Mathematics: The Language of STEM
What is a Percent?
Mr. Wysong

CONTENT AND TASK DECISIONS

Grade Level(s): 7

Description of the Task: Students will draw pictures of percents when dealing with factors of 100. Students will need to color in 30 percent on different grids. Then, students will draw various percents on different grids. The students will then relate these pictures to equivalent fractions (proportions).

Indiana Mathematics Content Standards: 7.C.6 Use proportional relationships to solve ratio and percent problems with multiple operations, such as the following: simple interest, tax, markups, markdowns, gratuities, commissions, fees, conversions within and across measurement systems, percent increase and decrease, and percent error.

Indiana Mathematics Process Standards:
PS.1: Make sense of problems and persevere in solving them.
- Drawing a picture of a percent might take a little while for students to get their heads around when the number is not out of 100.

PS.2: Reason abstractly and quantitatively.
- Students will have a develop a concrete understanding of a percent. This will definitely take perseverance with harder and harder examples (ie. percent of 100, of 50, of 20, of 15)

PS.4: Model with mathematics.
- The whole task is about visualizing a percent.

PS.8: Look for and express regularity in repeated reasoning.
- The goal is to for students to connect the concrete drawings to the abstract concept of a proportion out of 100.

Mathematics Content Goals: Students will understand that a percent is a proportion of a value always compared to 100. Students will also understand what a proportion is (how two equal fractions are the same).

Language Objectives: Students will be able to explain what a proportion is using appropriate vocabulary. The teacher will need to intentionally focus on each part of a proportion and percent (visuals are key!).

Materials: Students will need paper with a 100-square grid, 50-square grid, 20-square grid, 10-square grid, and 8-square grid. They will need different colors of writing utensils and a pencil.

THE LESSON

Before:
- **Activate prior knowledge** Students will begin this lesson by briefly showing what they know about percents. They will write their own definition and give an example of a percent in context.
- **Be sure the problem is understood** students need to know what a percent really is and how they relate to numbers other than 100.
- **Establish clear expectations:** Students will stay on task working with only one other person.

During:

- **Let go,** students will draw 30% on the 100 grid. Then they will draw 30% on the 50 grid. Students will model 30% on the 20 grid and 10 grid as well. We will discuss how to find 30% of each number visually (not by multiplying!). I will ask students how to cut the grid in order to have 100 boxes. This will be the same factor used to multiply to get 100. I hope students will explore the relationship between the number of pieces the boxes need to be cut into and the number of boxes shaded on each grid.
- **Listen actively,** this process will be repeated for each grid.
- **Provide appropriate support**…ask, is there more than one way to find 30% of this grid? How can we color it in without cutting the grid into 100 squares? What is 30/100 equivalent to?
- **Provide worthwhile extensions**. Students will color 30% of the 8 grid. How do we find a percent of a value without having a grid at all? Can you have a percent higher than 100? What types of situations in real life might have a percent over 100 (no talking about extra credit)?

After: Students will work with a partner to set up proportions and solve problems with percents. Then we will solve proportions NOT related to percents. Students will be given a few proportions to solve that have denominators that are factors of one another. Then, we will have a class discussion of how to solve a proportion with denominators of 5 and 8.

The next day's lesson will address WHY cross multiplying works!

- **Promote a mathematical community of learners:** Students will individually complete two problems. They will then talk with their partner about what they did. I will give a few groups the opportunity to share their ideas with the whole class. Then we will repeat the process two more times. I will try to have every partnership share after one of the three pairs of questions.
- **Listen actively without evaluation:** After each partnership shares, we will have whole group discussion on what other students like and what they have questions about.
- **Make connections:** Each set of two questions will lead to generalizations. Hopefully, at least a few groups will catch on and share them. If not, I will ask some leading questions to help the class make connections. Examples are listed below.
  1) Would this work for all percents?
  2) Would this work for grids of all sizes?
  3) Is there a different way to come to the same answer?
  4) Can we write a rule for a new student on how to (find a percent, the number of boxes, etc)?
- **Summarize main ideas:** I will ask the partners to work together to generalize how we can solve a problem of each of the three types. I will write each of the ideas on the board.

ASSESSMENT

Observe: I will circulate the room while students are working with partners on the original task (grid coloring). I will have spaces to fill in on a worksheet that I will be able to see as they work. I could even collect this at the end of class if the questions below are written on it. The class discussions throughout the period will help me determine if students are ready to move on to the next level of problems.

Ask: Explain in your own words what a percent is. How can we find a percent of a number? What was confusing or challenging today?

Understanding Percents

What is a percent (in your own words)?

