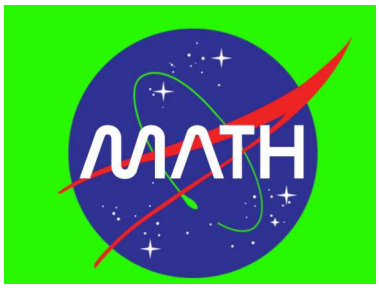

Probability and Statistics
8^{th} Grade

1. **2 points:** How many four-digit positive integers have exactly two odd digits and two even digits?

2. **2 points:** A fair coin is flipped five times. What is the probability that exactly three flips in a row will turn up heads or that exactly three flips in a row will turn up tails? **Express your answer as a reduced fraction.**

3. **2 points:** A fourth grade teacher is having Ara, Bob, Elle, Naan, and Pip line up, for no real purpose except so that they can solve this math problem. Unfortunately, Ara and Bob are BFFs (best friends forever), so they always have to stand next to each other, and Ara and Naan are BEEs (biggest enemies ever), so they cannot stand next to each other. In how many unique ways can the students line up from first to fifth in line?

4. **3 points:** Four integers are selected randomly and with replacement between -2 and 1, inclusively. What is the probability that the product of the four integers will be negative? **Express your answer as a reduced fraction.**

5. **3 points:** The infamous sock drawer contains 3 pairs of red socks, 4 pairs of white socks, 5 pairs of blue socks, and X pairs of star-covered socks. Given that the probability of drawing two pairs of blue socks, without replacement, is $\frac{1}{12}$, what is the value of X?

6. **3 points:** Suppose that to make up for all the rough seasons, baseball players Cano, Cruz, and Seager magically have a 30%, 40%, and 50% chance, respectively, of getting a hit each time they are up to bat. If they each go up to bat once, what is the probability that at least two of them will get a hit? **Express your answer as a percent.**

7. **3 points:** Wiley Coyote has created a sneaky carnival game where he can set the probability p of winning on a given play to whatever he wants. Players can buy 8 plays for \$2. Each prize costs Wiley \$4.50. What is the maximum value of p so that Wiley's expected profit would be at least 50%? **Express your answer as a reduced fraction.**

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8. **4 points:** Roy and Biv went around and asked 40 students to share which of the primary colors they liked. They found that:

   - 16 students liked at least red;
   - 15 students liked at least yellow;
   - 30 students liked at least blue;
   - 3 students liked red and yellow, but not blue;
   - 11 students liked blue and red, but not yellow;
   - 12 students liked at least blue and red;
   - 6 students liked at least blue and yellow.

   If each student liked at least one of the three colors, how many students only liked blue?

9. **4 points:** Suppose that the thousands digit, hundreds digit, tens digit, and ones digit in a four-digit number are used to determine the number of feet walked north, east, south, and west, respectively from your house. If a random four-digit number is chosen, what is the probability that you will be no more than 1 foot from returning to your house in a straight line? **Express your answer as a reduced fraction.**

10. **4 points:** In a simplified version of Yahtzee, you roll five standard, fair six-sided dice, and then can choose to re-roll any number of the dice. To get a Yahtzee, you must roll five of the same number. If none of them match on the initial roll, you re-roll four of the dice. If two match, you re-roll three of the dice. If three match, you re-roll two of the dice. Lastly, if four match, you re-roll the other die. What is the probability of getting a Yahtzee either on the first or second roll? **Express your answer to the nearest tenth of a percent.**