

Important Concepts . . .

Preview Review



Mathematics Grade 8 TEACHER KEY
**W2 - Lesson 5: Probability of
Independent Events**

Important Concepts of Grade 8 Mathematics

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W1 - Lesson 2	Working with Ratios and Rates
W1 - Lesson 3	Multiplying and Dividing Fractions
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Materials Required

Protractor
Ruler
Calculator

**No Textbook
Required**

**This is a stand-
alone course.**

Mathematics Grade 8

Version 6

Preview/Review W2 - Lesson 5

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Preview/Review Concepts for Grade Eight Mathematics

Teacher Key



W2 - Lesson 5:

*Probability of Independent
Events*

OBJECTIVES

By the end of this lesson, you will be able to:

- Determine the probability of two given independent events
- Solve a given problem that involves determining the probability of independent events

GLOSSARY

Probability – the chance of an event occurring. Probability is always expressed as a number between 0 and 1.

Independent Events – when the occurrence of one event does not depend on the occurrence of another event.

W2 – Lesson 5: Probability of Independent Events

Materials required:

- Paper, and Pencil

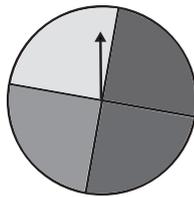
Part 1: Independent Events

Probability is calculated by applying the following formula:

$$\text{Probability} = \frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$$

Two events are said to be independent when the occurrence of one event does not affect the occurrence of another.

Spinning red on a coloured spinner and landing on tails on a coin are examples of two independent events. Spinning a particular colour on a coloured spinner will not affect the outcome of flipping a coin.



There are eight possible outcomes of spinning a red on the spinner and tossing a tails on the coin:

RT, RH, YT, YH, BT, BH, GT, GH. The probability of spinning a red and tossing a tails is $\frac{1}{8}$
 The probability of landing on red is $\frac{1}{4}$ and the probability of landing on tails is $\frac{1}{2}$.

Therefore, to determine the probability of two independent events you must multiply the individual probabilities of each event.

$$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

The formula to use to calculate the probability of independent events is

$$P(A \text{ and } B) = P(A) \times P(B).$$

Example 1

What is the probability of rolling a 3 and tossing a head at the same time?

Let event A represent rolling a 3 on a regular die.

Let event B represent tossing heads on a coin.

Apply the formula.

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

$$P(\text{3 and heads}) = P(\text{3}) \times P(\text{heads})$$

$$= \frac{1}{6} \times \frac{1}{2}$$

$$= \frac{1}{12}$$

The probability of rolling a 3 on a die and tossing a heads is $\frac{1}{12}$.

Practice Questions

Determine which type of graph would be the best to use to display the given information.

1. A bag of marbles contains 3 yellow marbles, 5 green marbles, and 4 red marbles. A spinner has sections numbers 1, 2, 3, and 4.

Calculate the probability of each of the following scenarios:

- a. Picking a yellow marble and spinning a 4?

Let event A represent picking a yellow marble and let event B represent spinning a 4 on the spinner.

The probability of picking a yellow marble is $\frac{3}{12}$ because there are 3 yellow marbles and 12 marbles in total. $\frac{3}{12}$ is equivalent to $\frac{1}{4}$.

The probability of spinning a 4 is $\frac{1}{4}$ because there is 1 number four and 4 numbers in total.

Apply the formula:

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

$$P(\text{yellow marble and 4}) = P(\text{yellow marble}) \times P(4)$$

$$= \frac{1}{4} \times \frac{1}{4}$$

$$= \frac{1}{16}$$

- b. Not picking a green marble and spinning a 2?

Let event A represent not picking a green marble and let event B represent spinning a 2 on the spinner. The probability of not picking a green marble is $\frac{7}{12}$ because there are 7 marbles that are not green in colour and 12 marbles in total. The probability of spinning a 2 is $\frac{1}{4}$ because there is 1 number two and 4 numbers in total.

Apply the formula:

$$\begin{aligned} P(A \text{ and } B) &= P(A) \times P(B) \\ P(\text{not a green marble and } 2) &= P(\text{not a green marble}) \times P(2) \\ &= \frac{7}{12} \times \frac{1}{4} \\ &= \frac{7}{48} \end{aligned}$$

- c. Picking a red marble and spinning an even number?

Let event A represent picking a red marble and let event B represent spinning an even number on the spinner.

