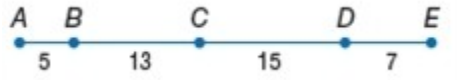
**Practice Test - Chapter 13**

**Point $X$ is chosen at random on $\overline{AE}$. Find the probability of each event.**




1. $P(X$ is on $\overline{AC})$

*SOLUTION:*

$$P(X \text{ is on } \overline{AC}) = \frac{\text{length of } AC}{\text{length of } AE}$$
$$= \frac{5+13}{5+13+15+7}$$
$$= \frac{18}{40}$$
$$= \frac{9}{20}$$

*ANSWER:*

$\frac{9}{20}$, 0.45, or 45%

2. $P(X$ is on $\overline{CD})$

*SOLUTION:*

$$P(X \text{ is on } \overline{CD}) = \frac{\text{length of } CD}{\text{length of } AE}$$
$$= \frac{15}{5+13+15+7}$$
$$= \frac{15}{40}$$
$$= \frac{3}{8}$$

*ANSWER:*

$\frac{3}{8}$, 0.375, or 37.5%

3. **BASEBALL** A baseball team fields 9 players. How many possible batting orders are there for the 9 players?

*SOLUTION:*

The number of possible batting orders for the 9 players is $9! = 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ or 362,880.

*ANSWER:*

362,880

4. **TRAVEL** A traveling salesperson needs to visit four cities in her territory. How many distinct itineraries are there for visiting each city once?

*SOLUTION:*

The number of possible distinct itineraries for visiting each city once is $4! = 4 \times 3 \times 2 \times 1$ or 24.

*ANSWER:*

24

**Represent the sample space for each experiment by making an organized list, a table, and a tree diagram.**

5. A box has 1 red ball, 1 green ball, and 1 blue ball. Two balls are drawn from the box one after the other, without replacement.

*SOLUTION:*

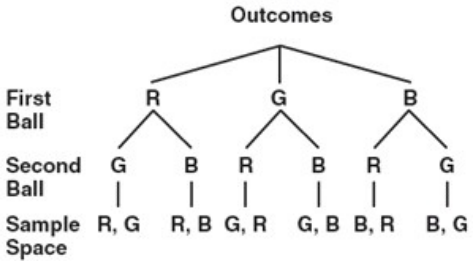
**Organized List:**
Pair each possible outcome for the first draw with the possible outcomes for the second draw.

R, G
R, B
G, R
G, B
B, R
B, G

**Table:**
List the outcomes of the first draw in the left column and those of the second draw in the top row.

| Outcomes | Red | Green | Blue |
|---|---|---|---|
| Red | | R, G | R, B |
| Green | G, R | | G, B |
| Blue | B, R | B, G | |

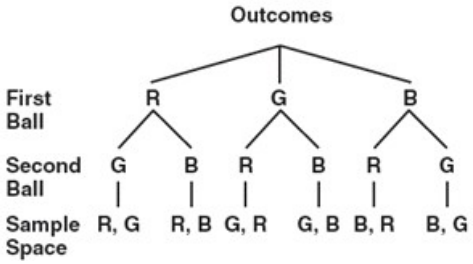
**Tree Diagram:**
The top group is all of the outcomes for the first draw. The second group includes all of the outcomes for the second draw. The last group shows the sample space.




*ANSWER:*

R, G
R, B
G, R
G, B
B, R
B, G

| Outcomes | Red | Green | Blue |
|---|---|---|---|
| Red | | R, G | R, B |
| Green | G, R | | G, B |
| Blue | B, R | B, G | |




6. Shinsuke wants to adopt a pet and goes to his local humane society to find a dog or cat. While he is there, he decides to adopt two pets.

*SOLUTION:*

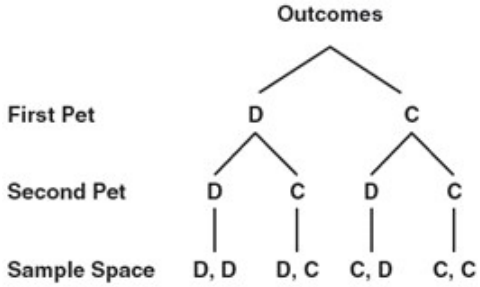
**Organized List:**
Pair each possible outcome for the first pet with the possible outcomes for the second pet.

D, D
D, C
C, D
C, C

**Table:**
List the outcomes of the first pet in the left column and those of the second pet in the top row.

| Outcome | Dog | Cat |
|---|---|---|
| Dog | D, D | D, C |
| Cat | C, D | C, C |

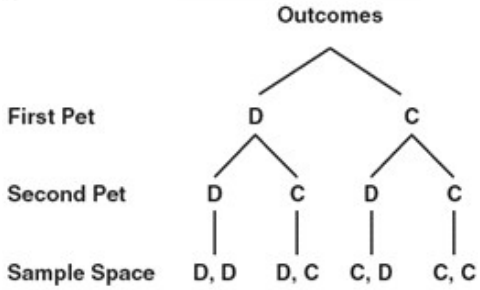
**Tree Diagram:**
The top group is all of the outcomes for the first pet. The second group includes all of the outcomes for the second pet. The last group shows the sample space.




