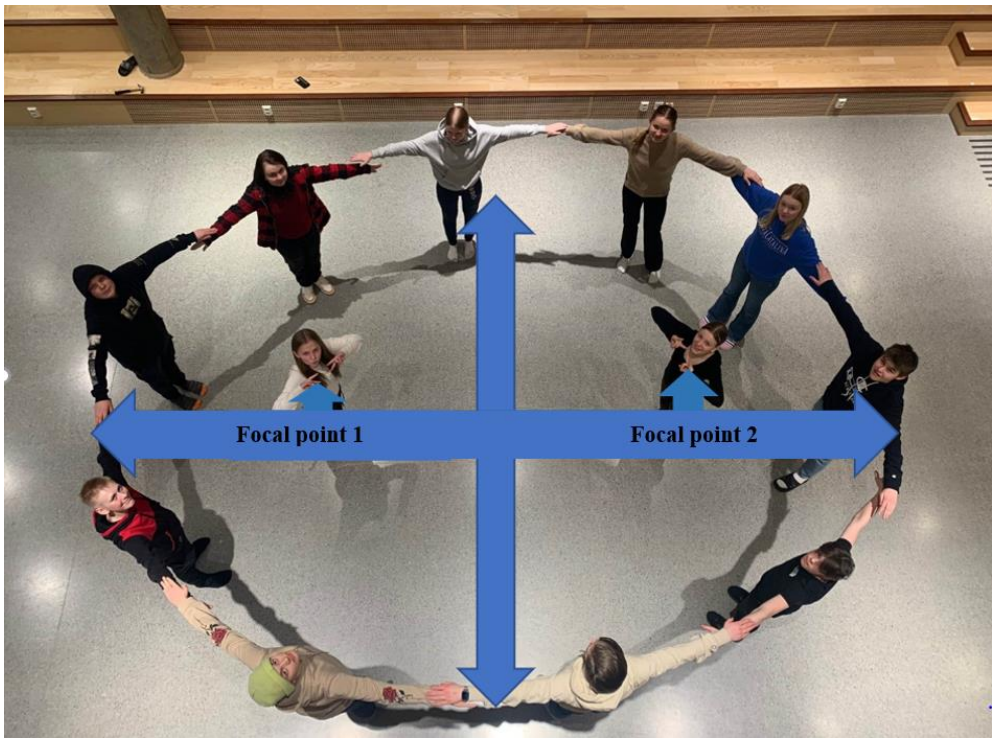
NNMC – YoungAbel

2023

Norway, Finnmark; Sandnes og Bjørnevatn School, 9th grade

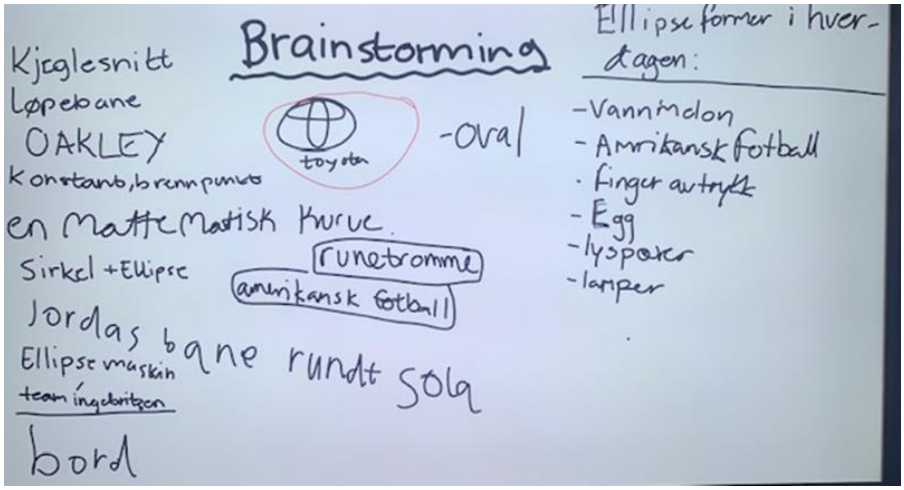


Innhold

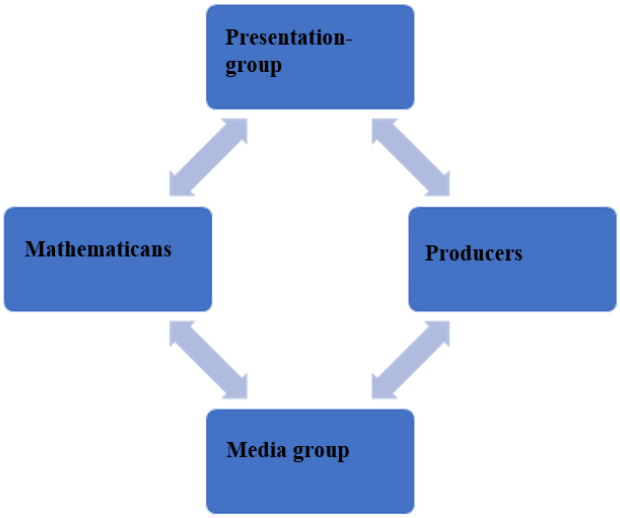
Introduction

We started working with the task 22nd February 2023, we had a brainstorming where we wrote down all our ideas and everything we knew about ellipses. Our teacher Pål came up with an idea about building a team consisting of four groups, where the group leader on each team is going to represent the class. He needed four people with different skills, and we had to apply for the different jobs. These jobs were the producers who wrote the report and a log, the mathematicians who found all the formulas and did the math, the presentation group who had the responsibility for the presentation, and the media group who made the film.

The presentation group worked with the presentation and funny ways we could stand out, "we have to show x-factor, humor and knowledge". While working with the project we have gotten challenges from our teacher, he has challenged us mathematically where we had to solve the problems in the class, together. An example of this is when we had to find out if an ellipse machine really moves in an elliptical shape



Cooperation between the groups



This model shows how we have cooperated between the groups. Everybody has followed each other through the whole process, an example is when the mathematicians found out properties in ellipses and the others learned from them.

The Producers

