

Date: 18.04.2013

Teacher: Pelin Konuk

Number of Students: 20

Grade Level: 11th grade (11-I)

Time Frame: 45 minutes

Mathematics Learning Plan

1. Goal(s)

- To develop an understanding of product notation and its properties.

2A. Specific Objectives

- Students will be able to define product notation.
- Students will be able to apply product notation properties into exercises.
- Students will be able to represent the patterns with product notation.

2B. Ministry of National Education (MoNE) Objectives

- Çarpım sembolünü açıklar, kullanışları ile ilgili özellikleri gösterir, temel çarpım formüllerini modelleyerek inşa eder.

2C. NCTM-CCSS-IB or IGCSE Standards:

- In grades 9-12 all students should use symbolic algebra to represent and explain mathematical relationships.

3. Materials

- Worksheet
- Computer

4. Resources

- MoNE 11th grade mathematics book
- TED Collage power point presentation about product notation
- Worksheet that prepared by the teacher

5. Getting Ready for the Lesson

- Write topic and agenda on the board before the lesson starts.
- Prepare a worksheet about product notation and its' properties.

- Do not forget to distribute the worksheet.

6. Prior Background Knowledge

- Students should know method of induction and how to generalize a rule before this lesson.
- Students should know how to do multiplication.
- Students should know the sigma notation and its' properties in order to solve questions which include sigma and product notation together.

Lesson Procedures

Transition: The teacher will introduce herself to the classroom. Then the teacher should inform the students about today's topic which is product notation.

7A. Engage

- The teacher will ask students how they can multiply numbers from 1 to 1000. Also the teacher will ask in order to multiply all the numbers do they all need to write all the numbers one by one.
- The teacher will ask students how they can represent the multiplication of numbers from 1 to 1000.
- According to students answers the teacher will introduce the product notation. (The concept of product notation means to multiply all terms in the notation. Because mathematicians are very lazy about writing they found a way to do it easier. The Greek letter \prod is the product operator and means the product of all the terms, i is called the index number, and a_i refers to a series of terms to be multiply together. This mathematical notation is used to write down the equations which require the product of all the terms in.
- The teacher will ask students: “*why do we need to use product notation?*” (to make it easier to represent).

Transition: The teacher will write following exercises on the board and want students to work on them.

B. Explore

- The teacher will ask students to answer her questions.
 - a-) How can we write the multiplication of the numbers 3.5.7.9.11 by using the product notation?
 - b-) How can we write the 4^{43} by using the product notation?
 - c-) How can we write the $n!$ by using product notation?
 - d-) How can you write the statement $r^{\sum_{k=1}^n a_k}$ by using product notation?
- The teacher should wait the students until they will answer to the questions.

- The teacher should monitor the students' working process while they are trying to find the answers.
- The teacher should write the formulae and answers on the board after students give the answers.

$$\text{a-)} \prod_{k=1}^5 2k+1 \quad \text{b-)} \prod_{k=1}^{43} 4 \quad \text{c-)} \prod_{k=1}^n k \quad \text{d-)} \prod_{k=1}^n r^{a_k}$$

C. Explain

- The teacher will begin to explain the properties on the board.
- The teacher will write the following questions on the board and wait students to solve. Then the teacher will explain the questions one more time and give the properties related to the examples.

- $\prod_{k=1}^{20} 3.k$

- $\prod_{k=1}^n c.a_k = c^n \prod_{k=1}^n a_k$

- $\prod_{k=1}^6 3^k$

- $\prod_{k=1}^n r^k = r^{\frac{n(n+1)}{2}}$

- $\prod_{k=1}^6 k.Cosk\pi$

- $\prod_{k=1}^n a_k b_k = \prod_{k=1}^n a_k \cdot \prod_{k=1}^n b_k$

D. Extend

- The teacher will distribute a worksheet and ask students to solve exercises on the worksheet.

E. Evaluate

- The teacher will walk around the class while students are solving the worksheet and observe students' work.
- The teacher will follow the checklist to try to evaluate students' understanding.

Checklist

- The student represents the given pattern with product notation.
- The student generalizes the given pattern.
- The student makes connections with the previous topic.
- The student applies his/her knowledge into exercises.
- The student can solve the exercises correctly.

9. Closure & Relevance for Future Learning

- The teacher will ask students what they have done today.
- The teacher will direct to students to express product notation properties and how to use it.
- The teacher will give the homework. (rest of the exercises from the worksheet.)

10. Specific Key Questions:

- How can you add multiply the numbers from the 1 to the 1000?
- How can you represent numbers from 1 to the 1000?
- Why do we need to use the product notation?
- How can we use product notation into real life?
- How can you represent the given patterns with the product notation?
- If you did not know the answer how would you find it?
- Which product notation properties do we know so far?

- What we have learned today?

11. Modifications

- The exercises level verifies from the basic to the complex therefore every students in the class have a chance to deal with the exercises.
- I can expand the exploration part in order to ensure that every student reach the conceptual understanding of properties of product notation.
- In the worksheet there will be easy questions as well as hard ones in order to not to discourage the weakest students in the classroom.

Questions that will solved during the lesson:

$$1) 3.5.7.9.11 = \prod_{k=1}^5 2k + 1$$

$$2) 4^{43} = \prod_{i=1}^{43} 4$$

$$3) 3^{20} = \prod_{k=-5}^{14} 3$$

$$4) \prod_{k=1}^5 2^k k = \prod_{k=1}^5 2^k \prod_{k=1}^5 k = 2^{\frac{5*6}{2}} .5!$$

$$5) \prod_{k=1}^6 3^k = 3^{\frac{6*7}{2}} = 3^{21}$$

$$6) \prod_{k=1}^6 k \cdot \text{Cos} k\pi = \prod_{k=1}^6 k \prod_{k=1}^6 \text{Cos} k\pi = 6! \cdot \cos \pi \cdot \cos 2\pi \cdot \cos 3\pi \cdot \cos 4\pi \cdot \cos 5\pi \cdot \cos 6\pi$$

$$7) \prod_{k=1}^5 2^k k = \prod_{k=1}^5 2^k \prod_{k=1}^5 k = 2^{\frac{5*6}{2}} .5!$$

- Worksheet