

MATHCOUNTS[®] Problem of the Week Archive

Inauguration Day Balls – January 25, 2021

Problems & Solutions

While last week's Inauguration looked quite different than usual and there were none of the traditional Inauguration Day Balls, here are some problems to commemorate that tradition.

There are nine official Inauguration Balls on the evening of Inauguration Day. Each ball lasts from 7 p.m. to 1 a.m. Let's assume the President would like to attend each ball. Assuming that the President requires 15 minutes of travel time between each ball, what is the average number of minutes he will be able to spend at each ball if he arrives at the first one at 7 p.m. and leaves the last one at 1 a.m.? Express your answer to the nearest whole number.

*Since there are nine balls, there will only be 8 times that he will need to leave one ball to get to the next. This is a total of $8 \times 15 = 120$ minutes or 2 hours. Since each ball lasts 6 hours, this leaves the President with exactly 4 hours, or 240 minutes, to attend the nine balls. Dividing 240 minutes evenly between the nine balls leaves approximately **27** minutes to attend each ball.*

Perhaps the order in which the President will attend the balls is based on the most efficient path between them. (Most of them are located at the same Convention Center). Or maybe it will be based on the number of people attending each. In how many possible orders could the President visit each of the nine balls exactly once?

This is going to be a very large number, so making a tree diagram is perhaps not the best method. Using the Counting Principle, though, will work nicely. The President has 9 options for the first visit, then 8 for the second visit, and so on. This results in $9! = 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = \mathbf{362,880}$ different orders in which to visit the nine balls.

One of the nine Inaugural Balls is designated specifically to honor and thank our troops and their families. Each of the other 8 balls will be organized by state. Every state will be represented at a ball to ensure that participants of the Inaugural celebrations can attend a ball with their state. The District of Columbia, Virgin Islands, American Samoa, Puerto Rico, Guam and the Diplomatic Corps will also be represented at an Inaugural ball. The Constitution Ball is for 18 of the 56 states/groups, while the Liberty Ball is solely for the state of Florida. The Constitution Ball obviously has more states/groups than the average number of states/groups per ball for these eight balls. By what percent does the actual number of states/groups represented at the Constitution Ball exceed the average number for each of the eight balls? Express your answer to the nearest whole number.

The average number of states/groups per ball is $56 \div 8 = 7$. However, the Constitution Ball is for 18 states. This is 11 more than the average 7, which is an excess of $(11 \div 7) \times 100 \approx \mathbf{157\%}$.

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