

## Algebra 2

### Topic 1: Counting Rules – “Capsule Wardrobe”

Capsule wardrobe is a term coined by Susie Faux, the owner of a London boutique called "Wardrobe" in the 1970s. According to Faux, a capsule wardrobe is a collection of a few essential items of clothing in five categories that will not go out of fashion, such as skirts and trousers (called bottoms, category 1), shirts (tops, category 2), shoes (3), for women accessories (4) like jewelry and purses, and coats (toppers, 5), which can then be updated with seasonal pieces and t-shirts.<sup>[1]</sup> An outfit consists of one piece from each category. This idea was popularized by American designer Donna Karan, who, in 1985, released an influential capsule collection of seven interchangeable work-wear pieces. (Retrieved from Wikipedia, "Capsule wardrobe", August 21, 2013.)

If you have one pair of jeans, two shirts, two pairs of shoes, one coat and one belt, you could make four outfits. With a wardrobe this small, you could create a sample space or a list all the possibilities:

1 jeans, shirt 1, shoes 1, coat, belt	3 jeans, shirt 1, shoes 2, coat, belt
2 jeans, shirt 2, shoes 1, coat, belt	4 jeans, shirt 2, shoes 2, coat, belt

You will need a calculator and use a few keys you may not have found before

	TI	Casio
! – factorial	enter a number and then tap MATH, right arrow over to PRB down arrow to ! and “enter”	enter a number and then tap OPTN, F6 (right arrow), F3 (PROB), F1 (x!) and “enter”
nPr – permutation	enter the n, enter nPr, enter the r	
nCr – combination		

If needed, you can go to <http://www.youtube.com/watch?v=eEC1f97XYGY&feature=related> and watch a video that shows how to solve permutations and combination on a TI calculator.

**STEP 1:** Search to find answers for these questions. Write your answers on another sheet of paper. Put your name and class period at the top of each page you use. (Ask your teacher if you should work together if you do not have your laptop yet.) **Make sure you understand your answer!**

- 1) What is a permutation?
- 2) What is the mathematical formula for a permutation?
- 3) What is a combination?
- 4) What is the formula for a combination?
- 5) In your own words, what is the difference between a permutation and a combination?

## Step 2: Practice

- 6) Many of today's shirts are designed to be layered. How many ways can one pick 2 shirts to layer and wear from the 3 clean shirts in the closet? (think for a second, if you picked a red shirt and a blue shirt, would that be two ways of wearing the shirts or one way?)
- 7) If one owns two pieces from every category, how many different outfits could be made?
- 8) At a pep rally, everyone in the spirit section says they will wear 3 spirit shirts and pull one off after each senior cheer. How many ways could one wear 3 of the 8 different spirit shirts they own?
- 9) A Henrico HS student wants to buy more shoes after the sidewalks are repaired but first, she needs to make some room in her closet. She decides to only keep 3 of the 12 pairs of boots she owns. How many ways could she select pairs of boots to keep?

## Step 3: Assignment

- 10) How many different outfits do you currently own, an outfit is one piece from each category?
- 11) How many pieces of clothing in each category do you need to have 180 different outfits?
- 12) What is the fewest number of pieces of clothing in each category you would need to have 180 different outfits?
- 13) What is your recommendation for the number of pieces in a high school student's capsule wardrobe?

## Step 4: Reflection

- 14) Will question #11 or #12 have answers that are more different between classmates? Why?
- 15) What will you do to remember when to use a permutation or a combination?

Suggested Teacher Scoring

<b>Definitions and Practice</b>	<p>1) The number of outcomes where order or placement matters</p> <p>2) <math>\frac{n!}{(n-r)!}</math></p> <p>3) The number of outcome where order does not matter.</p> <p>4) <math>\frac{n!}{(n-r)!r!}</math></p> <p>5) The order of the sequence does not matter in a combination</p> <p>6) 6</p> <p>7) 32</p> <p>8) 336</p> <p>9) 220</p>	9 points
<b>Assignment</b>	<p>One point for any answer to each question, 9-12.</p> <p>Two points, problems not trivialized</p> <p>Two points, work shown</p> <p>12) 3 pieces in each category will be more than 180 outfits, <math>3^5 &gt; 180</math></p>	8 Points
<b>Reflection</b>	<p>One point for any answer that is written clearly (2 points #14, one point #15)</p> <p>14) one would expect #12 to have more similar answers because it states the fewest number of pieces in each category, so #11 would be more different between classmates.</p>	3 points
<b>Total</b>		20 points