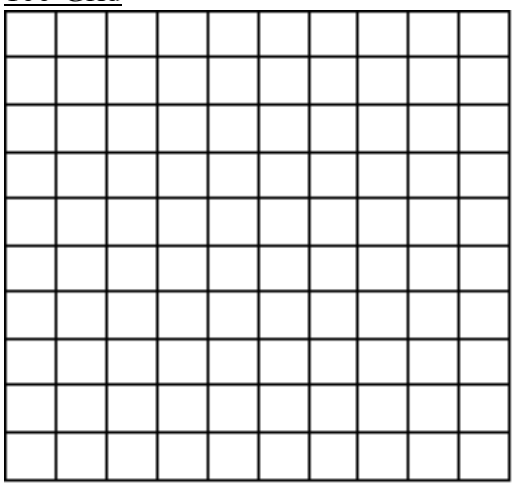
_____

When would you see a percent (outside of school)? Explain what the percent means in that context.

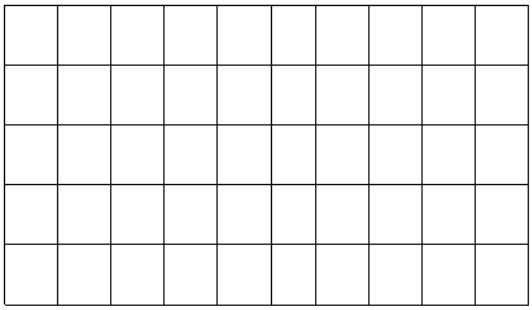
_____

_____

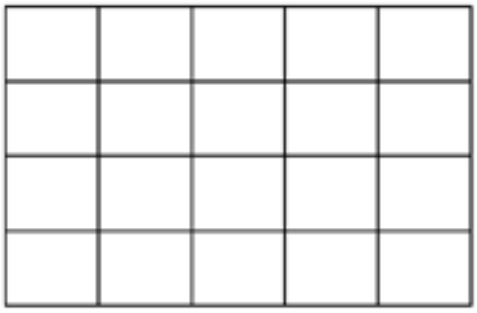
100-Grid



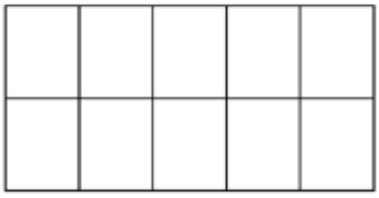
50-Grid



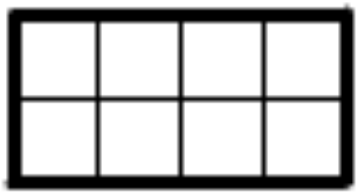
20-Grid



10-Grid



8-Grid

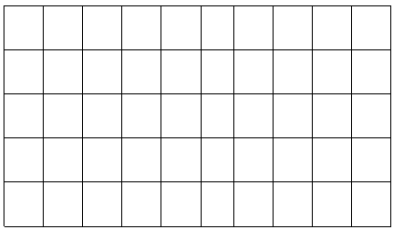


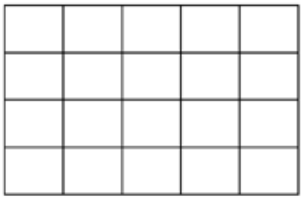
What is a proportion?

_____

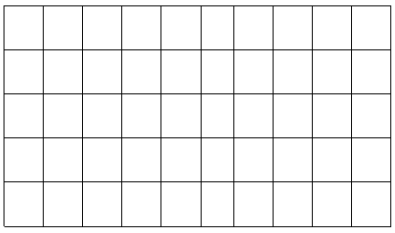
_____

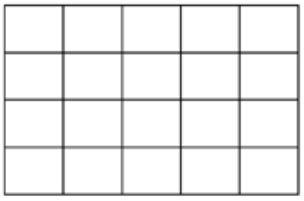
Shade 50% of both grids. Write the shaded region as a fraction.



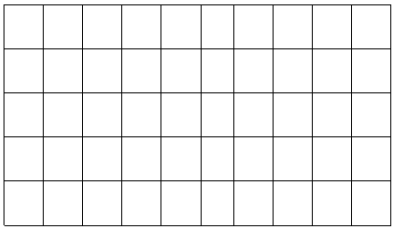


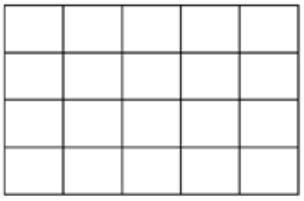
Shade 20% of both grids. Write the shaded region as a fraction.





Shade 15% of both grids. Write the shaded region as a fraction.





How many boxes would be shaded on each grid to represent 65%?

_____

How many boxes would be shaded on each grid to represent 80%?

_____

If 30 boxes are shaded on the 50-grid, how many boxes should be shaded on the 20-grid?

_____

If 8 boxes are shaded on the 20-grid, how many boxes should be shaded on the 50-grid?

_____

If John makes 3 out of 8 shots, how many shots would Raúl need to make out of 40 to make the same percent? How do you know?

_____

If Jess is at school 40 out of 45 days this quarter, how many days would she need to be at school during the next 18 days to keep her absent percentage the same?

_____