Probability Matters (Level 3)

Description	The learner will explore the concept of chances and probability and learn how to calculate probability.
Leading Question	Can you design a game using probability?
Total Time Required	6 hours over 5 days
Supplies Required	Papers, cardboard, pencils, colors, rulers, glue.
Learning Outcomes	1. Learners will use coins and dice to understand and calculate probabilities of occurrence of events. 2. Learners will understand the applications of probability in real life 3. Learners will be able to collect and summarize data on chances of daily life outcomes using tables 4. Learners will learn more about their families and different genetic features that they commonly have in their family. 5. Learners will learn how to use tree diagrams and probability trees to think through chance problems. 6. Enhance the learner's critical thinking, creativity and communication skills.
Previous Learning	● Calculation of probability for simple experiments (coins) ● Draw 2D shapes (square, rectangle) ● Drawing tables. ● Writing skills. ● Multiplication (mental math)

Day 1

Today you will learn about probability and how it works.

Suggested Duration	**Activity and Description**
25 minutes	● What is your favorite sport? ● Make sure it is a match-based sport played with two teams (football, American football, volleyball, Cricket, basketball, etc.)

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Write an essay describing your favorite sport in detail using diagrams. Answer questions such as how many players are needed to play, what are the rules, who wins in the match, etc.
How does the match kick-off?
Why do you think you need to toss a coin? Explain.

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Play a match of your own favorite sport with friends and family members a specific number of times. Before starting the match, if you played 6 games with the opposing team, how many games would you win?
For example: The odds of my team winning are $\frac{5}{6}$ because we have a better goalkeeper and striker. This means if my team plays 6 matches we will win 5 out of the 6 and we will lose 1. So the probability is $\frac{5}{6}$.
Record the result of the game and set a prize for the correct match prediction.

- Set out to play the sport a specific number of times,
- Ask each family member to predict how many times each of their teams is going to win
- Record the result of each time the sport has been played,
- And award a prize for the correct match winning prediction.

Conclusion:

Probability is very important in sports, some sports use probability in kick-off. The most popular use of probability in sports is through betting, which is a large profit industry.
In probability there is no right or wrong, it is all about chances.

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What are the outcomes if you toss one coin? What are the outcomes if you toss two coins?
Draw a diagram that represents flipping one coin and another diagram that represents tossing two coins.

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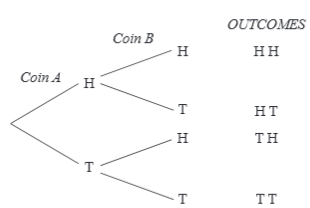
Use a tree diagram for probability.
If you flip one coin once, the outcome will be either heads or tails
If you toss two coins, this is a tree diagram of outcomes of all the potential outcomes:



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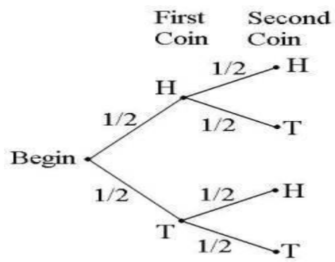
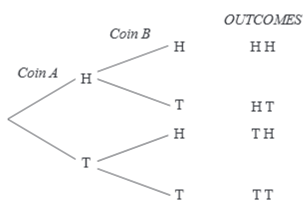
- Calculate the probability of each outcome



- To calculate the probability of an outcome, we have to ask, when a coin is tossed, what are possible outcomes (the possible result of a coin throw)?
- There are two possible outcomes, and you can only one of them at each throw therefore, the probability of heads P(H) or tails P(T) for one coin is $\frac{1}{2}$.
- The probability of the outcomes being either heads or tails is $\frac{1}{2}$ so if you are looking at the tree and calculate P(HH)= $\frac{1}{2}$x$\frac{1}{2}$=$\frac{1}{4}$ or P(HT)= $\frac{1}{2}$x$\frac{1}{2}$=$\frac{1}{4}$

Alternatively, we can count how many times we see the outcome we desire to compute on the tree diagram. See below:



e.g., for P(HH), for two coin toss, you have 4 potential outcomes and HH only appears once, therefore, P(HH) = $\frac{}{4}$

- Draw a tree diagram of tossing 3 coins and calculate the probability of all outcomes.
- Create your own experiment.
- Draw the tree diagram
- Calculate the probability of all outcomes.

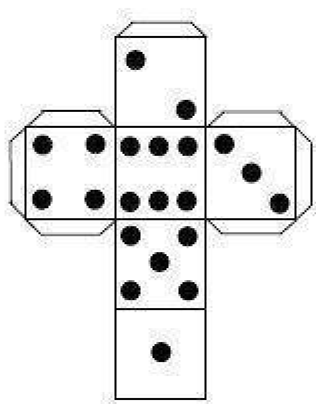
Present all the day's work to your parents or family members for feedback and suggestions for improvement. The parents or family members should provide feedback using the following format:

- Praise: What did you like about the learner's work?

