



Algebra 2 – Year 2

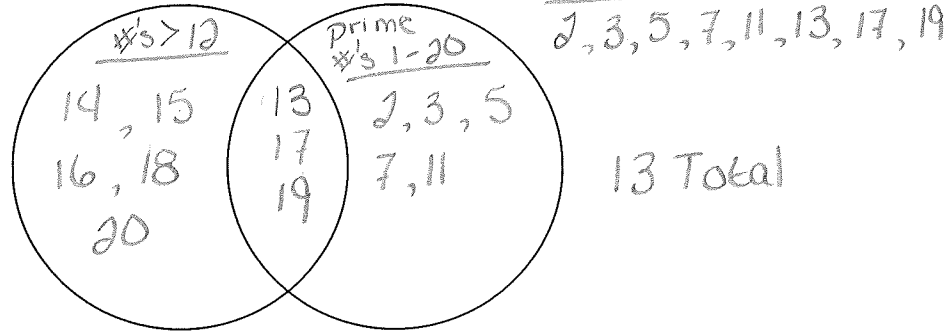
Name: _____

Lesson 11.3 – Probability of Multiple Events

Notes & Examples (Day 2)

Date: _____ Hour: _____

Create a Venn diagram where one circle represents {numbers greater than 12} and the other circle represents {prime numbers} for whole numbers 1 through 20.



What is the probability that a randomly selected number from 1 through 20 will be:

- a. A number greater than 12? $P(>12) = \frac{8}{20}$
- b. A prime number? $P(\text{prime}) = \frac{8}{20}$
- c. A number that is greater than 12 AND prime? $P(>12 \text{ and prime}) = \frac{3}{20}$
- d. A number that is greater than 12 OR prime? $P(>12 \text{ or prime}) = \frac{8}{20} + \frac{8}{20} - \frac{3}{20} = \frac{13}{20}$
inclusive

Mutually exclusive events: When two or more events cannot happen at the same time

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

Inclusive events: When two or more events can happen at the same time

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

Determine if the following events are mutually exclusive or inclusive.

- | | | |
|---|--------------------|-----------|
| ▪ Having black hair and wearing glasses | MUTUALLY EXCLUSIVE | INCLUSIVE |
| ▪ Having blue eyes and having brown eyes | MUTUALLY EXCLUSIVE | INCLUSIVE |
| ▪ Being a number greater than 12 and being a prime number | MUTUALLY EXCLUSIVE | INCLUSIVE |
| ▪ Being a multiple of 4 and being an odd number | MUTUALLY EXCLUSIVE | INCLUSIVE |

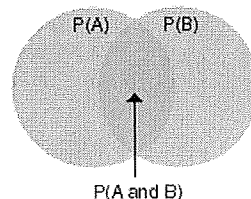
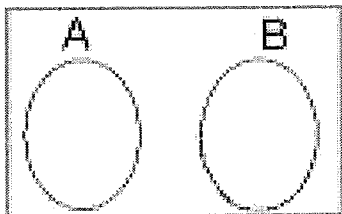
Let A and B represents events in the same sample space.

Probability for **MUTUALLY EXCLUSIVE** events:

Probability for **INCLUSIVE** events:

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

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$



Example 1 – One die is rolled. Find the probability of each event and identify as inclusive or mutually exclusive. 1 2 3 4 5 6

a. $P(1 \text{ OR } 6) = P(1) + P(6)$

$$P(1) = \frac{1}{6} = \frac{1}{6} + \frac{1}{6}$$

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

MUTUALLY EXCLUSIVE

INCLUSIVE

b. $P(\text{even OR prime}) = P(\text{even}) + P(\text{prime}) - P(\text{even and prime})$

$$P(\text{even}) = \frac{3}{6}$$

$$P(\text{prime}) = \frac{3}{6}$$

$$P(\text{even and prime}) = \frac{1}{6}$$

$$= \frac{3}{6} + \frac{3}{6} - \frac{1}{6} = \frac{5}{6}$$

MUTUALLY EXCLUSIVE

INCLUSIVE

c. $P(\text{multiple of 2 or multiple of 3})$

$$P(\text{mult. 2}) = \frac{3}{6}$$

$$P(\text{mult. 3}) = \frac{2}{6}$$

$$P(\text{mult. 2 and mult. 3}) = \frac{1}{6}$$

MUTUALLY EXCLUSIVE

INCLUSIVE

$$= P(\text{mult. 2}) + P(\text{mult. 3}) - P(\text{mult. 2 and mult. 3})$$

$$= \frac{3}{6} + \frac{2}{6} - \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$$

