

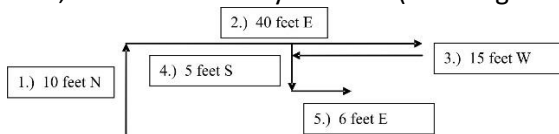
# MATHCOUNTS® Problem of the Week Archive

## A Maze of Maize – October 16, 2023

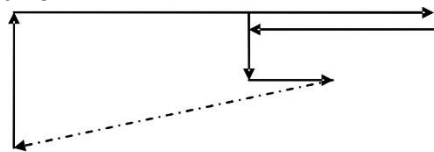
### Problems & Solutions

Bethany and her family are attending the Funville Town Fall Festival, and the first thing they do is get in line for the Maize (corn) Maze. When Bethany gets to the entrance of the Maze she is facing north. Following the paths, she walks straight ahead for 10 feet and reaches an intersection at which she turns right and walks 40 feet east, at which point the path dead ends. Bethany decides to back-track 15 feet and turns south. She walks 5 feet south and then turns and walks 6 feet east. If Bethany was to walk straight back to the entrance, cutting through the corn and disregarding the paths, how far would she have to walk? Express your answer as a decimal to the nearest tenth.

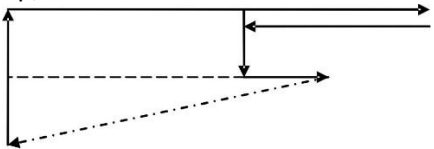
First, draw out Bethany's route. (Note: figure below is NOT drawn to scale.)



We want to know the distance between the end of the step 5 arrow and the beginning of the step 1 arrow.

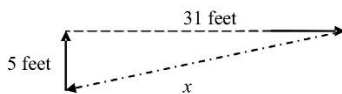


If we figure out the how much north of her starting point she ended up and how much east she ended up, we can solve for the dotted line (above) like the hypotenuse of a right triangle.



To figure out how far north she ended up, subtract the distance she walked south from the distance she walked north: 10 feet – 5 feet = 5 feet. To figure out how far east she ended up, subtract the distance she walked west from the sum of the distances she walked east: (40 feet + 6 feet) – 15 feet = 31 feet.

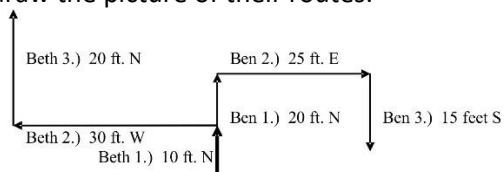
This gives:



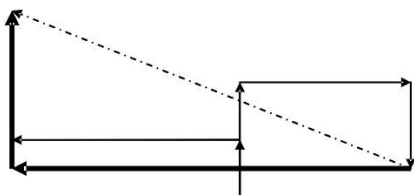
Using the Pythagorean theorem, we can find the value of  $x$ , Bethany's distance from the entrance:  $5^2 + 31^2 = x^2 \rightarrow 25 + 961 = x^2 \rightarrow 986 = x^2 \rightarrow x \approx 31.4$  feet, to the nearest tenth.

Later that day Bethany and her brother Ben decide to go through the Maize Maze again. When Bethany starts, she walks 10 feet north, 30 feet west, and then 20 feet north. During this same time, Ben walks 20 feet north, 25 feet east, and then 15 feet south. Disregarding paths, what is the shortest distance between Ben and Bethany? Express your answer to the nearest whole number.

For this question, we will use the same process as we used for question 1. First, draw the picture of their routes.



We want to figure out the length of the dotted line below. So, we'll make a triangle (with the thick lines and dotted line below).



Since Ben went 20 feet north and eventually 15 feet south, the vertical side of the triangle (or the thick-north-pointing arrow) starts 5 feet north of their starting place. Bethany went a total of 30 feet north, so the height of the triangle is  $30 - 5$  feet, or 25 feet. Since Bethany walked 30 feet west and Ben walked 25 feet east, the base of the triangle is 55 feet. Now, using the Pythagorean theorem, we can solve for the shortest possible distance between Bethany and Ben (represented above by the dotted line and by  $x$  in the calculations here):  $25^2 + 55^2 = x^2 \rightarrow x^2 = 3650 \rightarrow x \approx 60$  feet, to the nearest whole number.

When Bethany's family is leaving the festival, they pick up a flyer, and it says that the Maize Maze is on a square plot of land that is 100 yards by 100 yards. The path through the maze is 1.5 yards wide and 3000 yards long. If one square yard of land holds 18 stalks of corn, how many stalks of corn are in the Maize Maze? Assume that the entire plot of land has corn planted on it except for what is cleared to create the paths.

Since the plot of land is 100 yards by 100 yards, the area of the field is 10,000 square yards. This is the total area that corn could be planted on. From this, we will subtract the area cleared for paths. Since there are 3000 yards of path that is 1.5 yards wide, the area cleared for paths is  $3000 \times 1.5$  yards, or 4500 square yards. Thus, there are  $10,000 - 4500 = 5500$  square yards of planted land. We are told that the corn is planted such that there are 18 stalks per 1 square yard. Therefore, in the Maize Maze, there are  $18 \times 5500 = 99,000$  stalks of corn.

# **MATHCOUNTS<sup>®</sup> Problem of the Week Archive**

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### ***Problems***

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