# Sector graphs

Students collect simple data without a definite end and examine the advantages of a sector graph over other representations.

## Visible learning

### Learning intention

* To understand scenarios where a sector graph is a useful representation of data.

### Success criteria

* I can draw a sector graph using technology.
* I can interpret data presented in a sector graph.
* I can explain scenarios where a sector graph would be an appropriate choice to represent a data set.

### 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**
* solves problems involving the probabilities of simple chance experiments
**MA4-PRO-C-01**
* classifies and displays data using a variety of graphical representations
**MA4-DAT-C-01**

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## Activity structure

### Launch

1. Open the website ([bouncingdvdlogo.com/](https://bouncingdvdlogo.com/)) and leave the image on the screen. Allow a few minutes for students to view what the clip.
2. Have students construct a [Notice and Wonder](https://bit.ly/noticewonderstrategy) list ([bit.ly/noticewonderstrategy](https://bit.ly/noticewonderstrategy)) for this clip. Students may then like to share some of these with a partner.
3. Students are then to make a prediction, what are the chances of the logo hitting the corner? Results from the class can be collected as a [Mentimeter](https://www.mentimeter.com/) ([mentimeter.com/](https://www.mentimeter.com/)). Student answers may be represented as a fraction, using probability words or any other format, although allow students to submit answers before suggesting this.
4. Show the clip from [The Office](https://bit.ly/TheOfficeDVDlogo) ([bit.ly/TheOfficeDVDlogo](https://bit.ly/TheOfficeDVDlogo)), where staff are fixated on the image, waiting for the DVD logo to hit the corner.

### Explore

1. Open and display the [Desmos graph](http://bit.ly/desmoscolumngraphDVD) ([bit.ly/desmoscolumngraphDVD](http://bit.ly/desmoscolumngraphDVD)) for students. Demonstrate to students how to use the graph, for instance, every time the logo hits an edge, select the button titled Walls. If the logo hits the corner, click on the button titled Corners.
2. Issue the above link to students and have them open the Desmos graph on their own devices and play the bouncing DVD logo website on the main screen for the whole class to view ([bouncingdvdlogo.com/](https://bouncingdvdlogo.com/)).
3. Whilst watching the DVD logo on the main screen, students should collect data on their own devices using the Desmos graph.
4. Wait for approximately 50 bounces before stopping students. Ask students to reflect back to their initial prediction on the chances of the logo hitting the corner. Would they change their prediction after this analysis?
5. Have a class discussion on potential limitations of this particular graph moving forward. This could be done firstly as a [Notice and Wonder](https://bit.ly/noticewonderstrategy) strategy with students ([bit.ly/noticewonderstrategy](https://bit.ly/noticewonderstrategy)).

Students should conclude that when collecting an infinite amount of data, a column graph may not be the most effective graph to use. In this particular example, the “walls” column will continue to get bigger and bigger whilst the “corner” column will remain extremely small or non-existent, making the graph more difficult to draw and read as time goes on.

1. Once students have concluded that the column graph may not be the best graph to use in this situation, ask them what other types of graphs they think could be more effective with this data set. This could be conducted as a [Think-Pair-Share](https://bit.ly/thinkpairsharestrategy) activity ([bit.ly/thinkpairsharestrategy](https://bit.ly/thinkpairsharestrategy)).
2. Distribute to students the link for the Desmos graph, Sector graphs DVD screen saver ([bit.ly/desmossectorgraphDVD](https://bit.ly/desmossectorgraphDVD)), explaining that it works in a similar way to the previous graph.
3. Students are then to watch the DVD logo again (display on the main screen for all students to view), recording their results in this new graph. After a few minutes, encourage students to eventually be generous on what they call a corner to ensure their graph displays at least one corner.
4. Students are to reflect on their initial prediction and consider if it is easier to confirm or prove their prediction from this graph.
5. Using this graph, ask students to make a prediction of how often they think the DVD logo will reach the corner in 100 bounces.

### Summarise

1. Students are to consider the advantages and disadvantages of the sector graph compared to the initial column graph and other graphs that they know, by the [Think-Pair-Share](bit.ly/thinkpairsharestrategy) strategy ([bit.ly/thinkpairsharestrategy](https://bit.ly/thinkpairsharestrategy)).
2. Student answers can then be shared through a [Mentimeter](https://www.mentimeter.com/) Word cloud ([mentimeter.com/](https://www.mentimeter.com/)) for all students to view.
3. Lead a class discussion on the main advantages and disadvantages of the sector graph, relating each one back to the context of the data collected in this lesson.

Students should conclude that unlike a column graph where the size of the columns becomes unmanageable, the size of each sector in the sector graph remains relatively unchanged. This is due to each sector representing a proportion of responses, not a count of the responses.

1. Students should then record notes to their future self ([bit.ly/notesstrategy](https://bit.ly/notesstrategy)) on the advantages and disadvantages of a sector graph.

### Apply

Students will explore the DVD logo pattern of movement in more detail by recording whether the logo hits the top, bottom, left or right sides and corners.

1. Ask students to predict which side (or corner) the logo hits the most. They should provide a reason for their choice.
2. Issue students with the Desmos graph, [Sector Graphs 2](https://bit.ly/desmossectorgraphDVD2) link ([bit.ly/desmossectorgraphDVD2](https://bit.ly/desmossectorgraphDVD2)).
3. Display the DVD logo clip on the main screen for students to view and record their results in the Desmos graph.
4. Students are to discuss in pairs what they notice and what they wonder ([bit.ly/noticewonderstrategy](https://bit.ly/noticewonderstrategy)) in regard to the distribution of each category. Was their prediction correct?
5. Students should be challenged through a class discussion to consider questions such as:
6. If 100 bounces were recorded, make a prediction on how many corners, top, bottom, left and right would be recorded.
7. Is there an option that came up the most?
8. Why might an option come up more than others?

## Assessment and Differentiation

### Suggested opportunities for differentiation

**Explore**

* The Desmos activity allows an exploration for students that does not depend on their skills with constructing graphs.
* Ask students to find the relative frequency of the logo hitting the corner after 50 trials.
* Some graphs may need to be developed as a whole class to suit the needs of the students.

**Summarise**

* Students could be challenged to display the data collected in another type of graph of their choosing. Does this make the results easier to read?

### Suggested opportunities for assessment

* Review students’ notes to future selves.
* Monitor students’ predictions throughout the lesson to assess their understanding.

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