MATHCOUNTS® Problem of the Week Archive

Spring Festival – April 10, 2023

Problems & Solutions

It's time for the Spring Festival. This year, 63 children will be attending, and each child will receive a basket that includes 2 candy-filled Easter eggs. If the candy-filled eggs are sold by the dozen like real eggs, what is the minimum number of dozens needed for the children's baskets?

*If there are 63 children attending the festival, and each child will receive two eggs, the total number of eggs needed is 63 × 2 = 126 eggs. Dividing, we see that 126 ÷ 12 = 10.5, so **11** dozen eggs are needed for the children's baskets.*

For the Easter Egg Hunt, 126 eggs will be hand-dyed using one or more colors of egg dye and hidden around the community center. What is the minimum number of different colors of egg dye needed if there are to be two eggs in every possible color combination?

Since we know that there will be two eggs of each color combination, we will need 126 ÷ 2 = 63 different color combinations for the eggs. Using one color of egg dye will result in only one color option. Using two colors of egg dye will result in one egg dyed with the first color, one egg dyed with the second color and one egg dyed with the two colors combined. That's a total of 3 different colors of eggs. Another way to think of it is using combinations. With two colors of egg dye, we must determine the number of combinations of one or more of the colors. There are $_2C_1$ *ways an egg can be colored using one color of egg dye, and* $_2C_2$ *ways an egg can be colored using a combination of two colors for a total of 2 + 1 = 3 different combinations. So if three colors are used, that's a total of* $_3C_1 + {}_3C_2 + {}_3C_3 = 3 + 3 + 1 = 7$ *different combinations. Using four colors of egg dye results in a total of* $_4C_1 + {}_4C_2 + {}_4C_3 + {}_4C_4 = 4 + 6 + 4 + 1 = 15$ *different combinations. Similarly, using five colors of egg dye results in a total* $_5C_1 + {}_5C_2 + {}_5C_3 + {}_5C_4 + {}_5C_5 = 5 + 10 + 10 + 5 + 1 = 31$ *different combinations. Finally, using six colors of egg dye, the result is* $_6C_1 + {}_6C_2 + {}_6C_3 + {}_6C_4 + {}_6C_5 + {}_6C_6 = 6 + 15 + 20 + 15 + 6 + 1 = 63$ *different combinations. So the minimum number of different colors of egg dye needed to produce two eggs of every possible color combination is **6** colors.*

This year 3/7 of the hidden eggs were found by 5/7 of the children attending the Spring Festival. What is the average number of eggs found by each of the remaining children attending the festival?

*If 3/7 of the hidden eggs were found by 5/7 of the children attending, that means that the other 4/7 of the hidden eggs were found by the remaining 2/7 of the children. So, 126 × (4/7) = 72 eggs were found by 63 × (2/7) = 18 children. Therefore, the average number of eggs found by these 18 children is 72 ÷ 18 = **4** eggs.*

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