*ANSWER:*

D, D
D, C
C, D
C, C

| Outcome | Dog | Cat |
|---|---|---|
| Dog | D, D | D, C |
| Cat | C, D | C, C |



7. **ENGINEERING** An engineer is analyzing three factors that affect the quality of semiconductors: temperature, humidity, and material selection. There are 6 possible temperature settings, 4 possible humidity settings, and 6 choices of materials. How many combinations of settings are there?

*SOLUTION:*

By the Fundamental Counting Principle the number of possible outcomes in a sample space can be found by multiplying the number of possible outcomes from each stage or event.

There are 6 possible temperature settings, 4 possible humidity settings, and 6 choices of materials. Therefore, an engineer can analyze semiconductor in $6 \times 4 \times 6 = 144$ ways.

*ANSWER:*

144

8. **SPELLING** How many distinguishable ways are there to arrange the letters in the word "bubble"?

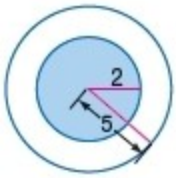
*SOLUTION:*

There are 6 letters in which b appears three times. So, the number of distinguishable permutations is $\frac{6!}{3!} = 120$.

*ANSWER:*

120

9. **PAINTBALL** Cordell is shooting a paintball gun at the target. What is the probability that he will shoot the shaded region?




*SOLUTION:*

$$\begin{aligned} A(\text{shaded}) &= \pi(2)^2 \\ &= 4\pi \end{aligned}$$

$$\begin{aligned} A(\text{total}) &= \pi(5)^2 \\ &= 25\pi \end{aligned}$$

$$\begin{aligned} P(\text{shaded}) &= \frac{\text{Area(shaded)}}{\text{Area(total)}} \\ &= \frac{4\pi}{25\pi} \\ &= \frac{4}{25} \text{ or } 0.16 \end{aligned}$$

*ANSWER:*

0.16 or $\frac{4}{16}$

10. **SHORT RESPONSE** What is the probability that a phone number using the numbers 7, 7, 7, 2, 2, 2, and 6 will be 622-2777?

*SOLUTION:*

There are 7 digits in which 7 appears three times, 2 appears three times, and 1 once.

The number of distinguishable permutations is $\frac{7!}{3! \cdot 3!} = 140$.

The total number of possible outcomes is 140 and there is only one favorable outcome which is 622-2777. Therefore, the probability is $\frac{1}{140}$.

*ANSWER:*

$\frac{1}{140}$

11. **TICKETS** Fifteen people entered the drawing at the right. What is the probability that Jodi, Dan, and Pilar all won the tickets?


*SOLUTION:*

The order in which they are chosen does not matter, so this is a combination.

3 people can be chosen from 15 people in ${}_{15}C_3$ ways and Jodi, Dan, and Pilar can be chosen in only one way.

$${}_{15}C_3 = \frac{15!}{(15-3)!3!} = \frac{15 \cdot 14 \cdot 13 \cdot 12!}{12! \cdot 3 \cdot 2 \cdot 1} = 455$$

The number of possible outcomes is 455 and the number of favorable outcomes is 1. Therefore, the probability is $\frac{1}{455}$.

*ANSWER:*

$\frac{1}{455}$

**Determine whether the events are *independent* or *dependent*. Then find the probability.**

12. A deck of cards has 5 yellow, 5 pink, and 5 orange cards. Two cards are chosen from the deck with replacement. Find $P$(the first card is pink and the second card is pink).

*SOLUTION:*

Since the probability of the fist event does not affect the probability of the second event, these are independent events.

$$P(\text{pink}) = \frac{5}{15}$$

$$P(\text{another pink}) = \frac{5}{15}$$

If two events $A$ and $B$ are independent, then $P(A \text{ and } B) = P(A) \cdot P(B)$.

$$\begin{aligned} P(\text{2 pink cards}) &= P(\text{pink}) \cdot P(\text{pink}) \\ &= \frac{5}{15} \cdot \frac{5}{15} \\ &= \frac{1}{3} \cdot \frac{1}{3} \\ &= \frac{1}{9} \end{aligned}$$

*ANSWER:*

independent, $\frac{1}{9}$

13. There are 6 green, 2 red, 2 brown, 4 navy, and 2 purple marbles in a hat. Sadie picks 2 marbles from the hat without replacement. What is the probability that the first marble is brown and the second marble is not purple?

