Lesson Title: ___Cube Hotel_____ Course: _____
Date: _____ Teacher(s): _____ Start/end times: _____

Lesson Objective(s): *What mathematical skill(s) and understanding(s) will be developed?*

8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2=p$ and $x^3=p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that the square root of 2 is irrational.

Lesson Launch Notes: *Exactly how will you use the first five minutes of the lesson?*

1. Display: http://www.entrepreneur.com/slideshow/175884#11
2. Say, "A new hotel is opening in town. Their guiding concept is similar to this hotel's; everything possible will be in the shape of a cube. "
3. Ask, "Can you think of some names for the new hotel that focus on this theme?
4. Ask the follow-up questions, "Can you incorporate the formula for the volume of a cube?" and "Which of these best models the actual formula for the volume of a cube?" (Possible answers: This didn't show up when downloaded-it's written in equation editor.)
5. Use this question to clarify vocabulary and activate prior knowledge.

Lesson Closure Notes: *Exactly what summary activity, questions, and discussion will close the lesson and provide a foreshadowing of tomorrow? List the questions.*

Ask, "Which is easier to have the length of the side of a cube and figure out the volume or to have the volume and figure out the side? Why? How are the two questions related? Can you write an equation that models each of these scenarios?"

The relationship between the edge of a cube and the volume when x is the edge of the cube and v is the volume.

The relationship between the volume of the cube and the length of one edge when x is the edge of the cube and v is the volume.

Lesson Tasks, Problems, and Activities (attach resource sheets): *What specific activities, investigations, problems, questions, or tasks will students be working on during the lesson?*

1. Ask, "What do you imagine this hotel looking like? What shapes would you see most often in this new hotel? Can you think of things inside a hotel with this theme that might be square? Can you think of things that might be cubes?"
2. Have students answer by choosing one thing they can think of that might be square and one thing that might be a cube. Ask students to draw each item. (Possible student drawings could include tiles, soap, stools, beds, desks, shampoo bottles, pools, hot tubs, bathtubs, phones, plates, room keys, tables, pictures, rugs, etc.)
3. Have students do a gallery walk or share on the board different student creations. Choose student suggestions that represent squares or cubes to model for the class. Then, ask students to think about how they would go about designing the different objects. Ask, "What information would you need in order to tell a manufacturer how to make this?" Students should realize that you would need to know the dimensions of the sides, the area, and the volume of the cubic objects. Make sure students can support their ideas. Ask, "Why would you need to know the volume of the object?"
4. Ask students to go back to their drawings and add in dimensions. Ask students to use the dimensions to figure out the volume. Consider using Katie Cubes, graph paper, or base ten cubes.
5. Ask, "What if the dimensions didn't matter, but the volume did? For example, we know that airlines only allow 3 ounce bottles of liquid in carry on bags. Any shampoo bottle, conditioner, water bottle, etc. shouldn't be any larger than three ounces. How could we figure out the necessary dimensions to create a cube that is three ounces in volume?" Model how to solve. Discuss how difficult these numbers are to work with. You will need to convert ounces to inches or centimeters. A good resource for conversions is http://www.infoplease.com/pages/unitconversion.html You may want to pick a different number to begin with, and model using the Katie Cubes.
6. Extend student thinking by looking at the hot tub design. Ask students to think about different volumes of a hot tub. Again, provide Katie Cubes if needed. If we were looking for numbers to make our design easy, what

volumes would give us those numbers?
   - If the volume is 8 cubic feet, what would the side dimensions be? Would that be big enough for a hot tub?
   - What if we increased the volume? If the volume is 10 cubic feet, what would the side dimensions be? Is that an easy number to work with?
7. Ask students to figure out some options for a cubic hot tub that result in whole numbers. Review the meaning and definition of "perfect cubes." As a class, create a chart for notes to keep in student notebooks. Review this process with squares. Good examples to use include the bathmat, area rug, or plates.
8. Distribute **Cube Hotel.** Before students begin, ask, "How do you know if the measurement given is a volume or an area?" Students may respond that they will know by the shape of the object or by the exponent.
9. Review the question that requires students to find the square root of 2 in detail. Depending on the level of your class and the time remaining, the depth of discussion regarding irrational numbers will vary. Some students may need a reminder of the definition of an irrational number. Others may want to know why the square root of 2 is an irrational number and could do research.

Evidence of Success: *What exactly do I expect students to be able to do by the end of the lesson, and how will I measure student mastery? That is, deliberate consideration of what performances will convince you (and any outside observer) that your students have developed a deepened (and conceptual) understanding.*

Students will solve problems by finding the square root or cube root of a number, identify perfect squares and identify perfect cubes. Mastery will be measured based on the Frog Habitat Task to follow this lesson.

Notes and Nuances: *Vocabulary, connections, common mistakes, typical misconceptions, etc.*

Vocabulary: perfect square, perfect cube, irrational number

A common mistake students may make is failing to convert between liquid measures and cubic linear measures.

Resources: *What materials or resources are essential for students to successfully complete the lesson tasks or activities?*

- Computers with Internet access
- **Cube Hotel** (Student Resource)
- Paper for drawing
- Graph paper
- Calculators
- Katie Cubes
- Base ten cubes

Homework: *Exactly what follow-up homework tasks, problems, and/or exercises will be assigned upon the completion of the lesson?*

To be determined by teacher.

Lesson Reflections: *What questions, connected to the lesson objectives and evidence of success, will you use to reflect on the effectiveness of this lesson?*

Are students able to solve equations in the form?
Do students recognize some small perfect squares and some small perfect cubes?
What am I going to do in future lessons to continue to develop student conceptual understanding of these concepts?