The probability of picking a red marble is $\frac{4}{12}$ because there are 4 red marbles and 12 marbles in total. $\frac{4}{12}$ is equivalent to $\frac{1}{3}$.

The probability of spinning an even number is $\frac{2}{4}$ because there are 2 even numbers and 4 numbers in total. $\frac{2}{4}$ is equivalent to $\frac{1}{2}$.

Apply the formula:

$$\begin{aligned} P(A \text{ and } B) &= P(A) \times P(B) \\ P(\text{red marble and even number}) &= P(\text{red marble}) \times P(\text{even number}) \\ &= \frac{1}{3} \times \frac{1}{2} \\ &= \frac{1}{6} \end{aligned}$$

Part 2: Solving Problems Involving Independent Events

When solving problems involving independent events, sometimes the probabilities are expressed as percentages or decimals. Convert all the numbers into either decimals or fractions before multiplying the probabilities together.

Also, you can calculate the probability of more than two independent events by applying the same relationship as with two independent events.

$$P(\text{A and B and C}) = P(\text{A}) \times P(\text{B}) \times P(\text{C})$$

Use this relationship to determine the probability of any number of independent events.

Example 1

On Monday, the probability of snowfall in the town of Mesa is 60%, 42% in Cootney, and 10% in Summerside. What is the probability that it will snow in each town on the same day?

Step 1: Convert each percentage into a decimal number.

$$60\% = 0.60 = \text{event A}$$

$$42\% = 0.42 = \text{event B}$$

$$10\% = 0.10 = \text{event C}$$

Step 2: Apply the formula to calculate the probability.

$$P(\text{A and B and C}) = P(\text{A}) \times P(\text{B}) \times P(\text{C})$$

$$\begin{aligned} P(\text{snow in M and C and S}) &= P(\text{snow in M}) \times P(\text{snow in C}) \times P(\text{snow in S}) \\ &= 0.60 \times 0.42 \times 0.10 \\ &= 0.0252 \end{aligned}$$

Step 3: Express the decimal number as a percentage.

$$0.0252 \times 100 = 2.52\%$$

The probability of it snowing in all three towns on the same day is 2.52%.

Practice Questions

1. In a flower shop, there are 3 vases. In the first vase half of the flowers are lilies and the rest are daisies. In the second vase, 75% are lilies and the rest are daisies. In the third vase, 80% are daisies and the rest are lilies.
 - a. What is the probability of choosing a lily from the first vase, a daisy from the second vase, and a lily from the third vase, without looking?

Step 1: Convert each percentage into a decimal number.

$$P(\text{lily}) = 50\% = 0.50 = \text{event } A$$

$$P(\text{daisy}) = 25\% = 0.25 = \text{event } B$$

$$P(\text{lily}) = 20\% = 0.20 = \text{event } C$$

Step 2: Apply the formula to calculate the probability.

$$P(A \text{ and } B \text{ and } C) = P(A) \times P(B) \times P(C)$$

$$P(\text{lily and daisy and lily}) = P(\text{lily}) \times P(\text{daisy}) \times P(\text{lily})$$

$$= 0.50 \times 0.25 \times 0.20$$

$$= 0.025$$

Step 3: Express the decimal number as a percentage.

$$0.025 \times 100 = 2.5\%$$

The probability choosing a lily, then a daisy, and then another lily, without looking, is 2.5%.

- b. What is the probability of choosing a daisy from the first vase, a lily from the second vase, and a daisy from the third vase, without looking?

Step 1: Convert each percentage into a decimal number.

$$P(\text{daisy}) = 50\% = 0.50 = \text{event } A$$

$$P(\text{lily}) = 75\% = 0.75 = \text{event } B$$

$$P(\text{daisy}) = 80\% = 0.80 = \text{event } C$$

Step 2: Apply the formula to calculate the probability.

$$P(A \text{ and } B \text{ and } C) = P(A) \times P(B) \times P(C)$$

$$\begin{aligned} P(\text{daisy and lily and daisy}) &= P(\text{daisy}) \times P(\text{lily}) \times P(\text{daisy}) \\ &= 0.50 \times 0.75 \times 0.80 \\ &= 0.30 \end{aligned}$$

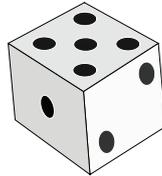
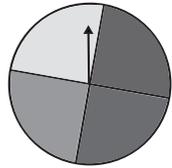
Step 3: Express the decimal number as a percentage.

$$0.30 \times 100 = 30\%$$

The probability choosing a daisy, then a lily, and then another daisy, without looking, is 30%.