The producing-group have followed the other groups closely to get their mindset, procedures and solutions, and how they have worked with their task. They have helped with ideas at the same time as they have worked on writing a log so it would be easier to write the report. They also wrote a log from a Teams meeting that the class had with Vegard Rekaa from Astronomen, they got very useful information about ellipses and satellites in space.

In this picture we see the class discussing while someone is taking notes, and someone

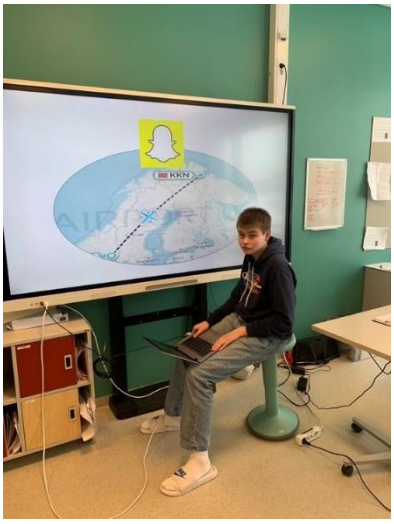
working on the film. This is a good way of working because everyone gets included and everybody can say what they know.

The mathematicians

The mathematicians have used many hours calculating and checking in GeoGebra if some logos are an elliptical shape, and where we can find them in our life. They have gotten many challenges from our teacher Pål, which they have solved and presented to the rest of the class.

The presentation group

The presentation group have worked making the presentation we are going to present. We started having a small brainstorming session with our teacher Pål, where they came up with ideas that would get us to stand out with culture and humor. Everyone in the group agreed that we have to show x-factor, humor and knowledge about ellipses. We are going to do this by having a "act" where we are going to talk between us on the stage and the audience at the same time. In the presentation we have decided that the main theme is youth culture in Sør-Varanger. The way we agreed on this theme was by talking to all the groups, different teachers and using internet.



