

Probabilities, Relative Benefits.

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Differentiate and Assess

Not every student will be ready to investigate this concept at this Level and so we will need to differentiate to ensure every student is learning at their leading edge. Select the Differentiate button on this screen.

Integrate

Every mathematical concept is integrally related to other mathematical concepts. Teaching and learning related concepts simultaneously develops deep relational understanding. Select the Integrate button on this screen.

Intervene

Some students may not yet be ready to investigate this concept at any Level, and so we will need to provide some intervention. Select the Intervention button on this screen.

PROBABILITIES, RELATIVE BENEFITS.

EXPLICIT TEACHING PLAN OVERVIEW PAGE

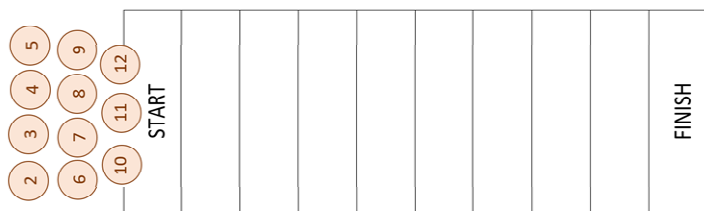
THIS PAGE IS A SUMMARY OF THE EXPLICIT TEACHING PLAN, INCLUDING STRATEGIC QUESTIONS, AND DESCRIBING THE SEQUENCE WHICH WILL OCCUR OVER MULTIPLE LESSONS.

RESOURCES: 2 DICE, DATA FROM CHANCE EXPERIMENT, PENCIL, PAPER

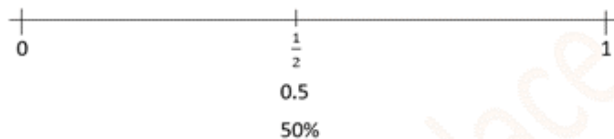
WHAT COULD WE DO?

Children:

- use data from chance experiments to create a game that benefits the organiser, for example, roll 7 with 2 dice



- describe probabilities using fractions, decimals and percentages, for example,



- use data from chance experiments to create a game where all players have an equal chance of winning, for example, roll an even sum or an odd sum



WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

Children

- ask one another questions about games of chance, for example:
 - ▶ How could we use data from our chance experiment to create a game which benefits the organiser?
 - ▶ Which outcome has the greatest chance of occurring?
 - ▶ How can we describe the probability of each outcome as a fraction on a number line?
 - ▶ How can we describe the probability of each outcome as a decimal on a number line?
 - ▶ How can we describe the probability of each outcome as a percentage on a number line?
 - ▶ How can we use data from our chance experiment to create a game where all players have an equal chance of winning?

PROBABILITIES, RELATIVE BENEFITS.

EXPLICIT TEACHING PLAN

FULL EXPLICIT TEACHING PLAN, EMBEDDING DEEP RELATIONAL UNDERSTANDING, METALANGUAGE, AND QUESTIONS THAT MAY BE USED OVER MULTIPLE LESSONS.

WHAT COULD WE DO?

Children think about, talk and listen to a friend about, then have the opportunity to share what they already know.

Allow children to discuss games of chance that they know. This could include board games with dice, card games, computer games, lotteries, gaming machines, horse races.

WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

- ▶ Today brings an investigation about chance and data.
- ▶ What do you know about chance and data?
- ▶ Talk about chance and data with a friend.
- ▶ Is anyone ready to share what they are thinking about chance and data?

- ▶ We've investigated chance experiments.
- ▶ And we found that we could use data about the frequencies from a small trial to predict the frequencies in larger trials.

- ▶ **Today we're going to investigate how we can use this data to create a game of chance.**
- ▶ What games of chance do you know?
- ▶ Are board games like Monopoly games of chance?
- ▶ Where is the chance?
- ▶ Does everyone have an equal chance of winning?
- ▶ Will you definitely win?
- ▶ Is Lotto a game of chance?
- ▶ Where is the chance?
- ▶ Does everyone have an equal chance of winning?

