# Mid-Chapter Quiz: Lessons 13-1 through 13-3

1. **LUNCH** A deli has a lunch special, which consists of a sandwich, soup, dessert, and a drink for $4.99. The choices are in the table below.

| Sandwich | Soup | Dessert | Drink |
|---|---|---|---|
| chicken salad | tomato | cookie | tea |
| ham | chicken noodle | pie | coffee |
| tuna | vegetable | | cola |
| roast beef | | | diet cola |
| | | | milk |

a. How many different lunches can be created from the items shown in the table?
b. If a soup and two desserts were added, how many different lunches could be created?

*SOLUTION:*

a. 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.

A sandwich can be ordered in 4 different ways, soup in 3 different ways, dessert in 2 different ways, and a drink in 5 different ways. Therefore, a lunch can be ordered in $4 \times 3 \times 2 \times 5 = 120$ ways.

b. If a soup and two desserts were added, the total number of choices for a lunch will be $4 \times 4 \times 4 \times 5 = 320$.

*ANSWER:*

a. 120
b. 320

2. FLAGS How many different signals can be made with 5 flags from 8 flags of different colors?

*SOLUTION:*

The number of ways that 5 flags can be selected is the combination of 8 flags taken 5 at a time. After choosing 5 flags from 8, it can be arranged in ${}_5P_5$ ways. Therefore, the total number of signals that can be made is ${}_8C_5\left({}_5P_5\right)=\left(\frac{8!}{(8-5)!(5)!}\right)(5!)=6720.$

*ANSWER:*

6720

3. CLOTHING Marcy has six colors of shirts: red, blue, yellow, green, pink, and orange. She has each color in short-sleeved and long-sleeved styles. Represent the sample space for Marcy's shirt choices by making an organized list, a table, and a tree diagram.

*SOLUTION:*

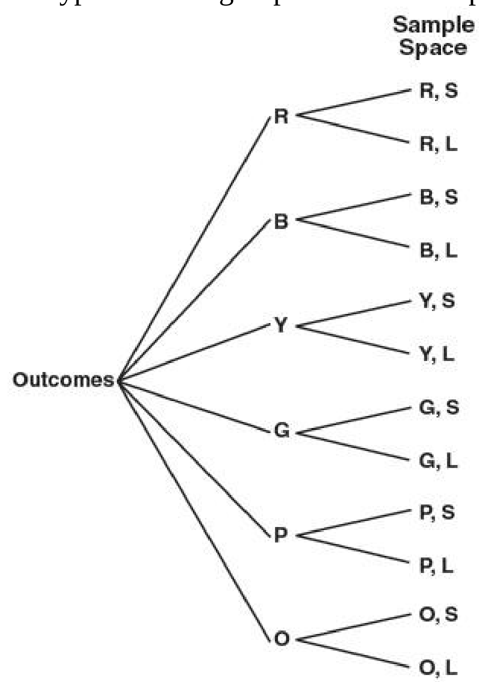
**Organized List:**
Pair each possible outcome for the color with the possible outcomes for the type.

R, S; R, L; B, S; B, L; Y, S; Y, L; G, S; G, L; P, S; P, L; O, S; O, L

**Table:**
List the outcomes of the color in the left column and those of the type in the top row.

| Outcomes | Red | Blue | Yellow | Green | Pink | Orange |
|---|---|---|---|---|---|---|
| Short-sleeved | R, S | B, S | Y, S | G, S | P, S | O, S |
| Long-sleeved | R, L | B, L | Y, L | G, L | P, L | O, L |

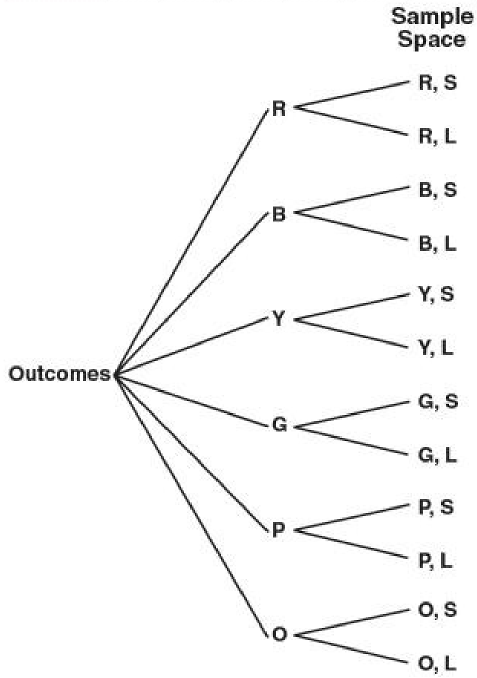
**Tree Diagram:**
The top group is all of the outcomes for the color. The second group includes all of the outcomes for the type. The last group shows the sample space.




