multiple amounts of toppings, is

$$\binom{15}{5}+\binom{14}{4}+\binom{13}{3}+\binom{12}{2}+\binom{11}{1}+\binom{10}{0}=4368.$$

Thus, reasoning as before, the number of possible orders for two pizzas is $\binom{4368}{2}+4368=9{,}541{,}896$.

The "math whiz" should now be informed that he can order a different set of two pizzas each day for over eight million more days than he originally calculated. But wait! What if we allow "extra cheese" to count as a topping, or allow no more than doubles of any topping...?

Enjoy!

Visualizing the Group Homomorphism Theorem

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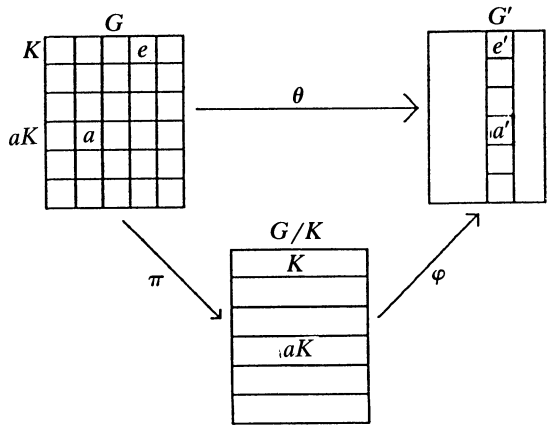
Inability to visualize the abstract concepts of group theory is one reason many students find the subject difficult. The accompanying figure should help such students visualize the cosets of a subgroup K of a finite group G, the quotient group G/K, and the fundamental group homomorphism theorem.



The group homomorphism theorem.

The groups are pictured as rectangles, rather than the usual ovals, and small squares inside G represent the group elements. The figure illustrates the partition of G into cosets of a normal subgroup K, indicating that all the cosets have the same number of members, and the order of K divides that of G. The strips forming G/K illustrate that the individual members of the quotient group are sets (the cosets of K). The diagram shows that a homomorphism $\theta\colon G \to G'$ with kernel K maps all members of a given coset of K to a single element in G', while the projection $\pi\colon G \to G/K$ maps all members of that coset to a single member of the quotient group; hence there is a one-to-one correspondence φ (a group isomorphism) between G/K and the image $\theta(G)$ (a subgroup of G'), making the diagram commute.