**Lesson Title: Domino matrices – computation practice**

**Unit Title: Matrices**

**Teacher Candidate: Laurel Lefebvre**

**Subject, Grade Level, and Date: 11th grade mathematics, March 2014**

**Placement of Lesson in Sequence**

This is the third day of a seven-day unit on matrices that is designed to cover the Common Core State Standards (CCSS) cluster for matrices within the Number and Quantity section of the standards for high school.

**Central Focus and Essential Questions**

The central focus of this lesson is calculation methods for adding, subtracting, and multiplying matrices of appropriate dimensions. Essential questions include knowing when (i.e. what dimensions) matrices can be added, subtracted, or multiplied together, and what the methods are to perform the calculations.

**Content Standards**

The Common Core State Standard this lesson is designed to address is:

N-VM.7. (+) Add, subtract, and multiply matrices of appropriate dimensions.

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| **Learning Outcomes** | **Assessment** |
| * Students will determine whether or not given matrices may be added, subtracted, or multiplied together.
* Students will give written and/or verbal explanations as to why or why not the indicated operation could be performed with the given matrices
* Students will perform the requested calculations, with answers presented in the proper format
 | * Students will complete a worksheet showing various matrices along with their calculations of the resultant matrices under the given operations (addition, subtraction, multiplication) or, if the operation is not possible with the given matrices, a written statement explaining why the operation is not possible
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| **Learning Targets** | **Student Voice** |
| * I can determine the dimensions of a given matrix
* I can create a matrix of given dimensions
* I can determine whether or not given matrices can be added, subtracted, or multiplied together
* If the operation cannot be performed on the matrices, I can explain in my own words why it cannot
* If the operation can be performed, I can do the calculations and present my answer in the proper format
 | * Students will create their own 1x2, 2x1, and 2x2 matrices using dominoes.
* Students will write explanations in their own words as to why or why not calculations could be performed on matrices with given dimensions.
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**Prior Content Knowledge and Pre-Assessment**

Matrices are a new topic that students have not previously encountered in their study of mathematics in school. No pre-assessment was done because it is assumed that students have no prior knowledge. The mathematics needed to perform the calculations is simply basic addition, subtraction, and multiplication.

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| **Academic Language Demands** |
| **Vocabulary & Symbols** | **Language Functions** | **Precision, Syntax & Discourse** |
| * Matrix (plural, matrices), row, column, dimension (size of the matrix)
* Bracket symbols that indicate a matrix, [ ]
* ‘X’ (the ‘by’ symbol, used in indicating the dimensions of the matrix)
 | * Students should be able to use the terms row, column, and by to describe the numbers within a matrix
* Students should NOT describe a matrix as a set.
 | **Mathematical Precision:** **Syntax:** Students should recognize and use correctly the singular (matrix) and plural (matrices) terms**Discourse:**  Students should be able to discuss the dimensions of the matrices they are creating with each other and with the teacher |

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| **Language Target** | **Language Support**  | **Assessment of Language Target** |
| Students will use the appropriate terminology at least 90% of the time when discoursing about the topic, whether orally or in writing. | Modeling of proper use of terms by the teacher in both spoken and written discourse.Explicit instruction in the meaning of the terms as part of the lecture portion of instruction | Listen while students complete the worksheet and discuss the problems in class. Review students’ use of proper terms (or lack thereof) in their written work turned in for the lesson  |

**Lesson Rationale (Connection to previous instruction and Objective Standards)**

Students will have been introduced during days 1 and 2 of this unit to the basic format of matrices, including the terminology for describing the “size” of a matrix, based on the number of rows and columns. The concepts and techniques of matrix addition, subtraction, and multiplication have been explained and demonstrated; today’s lesson is intended to provide further practice to the students to deepen their understanding.

Students will generate their own matrices by selecting dominoes from the random assortment of dominoes given them by the instructor. 1x2 and 2x1 matrices can be generated, depending on the orientation of the domino, and 2x2 matrices can be generated using two dominoes. Students who attempt the challenge question, which is optional, can use the dominoes to create 3x2 or 2x3 matrices as well.

**Differentiation, Cultural Responsiveness and/or Accommodation for Individual Differences**

This lesson should appeal to students with a variety of learning styles, as it is activity based, visual, and kinesthetic. The previous lesson where the topic was initially introduced was primarily auditory, so this lesson will teach the information in a different way in order to address the needs of students with different learning styles. Students can work individually or in pairs, based upon need and preference, as long as each student completes his or her own worksheet.

**Materials – Instructional and Technological Needs (attach worksheets used)**

**Teacher needs:**

* Overhead document camera
* Several sets of dominoes
* Worksheets
* Extra calculators (for students who did not bring)

**Student needs:**

* Pen or pencil
* Calculator
* Class notes or textbook

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| **Teaching & Instructional Activities** |
| **Time** | **Teacher Activity** | **Student Activity** | **Purpose** |
| :00 | Brief review of previous lesson; introduction of the day’s learning targets | Listen to and participate in review; read learning targets | Topic refresher, prepare for today’s lesson |
| :05 | Explanation and demonstration of activity | Get out calculator and writing utensil | Prepare for activity |
| :08 | Hand out worksheets and dominoes; walk around room to observe students and give assistance as needed | Students create matrices using their choice of dominoes, as directed by the worksheet concerning dimensions. Students record the matrices on their worksheets, then do the operation(s) indicated | Practice adding, subtracting, and multiplying matrices |
| :38 | If students are finishing early, direct them to the optional “challenge yourself” questions on the back of the worksheet | Use dominoes to conceptualize the questions posed in the “challenge yourself” questions, think critically and respond | Keep students engaged, provide additional challenge for gifted students |
| :48 | Collect dominoes (and worksheets if completed); review learning targets | Take worksheets home as homework if not completed; review learning targets | Reinforce learning targets. transition at end of class time |
| :50 | Dismiss students | Leave classroom in an orderly manner |  |