

# MATHCOUNTS® Problem of the Week Archive

## Standing in Lines – November 9, 2020

### Problems & Solutions

Just a few weeks ago, the Los Angeles Dodgers became the 2020 World Series Champions. While the COVID-19 pandemic may have affected the way Los Angelans were able to officially celebrate, let's imagine that if permitted, the city would have had a parade.

The parade route was 3 miles long. Lolly was excited to attend the parade and heard that people would be able to stand on both sides of the route, so there would be about 6-miles of people standing along the route. Lolly saw a flaw in this plan, though, since the city was estimating a possible 4 million people to attend this parade. She asked, "If people stood shoulder-to-shoulder along all 6 miles of the route, and then started another row of people behind and continued adding rows of people behind the front rows of people, how many rows deep would the people be along each side of the parade route?" It was estimated that each person occupied 18 inches of space along the route when standing shoulder-to-shoulder. Express your answer to the nearest ten rows.

*First, we know that there are 5280 feet in a mile, so there are  $5280 \times 12 = 63,360$  inches in a mile. We have 6 miles of parade route, so this is  $63,360 \times 6 = 380,160$  inches along the route. If each person takes up 18 inches of this space, then we can put  $380,160 \div 18 = 21,120$  people in the first row along the route. The next 21,120 people would form the second row of people along the route, and so on. If all 4 million people showed up to the parade, then there would be  $4,000,000 \div 21,120 \approx 190$  rows of people along each side of the parade route.*

Then, a few days ago, Lolly had to get in another type of line -- lines at the polls on Election Day. Suppose her voting area had seven voting machines running the entire time, and it was taking each voter an estimated 1 minute 15 seconds to vote. If Lolly got at the end of the line when the line was exactly half a mile long, and each person in the line was taking up about 1.5 feet of the line, how many hours will she be in line before being able to vote? Express your answer to the nearest whole hour.

*Again, we need to make use of the fact that there are 5280 feet in one mile. Therefore, there are 2640 feet in half of a mile, and this is where our voter is standing when she first gets in line. Since each person takes up 1.5 feet of space in line, we know there are  $2640 \div 1.5 = 1760$  people in the line. Since all seven voting machines are being used, we can assume that seven people are voting at the same time. So, there will be  $1760 \div 7 \approx 251.4$  or 251 groups of seven people voting before our voter. Since it takes 1 minute 15 seconds (or 1.25 minutes) to vote, these 251 groups will take about  $251 \times 1.25 = 313.75$  minutes to vote. This is 5 hours, 13 minutes and 45 seconds. Our voter will have to wait approximately 5 hours, to the nearest whole hour.*

On her way home from the voting booth, Lolly went to pick up her little boy, Bobby, from daycare. When Lolly got there, she saw that Bobby was walking on the sidewalk in a line with the other 15 kids in his class; he was the first student in line. Each student was holding on with one hand to a long string, the teacher was holding on to the front end of the string, and the assistant was holding on to the back end of the string. This string is what kept the kids in a line, and they each knew that they had to hold on to

the string and not let go. The string was 32 feet long. If each hand (kids and adults) on the string occupied approximately 3 inches of the string, and there was the same amount of string between each pair of consecutive hands, approximately how many inches of string were between the teacher's hand and Bobby's hand? Express your answer to the nearest whole number.

*There are 16 kids and 2 teachers, so  $18 \times 3 = 54$  inches of string taken up by their 18 hands. Since there are 18 people holding on to the string, there are 17 "gaps" between the 18 hands. The string is  $32 \times 12 = 384$  inches long, so there are  $384 - 54 = 330$  inches for the gaps. Therefore, each gap is  $330 \div 17 \approx 19.4$  inches long, so there are about 19 inches of string between the teacher's hand and Bobby's hand, to the nearest whole number.*

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### ***Problems***

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The parade route was 3 miles long. Lolly was excited to attend the parade and heard that people would be able to stand on both sides of the route, so there would be about 6-miles of people standing along the route. Lolly saw a flaw in this plan, though, since the city was estimating a possible 4 million people to attend this parade. She asked, "If people stood shoulder-to-shoulder along all 6 miles of the route, and then started another row of people behind and continued adding rows of people behind the front rows of people, how many rows deep would the people be along each side of the parade route?" It was estimated that each person occupied 18 inches of space along the route when standing shoulder-to-shoulder. Express your answer to the nearest ten rows.

Then, a few days ago, Lolly had to get in another type of line -- lines at the polls on Election Day. Suppose her voting area had seven voting machines running the entire time, and it was taking each voter an estimated 1 minute 15 seconds to vote. If Lolly got at the end of the line when the line was exactly half a mile long, and each person in the line was taking up about 1.5 feet of the line, how many hours will she be in line before being able to vote? Express your answer to the nearest whole hour.

On her way home from the voting booth, Lolly went to pick up her little boy, Bobby, from daycare. When Lolly got there, she saw that Bobby was walking on the sidewalk in a line with the other 15 kids in his class; he was the first student in line. Each student was holding on with one hand to a long string, the teacher was holding on to the front end of the string, and the assistant was holding on to the back end of the string. This string is what kept the kids in a line, and they each knew that they had to hold on to the string and not let go. The string was 32 feet long. If each hand (kids and adults) on the string occupied approximately 3 inches of the string, and there was the same amount of string between each pair of consecutive hands, approximately how many inches of string were between the teacher's hand and Bobby's hand? Express your answer to the nearest whole number.