"when will I ever use this?"

MATH TOPICS ADDRESSED:
- Permutations and combinations
- Communication
- Representations

The Scoop on Ice Cream

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An ice cream shop offers 30 different flavors in 3 sizes: 1 scoop, 2 scoops, or 3 scoops. The store claims that "over 30,000 different selections are possible." Let's explore whether this claim is true. To start, 30 single-scoop servings are possible.

1. For multiple scoops, does the order in which scoops are put in a cone matter? For example, does a cone with vanilla first and chocolate second differ from one with chocolate then vanilla?

2. Assume that order matters. If there were only 8 flavors, how many 2-scoop servings of different flavors can you make? What changes if you assume that the order of the scoops does *not* matter?

3. What happens to the number of 2-scoop servings if a serving can be scoops of the same flavor? Does the order count in this type of serving?

4. Suppose the store has only 4 flavors—strawberry, vanilla, chocolate, and mint. How many 3-scoop servings could you make, with 3 *different* flavors per cone, assuming that order matters? How many of these cones have only strawberry, vanilla, and chocolate?

5. Assume that the order does not matter for 3-scoop servings. How can you get the number of 3-scoop servings quickly using your answer from question 4? What is the number of 3-scoop servings in this situation?

6. If there are only 4 flavors, how many 3-scoop servings are possible when 2 scoops are 1 flavor and the other scoop is another flavor, assuming that order does not matter? What changes if the order matters?

7. How many 3-scoop servings are available altogether (repeating flavors or not) if order matters? If order does not matter?

8. **Challenge:** Use the thinking from the previous questions to see if it is possible to make 30,000 different combinations with 30 flavors.

Edited by **Erik Tillema,** etillema@iupui.edu, who teaches at Indiana University in Indianapolis. Readers are encouraged to submit manuscripts through **http://mtms.msubmit.net**.

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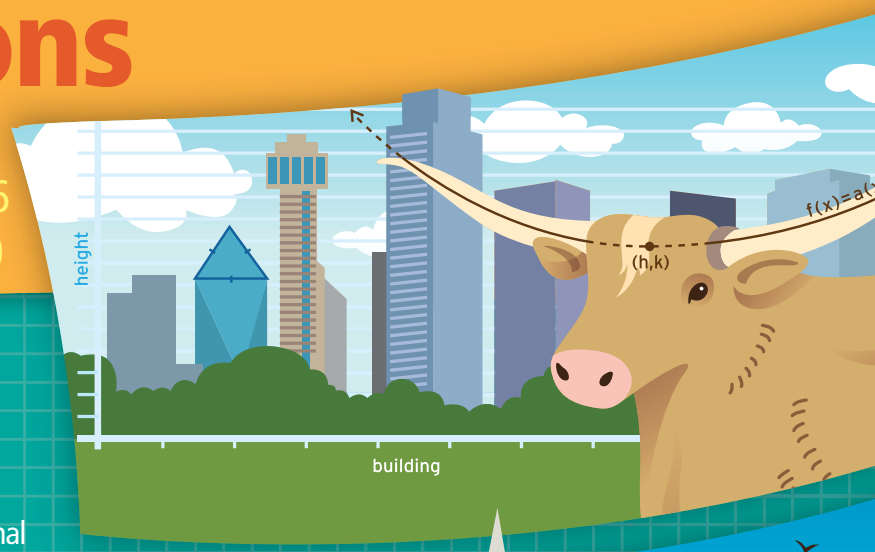

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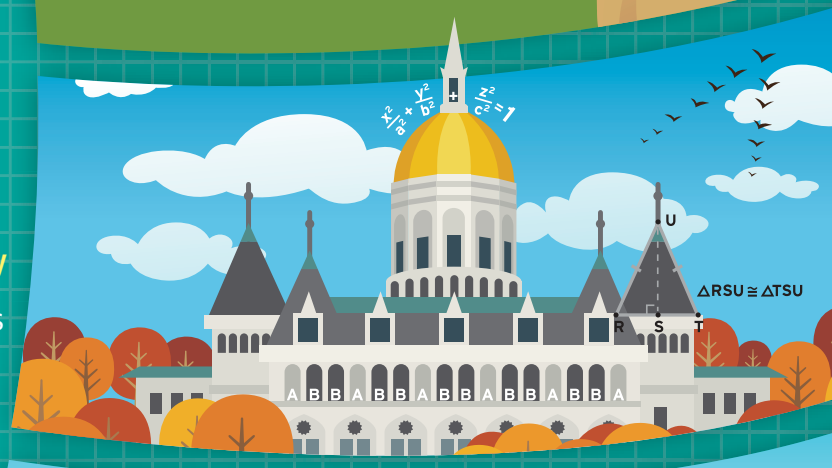

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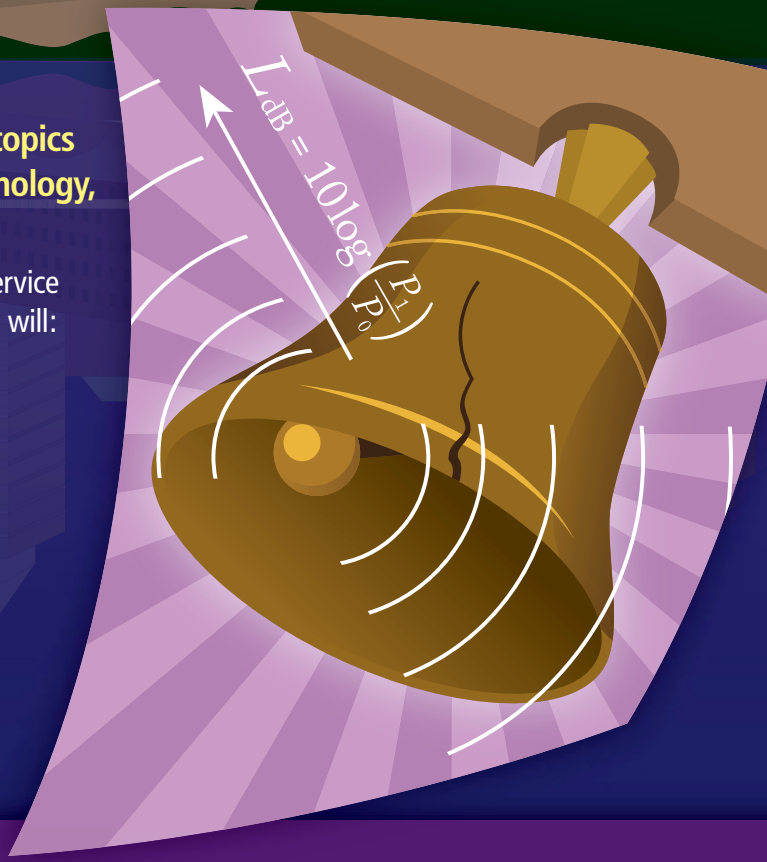

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