

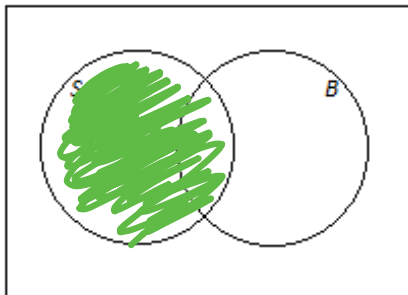
Module 4, Unit 8, Lesson 5 : Events and Venn Diagrams

Example 1: High School Athletes

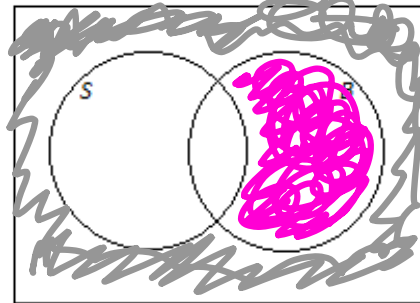
At a high school, some students play soccer, and some do not. Also, some students play basketball, and some do not. This scenario can be represented by a Venn diagram, as shown below. The circle labeled *S* represents the students who play soccer, the circle labeled *B* represents the students who play basketball, and the rectangle represents all the students at the school.

On the Venn diagrams provided, shade the region representing the following instances:

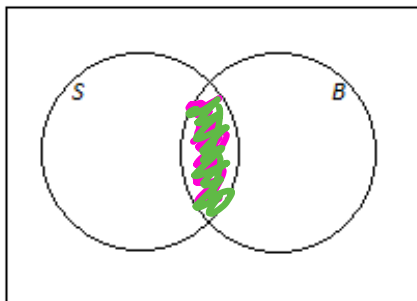
- a. The students who play soccer



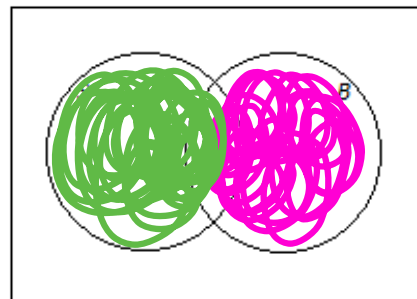
- b. The students who do not play soccer



- c. The students who play soccer and basketball



- d. The students who play soccer or basketball



Suppose we have more information on the school mentioned above. We know that 230 students play soccer, 190 students play basketball, and 60 students play both sports. There are a total of 500 students at the school.

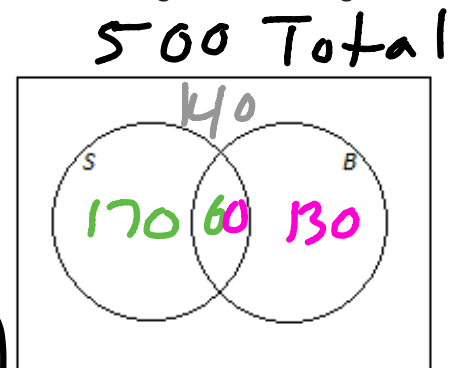
- e. Complete the Venn diagram below by writing the numbers of students in the various regions of the diagram.

- f. How many students play basketball but not soccer?

$$190 - 60 = 130$$

- g. How many students play neither basketball nor soccer?

$$230 + 190 - 60 = 140$$



h. Suppose that a student will be selected at random from the school.

i. What is the probability that the selected student plays both sports?

$$\frac{60}{500} =$$

ii. What is the probability that the selected student doesn't play either sport?

$$\frac{140}{500} =$$

iii. Find $P(S \cup B)$

$$\frac{360}{500} =$$

Find $P(B^c)$

$$\frac{310}{500} =$$

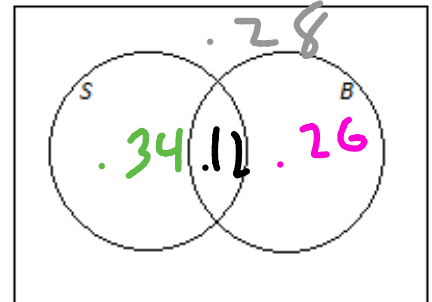
iv. What is the probability that a soccer player also plays basketball?

$$\frac{60}{230} =$$

v. What is the probability that a basketball player doesn't play soccer?

$$\frac{130}{190} =$$

i. Complete the Venn diagram to the right by writing the probabilities associated with the various regions of the diagram.



j. Are playing basketball and playing soccer independent? How do you know?

