**Math modeling unit and activity** - Probability

Activity name: Two dice bingo

Big Idea(s)/ Concept(s)/major math area(s):

**Probability Rules:** (Empirical Rule, Addition Rule, Multiplication Rule)

**Vocabulary:** Probability, Outcomes, Experimental/Theoretical Probability, Combination, Sample space.

Grade level(s): Grade 11 DP IB Math Standard Level/Math Studies

**Math Standards included:** **Standard Level Math:** [need number sections from the standards] Descriptive statistics: collection of raw data; display of data in pictorial and diagrammatic forms, including pie charts, pictograms, stem and leaf diagrams, bar graphs and line graphs. Obtaining simple statistics from discrete and continuous data, including mean, median, quartiles, range, interquartile range. Calculating probabilities of simple events.

**Math Studies:** Sample space; event A; complementary event, A . Probability of an event. Probability of a complementary event. Expected value.

**Procedure overview/ teacher directions:**

**Using the natural numbers (integers?) 1-12 without duplication, design a 3x3 card for winning bingo. (3 Columns, 3 rows and 2 diagonals)**

**We will play using 2 dice and adding the digits on each die for each roll.**

**You have 2 minutes. GO [I think a longer time ... this is not a race, and we need to allow them to think about it, trying to visualize what is happening]**

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**WHOLE CLASS REGULAR BINGO RULES**

1. *Teacher rolls dice the students - to get better statistics????*
2. *They would also record the number of each number comes up*
3. *Dice are added to get a number between 2 and 12*
4. *Students mark their cards*
5. *Play continues until a bingo occurs*
6. *[From the test run, it seems that you need a greater number of dice rolls to obtain the statistics... also I thought you were going to ask about likelihood for single die rolls as an introduction.]*
7. *Perhaps a few lead questions.. How many rolls will produce good statistics (not just how to win at bingo - after all that is one of the major goals of the activity*

**Lesson details**

1. Once the two minutes are up, we play the game as a class. We will record the outcomes of the dice as we go along.
2. We will play until 3 bingos are called.
3. **Now that we have played, redesign your bingo card or stick with your original on the white board to make sure it is the winning card for sure. You have 10 minutes. GO.**
4. Once ten minutes are up, we play the game as a class, continuing with the recording of the outcomes of the dice as we go along.
5. We will play until 3 bingos are called.
6. **Now that we have played a second time, prepare the board for a board meeting. Be ready to justify your design of your card, problems you ran into and how can you prove your choice is the best/worse. You have 20 minutes. GO**

Discussions that should come up: (with/without guidance from teacher)

1. *Ask students to think of a way to get the likelihood of getting two specific numbers on two rolls. (2&7, 3&5, 9&11, etc) What method did they use?*

**Vocabulary being looked for......Sample space, Theoretical probability, Relative frequency, tables of outcomes, Histogram**

1. *How can you show mathematically that there is a “best card”?*

*This is the important analytical part of the unit which should help to develop their mental models of probability...*

1. *How many times does one have to roll the dice to get the first bingo?*

*Can they create a formula which predicts the number of times /probability that each number comes up... Does this formula fit the data - their own, the whole class, etc...*

*What extensions are there to this activity*

*Lesson: Addition rule, multiplication rule, Venn Diagrams, any real life experiences*