

## What are the Odds?

Grade Level(s): 9-12
Subject: Math
Florida Standard: MA.912.DP.4.1 Describe events as subsets of a sample space using characteristics, or categories, of the outcomes, or as unions, intersections or complements of other events.

MA.912.DP.4.2 Determine if events $A$ and $B$ are independent by calculating the product of their probabilities. MA.912.DP.4.3 Calculate the conditional probability of two events and interpret the result in terms of its context. MA.912.DP.4.4 Interpret the independence of two events using conditional probability.

MA.912.DP.4.8 Apply the general multiplication rule for probability, taking into consideration whether the events are independent, and interpret the result in terms of the context.

Objective: Students will understand what conditional probability is, how to calculate it, and when it is used.
Duration: 50 Minutes

## Key Vocabulary Terms:

1. Independent Probability
2. Dependent Probability
3. Conditional Probability

## Do Now/Bellwork:

The table below shows students' favorite type of plays broken down by gender and category. Calculate the probability of each situation given the chart below:

| Gender | Action | Comedy | Drama |
| :---: | :---: | :---: | :---: |
| Male | 8 | 6 | 2 |
| Female | 4 | 1 | 8 |

1. $P$ (MalethatlikesAction)
2. P(FemalethatlikesDrama)
3.P(If you like drama that you are female)


## What are the Odds?

## Lesson Steps:

1. Explain and define the difference between an independent event and a dependent event
2.Explain and define conditional probability
2. Demonstrate examples of conditional probability
3. Explain when to use

## Assessment Steps:

1. Students should complete the various conditional probabilities below
2. Exit ticket: Find the conditional probability for the plot of Shakespeare's Comedy of Errors using the chart below:

## What Are the Odds Worksheet

In probability, a dependent event is when a new event is $\qquad$ , whereas an independent event occurs when a new event is $\qquad$ .

Given the following probabilities below, find the conditional probability that each of the following can occur.
$P(A)=\frac{1}{2}$
$P(B)=\frac{2}{3}$
$P(C)=\frac{5}{8}$
$P(D)=\frac{7}{12}$

1. $P(A \mid B)$
2. $P(A \mid C)$
3. $P(A \mid D)$
4. $P(B \mid C)$
5. $P(D \mid B)$
6. $P(A|B| C)$
7. $P(A|B| C \mid D)$

Exit Ticket: Use the table below to calculate the probability of Antipholus finding his twin brother in Ephesus after being shipwrecked at birth.

Probability of having a set of twins: 1/250 [1]
Probability of surviving a ship wreck: $18 \%$ chance in main sample [2]
Probability of living to age 18 in ancient Greece: 50\% chance to live to age 10 [3]
Probability of being in the same town in ancient Greece: 1/150,000,000 [4]

[^0]

## What Are the Odds Worksheet

In probability, a dependent event is when a new event is based on a prior event happen,ing whereas an independent event occurs when a new event is happens regardless of a prior event

Given the following probabilities below, find the conditional probability that each of the following can occur.
$P(A)=\frac{1}{2}$
$P(B)=\frac{2}{3}$
$P(C)=\frac{5}{8}$
$P(D)=\frac{7}{12}$

1. $P(A \mid B)$

$$
\mathrm{P}(\mathrm{~A} \mid \mathrm{B})=\frac{1}{2} * \frac{2}{3}
$$

2. $P(A \mid C)$
$P(A \mid C)=\frac{1}{2} * \frac{5}{8}$
$P(A \mid C)=31 \%$
3. $P(A \mid D)$

$$
\begin{aligned}
& P(A \mid D)=\frac{1}{2} * \frac{7}{12} \\
& P(A \mid D)=29 \%
\end{aligned}
$$

4. $P(B \mid C)$

$$
\begin{aligned}
& P(B \mid C)=\frac{2}{3} * \frac{5}{8} \\
& P(B \mid C)=42 \%
\end{aligned}
$$

5. $P(D \mid B)$
$P(D \mid B)=\frac{7}{12} * \frac{2}{3}$
$P(D \mid B)=39 \%$
6. $P(A|B| C)$

$$
\begin{aligned}
& \mathrm{P}(\mathrm{~A}|\mathrm{~B}| \mathrm{C})=\frac{1}{2} * \frac{2}{3} * \frac{5}{8} \\
& \mathrm{P}(\mathrm{~A}|\mathrm{~B}| \mathrm{C})=21 \%
\end{aligned}
$$

7. $P(A|B| C \mid D)$

$$
\begin{aligned}
& P(A|B| C \mid D)=\frac{1}{2} * \frac{2}{3} * \frac{5}{8} * \frac{7}{12} \\
& P(A|B| C \mid D)=12 \%
\end{aligned}
$$

Exit Ticket: Use the table below to calculate the probability of Antipholus finding his twin brother in Ephesus after being shipwrecked at birth?

Probablility of having a set of twins $P(A): 1 / 250$ [1]
Probability of surviving a ship wreck $P(B)$ : $18 \%$ chance [2]
Probability of living to age 18 in ancient Greece $P(C)$ : $50 \%$ chance to live to age 10 [3]
Probabilit of being in the same town in ancient Greece P(D): 1/150,000,000 [4]

$$
P(A|B| C \mid D)=\frac{1}{250} * \frac{18}{100} * \frac{1}{2} * \frac{1}{150,000,000}
$$

$$
\mathrm{P}(\mathrm{~A}|\mathrm{~B}| \mathrm{C} \mid \mathrm{D})=\frac{3}{1,250,000,000,000}
$$

Sources:

$$
P(A|B| C \mid D)=.0000000000024 \%
$$

[1] https://www.nhs.uk/pregnancy/finding-out/pregnant-with-twins/
[2]https://gcaptain.com/women-and-children-survival-rates-maritime-
disaster/\#:~:text=Specifically\%2C\%20the\%2Ostudy\%20shows\%20that,likely\%20to\%20survive\%20than\%20passengers.
[3] https://en.wikipedia.org/wiki/Life expectancy
[4]. https://www.census.gov/data/tables/time-series/demo/international-programs/historical-est-worldpop.html


[^0]:    Sources:
    [1] https://www.nhs.uk/pregnancy/finding-out/pregnant-with-twins/
    [2]https://gcaptain.com/women-and-children-survival-rates-maritime-
    disaster/\#: $\sim$ :text=Specifically\%2C\%20the\%20study\%20shows\%20that,likely\%20to\%20survive\%20than\%20passengers.
    [3] https://en.wikipedia.org/wiki/Life expectancy
    [4]. https://www.census.gov/data/tables/time-series/demo/international-programs/historical-est-worldpop.html