$P(B) \neq P(B|A)$ Not Independent

Example 2: Online Bookstore.

An online bookstore offers a large selection of books. Some of the books are works of fiction, and some are not. Also, some of the books are available as e-books, and some are not. Let F be the set of books that are works of fiction, and let E be the set of books that are available as e-books. Suppose that 62% of the books are works of fiction, 47% are available as e-books, and 14% are available as e-books but are not works of fiction. A book will be selected at random.

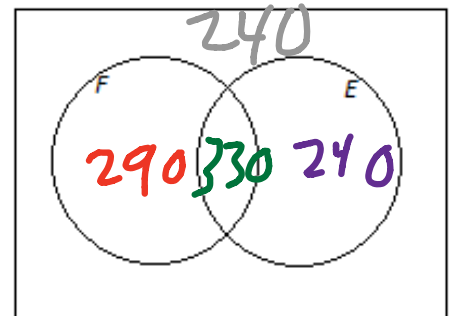
a. Using a Venn diagram, find the following probabilities:

i. The book is a work of fiction and available as an e-book.

$$\frac{330}{1000} = 33\%$$

ii. The book is neither a work of fiction nor available as an e-book.

$$\frac{240}{1000} = 24\%$$



- b. Return to the information given at the beginning of the question: 62% of the books are works of fiction, 47% are available as e-books, and 14% are available as e-books but are not works of fiction.
- i. Use this information to fill in the hypothetical 1000 table

	Fiction	Not Fiction	Total
Available as E-Book	330	140	470
Not Available as E-Book	290	240	530
Total	620	380	1,000

- ii. Complete the table below showing the probabilities of the events represented by the cells in the table.

	Fiction	Not Fiction	Total
Available as E-Book	.33	.14	.47
Not Available as E-Book	.29	.24	.53
Total	.62	.38	1

- iii. How do the probabilities in your table relate to the probabilities you calculated in part (a)?

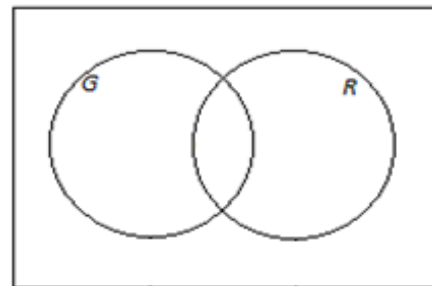
Be sure to emphasize that students may use either or both tools in these types of problems. Students naturally tend to gravitate toward one or the other.

- iv. Are being fiction and being available as an e-book independent? Explain and show calculations.

Practice

When a fish is selected at random from a tank, the probability that it has a green tail is 0.64, the probability that it has red fins is 0.25, and the probability that it has both a green tail and red fins is 0.19.

1. Label the Venn diagram to represent this information.



2. Find the following probabilities:

- a. The fish has red fins but does not have a green tail.
- b. The fish has a green tail but not red fins.
- c. The fish has neither a green tail nor red fins.
- d. Are having a green tail and having red fins independent? Explain.

- e. Complete the table to the right showing the probabilities of the events corresponding to the cells of the table.

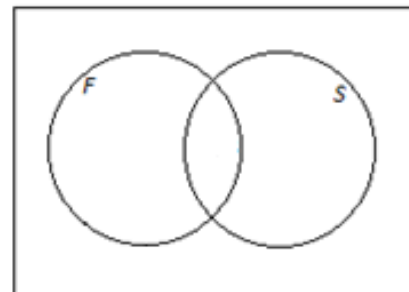
	Green Tail	Not Green Tail	Total
Red Fins			
Not Red Fins			
Total			

Example 3: Faxes and Scanners

In a company, 43% of the employees have access to a fax machine, 38% have access to a fax machine and a scanner, and 24% have access to neither a fax machine nor a scanner. Suppose that an employee will be selected at random. Using a Venn diagram, calculate each probability *and* express it in words

a. $P(S^c)$

b. $P(F \cup S)$



c. $P(F \cap S)$

d. $P(F^c \cap S^c)$

e. $P(F^c \cap S)$

f. $P(F|S)$

g. $P(S|F^c)$

Closing: Final Notation Review

For each Venn Diagram below, depicting events A and B, use notation to describe the shaded region.