Example 2 – A card is drawn from a standard deck of playing cards. Find the probability of each event and identify as inclusive or mutually exclusive.

a. Find $P(\text{heart OR ace})$.

$$P(\text{heart}) = \frac{13}{52}$$

$$P(\text{Ace}) = \frac{4}{52}$$

$$P(\text{heart and ace}) = \frac{1}{52}$$

MUTUALLY EXCLUSIVE

INCLUSIVE

$$= P(\text{heart}) + P(\text{ace}) - P(\text{heart and ace})$$

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

b. Find $P(\text{face card OR number card})$.

$$P(\text{face}) = \frac{12}{52}$$

$$P(\text{number}) = \frac{36}{52}$$

MUTUALLY EXCLUSIVE

INCLUSIVE

$$P(\text{face or number}) = P(\text{face}) + P(\text{number})$$

$$= \frac{12}{52} + \frac{36}{52} = \frac{48}{52} = \frac{12}{13}$$

? c. Find $P(\text{odd number OR red})$.

$$P(\text{odd}) = \frac{16}{52}$$

$$P(\text{red}) = \frac{26}{52}$$

$$P(\text{odd and red}) = \frac{8}{52}$$

MUTUALLY EXCLUSIVE

INCLUSIVE

$$= P(\text{odd}) + P(\text{red}) - P(\text{odd and red})$$

$$= \frac{16}{52} + \frac{26}{52} - \frac{8}{52} = \frac{34}{52} = \frac{17}{26}$$





Algebra 2 - Year 2

Assignment: Lesson 11.3 worksheet #2

Name: _____

Date: _____ Hour: _____

Give all probabilities as simplified fractions and percents rounded to the nearest tenth of percent.

A spinner is divided into 8 congruent regions numbered 1 through 8. The spinner is spun once. Identify the event as inclusive or mutually exclusive and find the probability of each event.

1 2 3 4 5 6 7 8

1. The number is even or divisible by 3.

$$P(\text{even}) = \frac{4}{8}$$

$$P(\text{even and div. 3}) = \frac{1}{8}$$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{4}{8} + \frac{2}{8} - \frac{1}{8}}{8} = \frac{5}{8}$$

$$P(\text{div. 3}) = \frac{2}{8}$$

2. The number is less than 2 or greater than 6.

$$P(< 2) = \frac{1}{8}$$

$$P(> 6) = \frac{2}{8}$$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{1}{8} + \frac{2}{8}}{8} = \frac{3}{8}$$

3. The number is odd or divisible by 4.

$$P(\text{odd}) = \frac{4}{8}$$

$$P(\text{div. 4}) = \frac{2}{8}$$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{4}{8} + \frac{2}{8}}{8} = \frac{6}{8} = \frac{3}{4}$$

4. The number is odd or greater than 7.

$$P(\text{odd}) = \frac{4}{8}$$

$$P(> 7) = \frac{1}{8}$$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{4}{8} + \frac{1}{8}}{8} = \frac{5}{8}$$

A card is drawn at random from a standard 52 card deck. Tell whether events A and B are inclusive or mutually exclusive. Then find $P(A \text{ or } B)$.

5. A: The card is a heart. $P(\heartsuit) = \frac{13}{52}$
B: The card is an 8. $P(8) = \frac{4}{52}$
 $P(\heartsuit \text{ and } 8) = \frac{1}{52}$

MUTUALLY EXCLUSIVE INCLUSIVE

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

6. A: The card is a number less than 5. $P(< 5) = \frac{12}{52}$
B: The card is a jack, a king, or a queen. $P(J, K, Q) = \frac{12}{52}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{12}{52} + \frac{12}{52}}{52} = \frac{24}{52}$$

7. A: The card is black. $P(\text{black}) = \frac{26}{52}$
B: The card is a number greater than 4. $P(> 4) = \frac{24}{52}$
 $P(\text{black and } > 4) = \frac{12}{52}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{26}{52} + \frac{24}{52} - \frac{12}{52}}{52} = \frac{38}{52} = \frac{19}{26}$$

