

Curriculum Inspirations

Inspiring students with rich content from the
MAA American Mathematics Competitions



Curriculum Burst 131: Selecting Donuts

By Dr. James Tanton, MAA Mathematician at Large

Pat wants to buy four donuts from an ample supply of three types of donuts: glazed, chocolate, and powdered. How many different selections are possible?

QUICK STATS:

MAA AMC GRADE LEVEL

This question is appropriate for the lower high-school grades.

MATHEMATICAL TOPICS

Permutations and Combinations

COMMON CORE STATE STANDARDS

S-CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.

MATHEMATICAL PRACTICE STANDARDS

- MP1** Make sense of problems and persevere in solving them.
- MP2** Reason abstractly and quantitatively.
- MP3** Construct viable arguments and critique the reasoning of others.
- MP7** Look for and make use of structure.

PROBLEM SOLVING STRATEGY

ESSAY 4: [DRAW A PICTURE.](#)

SOURCE: This is question # 19 from the 2001 MAA AMC 10 Competition.



THE PROBLEM-SOLVING PROCESS:

The best, and most appropriate, first step is always ...

STEP 1: Read the question, have an emotional reaction to it, take a deep breath, and then reread the question.

This question seems straightforward – in principle. All we have to do is list all the different combinations of donuts Pat could buy. For example, we could have:

Glazed = 4, Chocolate = 0, Powered = 0
or
Glazed = 1, Chocolate = 0, Powered = 3
or
Glazed = 1, Chocolate = 2, Powered = 1

But it feels like it is going to be a lot of work listing all the options. And I don't want to do that work!

I am picturing in my mind a store-front with three adjacent stacks of shelves. The left stack has all the glazed donuts, the middle stack the chocolate donuts, and the right stack the powdered donuts. Pat will pull out some donuts from each stack. So her four donuts could be represented as follows:



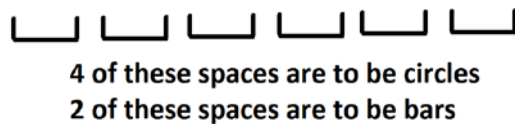
(this, to me, represents 1 glazed, 2 chocolate, and 1 powdered set of donuts) or



(no glazed, 2 chocolate, and 2 powdered), and so on.

Each option for Pat is represented by a picture of four donuts (circles) and two bars (shelf separators). (Hmm. Are pictures helpful or is my mind just being strange?)

Well, we've got pictures of six symbols in a row – four circles and two bars. How many different pictures are there?



Oh! All we have to do is select two spaces to be the bars. (The remaining four spaces will then be circles.) So Pat's donut puzzle boils down to the question:

How many ways can I select two spaces from six?

I know the answer to that! There are $\frac{6!}{2!4!} = 15$ ways to select two objects from six.

So there are 15 different "donut pictures" we can draw, and thus 15 different donut options for Pat!

One of my Favorite Puzzles: An ice-cream stand is having a "mega-bowl" special: 12 scoops of ice-cream in a bowl from any of 12 possible flavors. How many different mega-bowl options are there?

(See the video <http://www.jamestanton.com/?p=822> for more on this!)

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