*ANSWER:*

R, S; R, L; B, S; B, L; Y, S; Y, L; G, S; G, L; P, S; P, L; O, S; O, L

| Outcomes | Red | Blue | Yellow | Green | Pink | Orange |
|---|---|---|---|---|---|---|
| Short-sleeved | R, S | B, S | Y, S | G, S | P, S | O, S |
| Long-sleeved | R, L | B, L | Y, L | G, L | P, L | O, L |




4. **SPELLING** A bag contains one tile for each letter of the alphabet. If you selected a permutation of these letters at random, what is the probability that they would spell TRAINS?

*SOLUTION:*

There are 6 letters in the word and the number of arrangements is the permutation of 6 taken 6 at a time. So, it is 6! = 720.
The total number of possible outcomes is 720 and there is only one favorable outcome which is TRAINS. Therefore, the probability is $\frac{1}{720}$.

*ANSWER:*

1/720

5. CHANGE Augusto has 3 pockets and 4 different coins. In how many ways can he put one coin in each pocket?

*SOLUTION:*

Augusto has 4 different coins that he is choosing 3 at a time. The number of ways to put one coin in each pocket is the permutation of 4 coins taken 3 at a time.

$$
\begin{aligned}
{}_nP_r &= \frac{n!}{(n-r)} \\
{}_4P_3 &= \frac{4!}{(4-3)!} \\
&= 24
\end{aligned}
$$

So, there are 24 ways to put one coin in each pocket.

*ANSWER:*

24

6. COINS Ten coins are tossed simultaneously. In how many of the outcomes will the third coin turn up a head?

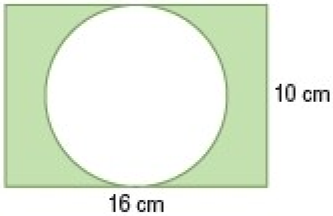
*SOLUTION:*

The third coin must be a head. The rest of the coins can be heads or tails. Therefore, there are $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^9$ different outcomes for the rest of the coins.

*ANSWER:*

$2^9$

7. Find the probability that a point chosen at random lies in the shaded region.




*SOLUTION:*

The area of the shaded region is the difference of areas of the rectangle and the circle. So, it is $(10 \times 16) - \pi(5)^2 \approx 81.5 \text{ cm}^2$. The shaded area is $\frac{81.5}{160}$ of the total area. Therefore, the probability that a point chosen at random lies in the shaded region is $\frac{81.5}{160} \approx 51\%$.

*ANSWER:*

about 51%

8. **EXTENDED RESPONSE** A 320 meter long tightrope is suspended between two poles. Assume that the line has an equal chance of breaking anywhere along its length.
a. Determine the probability that a break will occur in the first 50 meters of the tightrope.
b. Determine the probability that the break will occur within 20 meters of a pole.

*SOLUTION:*

a. The line has an equal chance of breaking anywhere along its length. The first 50 meters form $\frac{50}{320} \times 100 \approx 16\%$ of the total length. Therefore, the probability that a break will occur in the first 50 meters of the tightrope is about 16%.
b. The line has an equal chance of breaking anywhere along its length. The first and last 20 meters form $\frac{20+20}{320} \times 100 \approx 13\%$ of the total length. Therefore, the probability that a break will occur within 20 meters of a pole is about 13%.

*ANSWER:*

a. about 16%
b. about 13%

Point A is chosen at random on BE. Find the probability of each event.


