Geometry 13.6

Find probability of events that are mutually exclusive

Find probability of events that are not mutually exclusive (inclusive)

Find probabilities of complements

ME $P_A + P_B$

mutually exclusive (one or the other)

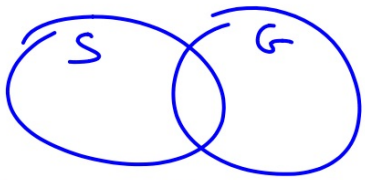
I inclusive (can it be both?) NME $P_A + P_B - P_{both}$

complement (of an event)

$P_A + P_B = 100\%$

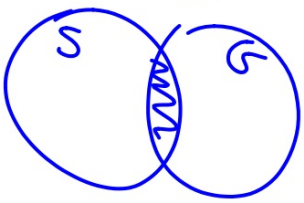
$P_A = 100 - P_B$

Conditional prob: addl. info given sum is even...




or

and




$P(A \text{ and } B)$

Indicates an intersection of two sample spaces.

$A \wedge B$

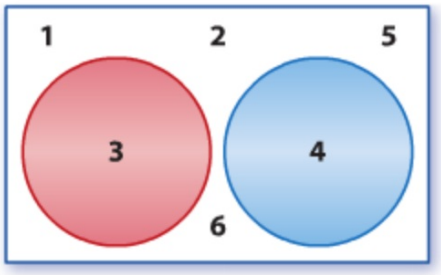
$A \cap B$

$P(A \text{ or } B)$

Indicates a union of two sample spaces.

$A \vee B$

$A \cup B$




mutually exclusive

P3 $\frac{1}{6}$

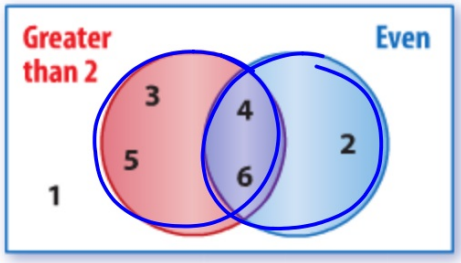
P4 $\frac{1}{6}$

P(3 or 4) $\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

## KeyConcept Probability of Mutually Exclusive Events

| | |
|---|---|
| **Words** | If two events $A$ and $B$ are mutually exclusive, then the probability that $A$ or $B$ occurs is the sum of the probabilities of each individual event. |
| **Example** | If two events $A$ or $B$ are mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B)$. $+ P(C) + P(D) \ldots$ |

This rule can be extended to any number of events.




Can it be both?

$\frac{4}{6} + \frac{3}{6} - \frac{2}{6} = \frac{5}{6}$

double

not mutually exclusive (inclusive)

nmt

I

## KeyConcept Probability of Events That Are Not Mutually Exclusive

| | |
|---|---|
| **Words** | If two events $A$ and $B$ are not mutually exclusive, then the probability that $A$ or $B$ occurs is the sum of their individual probabilities minus the probability that both $A$ and $B$ occur. |
| **Symbols** | If two events $A$ and $B$ are not mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$. |

Can it be both? So you counted something twice...

Can it be both?

**GuidedPractice**

**3.** What is the probability of drawing a king or a diamond from a standard deck of 52 cards?

$$P_K + P_D$$

$$\frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$$

## KeyConcept Probability of the Complement of an Event

| | |
|---|---|
| **Words** | The probability that an event will not occur is equal to 1 minus the probability that the event will occur. |
| **Symbols** | For an event $A$, $P(\text{not } A) = 1 - P(A)$. |

$100\% -$

$1 - \frac{1}{3}$

*30% chance of rain*

## GuidedPractice

**4.** If the chance of rain is 70%, what is the probability that it will not rain?

p. 959

## ConceptSummary Probability Rules

| Types of Events | Words | Probability Rule |
|---|---|---|
| Independent Events | The outcome of a first event *does not affect* the outcome of the second event. | If two events $A$ and $B$ are independent, then $P(A \text{ and } B) = P(A) \cdot P(B)$. |
| Dependent Events | The outcome of a first event *does affect* the outcome of the other event. | If two events $A$ and $B$ are dependent, then $P(A \text{ and } B) = P(A) \cdot P(B\|A)$. |
| ≠ Conditional | Additional information is known about the probability of an event. | The conditional probability of $A$ given $B$ is $P(A\|B) = \frac{P(A \text{ and } B)}{P(B)}$. |
| Mutually Exclusive Events | Events *do not share* common outcomes. | If two events $A$ or $B$ are mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B)$. |
| Not Mutually Exclusive Events | Events *do share* common outcomes. inclusive | If two events $A$ and $B$ are not mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$. |
| Complementary Events | The outcomes of one event consist of all the outcomes in the sample space that are not outcomes of the other event. | For an event $A$, $P(\text{not } A) = 1 - P(A)$. |

Reduced sample space

Can it be both? no

Can it be both? yes

100%-P

Conditional probability:
Reduced sample space (we already know...)

Roll 2 dice

P(10) $\frac{3}{36}$ $\frac{1}{12}$

P(10 given that the sum is even) $\frac{3}{18} = \frac{1}{6}$

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 2 | ~~3~~ | 4 | ~~5~~ | 6 | ~~7~~ |
| 2 | ~~3~~ | 4 | ~~5~~ | 6 | ~~7~~ | 8 |
| 3 | 4 | ~~5~~ | 6 | ~~7~~ | 8 | ~~9~~ |
| 4 | ~~5~~ | 6 | ~~7~~ | 8 | ~~9~~ | 10 |
| 5 | 6 | ~~7~~ | 8 | ~~9~~ | 10 | ~~11~~ |
| 6 | ~~7~~ | 8 | ~~9~~ | 10 | ~~11~~ | 12 |

P 8|doubles $\frac{1}{6}$

79 HS students
Fr. 8 girls 11 boys = 19
So. 12 girls 15 boys = 27
Jr. 9 girls 6 boys = 15
Sen. 10 girls 8 boys = 18

Draw one name

P(soph) $\frac{27}{79} \approx 34\%$ 79

P(soph given that it is a girl) $\frac{12}{39} = \frac{4}{13} \approx 31\%$

WB 13.6

sk + pr.