***Lesson Plan Template for\_\_\_6EE1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

Adapted from: Smith, Margaret Schwan, Victoria Bill, and Elizabeth K. Hughes. “Thinking Through a Lesson Protocol: Successfully Implementi ng High-Level Tasks.”

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| **PART 1: SELECTING AND SETTING UP A MATHEMATICAL TASK** | |
| What are your mathematical goals for the lesson? (i.e., what do you want  students to know and understand about mathematics as a result of this lesson?) | Understand that exponential notation represents multiplication where the base always remains the same.  When you were born, there was 1 tree in your hometown. If the trees double every 2 years, how many trees are there now? |
| What are your expectations for students as they work on and complete this task?   What resources or tools will students have to use in their  work that will give them entry into, and help them reason through, the task?   How will the students work—  independently, in small groups, or in pairs—to explore this task?   * How will students record and report their work? | * Background Knowledge:   Understand the meaning of exponents  Understand exponential notation (e.g., 3^4 = 3 superscript 4) and 3 superscript 4 = 3 x 3 x 3 x 3   * Expectations for students:   Students will be asked to work for about 3 minutes independently and then work with a partner or in a small group to figure out the task.  Students shall record their work in their math journal. Students may work through task using a variety of methods. These may include, graphs, charts, formulas, repeated addition, guess and check, pictures, models, etc.   * Students may be asked to report their work to partner, teacher, small group or whole group. |
| How will you introduce students to the activity so as to provide access to *all*  students while maintaining the cognitive demands of the task? | Gather a picture of a young tree. On the bottom of the picture or underneath write, “This tree was planted the year you were born.” After showing the picture, state the question for the task and write it on the board. |

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| **PART 2: SUPPORTING STUDENTS’ EXPLORATION OF THE TASK** | |
| As students work independently or in small groups, what questions will you ask to—   help a group get started or make progress on the task?   focus students’ thinking on the  key mathematical ideas in the task?   assess students’ understanding of  key mathematical ideas, problem- solving strategies, or the representations?   advance students’ understanding  of the mathematical ideas? | Help:  Ask questions….  “How are you going to show your thinking? What do you already know? Write your thinking in your math journal.  Focus:  When appropriate, use the vocabulary key words base and exponent. Using these words too early may take away from their exploration.  Assess:  Move out and monitor. Listen as students explain concepts to peers and to teacher. Teachers should record if understanding is there. Have students write down justification to problem. Have students share with the whole group if appropriate. |
| How will you ensure that students remain engaged in the task?   What assistance will you give or what questions will you ask a  student (or group) who becomes  quickly frustrated and requests more direction and guidance is  solving the task?   What will you do if a student (or group) finishes the task almost  immediately? How will you  extend the task so as to provide additional challenge? | * If they write down the numbers doubling every year but can’t get to the base… ask, “Do you see any patterns with the number of trees?”   How many times did you double the trees? (helping to find exponent)  Students may say, “If it doubles every two years then that means it adds 1 every year.” To this the teacher may respond, “Write that out.” “Show me how that doubles.”   * Immediate finishers and extensions…Students should be asked questions to promote higher learning if they finish early. Example: How would your pattern change if the trees quadrupled? How about tripled? Or if they doubled but it took 3 years or 10 years? Could you easily find the amount of trees there would be if you were 100? Could you find a formula that would work **every time**? * Extension, “Certain biological cells quadruple each hour. Start with one cell at 2:00 and find out how many cells there will be by 5:00. Create a diagram to represent the cell growth. Include an equation using exponential notation. * Extension: Have students read *One Grain of Rice* by Demi and refer their knowledge of the tree task to the story and have them predict and figure out some of the future numbers of rice in the book before actually finishing the entire story. If you want to use this as an introduction instead, stop early (such as page 4). |

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| **PART 3: SHARING AND DISCUSSING THE TASK** | |
| How will you orchestrate the class discussion so that you accomplish your mathematical goals?   Which solution paths do you want to have shared during the  class discussion? In what order will the solutions be presented? Why?   What specific questions will you ask so that students will—  1. make sense of the  mathematical ideas that you want them to learn?  2. expand on, debate, and question the solutions being shared?  3. make connections among the different strategies that are presented?  4. look for patterns?  5. begin to form generalizations?  What will you see or hear that lets you know that *all* students in the class  understand the mathematical ideas that  you intended for them to learn? | As teacher monitors class discussions during the task, specific learning will be shared during briefing  Pathways teachers should look and shared in this order…  Pictures  Repeated addition  List  Tables  Graphs  Repeated multiplication  Change of repeated multiplication to base and exponent  Equation  These should be shared in this order according to the Task Analysis Guide. These go from an easier to hard cognitive demand.  1.  2. Did anyone solve this the same way? Who got the same answer? (depending on age of students, there will be some different answers and this should be explored)  3. How can these two different strategies be different on paper but still produce the same results. How are these strategies connected.  4. What patterns do you see among the different solutions that have been shared?  5.  We are going to hear them make the connection between repeated multiplication and base and exponents. We are going to see and hear students justify their understanding of this concept to others. |