9. P(A is on $\overline{CD}$)

*SOLUTION:*

$$\begin{aligned} P(A \text{ is on } \overline{CD}) &= \frac{\text{length of } CD}{\text{length of } BE} \\ &= \frac{12}{5+12+9} \\ &= \frac{12}{26} \\ &= \frac{6}{13} \end{aligned}$$

*ANSWER:*

$\frac{6}{13}$

10. P(A is on $\overline{BD}$)

*SOLUTION:*

$$\begin{aligned} P(A \text{ is on } \overline{BD}) &= \frac{\text{length of } BD}{\text{length of } BE} \\ &= \frac{5+12}{5+12+9} \\ &= \frac{17}{26} \end{aligned}$$

*ANSWER:*

$\frac{17}{26}$

11. P(A is on $\overline{CE}$)

*SOLUTION:*

$$P(A \text{ is on } \overline{CE}) = \frac{\text{length of } CE}{\text{length of } BE} = \frac{12+9}{5+12+9} = \frac{21}{26}$$

*ANSWER:*

$\frac{21}{26}$

12. P(A is on $\overline{DE}$)

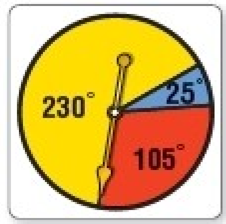
*SOLUTION:*

$$P(A \text{ is on } \overline{DE}) = \frac{\text{length of } DE}{\text{length of } BE} = \frac{9}{5+12+9} = \frac{9}{26}$$

*ANSWER:*

$\frac{9}{26}$

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




13. P(pointer landing on yellow)

*SOLUTION:*

The spinner is divided into 3 sectors. The ratio of the area of a sector of a circle to the area of the entire circle is the same as the ratio of the sector's central angle to 360.The measure of the sector colored in yellow is 230º. Therefore, the probability that the pointer will land on yellow is $\frac{230}{360} \approx 64\%$.

*ANSWER:*

about 64%

14. P(pointer landing on blue)

*SOLUTION:*

The spinner is divided into 3 sectors. The ratio of the area of a sector of a circle to the area of the entire circle is the same as the ratio of the sector's central angle to 360.The measure of the sector colored in blue is 25º. Therefore, the probability that the pointer will land on blue is $\frac{25}{360} \approx 7\%$.

*ANSWER:*

about 7%

15. P(pointer landing on red)

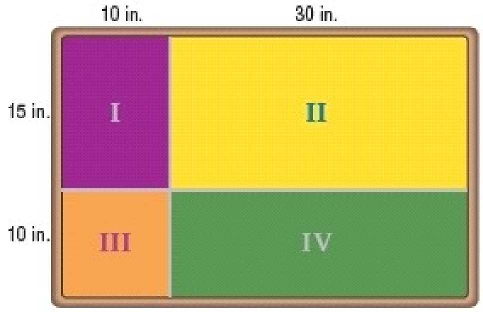
*SOLUTION:*

The spinner is divided into 3 sectors. The ratio of the area of a sector of a circle to the area of the entire circle is the same as the ratio of the sector's central angle to 360.The measure of the sector colored in red is 105º. Therefore, the probability that the pointer will land on red is $\frac{105}{360} \approx 29\%$.

*ANSWER:*

about 29%

16. GAMES At a carnival, the object of a game is to throw a dart at the board and hit region III.




a. What is the probability that it hits region I?
b. What is the probability that it hits region II?
c. What is the probability that it hits region III?
d. What is the probability that it hits region IV?

*SOLUTION:*

a. The total area of the board is (10 + 30)(10 + 15) = 1000 $in^2$.

The area of the region I is (10)(15) = 150 $in^2$.
Therefore, the probability that it hits region I is

$$\frac{150}{1000} = 15\%.$$

b. The area of the region II is (30)(15) = 450 $in^2$.
Therefore, the probability that it hits region II is

$$\frac{450}{1000} = 45\%.$$

c. The area of the region III is (10)(10) = 100 $in^2$.
Therefore, the probability that it hits region I is

$$\frac{100}{1000} = 10\%.$$

d. The area of the region IV is (10)(30) = 300 $in^2$.
Therefore, the probability that it hits region I is

$$\frac{300}{1000} = 30\%.$$

*ANSWER:*

a. 15%
b. 45%
c. 10%
d. 30%