Probability and Statistics Resource

<u>Information Regarding This Resource</u> The following resource will help to unify the concepts of conditional probability, inferences, and interpreting data by allowing students the opportunity to analyze data in a real-world scenario. Students will also collaborate, create and reflect on their learning.

<u>The Format of This Resource</u> This resource is organized into flexible components that can be utilized by educators, parents or students in its entirety or can be fragmented based on desired knowledge. Each text box contains the process skills students will use in the lesson to explore the mathematical content within the Probability and Statistics Curriculum. The focus of each lesson is highlighted for easy reference. The lessons have been designed to allow multiple entry points to accommodate for different levels of understanding.

Throughout this resource, students are asked to justify or explain their answers, thought process or understanding. The intent is for students to reflect on their mathematical thoughts. Students should keep in mind that justifications or explanations can take multiple forms, including, but not limited to, diagrams, graphs, text, or pictures. These are not meant to be right or wrong, rather a means of making learning visible.

Connection of Standards:

Process Standard(s): Students will show their understanding of ==subsets of sample spaces and the use of Venn diagrams to represent intersections, unions and complements== by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.

Content Standard(s):

PS.SPCR.1 Describe events as subsets of a sample space and a. Use Venn diagrams to represent intersections, unions, and complements. b. Relate intersections, unions, and complements to the words and, or, and not. c. Represent sample spaces for compound events using Venn diagrams.

a. **Create a sample space for two dimes.**
b. **Now create a sample space for a dime and a penny.**
c. **Are the above sample spaces the same or different? Explain your answer.**
d. **Construct Venn diagrams to represent the intersections, unions and complements of the above two sample spaces.**
e. **Explain what the intersection, union and complement tells you about the sample space.**
f. **Create Tree diagrams to represent the above sample spaces.**
g. **Explain a situation where you might benefit from analyzing information in this way.**

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Connection of Standards:

Process Standard(s): Students will show their understanding of <mark>conditional probability and independence</mark> by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.

Content Standard(s):

PS.SPCR.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

> a. **What is conditional probability?**
> b. **When would you use conditional probability?**
> c. **Solve the following problem: A large company surveyed its employees and found that 37% use Facebook, 58% use Instagram, and 28% use both. Suppose an employee was selected at random. Given that the employee uses Instagram, what is the probability that he or she uses Facebook?**
> d. **What does it mean for events to be independent?**
> e. **Why is it important to understand the difference between dependent and independent events? How would it skew your analysis if you did not differentiate between the two?**
> f. **Solve the following problem: Two independent food delivery services Q and P are used by a catering company. The probability of on-time delivery for Q is 0.75. the probability of on-time delivery for P is 0.85. What is the probability that all food will be delivered on time?**

Connection of Standards:

Process Standard(s): Students will show their understanding of <mark>conditional probability</mark> by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.

Content Standard(s):

PS.SPCR.6 Calculate the conditional probability of an event A given event B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

> **Conditional probability** is the **probability** of one event occurring with some relationship to one or more other events.
>
> a. **Reflect on the definition of Conditional Probability. Think of an event that effects your life where finding conditional probability would be beneficial. Explain this event.**
> b. **Why would this event use conditional probability?**

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Connection of Standards:

Process Standard(s): Students will show their understanding of <mark>experimental and theoretical probabilities</mark> by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.

Content Standard(s):

PS.SPMJ.2* Distinguish between experimental and theoretical probabilities. Collect data on a chance event and use the relative frequency to estimate the theoretical probability of that event. Determine whether a given probability model is consistent with experimental results.

> a. **Find an object in your house, such as a coin or dice and decide on an outcome you would like to occur (ex. Chance of rolling an even number on a dice.)**
> b. **Use theoretical probability to establish the likelihood of the even occurring.**
> c. **Experimentally test the theoretical probability using your object. Collect and record data for 5 trials, 25 trials, 50 trials and 100 trials.**
> d. **What do you notice about the theoretical and experimental probabilities as the number of trials increases?**
> e. **Why do you think you see this pattern?**
> f. **What would you predict your experimental probability to be after 10,000 trials?**

Connection of Standards:

Process Standard(s): Students will show their understanding of <mark>experiments and observational studies</mark> by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.

Content Standard(s):

PS.SPMJ.5 Distinguish between experiments and observational studies. Determine which of two or more possible experimental designs will best answer a given research question and justify the choice based on statistical significance.

> **Does tutoring at least 3 days a week improve student test scores in social studies?**
>
> a. **Explain the steps you would use to perform an experiment for the above scenario.**
> b. **Explain the steps you would use to perform an observational study for the above scenario.**
> c. **Which do you think would be best for this example?**
> d. **Justify your answer.**

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Connection of Standards:
Process Standard(s): Students will show their understanding of <mark>dot plots, histograms and box plots</mark> by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.
Content Standard(s):
PS.SPID.1* Select and create an appropriate display, including dot plots, histograms, and box plots, for data that includes only real numbers.

Answer the below questions in your own words and then explain your interpretation of each.
  a. **What is a dot plot and how is one created?**
  b. **Explain the type of data best represented by a dot plot.**
  c. **What is a histogram and how is one created?**
  d. **Explain the type of data best represented by a histogram.**
  e. **What is a box plot and how is one created?**
  f. **Explain the type of data best represented by a box plot.**
  g. **Draw examples of each of the three ways to represent data.**

Connection of Standards:
Process Standard(s): Students will show their understanding of <mark>linear regression models</mark> by making sense of problems, persevering, reasoning and making sense of relationships, using critical thinking skills to justify their mathematical reasoning, and connecting ideas to real world situations through modeling.
Content Standards(s):
PS.SPID.7* Find linear models using median fit and regression methods to make predictions. Interpret the slope and intercept of a linear model in the context of the data.

  a. **Give an example of two sets of data that usually show a positive correlation?**
  b. **What types of data sets might have a negative correlation?**
  c. **What types of data sets might have no correlation?**
  d. **Use the newspaper, magazine, television or create your own information to analyze the correlation between two events. Create a scatter plot of this information.**
  e. **Draw a best-fit line through as many points as possible.**
  f. **Write the equation for the best-fit line.**
  g. **How well does this line fit your data?**
  h. **When would a scatter plot be a good was to analyze data and make predictions?**

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a. Collaborate with someone in your family, a friend, or a neighbor. Ask them to look over your mathematical reasoning and ask you at least 5 guiding questions. Document the 5 questions they asked.
b. Document the answers you gave to the 5 questions.
c. Reflect on your work. Where did you struggle? Where did you triumph? What do you still wonder?
d. Look over the content you covered, the processes that guided you through your discoveries, and think about your collaboration. Write down your thoughts and allow your reflection to move you forward in your mathematical thinking.