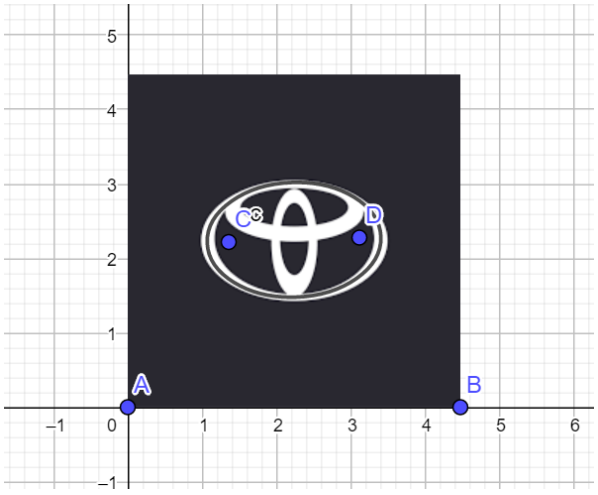
Here is an example of how they worked with the presentation, how they could get creative animations that show how they have thought and how things happen. As an example, as we see in the picture, a snapchat gets sent around the earth by satellites that go around the world in an elliptical shape around the earth.

Media-group

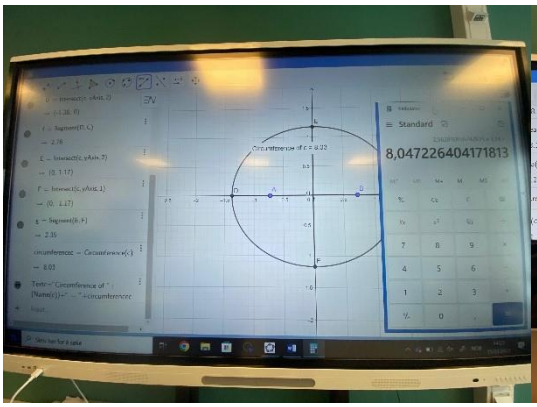
The media group got the responsibility for making the film that we were going to submit. They started by finding out how they could involve all the groups, and how they work in the film. They are going to do that by using pictures, and documenting everything that we do. The main story in the film is how ellipses affect the everyday life of a normal teenager – our youth culture.

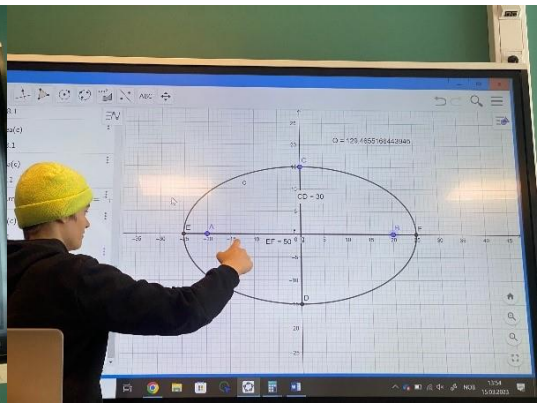
Different methods

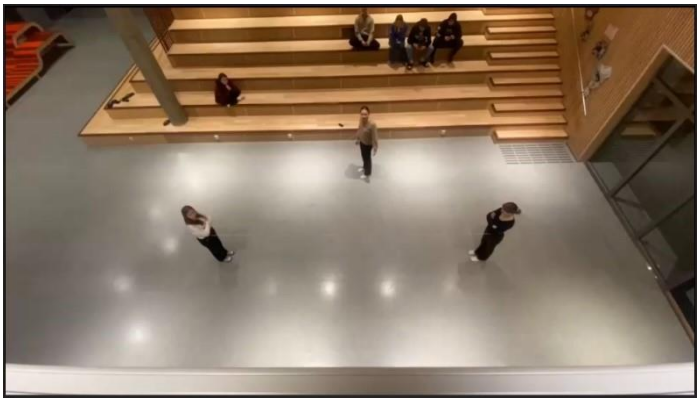
We have used different methods to explore ellipses. The mathematicians have used GeoGebra a lot, an example is the Toyota logo which is an ellipse shape. We can see it in the picture underneath:



Another method we used was to draw ellipses on the floor in school and on wooden planks. To do this we used a rope to keep a constant distance between the focal points and circumference, which is an important trait in an ellipse.