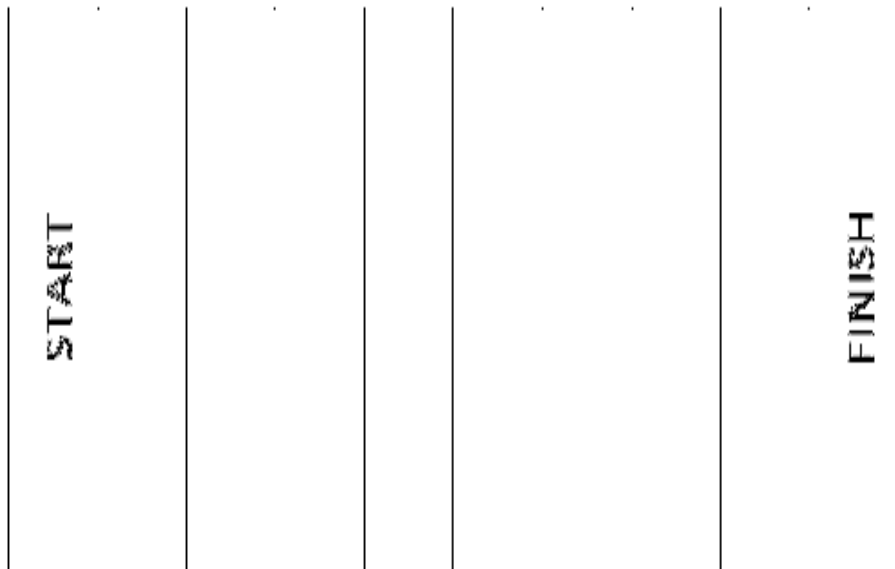
Children identify that these are games of chance because the outcomes are not definite.

Display the data of a experiment, for example,

$$\begin{aligned}2 &= 1 + 1 \\3 &= 1 + 2 = 2 + 1 \\4 &= 1 + 3 = 3 + 1 = 2 + 2 \\5 &= 4 + 1 = 3 + 2 = 2 + 3 = 1 + 4 \\6 &= 5 + 1 = 4 + 2 = 3 + 3 = 2 + 4 = 1 + 5 \\7 &= 6 + 1 = 5 + 2 = 4 + 3 = 3 + 4 = 2 + 5 = 1 + 6 \\8 &= 6 + 2 = 5 + 3 = 4 + 4 = 3 + 5 = 2 + 6 \\9 &= 6 + 3 = 5 + 4 = 4 + 5 = 3 + 6 \\10 &= 4 + 6 = 5 + 5 = 6 + 4 \\11 &= 5 + 6 = 6 + 5 \\12 &= 6 + 6\end{aligned}$$

- ▶ Will you definitely win?
- ▶ Are card games, games of chance?
- ▶ Where is the chance?
- ▶ Does everyone have an equal chance of winning?
- ▶ Will you definitely win?
- ▶ Are computer games, games of chance?
- ▶ Where is the chance?
- ▶ Does everyone have an equal chance of winning?
- ▶ Will you definitely win?
- ▶ Why are these called games of chance?
- ▶ Are the outcomes definite?
- ▶ Why not?
- ▶ Are some outcomes more likely than other outcomes?
- ▶ How do you think these games of chance were created?
- ▶ Do you think they were created by people who first conducted experiments to predict outcomes?
- ▶ If we create a game of chance, could we use data to try to make sure we have more chance of winning than the participants? Let's investigate!
- ▶ We've conducted chance experiments with small and large trials rolling 2 dice.
- ▶ We found that 7 is the most likely sum.
- ▶ We found that this because there are 6 combinations of numbers that give a sum of 7.
- ▶ And fewer combinations of numbers that give other sums.
- ▶ Could we use this data to create a game of chance?