	● Question: Any questions or clarifications you have about the work? ● Suggestions: In what areas does the learner need to improve their work?

Day 2

Today you will create your own dice and play a probability game with it.

Suggested Duration	Activity and Description
20 minutes	● Draw a table with two rows ● In the first row: write the 4 days of the week. ● In the second row: observe and record the weather for the next 4 days and show the weather with a drawing in each day. Note down if it is cloudy, windy, sunny or rainy.
15 minutes	● Design a cube: ● Draw, cut and glue the below to make your own dice, the lines will be folded and stuck together in the shape of a cube.  Color your dice with a color of your own choice.
15 minutes	How do you calculate the probability of which side the dice will land on? (1,2,3,4,5,6)? ● The outcomes of rolling a dice are (1, 2, 3, 4, 5, 6) ● Draw a table of two columns and roll the dice 10 times ● Record the outcome of each roll ● Calculate the probability of getting 4 or 1, P(4) or P(1) ● Calculate the probability of all the outcomes you had in this experiment

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Add them all and reflect. The sum is 10/10 which is equal to 1. What do you observe after adding them up?

Answer: The sum is 10/10 which is equal to 1.

Draw a table like the one below:

<table>
<tr><td>Roll</td><td>Number on Dice</td></tr>
<tr><td>1</td><td>4</td></tr>
<tr><td>2</td><td>6</td></tr>
<tr><td>3</td><td>…</td></tr>
<tr><td>… 10</td><td>…</td></tr>
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<td>15 minutes</td>
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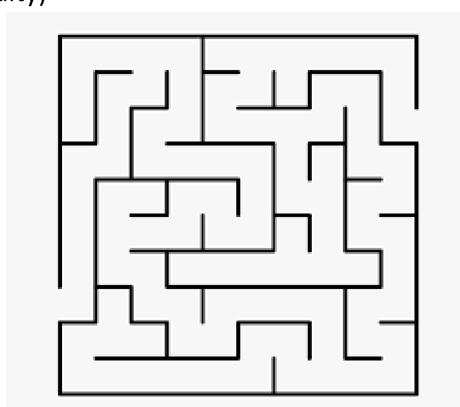
Who will get to the end first?

Teach a friend to draw and create a dice.
On the floor (see example of a maze below) draw two mazes divided into steps with some cushions or chairs (make sure both mazes are the same difficulty)



Each player rolls his dice according to the number the dice lands on and moves that amount of steps.
The one who finishes first wins.

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Day 3

Today you will learn more about probability through dice and how probability exists in our daily lives.

Suggested Duration	Activity and Description
10 minutes	• Reflect on the last two days. What have you learnt? What did you enjoy the most? Why?

	• Record today's weather to complete the weather table that you created on Day 2.
10 minutes	• Make a second dice and color it. • Challenge: Discover how many possible outcomes can happen when you roll two dice at the same time. • The answer is 36 outcomes (1, 2). (1, 1), (1, 3). (1, 4)….

	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

• Roll the two dice 10 times. Draw a table and record all the outcomes.

Trial	Dice 1	Dice2
1	3	4
2	1	5
3		
4….	..	..

15 minutes	• Calculate the probability of the outcomes. How many times did each outcome happen in the 10 rolls of the dice? What do you observe?
	• Add all the probabilities of all outcomes the sum will equal $\frac{10}{10}$=1
	• What are the chances of rolling two dices and get (7,2)
	• Answer: zero.
	• Conclusion
	  • One of the important applications of probability is developing games which require chances.
	  • Some games are for entertainment and having fun.
	  • Some games include profit and making money (clubs, casinos)

25 minutes	• Think through some of the common applications of probability in real life. Consult adults and other family members in case you are not sure of some of the applications. Write a 1-page essay on the applications of probability in real life.

	Common applications include: - One of the important applications of probability is developing games which require chances. - Some games are for entertainment and having fun. - Some games include profit and making money (clubs, casinos) - Predicting the occurrence of events (weather, sports betting) - Probability is very important in predicting the characteristics of the family tree. - It is also very important in disease diagnoses to improve the chances of protection and cure. List some games that require dice/s. Develop your own game using one dice or two dice (be creative!) Play the game with friends/siblings.
15 minutes	Present all the day's work to your parents or family members for feedback and suggestions for improvement. The parents or family members should provide feedback using the following format: ● Praise: What did you like about the learner's work done? ● Question: Any questions or clarifications you have about the work? ● Suggestions: In what areas does the learner need to improve their work?