In this picture we see Nora and Marthe who are standing as focal points, we have a rope between them and Iina (who is standing on the circumference). Iina is walking around them while keeping the rope with a constant length between the focal points and the circumference. The distance between the focal points and the circumference is the same the whole time, it means that the sum of the distance between the focal points is constant. We used this method multiple times, like when we found the area and circumference of an ellipse, that we drew ourselves. We were working in pairs before we summarized together with the whole group, this is a good way of learning because we get to learn by exploring without help.

Challenge #1 The circumference of an ellipse

We wanted to check if the formula for the perimeter is correct.

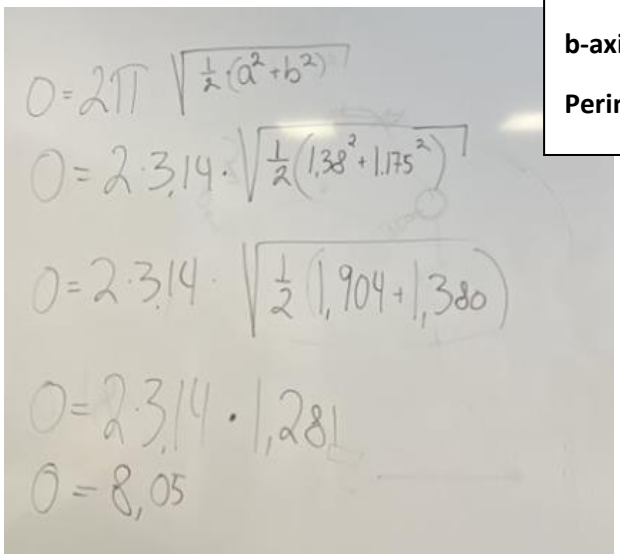
This is the formula we calculated the circumference with: $Circumference = 2 \times \pi \times \sqrt{\frac{1}{2} \times (a^2 + b^2)}$

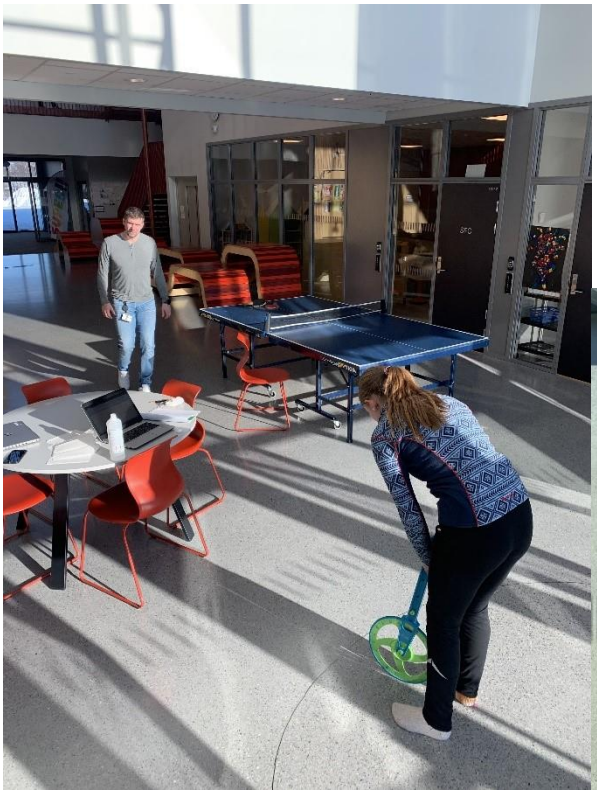
We marked two focal points on the floor and used the rope to get the perfect ellipse. As we see in this picture above everybody is helping, and everybody had a role in the task. To measure it we put a rope around the ellipse we drew and measured, the perimeter was 8,21 m. Afterwards we calculated with the formula for the circumference (picture under). It had a difference of 16 cm when we calculated and measured, this is probably because it is hard to place the rope exactly on the line on the floor.

