “The Answer”.

4) How close were your too high and too low guesses?

5) How close were your mathematical calculations?

Sequel

6) How large would a cup be that would require an entire lemon (eight 1/8ths of a lemon) to keep the same lemon taste?

# Nana's Lemonade - Student Activity

By Trey Cox

Act One:
Watch: "Drinking Lemon Water" Video:

On your own (without any help from other students):

1) Guess how many 1/8ths of a lemon (a wedge) should be used to make the large glass of water taste the same. Explain how you chose your guess. Write down one guess that you know will be too large but is still reasonable (e.g. don't write "a billion") and one guess you know will be too small but is still reasonable (e.g. don't write "0"). How do you this guess is too large?

*Answers will vary. The purpose of this question is to get students to make a conjecture as to what they believe the answer will be within a reasonable interval. Focus on getting students to vocalize how they know their guess is too large BUT reasonable.*

Act Two:
Team up with at least one other student and brainstorm an answer to the following question:

2) What additional information would you like to have so you can try to answer the questions "How many 1/8ths of a lemon (a wedge) should be used to make the large glass of water taste the same?" **Don't actually try to provide a numerical answer** – just state the information you think would be necessary to do so. (And you may **not** just say "keep putting in lemons and keep tasting the water.")

- *After brainstorming teams, pull together the class and have them discuss in a class discussion, record on white board*
- *Needed information includes:*
  - *The volume of the small cup*
  - *The volume of the large cup*

*After they ask for it, show students the image of the volume of the smaller and larger cups.*

3) Using the additional information you have been provided with regarding the glasses of water – answer the following questions:
   a. How many 1/8ths of a lemon will need to be squeezed into the larger cup to make it taste the same as the smaller cup of water?

*The problem can be defined by:* $\dfrac{\frac{1}{8}\text{ lemon}}{\frac{3}{4}\text{ cup}} = \dfrac{?\text{ lemon}}{3\text{ cups}}$.

*In other words, we will need to scale up by a factor of 4 to go from ¾ cup of water to 3 cups (* $\frac{3}{4}\ \text{cup of water} \cdot 4\ \text{copies} = 3\ \text{cups}$ *).*

*Therefore, we will also need 4 copies of 1/8ths of a lemon or four 1/8ths of a lemon.*

Act Three:
Watch "The Answer".

1) How close were your too high and too low guesses?

*Answers vary.*

2) How close were your mathematical calculations?

*Answers vary.*

Sequel

3) How large would a cup be that would require an entire lemon (eight 1/8ths of a lemon) to keep the same lemon taste?

*The problem can be defined by:* $\dfrac{8\ \text{copies of}\ \frac{1}{8}\ \text{of a lemon}}{?\ \text{cups}} = \dfrac{\frac{1}{8}\ \text{of a lemon}}{\frac{3}{4}\ \text{cup}}$.

*In other words, we will need to scale up by a factor of 8 to go from one 1/8th of a lemon to eight 1/8th of a lemon (* $\frac{1}{8}\ \text{of a lemon} \cdot 8\ \text{copies} = 1\ \text{lemon}$ *).*

*Therefore, we will also need 8 copies of ¾ cup of water or 6 cups of water.*