Day 4

Today you will look at one of the applications of probability in genetics.

Suggested Duration	Activity and Description
10 minutes	● Record today's weather to complete the weather table you created on Day 2
40 minutes	● Draw your family tree on a big poster (up to your grandparents or great-grandparents). Work with your parents to find out the following information about each of your family members. - Name - Age - Relation to you - Choose three characteristics such as (skin color, height, eye color, hair style…)

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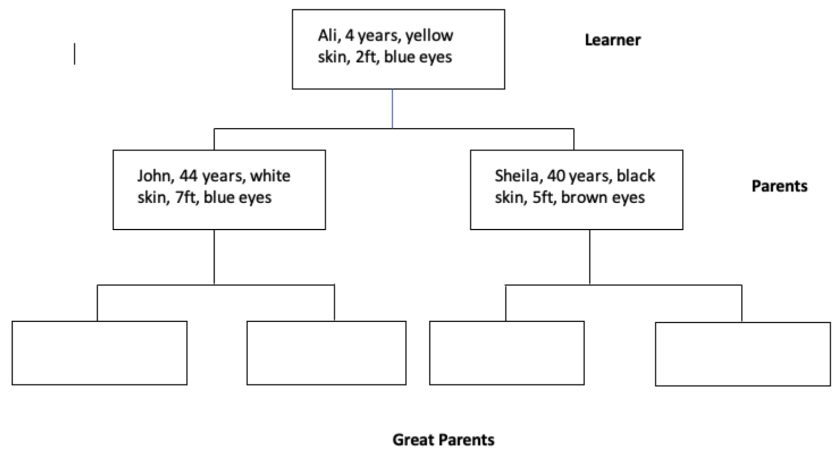
Now create a family tree like below:



- Now relate your own characteristics (skin color, height, eye color…) to your family tree.
- What are the chances of your future children having a characteristic (eye color, hair style, height...?) that many people in the family have?

Present all the day’s work to your parents or family members for feedback and suggestions for improvement. The parents or family members should provide feedback using the following format:

- Praise: What did you like about the learner’s work done?
- Question: Any questions or clarifications you have about the work?
- Suggestions: In what areas does the learner need to improve their work?

Day 5

Today you will look into the weather probability and probability of diseases.

Suggested Duration	Activity and Description
15 minutes	• Record today’s weather to complete the weather table in the table created on Day 2. • Calculate the probability of each outcome: sunny, rainy, windy and cloudy in the last 4 days?

	● To calculate it use however many times each outcome occurs in the 4 days and divide it by the number of days. ● Example: - If it was sunny for 2 days out of 4 days that means the probability is - $\frac{2}{4}$and calculate the percentage by multiplying it by 100 - $\frac{2}{4}$x100= 50% - So we can predict that for next week's weather, the probability it will be sunny is 50%. What did we learn from this weather prediction activity? What are the benefits of being able to predict the weather? Probability is very important in predicting the weather through the year so we can: ● Know what season to plant our crops ● What to wear for the next week ● when to travel to certain areas or places ● Know in advance the chances of floods, hurricanes for protective measures
15-20 minutes	● Go to your community or in your extended family members and count how many people have diabetes (or any other inherited disease) - Calculate the percentage of diabetics in the community. - If the percentage is 20% that means there is a very low chance of diabetics in the next generation. We call this outcome 'unlikely' - If the percentage is above 50% that means there is a very high chance of diabetics in the next generation. We call this outcome 'likely' What did we learn about the occurrence of disease from this example? What would be the benefits of being able to know how many people suffer from a specific disease within the community? Probability is important in measuring and curing. So that we know if we will have more diabetics in the next generation to prepare plans for cure and prevention
30 minutes	● Imagine our daily lives without probability or chances. ● Draw a table that compares our life with and without probability in it.
15 minutes	Think about all the exercises you have done for the past 3 days and take note of "TWO" of the following: o What is the most important lesson you have learnt through this project? o What did you find challenging, puzzling or difficult to understand?

	o What question would you most like to discuss? o What is something you found interesting?

Assessment criteria

- Creativity in designing posters to explain learning outcomes.
- Calculate accurately the probabilities of different basic outcomes in different experiments.
- Drawing accurate squares.
- Building an accurate 3D cube.
- Creativity in developing new games using probability.
- Communication skills in presentation of knowledge.

Additional Enrichment activities

- Watch this video- application of probability: https://www.youtube.com/watch?v=_sY3ZRxhBaM
- Mendel genes and inheritance: https://www.youtube.com/watch?v=jVlfbQdrmhE

EAA welcomes feedback on its projects in order to improve, please use this link: https://forms.gle/LGAP9k17fMyJrKJN7