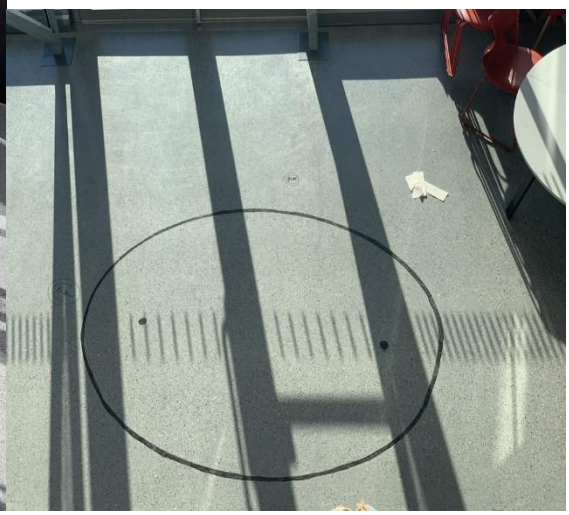
a-axis is here 1,38 m.

b-axis is 1,175 m.

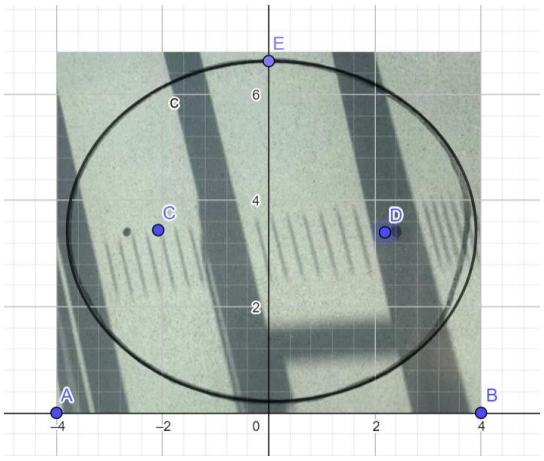
Perimeter is then 8,05 m.







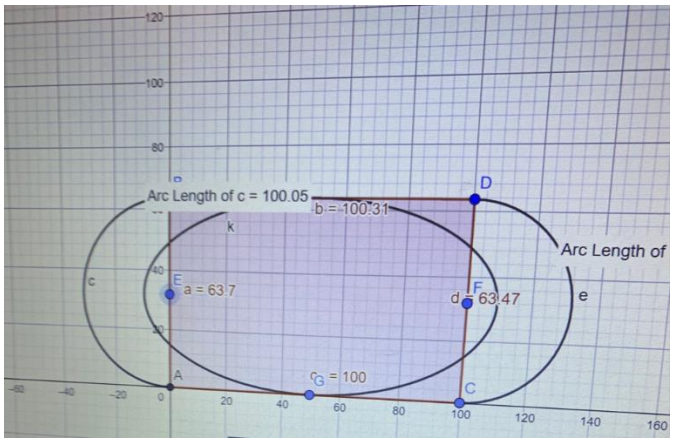
We would check the perimeter formula again, but more precisely this time. Here we have drawn with a marker on the floor, and then measured with a measuring wheel because it is more precise than measuring with a rope and measuring tape. Using this method, we found the a-axis and b-axis. After this we calculated the area and circumference of the ellipse. Then we put it in GeoGebra, in the right scale, and checked if we had calculated it right.



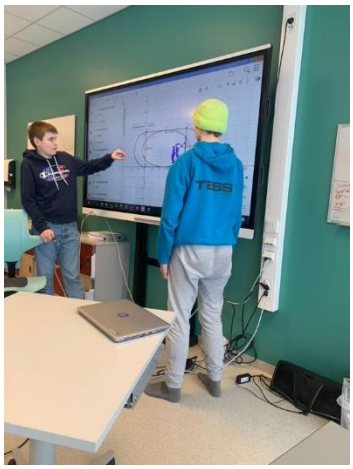
This picture is taken from the side; therefore, the focal points are not 100% right. The result was just like we expected, we had the right formula, and we got the same answer, 6,95m., with both methods.

