# Sense of order

Students explore different events with a range of probabilities and attempt to order these accurately on a number line.

## Visible learning

### Learning intentions

* To be able to use visual representations to compare the size of different probabilities.
* To be able to plot fractions with different denominators on a number line.

### Success criteria

* I can interpret visual representations of fractions to compare sizes.
* I can determine which fraction is larger or smaller.
* I can order fractions with different denominators on a number line.
* I can use fractions to describe probabilities to compare likelihood of events.

### Syllabus outcomes

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* represents and operates with fractions, decimals and percentages to solve problems **MA4-FRC-C-01**
* solves problems involving the probabilities of simple chance experiments   
  **MA4-PRO-C-01**

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## Activity structure

### Launch

1. Using one set of Appendix A, assign each card to a student. You may like to enlarge the appendix so that the cards can be seen by all students in the room.
2. Ask students with cards to silently position themselves in a row in ascending order.
3. Once the students have stopped moving about, blue tac the cards to the board in this order.
4. Tell students that we will come back to their order later to see how accurate they were.

This is a silent task, but it should spark some thoughts on:

* how far apart from each other the students should be
* the need to compare by finding the probabilities and making sense of ordering these fractions accurately.

### Explore

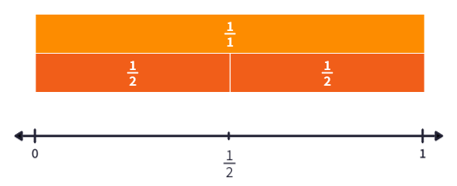
1. In pairs or small groups, students are to be issued with handout from Appendix B and a link to the Desmos activity – Fraction comparison ([bit.ly/desmosfractioncomparison](https://bit.ly/desmosfractioncomparison)).
2. Firstly, they write the probabilities for each event in the last column on the handout.
3. They then attempt to accurately place the probabilities on a number line, using the Desmos activity if needed. The Desmos activity allows students to compare the size of 2 fractions using visual representations.

### Summarise

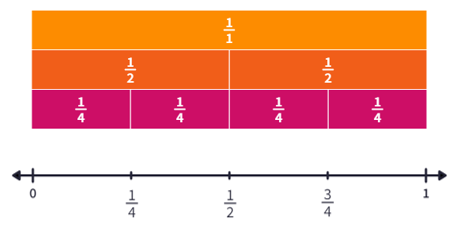
1. Ask the students if they think the initial ordering was correct, why or why not?
2. As a class allow students to share the strategies they used to plot the probabilities.
3. Slowly reveal the answers, showing where each probability should have been plotted. Ask the students what feature could be added to the number line to plot the probabilities more accurately.

Polypad fraction bars ([mathigon.org/polypad](https://mathigon.org/polypad)) can also be used to assist with this process.

For example, start with just plotting on the number line. Which events can be accurately plotted now?



What if we halved each section to make quarters? What events can be accurately plotted now?



Continue this by plotting thirds, fifths and sixths until all events can be shown. It may help students to see plotted with to see if they can plot from this.

Images from [Polypad](https://mathigon.org/polypad) by [Mathigon](https://mathigon.org/) in accordance with the [Mathigon Licence](https://mathigon.org/policies#terms).

### Apply

#### Would you rather…?

1. Either verbally call out each scenario and have students select which one by picking a side of the room or display each in a mentimeter poll ([mentimeter.com/](https://www.mentimeter.com/)) for the whole class.
2. After collecting results on what students would rather ask one student to display both options on a number line to confirm their selection.
3. Win $100 if you flip heads on a coin or win $100 if you roll a 3 on a 6-sided dice?
4. Win if you draw any card of hearts from a regular deck of cards or win if you roll a multiple of 3 on a 6-sided dice?
5. Win the game if you roll an even number with a 6-sided dice or win the game if you roll an even number with an 8-sided dice?

## Assessment and differentiation

### Suggested opportunities for differentiation

**Launch**

* You may like to allocate specific cards to particular students, knowing your students and how they learn, for example, students with a solid understanding of fractions and probability could be assigned the 8-sided dice card rather than 0 or 1.

