1. For this problem, explain or illustrate your reasoning in a way that would make sense to a middle school student. You are ordering a two-scoop ice cream cone and there are only three flavors to choose from: Chocolate, Vanilla, and Strawberry. Note: For this and for all ice cream cone problems that we do, we will assume that order matters. In other words, chocolate on top of vanilla is a different cone than vanilla on top of chocolate.

   a. If you let yourself repeat flavors (i.e., you could order double chocolate), how many different cones could you order from these flavors?

   b. If you decide that you do not want to repeat flavors, how many different cones could you order from these flavors?
2. The next time you go to get ice cream, you go to a place with more selection. This time there are six flavors to choose from: Chocolate, Vanilla, Strawberry, Butter Pecan, Fudge Ripple, and Mint Chocolate Chip.
   a. If you order a two-scoop cone and you cannot repeat flavors, how many different cones could you order from these flavors?

   b. If you order a two-scoop cone and you can repeat flavors, how many cones could you order?

   c. If you order a three-scoop cone and you cannot repeat flavors, how many cones could you order? For this part, explain your reasoning in a way that would be understandable to an upper elementary student.

3. You decide that having only six flavors to choose from limits your creativity so you go to Haskin and Dobbins where they have 32 flavors to choose from. You decide that with this many flavors, you do not want to repeat any flavors.
   a. How many two-scoop cones could you order?

   b. How many three-scoop cones could you order?

   c. How many four-scoop cones could you order?

4. If you have six flavors of ice cream, how many six-scoop cones could you make without repeating flavors? (I know that’s getting a bit dangerous, but let’s just pretend that we could make a six-scoop cone!)
5. What patterns do you see in the problems you have completed so far?

6. How might you generalize the work you have done so far?

7. Write several math questions you think you could answer that are similar to the ones you have answered here.
**Ice Cream Cones Galore Homework**

**Instructions:** Answer the following questions being sure to include some of your reasoning with your answer. For question 8d and 12, spend no more than 30 minutes on them combined.

8. Imagine that you are at an ice cream shop with 20 flavors. This ice cream shop has so many flavors, we won’t list them all. But, they definitely have chocolate and vanilla.
   a. How many two scoop cones could you order without repeating any flavors?
   
   b. How many three scoop cones could you order without repeating any flavors?
   
   c. How many four scoop cones could you order if you allow yourself to repeat flavors?
   
   d. How many four scoop cones could you order without repeating flavors if vanilla is one of the scoops?

9. If you are an elementary teacher with a class of 30 students, how many different ways could they line up to go to recess?

10. Suppose that you have a bottle collection with 8 different bottles and you want to arrange them in a line on a shelf. How many different ways could you arrange them?

11. If a campus telephone extension has four digits, how many different extensions are there with no repeated digits?

12. If a campus telephone extension has four digits and the first digit cannot be 0, how many different extensions are there with no repeated digits?
Ice Cream Dishes Galore

13. For this problem, explain or illustrate your reasoning in a way that would make sense to a middle school student. Let’s go back to the ice cream store. A friend takes you to a store with 4 flavors: Chocolate, Vanilla, Strawberry, and Mocha.
   a. Make an organized list of all the different three-scoop cones that you could make from 4 flavors without repeating flavors.

b. This store also offers the possibility of ordering your ice cream in a dish. In a dish, order does not matter because you can eat the flavors in any order regardless of how they are organized in the dish. How many different three-scoop dishes can you make from four flavors without repeating flavors?
14. Now you decide to take your friend to the store with six flavors: Chocolate, Vanilla, Strawberry, Butter Pecan, Fudge Ripple, and Mint Chocolate Chip. This store offers dishes too. Assume for each of the following that you cannot repeat flavors.
   
   a. How many 3-scoop cones can you make with 6 flavors?

   b. How many 3-scoop dishes can you make with 6 flavors?

   c. How many 2-scoop cones can you make with 6 flavors?

   d. How many 2-scoop dishes can you make with 6 flavors?

   e. How many 4-scoop cones can you make with 6 flavors?

   f. How many 4-scoop dishes can you make with 6 flavors?

15. Now you take your friend to Haskin & Dobbins where they have 32 flavors.
   
   a. How many 3-scoop dishes can you make with 32 flavors without repeating flavors?

   b. How many 4-scoop dishes can you make with 32 flavors without repeating flavors?
16. What patterns do you see in the problems you have completed thus far? In addition, do you see any relationships between the number of r-scoop cones of ice cream and r-scoop dishes of ice cream?

17. How might you generalize the work that you have done so far?

18. Write several math questions that you think you could answer that are similar to the ones you’ve answered here.
Ice Cream Dishes Galore Homework

Instructions: Answer the following questions being sure to include some of your reasoning with your answer.

19. Suppose you are at an ice cream shop with 20 flavors and that you do not want to repeat flavors.
   a. How many 3 scoop dishes can you make?

   b. How many 4 scoop dishes can you make?

20. How many different ways can you pick a committee of four people from a class of 35?

21. How many different combinations of six numbers can you draw out of 42 numbers if order does not matter? (Note: 1 divided by this number if the chance of winning the lotto with a particular set of 6 numbers.)
Ice Cream Extension Questions

22. Suppose you are at an ice cream shop with 32 flavors and you do not want to repeat flavors. This ice cream shop has so many flavors that we won’t list them all, but they definitely have chocolate, vanilla, mocha, and pecan praline.
   a. How many four-scoop cones could you order if pecan praline is one of the scoops?
   b. How many ten scoop cones could you order if at least one scoop is chocolate and one scoop is pecan praline?
   c. How many four-scoop dishes could you make if one scoop must be chocolate?
   d. How many four-scoop dishes could you make if one scoop must be chocolate and one scoop must be pecan praline?

23. How many ways can 3 cars and 4 trucks be selected from 8 cars and 11 trucks to be tested for a safety inspection?
24. How many different ways can you arrange the letters AAABBBBB?

25. How many different ways can you arrange the letters that spell Mississippi? (Note: the arrangements do not have to spell anything.)

26. FYI: This one is especially challenging. If a campus telephone extension has four digits, how many different extensions are there with no repeated digits if the first digit cannot be 0 and the second cannot be 1?