8. A: The card is not a diamond. $P(\text{not } \diamond) = \frac{39}{52}$
B: The card is a spade. $P(\spadesuit) = \frac{13}{52}$
 $P(\text{not } \diamond \text{ and spade}) = \frac{13}{52}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{\frac{39}{52} + \frac{13}{52} - \frac{13}{52}}{52} = \frac{39}{52}$$

9. A: The card is red. $P(\text{red}) = \frac{26}{52}$
 B: The card is the ace of spades $P(\text{ace } \spadesuit) = \frac{1}{52}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{26}{52} + \frac{1}{52} = \frac{27}{52}$$

10. A: the card is a 2 or a 3. $P(2 \text{ or } 3) = \frac{4}{52} + \frac{4}{52} = \frac{8}{52}$
 B: The card is not a heart. $P(\text{not } \heartsuit) = \frac{39}{52}$
 $P(2 \text{ or } 3 \text{ and not } \heartsuit) = \frac{6}{52}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{8}{52} + \frac{39}{52} - \frac{6}{52} = \frac{41}{52}$$

A fair die is tossed. Identify the event as inclusive or mutually exclusive and find the probability of each event. 1 2 3 4 5 6

11. P(even or 3) $P(\text{even}) = \frac{3}{6}$ $P(3) = \frac{1}{6}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$$

12. P(less than 2 or even) $P(< 2) = \frac{1}{6}$ $P(\text{even}) = \frac{3}{6}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{1}{6} + \frac{3}{6} = \frac{4}{6} = \frac{2}{3}$$

13. P(prime or 4) $P(\text{prime}) = \frac{3}{6}$ $P(4) = \frac{1}{6}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$$

14. P(greater than 4 or factor of 10) $P(> 4) = \frac{2}{6}$
 $P(7, 4 \text{ and } \text{factor } 10) = \frac{1}{6}$ $P(\text{factor } 10) = \frac{2}{6}$

MUTUALLY EXCLUSIVE INCLUSIVE

$$\frac{2}{6} + \frac{2}{6} - \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$$

15. You randomly choose a natural number from 1 to 20. What is the probability that you choose a multiple of 2 or a multiple of 3? Inclusive!

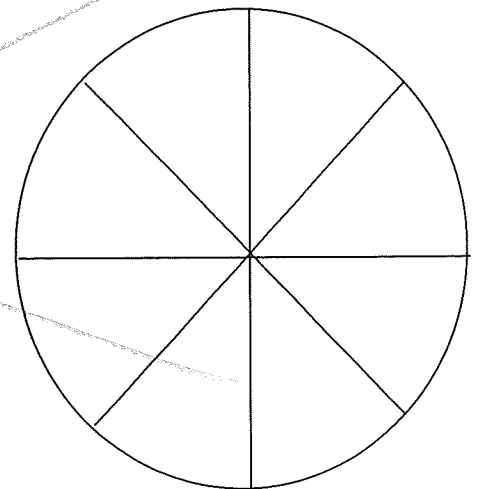
$$P(\text{mult. } 2) = \frac{10}{20} \quad \frac{10}{20} + \frac{6}{20} - \frac{3}{20} = \frac{13}{20}$$

$$P(\text{mult. } 3) = \frac{6}{20}$$

$$P(\text{mult. } 2 \text{ and mult. } 3) = \frac{3}{20}$$

The spinner shown is spun once. Find the probability of each event.

16. The number is odd or blue
 17. The number is prime or white
 18. The number is a multiple of 2 or red
 19. The number is greater than 3 or not red







Algebra 2 – Year 2

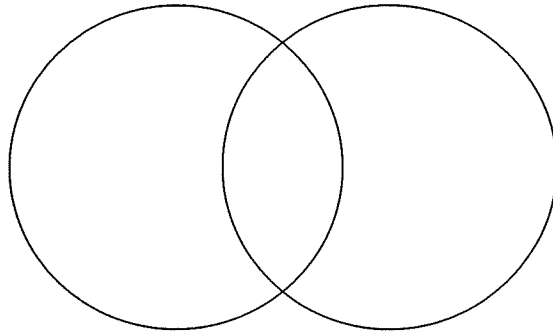
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Lesson 11.3 – Probability of Multiple Events

Notes & Examples (Day 2)

Date: _____ Hour: _____

Create a Venn diagram where one circle represents {numbers greater than 12} and the other circle represents {prime numbers} for whole numbers 1 through 20.



