

Analyzing Venn Diagrams

- Strand:** Data Analysis
- Topic:** Analyzing probability of events through Venn diagrams
- Primary SOL:** AFDA.6 The student will calculate probabilities. Key concepts include
- conditional probability;
 - dependent and independent events; and
 - mutually exclusive events.

Materials

- Venn Diagrams and Probabilities activity sheet (attached)

Vocabulary

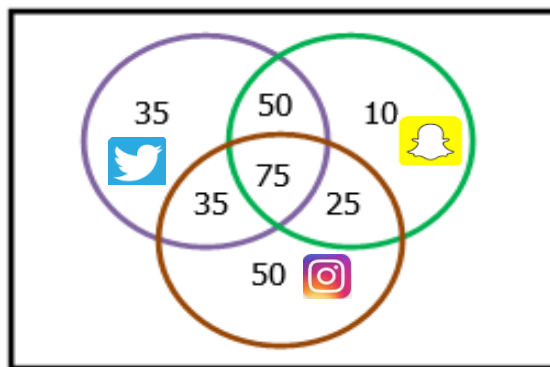
conditional probability, dependent events, events, independent events, intersection, mutually exclusive events, probability, sample size, union, Venn diagram

Student/Teacher Actions

Time: 90 minutes

1. Present this problem to the class and show students how to organize the information in a Venn diagram.

A survey was conducted among 300 students regarding the top three social media platforms they are using. The results shows that 195 are on Twitter, 160 are on Snapchat, and 185 are on Instagram. Additionally, 75 are using all three: Twitter, Snapchat, and Instagram. Both Twitter and Snapchat are being used by 125 students; Both Snapchat and Instagram are being used by 100 students. Last, 110 students are using both Twitter and Instagram.



2. Using the constructed Venn diagram, pose the following questions:
 - a. How many students are not using any of the three social media platforms?
 - b. How many students are using Twitter only?
 - c. How many students are using Snapchat only?
 - d. How many students are using Instagram only?

3. Review the basic concepts of probability that students have been exposed to in middle school. Give the definition of events and sample space, providing examples. Introduce the probability notation $P(E)$, which refers to the probability that the event E occurs.

$$\text{Students should already know that } P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

4. Next, explain how to calculate probabilities using information provided in the Venn diagram using the following examples. Emphasize the difference between the use of “and” and “or.”

If a student is chosen at random,

- a. What is the probability that the student is using Snapchat or Twitter?
 - b. What is the probability that the student is using Snapchat and Twitter?
 - c. What is the probability that the student is not using any of the social media platform?
 - d. What is the probability that the student is using at least one of the social media platform?
 - e. What is the probability that the student is using all three social media platforms?
5. Next, explain the concept of conditional probability with a reduced sample space through the following examples.

Given that a student uses Twitter,

- a. What is the probability that the student is also using Snapchat?
 - b. What is the probability that the student is also using Instagram?
 - c. What is the probability that the student is using Snapchat and Instagram?
6. Have students work in pairs to create questions with answers pertaining to probability of events using the same Venn diagram above.
 7. Have students complete the Venn Diagrams and Probabilities activity sheet to check understanding of concepts.

Assessment

- **Questions**

- In a class of 30 students, 12 are males and 18 are females. Of the 30 students, five boys and five girls are taking AP Statistics. Organize the information using a
 - Venn diagram; or
 - table.

Explain how to determine the probability that a student is taking AP Stat, given that he is a male.

- Change the class numbers from the question above. Ask students to determine a probability question that can be answered from the Venn diagram for the situation. Then, have students provide the answer to their question.

- **Journal/writing prompts**

- Explain, using examples, the difference between conditional probability for dependent events and conditional probability for independent events.

Mathematics Instructional Plan—AFDA

- Have students write about a practical situation in which Venn diagrams can be useful to organize the interaction of events. Then, have students explain how probabilities are determined and their usefulness in the practical situation.
- **Other Assessments**
 - [“Calculating Conditional Probability,”](#) Conditional Probability and Independence, Khan Academy website
 - [“Conditional Probability,”](#) CK-12 Foundation website

Extensions and Connections

- Use a contingency table or a tree diagram as an aid in understanding the problems. Allow students to discuss the meaning of important words in the problem.

