

COMBINATORIC

by

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1. School —Thomasville High School
2. Contact:

Andy - Assistant Manager

We contacted Andy by phone and received permission to do the field trip. We then met Andy and discussed how the field trip would be implemented. Once the details were worked out, we called Andy a couple of days before the field trip to confirm.

3. In tenth grade, the mathematics curriculum should include investigation of the connections and interplay among various mathematical topics and their applications so that all students can-
 - a. Recognize equivalent representations of the same concept.
 - b. Relate procedures in one representation to procedures in an equivalent representation.
 - c. Use and value the connections among mathematical concepts.
 - d. Use and value the connections between mathematics and other disciplines.

An emphasis in the standard is the importance of the connections among mathematical concepts and those between mathematics and other disciplines. There are two general connections are important:

- a. modeling connections between problem situations that may arise in the real world or in disciplines other than mathematics and their mathematical representations; and
- b. mathematical connections between two equivalent representations and between corresponding processes in each.

Within our project, we are emphasizing combinatorics. This idea is a very relevant mathematical concept for all students from all backgrounds. Not only can combinatorics be used in most work places, it can also be used in every day life. In our opinion, no one is exempt in his or her life from using this mathematical concept.

The core curriculum assumption in the standards says, " Three years of mathematical study will revolve around a core curriculum differentiated by the depth and breadth of the treatment of topics and by the nature of applications." This assumption is proposing that the curriculum topics described in this document apply to every single student-except where the topics are specifically differentiated for those who are college intending. In particular, if the sequence of courses often designated as "general mathematics" does not address the content and associated goals of the core curriculum, it will not be acceptable.

As stated above, combinatorics is a concept that can be integrated into statistics, geometry, and algebra. Therefore, many students can have the opportunity to take a course that emphasizes combinatorics, whether they are college bound or lower level.

The students in our school that we are focusing are primarily African-American with a very mixed group of Socio-Economic Status'. Therefore, because combinatorics can be stressed in many different subject areas, at many different levels of mathematical learning, then it is a great concept to teach.

1. We are going to be studying combinatorics. Our field study will include a trip to Chuck E. Cheese. While all students may not have the opportunity to go to this particular restaurant, every student should be familiar with pizza. Students who are not familiar with pizza from their home environment commonly see it on the lunch menu at school.
2. We are going to Chuck E. Cheese to study combinatorics. The way we are going to study combinatorics is by seeing how many different pizzas can be made given certain amounts of toppings. On our worksheet, we started with one topping, and then went up to 13 toppings, which is the amount of toppings Chuck E. Cheese has.
3. Time Line:

Day 1:

Introduce Combinatorics, including formulas and ways in which it can be used.

Day 2:

Go to Chuck E. Cheese, giving a worksheet to be completed for homework.

Day 3:

Go over homework and discuss the students learning experience at Chuck E. Cheese. Also, discuss other environments that contain combinatorics.

4. Assessment:

Students will be expected to participate in the field trip. We will also be grading their homework, and checking their class participation. Lastly, at the end of the unit, we will test their knowledge of combinatorics.

Chuck E. Cheese's Field Trip Worksheet

We will be investigating Combinatorics with the help of pizza toppings. Our goal is to solve the problem statement.

Problem Statement: Every Friday night you and your friends go to Chuck E. Cheese's for dinner. If you want to order a different pizza every Friday night for one year, how many different toppings would Chuck E. Cheese's have to offer?

1. How many different pizzas can you order with only one topping?
2. How many different pizzas can you order with a choice of two toppings?
3. How many different pizzas can you order if given a choice of three toppings?
4. How many different pizzas can you order if given a choice of four toppings?
5. Make a table that represents the number of toppings offered with the total number of

different pizzas you can order.

6. Draw a graph that represents your data in your table.

7. Determine a function that represents the graph.

8. Look at the handout of Pascal's Triangle. Can you find these numbers in Pascal's Triangle?

9. Can you use Pascal's Triangle to help you find the number of pizzas that can be ordered with five or six toppings?

10. Derive a closed formula for determining how many different pieces you can make with n toppings.

11. Determine a recursive formula that represents this problem

12. Answer the Problem Statement, using the closed formula

13. Write a letter to Chuck E. Cheese's explaining how many different toppings they need to offer in order for someone to order a different pizza, once a week, for a year. In your letter explain how you determined the answer.

Combinatorics Field Study Outline

First Day: Introduce Pascal's Triangle

- Handout several worksheets with Pascal's Triangle have several rows of

Pascal's triangle filled in and discuss what method is used to fill in Pascal's Triangle.

- Have students complete the remaining rows of Pascal's Triangle.
- Ask students: Is there a pattern in the sums of the numbers of the rows and do the numbers repeat.
- Ask students to find: natural numbers, powers of 2, triangular numbers, Fibonacci numbers.

Second Day: Continue Investigation of Pascal's Triangle

- Hand out worksheets of Pascal's triangle with seven colored cells one in the middle and six around. Discuss the product of two groups of three cells. The product will be the same. Ask for prime factorization of each of the numbers of one color and then the prime factorization of the other color.
- Try a different flower on Pascal's Triangle and compare.

Third Day

- Discuss Factorials
- Show student's different ways factorials can be used to figure out real-world experiences. For example, ask students to determine how many possible routes there are between 3 cities, 5 cities, 7 cities, etc.
- Discuss probability and combinations.
- Discuss Binomial Expansion and how it relates to Pascal's Triangle.

Fourth Day

- Field Trip to Chuck E. Cheese's
- Give students' worksheet with Problem Statement and have them work on the worksheet in-groups.

Feedback Form

1. Do you think a field trip to a Pizza restaurant is an interesting way to help students look at Combinatorics in the real world?
2. What did you like about the field trip?
3. What would you change about the field trip?
4. What would you add to the outline when students are studying Combinatorics and Pascal's triangle?
5. What other field trips would you recommend that could implement the study of Combinatorics and Pascal's triangle?

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