Challenge #2 Is a track field an ellipse or not

The mathematicians got a challenge finding out if a track field is an ellipse or not, which they found out it is not – something they had to prove mathematically to the class. We can see it in the picture underneath:



In the picture under we see how they worked with track fields, they drew an ellipse on the board, before they inserted a picture of a track field, and checked if it was right. This is not 100% correct mathematically, but you get a picture of what you can work with, so you can see if it is possible or not.



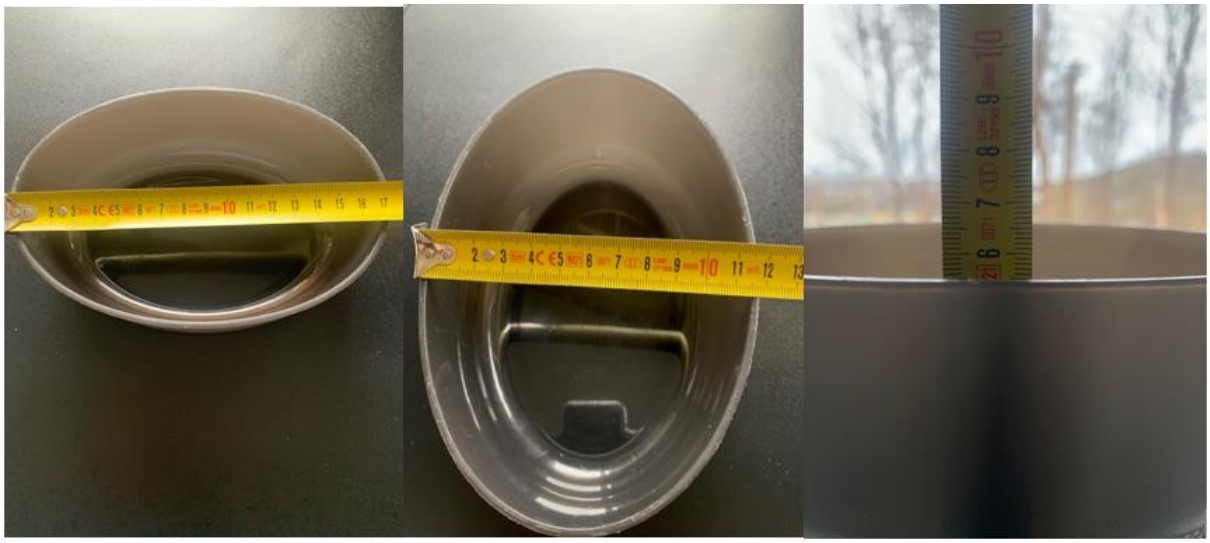
The whole group worked together, and we found out that it was not an ellipse.

Challenge #3 The area of an ellipse

The formula for area of an ellipse = a*b*π.

Checking if this formula is right can be a challenge. So, we were creative and found out that our teacher's lunch box had an ellipse shape. We checked the volume of the lunchbox by filling it with water, finding the height and that way we calculated the area. We did it by using 3 test tubes to find the volume in ml, then we put the volume which was 865ml which is 865cm^2 in the formula V=G*h.

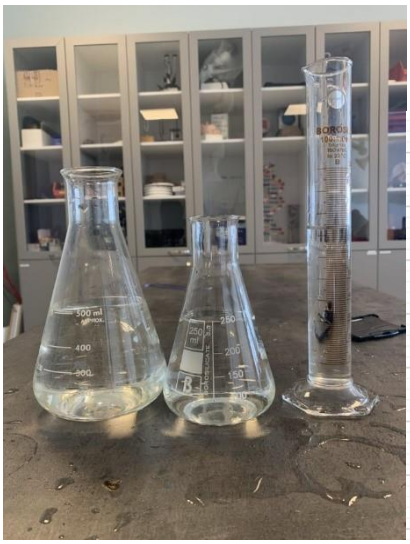
The pictures below show what small radius (5,8 cm.) large radius (8,6 cm.), and height (5,5 cm.) was in the ellipse-lunchbox.