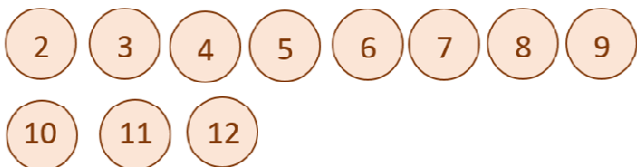
Display a simple game board, for example,



- ▶ Could we create a board with a horse race where every horse is numbered from 2 to 12?
- ▶ Then we roll 2 dice.
- ▶ Whichever horse's number is rolled, moves forward a space.
- ▶ What number horse would we, as the organisers, choose, so that we have the best chance of winning?
- ▶ Does horse number 7 have the greatest chance of winning?
- ▶ If we chose horse number 7, would we have the greatest chance of winning?
- ▶ How could we design a horse racing game?
- ▶ Could we design a horse racing track?
- ▶ What could the track look like?
- ▶ Could it look like this?
- ▶ Do we just need a start line and a finish line, and some spaces between?

Display some counters.

Number each counter from 2 to 12, for example,



Play the game with one child using playing piece 7, and other children using playing pieces 2, 3, 4, 5, 6, 8, 9, 10, 11 and 12.

Ask the child who had number 7.

Ask the children who had numbers 6 and 8.

Ask the children who had numbers 5 and 9.

Ask the children who had numbers 4 and 10.

Ask the children who had numbers 3 and 11.

Ask the children who had numbers 2 and 12.

- ▶ Will we need some playing pieces?
- ▶ Could we use counters?
- ▶ What outcomes are possible when rolling 2 dice?
- ▶ Are 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 the possible outcomes?
- ▶ Could we number our playing pieces from 2 to 12?
- ▶ Now all we need are 2 dice.

- ▶ Let's play!
- ▶ Which horse number won?
- ▶ Did number 7 win?
- ▶ Did we predict number 7 would win?
- ▶ Do we predict number 7 will win every time?
- ▶ Will there be some times when number 7 doesn't win?
- ▶ Is it definite that number 7 will win?
- ▶ Or is just more likely that number 7 will win?
- ▶ Was it a fair game?
- ▶ Do you think it was a fair game?
- ▶ Did everyone have an equal chance of winning?
- ▶ Which numbers had the greatest chance of winning?

- ▶ Which numbers had the least chance of winning?
- ▶ Do you predict number 2 or number 12 would win?

Display the data of a experiment,
for example,

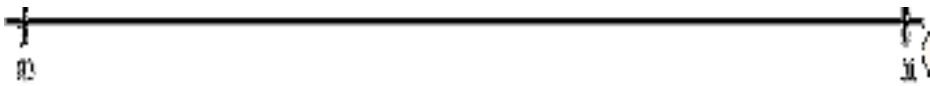
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Children count the number of combinations that give an even sum, and an odd sum.

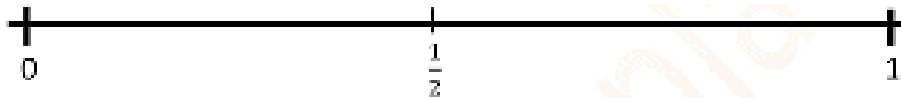
- ▶ How did we create this game to make sure the organiser had the greatest chance of winning?
- ▶ Did we conduct a chance experiment?
- ▶ And did we use the data from the chance experiment to create an unfair game?
- ▶ Do you think that there are some public games of chance where the organisers have used data to give themselves a greater chance of winning than the players?

- ▶ We've been investigating the likelihood to be rolled when rolling 2 dice.
- ▶ Could we use this data to create a game of chance where everyone has a fair chance of winning?
- ▶ From this data, can we tell what the chance is that an even number will be rolled?
- ▶ How many combinations give an even sum?
- ▶ Do the combinations $1 + 1, 1 + 3, 3 + 1, 2 + 2, 5 + 1, 4 + 2, 3 + 3, 2 + 4, 1 + 5, 6 + 2, 5 + 3, 4 + 4, 3 + 5, 2 + 6, 4 + 6, 5 + 5, 6 + 4, 6 + 6$ give an even number?
- ▶ Do 18 combinations give an even sum?
- ▶ From this data, can we tell what the chance is that an odd number will be rolled?
- ▶ How many combinations give an odd sum?
- ▶ Do the combinations $1 + 2, 2 + 1, 4 + 1, 3 + 2, 2 + 3, 1 + 4, 6 + 1, 5 + 2, 4 + 3, 3 + 4, 2 + 5, 1 + 6, 6 + 3, 5 + 4, 4 + 5, 3 + 6, 5 + 6, 6 + 5$ give an odd number?
- ▶ Do 18 combinations give an odd sum?
- ▶ Is there an equal chance of rolling an even number as rolling an odd number?