What is the probability that a randomly selected number from 1 through 20 will be:

- A number greater than 12? _____
- A prime number? _____
- A number that is greater than 12 AND prime? _____
- A number that is greater than 12 OR prime? _____

Mutually exclusive events: When two or more events **cannot** happen at the same time

Inclusive events: When two or more events **can** happen at the same time

Determine if the following events are mutually exclusive or inclusive.

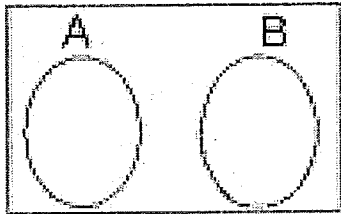
- | | | |
|--|--------------------|-----------|
| ▪ <i>Having black hair and wearing glasses</i> | MUTUALLY EXCLUSIVE | INCLUSIVE |
| ▪ <i>Having blue eyes and having brown eyes</i> | MUTUALLY EXCLUSIVE | INCLUSIVE |
| ▪ <i>Being a number greater than 12 and being a prime number</i> | MUTUALLY EXCLUSIVE | INCLUSIVE |
| ▪ <i>Being a multiple of 4 and being an odd number</i> | MUTUALLY EXCLUSIVE | INCLUSIVE |

Let A and B represents events in the same sample space.

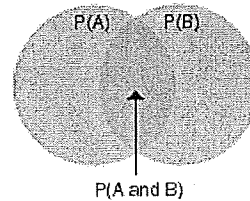
Probability for MUTUALLY EXCLUSIVE events:

Probability for INCLUSIVE events:

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



$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$



Example 1 – One die is rolled. Find the probability of each event and identify as inclusive or mutually exclusive.

- | | | |
|---------------------------------------|--------------------|-----------|
| a. P(1 OR 6). | MUTUALLY EXCLUSIVE | INCLUSIVE |
| b. P(even OR prime). | MUTUALLY EXCLUSIVE | INCLUSIVE |
| c. P(multiple of 2 or multiple of 3). | MUTUALLY EXCLUSIVE | INCLUSIVE |

Example 2 – A card is drawn from a standard deck of playing cards. Find the probability of each event and identify as inclusive or mutually exclusive.

- | | | |
|--------------------------------------|--------------------|-----------|
| a. Find P(heart OR ace). | MUTUALLY EXCLUSIVE | INCLUSIVE |
| b. Find P(face card OR number card). | MUTUALLY EXCLUSIVE | INCLUSIVE |
| c. Find P(odd number OR red). | MUTUALLY EXCLUSIVE | INCLUSIVE |



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1. The number is even or divisible by 3. MUTUALLY EXCLUSIVE INCLUSIVE

2. The number is less than 2 or greater than 6. MUTUALLY EXCLUSIVE INCLUSIVE

3. The number is odd or divisible by 4. MUTUALLY EXCLUSIVE INCLUSIVE

4. The number is odd or greater than 7. MUTUALLY EXCLUSIVE INCLUSIVE

A card is drawn at random from a standard 52 card deck. Tell whether events A and B are inclusive or mutually exclusive. Then find $P(A \text{ or } B)$.

5. A: The card is a heart.
B: The card is an 8.

6. A: The card is a number less than 5
B: The card is a jack, a king, or a queen.

MUTUALLY EXCLUSIVE INCLUSIVE

MUTUALLY EXCLUSIVE INCLUSIVE

7. A: The card is black.
B: The card is a number greater than 4

8. A: The card is not a diamond.
B: The card is a spade.

MUTUALLY EXCLUSIVE INCLUSIVE

MUTUALLY EXCLUSIVE INCLUSIVE

9. A: The card is red.
B: The card is the ace of spades

MUTUALLY EXCLUSIVE INCLUSIVE

10. A: the card is a 2 or a 3.
B: The card is not a heart.

MUTUALLY EXCLUSIVE INCLUSIVE

A fair die is tossed. Identify the event as inclusive or mutually exclusive and find the probability of each event.

11. P(even or 3)

MUTUALLY EXCLUSIVE INCLUSIVE

12. P(less than 2 or even)

MUTUALLY EXCLUSIVE INCLUSIVE

13. P(prime or 4)

MUTUALLY EXCLUSIVE INCLUSIVE

14. P(greater than 4 or factor of 10)

MUTUALLY EXCLUSIVE INCLUSIVE

15. You randomly choose a natural number from 1 to 20. What is the probability that you choose a multiple of 2 or a multiple of 3?

The spinner shown is spun once. Find the probability of each event.

16. The number is odd or blue

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