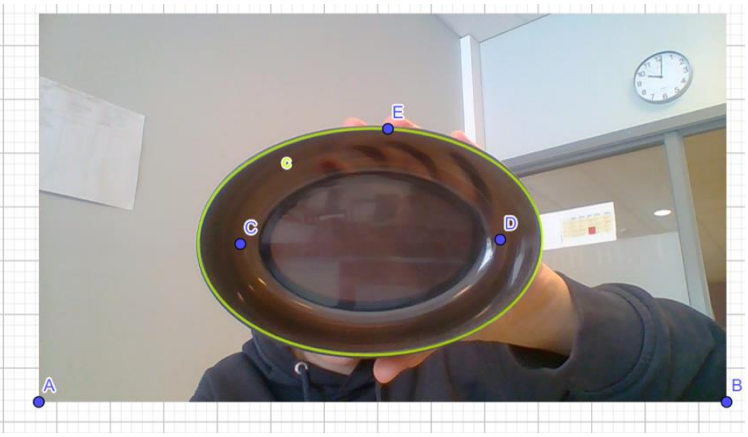


By calculating to find the Area, A = a*b*π = 5,6 cm. * 8,5 cm. * 3,14 ≈157 cm^2.

Then we measured the height in the lunchbox, that was 5,5 cm., and turned the formula, so G (the area) was unknown. G = V/h = 865 cm^3/5,5cm ≈ 157cm^2

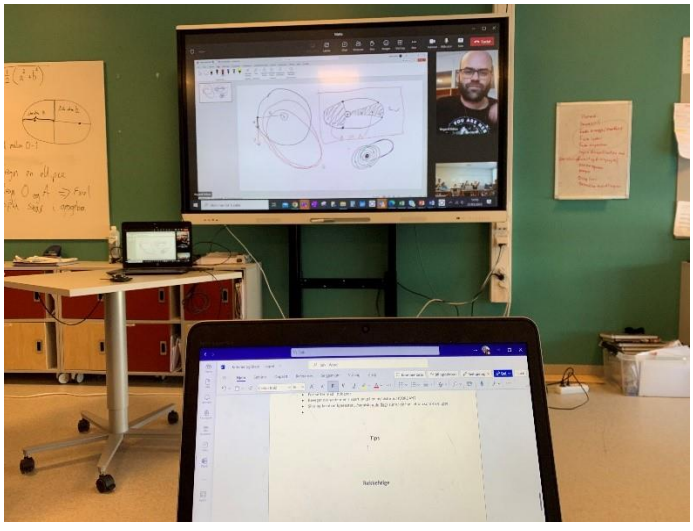
We calculated this and found out that the area of the lunchbox was 157cm^2, this agreed with what we calculated when we used the formula A = a*b*π





