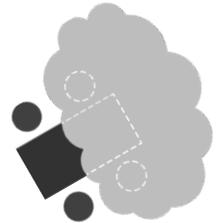


MATHCOUNTS[®] Problem of the Week Archive

In the Shade – July 2, 2018

Problems & Solutions

A tree shades part of a rectangular table, as shown, so that two seats are in the sun and two are in the shade. Will, Xavier, Yvette and Zoe are in search of a place to sit and enjoy their lunches. If Yvette insists on sitting in the shade, and Zoe refuses to sit next to Will, how many different arrangements are there for Will, Xavier, Yvette and Zoe to be seated at this table?



There are 2 ways for Yvette to select a seat in the shade. Next, since Zoe refuses to sit next to Will, either Zoe or Will must sit next to Yvette. Therefore, there are 2 ways to choose who will be seated next to Yvette. Finally, the remaining two individuals can be seated in 2 ways on the side of the table opposite Yvette. So, there are $2 \times 2 \times 2 = 8$ different seating arrangements.



A square table is also partly shaded by a tree, as shown, with two seats in the sun and two seats in the shade. Given that Yvette insists on sitting in the shade, and Zoe refuses to sit next to Will, how many different arrangements are there for Will, Xavier, Yvette and Zoe to be seated at this square table?

There are still 2 ways for Yvette to select a seat in the shade. Since Zoe refuses to sit next to Will, she must sit opposite him, so she cannot be seated opposite Yvette. There are 2 ways for Zoe to select a seat that is not opposite Yvette. Once Zoe is seated, there is only 1 way for Will and Xavier to be seated so that Yvette is not sitting next to Zoe. That's $2 \times 2 \times 1 = 4$ different seating arrangements.

If Zoe didn't mind sitting next to Will, how many more seating arrangements would there have been at the square table?

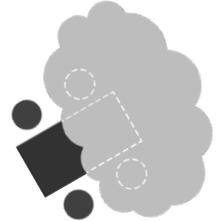
There are still 2 ways for Yvette to select a seat in the shade. However, without the restriction on who is seated next to Zoe, there are now $3 \times 2 \times 1 = 6$ ways for Will, Xavier and Zoe to be seated in the remaining three seats. Thus, there are a total of $2 \times 6 = 12$ different seating arrangements, which is $12 - 4 = 8$ more seating arrangements.

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