*SOLUTION:*

These events are dependent since a brown marble does not replace before the second draw. If two events $A$ and $B$ are dependent, then $P(A \text{ and } B) = P(A)P(B|A)$.

$$P(\text{brown}) = \frac{2}{16} = \frac{1}{8}$$

$$P(\text{purple}) = \frac{2}{15}$$

$$P(\text{not purple}) = 1 - P(\text{purple})$$

$$= 1 - \frac{2}{15}$$

$$= \frac{13}{15}$$

$$P(\text{brown and not purple}) = P(\text{brown}) \cdot P(\text{not purple})$$

$$= \frac{1}{8} \cdot \frac{13}{15}$$

$$= \frac{13}{120}$$

*ANSWER:*

dependent, $\frac{13}{120}$

**Use the spinner to find each probability. If the spinner lands on a line, it is spun again.**


14. $P$(pointer landing on purple)

*SOLUTION:*

$$P(\text{purple}) = \frac{35}{360}$$

$$\approx 9.7\%$$

*ANSWER:*

9.7%

15. $P$(pointer landing on red)

*SOLUTION:*

$$P(\text{red}) = \frac{90}{360}$$

$$= 25\%$$

*ANSWER:*

25%

16. $P$(pointer not landing on yellow)

*SOLUTION:*

$$P(\text{yellow}) = \frac{30}{360}$$

$$\approx 8.3\%$$

$$P(\text{not yellow}) \approx 100 - 8.3$$

$$= 91.7\%$$

*ANSWER:*

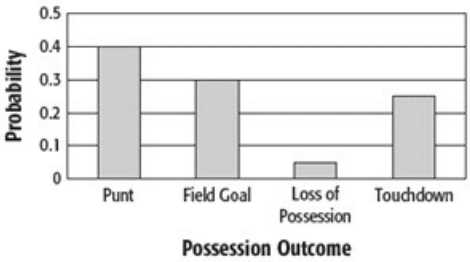
91.7%

17. **FOOTBALL** According to a football team's offensive success rate, the team punts 40% of the time, kicks a field goal 30% of the time, loses possession 5% of the time, and scores a touchdown 25% of the time. Design a simulation using a random number generator. Report the results using appropriate numerical and graphical summaries.

*SOLUTION:*

Sample answer: Use a random number generator to generate integers 1 through 20, where 1–8 represent a punt, 9–14 represent a field goal, 15 represents a turnover, and 16–20 represent touchdown. Do 20 trials and record the results in a frequency table. Use the results to find the probability of each hit.

| Outcome | Frequency |
|---|---|
| Punt | 8 |
| Field Goal | 6 |
| Loss of Possession | 1 |
| Touchdown | 5 |
| Total | 20 |




The probability of the team punting is 40%, kicking a field goal is 30%, losing possession is 5%, and scoring a touchdown is 25%.

*ANSWER:*

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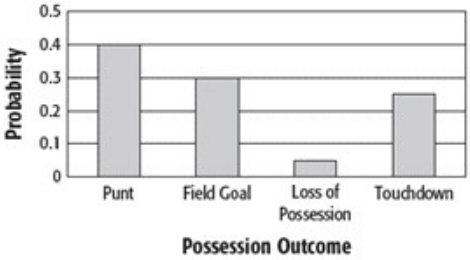



The probability of the team punting is 40%, kicking a field goal is 30%, losing possession is 5%, and scoring a touchdown is 25%.

**Determine whether the events are *mutually exclusive* or *not mutually exclusive*. Explain your reasoning.**

18. a person owning a car and a truck

*SOLUTION:*

These are not mutually exclusive because a person may own both a car and a truck. If it was stated that they could only own one vehicle, then the events would be mutually exclusive.

*ANSWER:*

Not mutually exclusive; a person may own both a car and a truck.

19. rolling a pair of dice and getting a sum of 7 and 6 on the face of one die

*SOLUTION:*

Events are mutually exclusive if they cannot occur at the same time.

Not mutually exclusive; you may roll 6 on one die and 1 on the other.

*ANSWER:*

Not mutually exclusive; you may roll 6 on one die and 1 on the other.

20. a playing card being both a spade and a club

*SOLUTION:*

Events are mutually exclusive if they cannot occur at the same time.

A card cannot be both a spade and a club, so the events are mutually exclusive.

*ANSWER:*

Mutually exclusive; a card cannot be both a spade and a club.

21. **GRADES** This quarter, Todd earned As in his classes 45% of the time. Design and conduct a simulation using a geometric probability model. Then report the results using appropriate numerical and graphical summaries.

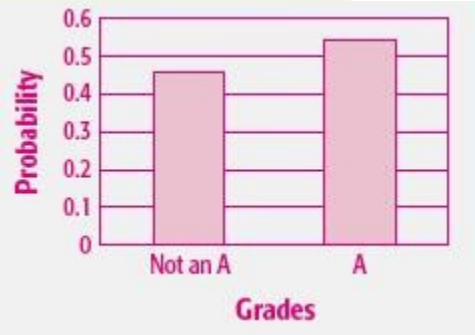
*SOLUTION:*

Sample answer: Use a spinner that is divided into two sectors, one containing 45% or 162° and the other containing 55% or 198°.

Another option would be to use a random number generator from 1-100. Let 1-45 represent A and let 46-100 represent non-A.

Perform 50 trials and record the results in a frequency table.

| Outcome | Frequency |
|---|---|
| A | 23 |
| Not an A | 27 |
| Total | 50 |




*ANSWER:*

Sample answer: Use a spinner that is divided into two sectors, one containing 45% or 162° and the other containing 55% or 198°. Perform 50 trials and record the results in a frequency table.

| Outcome | Frequency |
|---|---|
| A | 23 |
| Not an A | 27 |
| Total | 50 |