Challenge #4 Satellites and elliptical orbits

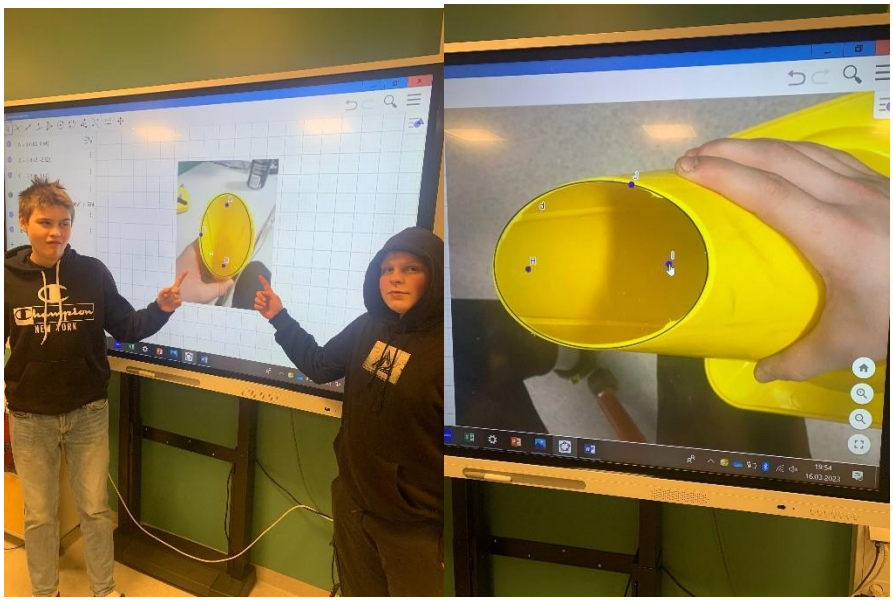
On 22nd-March we had a Teams meeting with Vegard Rekaa, he had a small lecture about ellipses in space. He told us that ellipses are important in the solar system, and that there are ellipses everywhere in space. In our solar system it is Neptune and Pluto that have the most elliptical shape around the sun, all the other planets have it too, but it is not as visible. Another thing he told us is that you can't send messages, snapchats or call without satellites. If the GMS-signals that controls GMS-watches on earth work – then all digital tele signals will stop. For all this to work the satellites have to move in an elliptical shape around the earth.



Here you can see a picture from the meeting with Vegard Rekaa from Astronomen who is explaining about satellite orbits and how ellipses occur in space. It was a very educational lecture that helped us a lot.

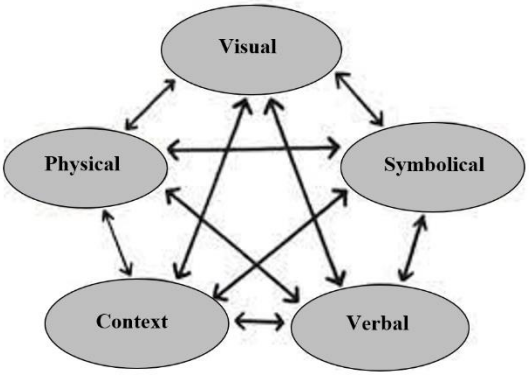
Challenge #5 Conic section

To explore conic sections, we cut a cone across, took a picture and put this in GeoGebra. The janitor helped us attach a hinge so we could show how we cut it. This is something we can use to show that a circle is a special case of an ellipse.



Different representations

We have used different representations; visual, context, verbal, symbolic and physical. The visual we have used are drawings, an example is when we drew on the floor and drew our own ellipses. The teacher challenged us if a track field is an elliptical shape, this is context. He wrote the challenge on the board and let us find out the rest ourselves. The verbal we have used is when the mathematics taught the rest of the class. The symbols we have used are formulas, we have found formulas to calculate area and the circumference of ellipses. The physical representations we have used are when we used ourselves, we placed two people as focal points and used a rope to have a constant length. By using all these representations, we have learnt very much about ellipses, in our opinion.



Conclusion

During this process we have learned a lot, one example is how to calculate the area and circumference of an ellipse, another example is what the different points in an ellipse are called.

Our first thought was to use GeoGebra, we have used it a lot and it is a good tool when working with ellipses. It has a lot of functions that you can use one example is the elliptical function, using it you can put a picture behind and check if it has an elliptical shape without having to calculate and measure everything.

One of the solutions we have found using the program is that a circle is a special case of an ellipse, and that this is shown in a cone.

Another solution we have found out is how to make your own ellipse, and this made us find out a lot about ellipses characteristics by learning ourselves.

We would also state, with what we know about ellipses, that an elliptical machine is only a "wheel machine", and that satellites have a major impact on our lives. Finally, we want to say that we have learnt a lot of mathematics by working with this project. We have used a lot of our spare time, but it has absolutely been worth it. 😊

Picture from" Sandnes and Bjørnevatn School goes off the victory."