**Explore and Summarise**

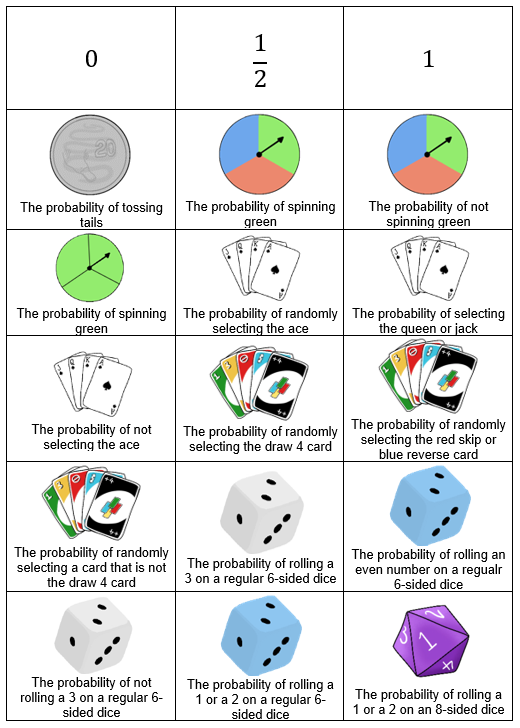
* Visual representations are used to assist students with their understanding when comparing the size of fractions with different denominators
* For some students, restrict the plotting of fractions on the number line to just and .
* Add in more cards for students that need a challenge, such as events where the probability is , etc.

### Suggested opportunities for assessment

* Monitor student responses during discussion to assess their understanding of likelihood of events**.**
* Collect Appendix B to check for student understanding of the probability terms and to use as summative assessment**.**
* The mentimeter poll at the conclusion of the lesson is a form of formative assessment to check students’ understanding.

## Appendix A

### Probability cards



## Appendix B

### Sense of size

Complete the table by writing the probability of each event in the final column.

|  |  |  |  |
| --- | --- | --- | --- |
| Card | Diagram | Description | Probability |
| A | Coin with tails side showing. | The probability of tossing tails |  |
| B | Spinner with three equal sectors. One blue, one red, one green. | The probability of spinning green |  |
| C | Spinner with three equal sectors. One blue, one red, one green. | The probability of not spinning green |  |
| D | Spinner with three equal sectors. All green. | The probability of spinning green |  |
| E | Four cards. One Ace, one King, one Queen, One Jack | The probability of randomly selecting the ace |  |
| F | Four cards. One Ace, one King, one Queen, One Jack | The probability of selecting the queen or jack |  |
| G | Four cards. One Ace, one King, one Queen, One Jack | The probability of not selecting the ace |  |
| H | 5 cards - Green 1, Yellow 3, red skip, blue reverse, draw four | The probability of randomly selecting the draw 4 card |  |
| I | 5 cards - Green 1, Yellow 3, red skip, blue reverse, draw four | The probability of randomly selecting the red skip or blue reverse card |  |
| J | 5 cards - Green 1, Yellow 3, red skip, blue reverse, draw four | The probability of randomly selecting a card that is not the draw 4 card |  |
| K | 6 sided die | The probability of rolling a 3 on a regular 6-sided dice |  |
| L | 6 sided die | The probability of rolling an even number on a regular 6-sided dice |  |
| M | 6 sided die | The probability of not rolling a 3 on a regular 6-sided dice |  |
| N | 6 sided die | The probability of rolling a 1 or a 2 on a regular 6-sided dice |  |
| O | 8 sided die | The probability of rolling a 1 or a 2 on an 8-sided dice |  |

#### Plotting on a number line

Use the letter associated with each card and plot each of the above events as accurately as possible on the number line below.

Use the Desmos graph – Fraction comparison (<https://bit.ly/fractioncomparison>), for assistance.A number line showing 0 and 1.

#### Sample answers

Number line from 0 to 1 with 1/6, 1/5, 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6 accurately marked out. K is plotted at 1/6, H is plotted at 1/5, E and O is plotted at 1/4, B and N is plotted at 1/3, I is plotted at 2/5, A, F and L is plotted at 1/2, C is plotted at 2/3, G is plotted at 3/4, J is plotted at 4/5, M is plotted at 5/6 and D is plotted at 1. 
Under the number line are fraction bars shown up to sixths. 

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