

5.4 Probability of Disjoint & Overlapping Events

Objective: Today we will find probabilities of compound events & we will use more than one probability rule to solve real-life problems.

Warm-up: Explorations 1–3



- a. Event A: The result is an even number.
Event B: The result is a prime number.
- b. Event A: The result is 2 or 4.
Event B: The result is an odd number.

EXPLORATION 1

Disjoint Events and Overlapping Events

Work with a partner. A six-sided die is rolled. Draw a Venn diagram that relates the two events. Then decide whether the events are disjoint or overlapping.

Two events are **disjoint**, or **mutually exclusive**, when they have no outcomes in common. Two events are **overlapping** when they have one or more outcomes in common.

EXPLORATION 2

Finding the Probability that Two Events Occur

Work with a partner. A six-sided die is rolled. For each pair of events, find (a) $P(A)$, (b) $P(B)$, (c) $P(A \text{ and } B)$, and (d) $P(A \text{ or } B)$.

EXPLORATION 3

Discovering Probability Formulas

Work with a partner.

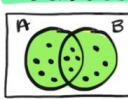
- a. In general, if event A and event B are disjoint, then what is the probability that event A or event B will occur? Use a Venn diagram to justify your conclusion.
- b. In general, if event A and event B are overlapping, then what is the probability that event A or event B will occur? Use a Venn diagram to justify your conclusion.

5.4 PROBABILITY OF DISJOINT & OVERLAPPING EVENTS

COMPOUND EVENTS

The UNION or INTERSECTION of two events is a COMPOUND EVENT.

The Union of A & B

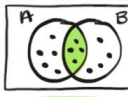


9 items in A, 8 items in B BUT 13 items in TOTAL.
When you consider ALL outcomes for either of two events A & B, you form the UNION of A and B.

$A \cup B$

The UNION of A and B for OVERLAPPING Events

The Intersection of A & B



4 items in the INTERSECTION
When you consider ONLY outcomes SHARED by BOTH events A and B, you form the INTERSECTION of A & B.

$A \cap B$

Two events are OVERLAPPING when they have AT LEAST ONE outcome in the intersection.

Disjoint (or Mutually Exclusive) Events



$A \cup B$ When the INTERSECTION of A & B is EMPTY, the two events are DISJOINT, or MUTUALLY EXCLUSIVE, & can be represented by NON-OVERLAPPING circles.

PROBABILITY OF COMPOUND EVENTS

IF A and B are ANY two events, THEN
 $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$.

IF A and B are DISJOINT, THEN
 $P(A \text{ or } B) = P(A) + P(B)$.

In Exercises 3–6, events A and B are disjoint.
Find $P(A \text{ or } B)$.

3. $P(A) = 0.3, P(B) = 0.1$

6. $P(A) = \frac{2}{3}, P(B) = \frac{1}{5}$

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8. **PROBLEM SOLVING** You and your friend are among several candidates running for class president. You estimate that there is a 45% chance you will win and a 25% chance your friend will win. What is the probability that you or your friend win the election?

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9. **PROBLEM SOLVING** You are performing an experiment to determine how well plants grow under different light sources. Of the 30 plants in the experiment, 12 receive visible light, 15 receive ultraviolet light, and 6 receive both visible and ultraviolet light. What is the probability that a plant in the experiment receives visible or ultraviolet light?

In Exercises 13 and 14, you roll a six-sided die. Find $P(A \text{ or } B)$.

13. Event A : Roll a 6.
Event B : Roll a prime number.

- 16. DRAWING CONCLUSIONS** A company paid overtime wages or hired temporary help during 9 months of the year. Overtime wages were paid during 7 months, and temporary help was hired during 4 months. At the end of the year, an auditor examines the accounting records and randomly selects one month to check the payroll. What is the probability that the auditor will select a month in which the company paid overtime wages and hired temporary help?

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- 18. DRAWING CONCLUSIONS** The Redbirds trail the Bluebirds by one goal with 1 minute left in the hockey game. The Redbirds' coach must decide whether to remove the goalie and add a frontline player. The probabilities of each team scoring are shown in the table.

	Goalie	No goalie
Redbirds score	0.1	0.3
Bluebirds score	0.1	0.6

- Find the probability that the Redbirds score and the Bluebirds do not score when the coach leaves the goalie in.
- Find the probability that the Redbirds score and the Bluebirds do not score when the coach takes the goalie out.
- Based on parts (a) and (b), what should the coach do?

- 21. PROBLEM SOLVING** You take a bus from your neighborhood to your school. The express bus arrives at your neighborhood at a random time between 7:30 and 7:36 A.M. The local bus arrives at your neighborhood at a random time between 7:30 and 7:40 A.M. You arrive at the bus stop at 7:33 A.M. Find the probability that you missed both the express bus and the local bus.