# Family Support Materials

## Conditional Probability

In this unit, your student will build on their understanding of probability, including conditional probability. The probability of an event is a number that measures how likely the event is to happen. It can be 0, 1, or any number in between. It is 0 if the event will never happen and 1 if the event must happen. If an event occurs half of the time in the long run, then its probability is 0.5. Conditional probability is the probability that one event occurs under the condition that another event occurs.

Here is an example. The table summarizes the type (medium, large, or extra-large) and condition (no cracked eggs, or one or more cracked eggs) of 50 cartons of eggs at a grocery store.

| | medium | large | extra-large | total |
|---|---|---|---|---|
| **one or more eggs cracked** | 1 | 3 | 1 | 10 |
| **no cracked eggs** | 4 | 22 | 19 | 40 |
| **total** | 5 | 25 | 20 | 50 |

One carton is selected at random.

What is the probability that the carton has no cracked eggs? This probability is 0.8. This is because 40 cartons have no cracked eggs out of a total of 50 cartons and $\frac{40}{50} = 0.8$. Students also see this type of of question written as $P(\text{no cracked eggs})$ which means “the probability that a randomly selected carton has no cracked eggs.” In this case, $P(\text{no cracked eggs}) = 0.8$.

What is the probability that the carton has no cracked eggs under the condition that it is a carton of extra-large eggs? This conditional probability is 0.95. This is because 19 cartons of extra-large eggs had no cracked eggs out of a total of 20 cartons of extra-large eggs and $\frac{19}{20} = 0.95$. This type of probability is called conditional probability because it is a probability based on the condition of selecting a carton of extra-large eggs. Students see this type of question written as $P(\text{no cracked eggs})$ which means that the “probability that a randomly selected carton has no cracked eggs under the condition that it is a carton of extra-large eggs.” In this case $P(\text{no cracked eggs} \mid \text{extra-large}) = 0.95$.

**Here is a task to try with your student:**

The table summarizes the position of loaves of bread at the grocery store (bread in the front row or bread not in the front row) and the sell-by date (within five days or more than 5 days away).

A loaf of bread is selected at random.

| | **sell-by date within 5 days** | **sell-by date more than 5 days away** |
|---|---|---|
| **bread in the front row** | 36 | 14 |
| **bread not in the front row** | 24 | 76 |

1. What is the probability that the bread has a sell-by date within 5 days?
2. What is the probability that bread has a sell-by date within 5 days under the condition that the loaf of bread is in the front row?
3. What is $P(\text{sell-by date more than 5 days away} \mid \text{bread not in the front row})$?
4. You are in a rush and want to grab a loaf of bread at this store without looking at the sell-by date. Does grabbing the loaf of bread from the front row give you the best chance of getting a loaf of bread with a sell-by date more than 5 days away? Use probability to explain your reasoning.

**Solution:**

1. 0.4 or $\frac{60}{150}$
2. 0.72 or $\frac{36}{50}$
3. 0.76 or $\frac{76}{100}$
4. No it does not give you the best chance of getting a loaf of bread with a sell-by date more than 5 days away. The probability of getting a loaf or bread with a sell-by date more than 5 days away under the condition that is in the front row is 0.28 compared to a probability of 0.72 for a loaf of bread that is not in the front row.