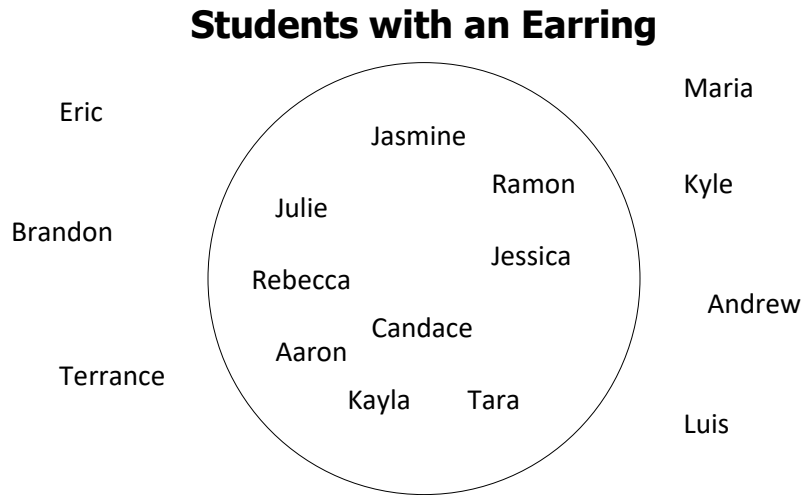
Strategies for Differentiation

- Use colored pencils/highlighters to shade the different regions of the Venn diagrams or utilize cross-shading.
- Use vocabulary cards for related vocabulary listed above.
- Use concrete examples to illustrate events and sample space. Consider having the students act out the problem, and encourage students to solve the problems in groups.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Venn Diagrams and Probabilities

The Venn diagram below will be used with questions 1-14.



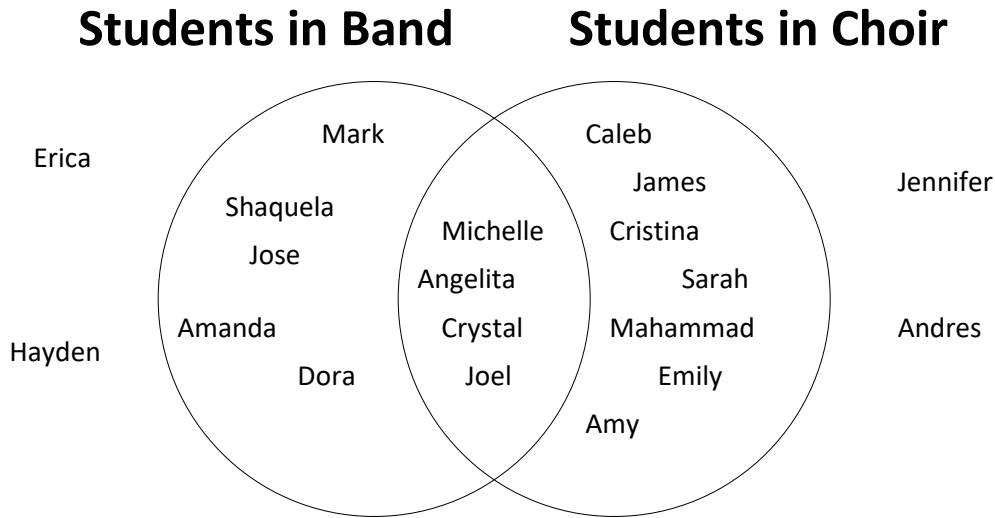
Answer the following questions using the Venn diagram above.

1. How many students are in the class?
2. How many students have earrings?
3. How many students do not have earrings?

If one student is picked at random, find the following probabilities.

4. $P(\text{girl})$
5. $P(\text{not a girl})$
6. $P(\text{boy})$
7. $P(\text{student with earring})$
8. $P(\text{student without earring})$
9. $P(\text{boy with earring})$
10. $P(\text{girl without earring})$
11. $P(\text{girl with earring})$
12. $P(\text{boy with earring} \cup \text{girl with name starting with J})$
13. $P(\text{name starting with A} \cup \text{name starting with T})$
14. Write a probability question which has an answer of $\frac{5}{8}$.

The Venn diagram below will be used to answer questions 15-28.



15. How many students are in the sample?

16. How many students are only in Band?

17. How many students are in Band and in Choir?

If one student is picked at random, find the following probabilities.

18. P(student in choir) 19. P(student in neither band nor choir)

20. P(boy in band) 21. P(girl in band and choir)

22. P(boy in band or choir) 23. P(name starts with C and in choir)

24. P(student in band | boy) 25. P(girl | student in band)

26. P(boy | student in both band and choir)

27. Write a probability question which has an answer of $\frac{1}{2}$.

28. Write a probability question which has an answer of $\frac{4}{7}$.