Lesson 10: Assignment

1. Calculate the following probabilities:



- a. Spinning a green and rolling a 5

$$\begin{aligned}
 P(A \text{ and } B) &= P(A) \times P(B) \\
 P(\text{green and } 5) &= P(\text{green}) \times P(5) \\
 &= \frac{1}{4} \times \frac{1}{6} \\
 &= \frac{1}{24}
 \end{aligned}$$

- b. Rolling an odd number and tossing tails

$$\begin{aligned}
 P(A \text{ and } B) &= P(A) \times P(B) \\
 P(\text{odd and tails}) &= P(\text{odd}) \times P(\text{tails}) \\
 &= \frac{3}{6} \times \frac{1}{2} \\
 &= \frac{3}{12} \\
 &= \frac{1}{4}
 \end{aligned}$$

- c. Not spinning yellow and rolling an even number

$$\begin{aligned}
 P(A \text{ and } B) &= P(A) \times P(B) \\
 P(\text{not yellow and even}) &= P(\text{not yellow}) \times P(\text{even}) \\
 &= \frac{3}{4} \times \frac{3}{6} \\
 &= \frac{9}{24} \\
 &= \frac{3}{8}
 \end{aligned}$$

- d. Spinning blue or red, rolling an even number, and tossing heads

$$\begin{aligned}
 P(A \text{ and } B \text{ and } C) &= P(A) \times P(B) \times P(C) \\
 P(\text{blue or red and even and heads}) &= P(\text{blue or red}) \times P(\text{even}) \times P(\text{heads}) \\
 &= \frac{2}{4} \times \frac{3}{6} \times \frac{1}{2} \\
 &= \frac{6}{48} \\
 &= \frac{1}{8}
 \end{aligned}$$

2. At an ice cream parlour, you can choose from the following flavours: vanilla, chocolate, or strawberry. You can add one of the following toppings: nuts, sprinkles, chocolate sauce, or coconut flakes. You can have it served to you in a cone or cup.
- a. What is the probability of someone ordering a vanilla cone with nuts?

$$\begin{aligned}
 P(A \text{ and } B \text{ and } C) &= P(A) \times P(B) \times P(C) \\
 P(\text{vanilla and cone and nuts}) &= P(\text{vanilla}) \times P(\text{cone}) \times P(\text{nuts}) \\
 &= \frac{1}{3} \times \frac{1}{2} \times \frac{1}{4} \\
 &= \frac{1}{24}
 \end{aligned}$$

- b. What is the probability of someone ordering a strawberry sundae in a cup topped with chocolate sauce and sprinkles?

$$P(A \text{ and } B \text{ and } C) = P(A) \times P(B) \times P(C)$$

$$\begin{aligned} P(\text{strawberry sundae with sauce \& sprinkles}) &= P(\text{strawberry}) \times P(\text{cup}) \times P(\text{sauce \& sprinkles}) \\ &= \frac{1}{3} \times \frac{1}{2} \times \frac{2}{4} \\ &= \frac{2}{24} \\ &= \frac{1}{12} \end{aligned}$$

3. Jose has the following colours of socks: blue, grey, and black. He can choose from the following shoes: sneakers, loafers, or sandals. He can choose dress socks or sweat socks to wear with the shoes. What is the probability of him choosing:

- a. Black sweat socks with sneakers or sandals?

$$P(A \text{ and } B \text{ and } C) = P(A) \times P(B) \times P(C)$$

$$\begin{aligned} P(\text{black and sweat and sneakers}) &= P(\text{black}) \times P(\text{sweat}) \times P(\text{sneakers}) \\ &= \frac{1}{3} \times \frac{1}{2} \times \frac{1}{3} \\ &= \frac{1}{18} \end{aligned}$$

- b. Grey dress socks with loafers?

$$P(A \text{ and } B \text{ and } C) = P(A) \times P(B) \times P(C)$$

$$\begin{aligned} P(\text{grey and dress and loafers}) &= P(\text{grey}) \times P(\text{dress}) \times P(\text{loafers}) \\ &= \frac{1}{3} \times \frac{1}{2} \times \frac{1}{3} \\ &= \frac{1}{18} \end{aligned}$$