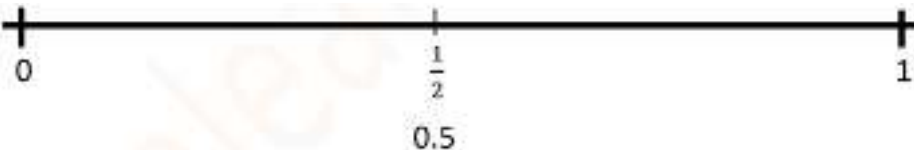
Record a number line with zero at one and 1 at the other, for example,



Record a half on the number line, for example,

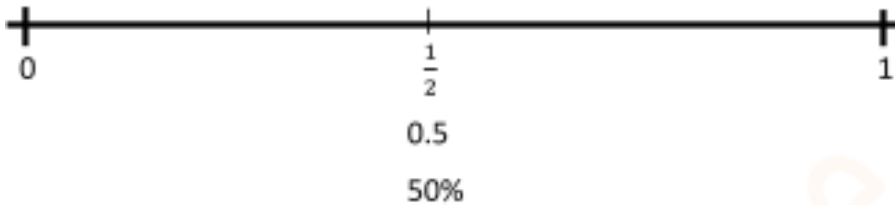


Record zero point 5 on the number line, for example,



- ▶ If there is an equal chance of rolling an even number as rolling an odd number, what fraction of the rolls would we predict to be even?
- ▶ Would we predict that half of the rolls will be even and half of the rolls will be odd?
- ▶ We've investigated recording chance as fractions, and we found that their sum equals 1.
- ▶ Let's record the chance of rolling even or odd as a fraction on a number line.
- ▶ The chance of rolling an odd number is a half.
- ▶ And the chance of rolling an even number is half.
- ▶ Do the sum of our chances equal 1?
- ▶ Does a half plus a half equal 1?
- ▶ Where will a half go on our number line?
- ▶ How could we record this chance as a decimal fraction on a number line?
- ▶ What is a half as a decimal fraction?
- ▶ Is a half, 5 tenths?
- ▶ How do we record 5 tenths as a decimal?
- ▶ Will the 5 go in the tenths column?
- ▶ Is a half, zero point 5?
- ▶ How could we record this chance as a percentage on a number line?
- ▶ If we have a percentage, do we have an amount out of 100?
- ▶ Is our fraction, hundredths?
- ▶ Is a half, 50 hundredths?
- ▶ Is a half, 50 per cent?

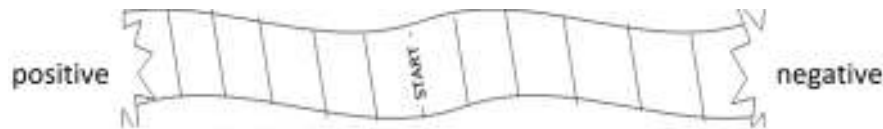
Record 50 percent on the number line, for example,



Display a track with start in the middle, for example,



Display a track with start in the middle and a positive result at one end and a negative result at the other end, for example,



- ▶ Are 50 hundredths and 5 tenths and a half equivalent fractions?
- ▶ If the chance of each outcome is a half, or 0.5 or 50 percent, does each outcome have an equal chance?
- ▶ So our data is telling us that we have an equal chance of rolling an odd or an even number.
- ▶ Let's use our data to create a game where everyone has an equal chance of winning.
- ▶ Could we create a game where we start in the middle of the track?
- ▶ When we roll an even number, could we move to the right?
- ▶ And when we roll an odd number, could we move to the left?
- ▶ On one end of the track could there be a negative outcome, for example, a monster?
- ▶ At the other end of the track could there be a positive outcome, for example, a pot of gold?
- ▶ Let's experiment to design a game!