

ACTIVITY 12

Aerodynamics - Lesson plan

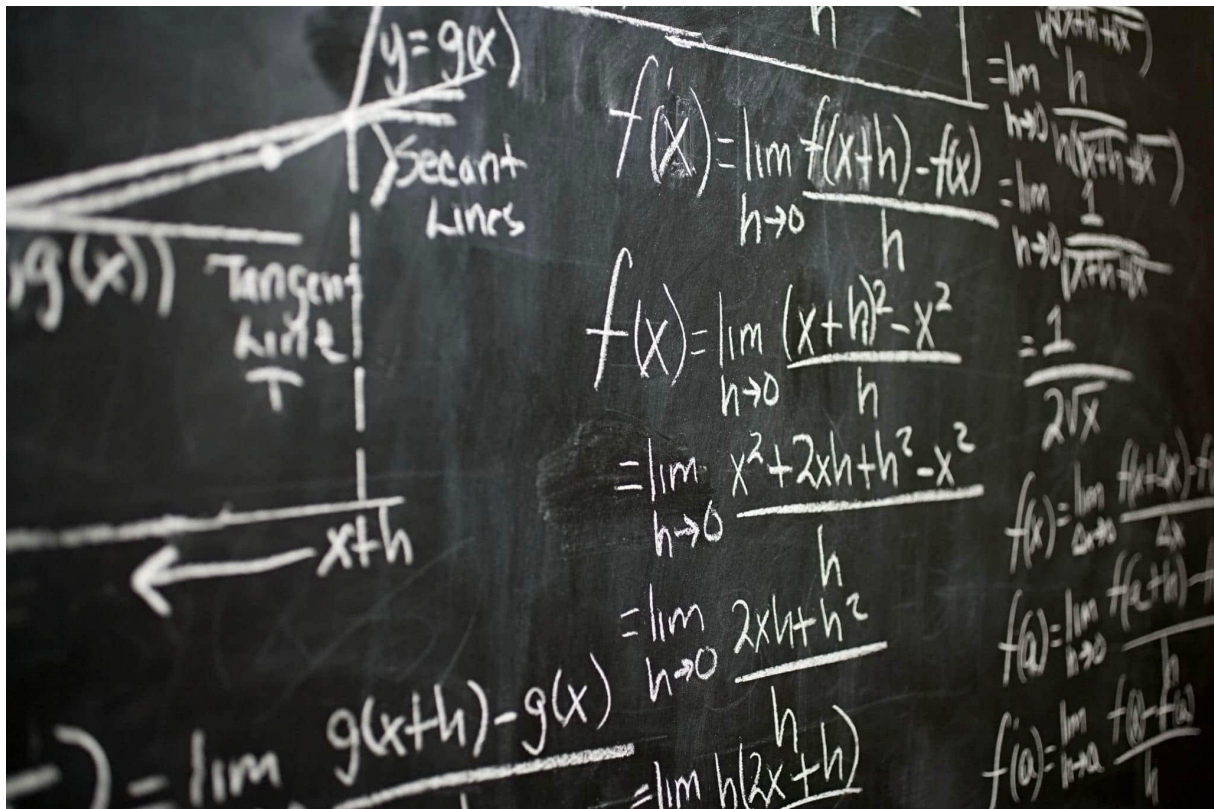


Illustration from the activity

Lesson plan

Aerodynamics

Class

- 6th Grade secondary school
- Compulsory elective subject Physics
- Cross – curricular between Mathematics and Physics

The chalkboard shows the following content:

Left side (graph):

- Equation: $y = g(x)$
- Text: Secant Lines
- Text: Tangent Line
- Text: $x+h$

Right side (algebra):

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$
$$f(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h}$$
$$= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - x^2}{h}$$
$$= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$$
$$= \lim_{h \rightarrow 0} h(2x + h)$$

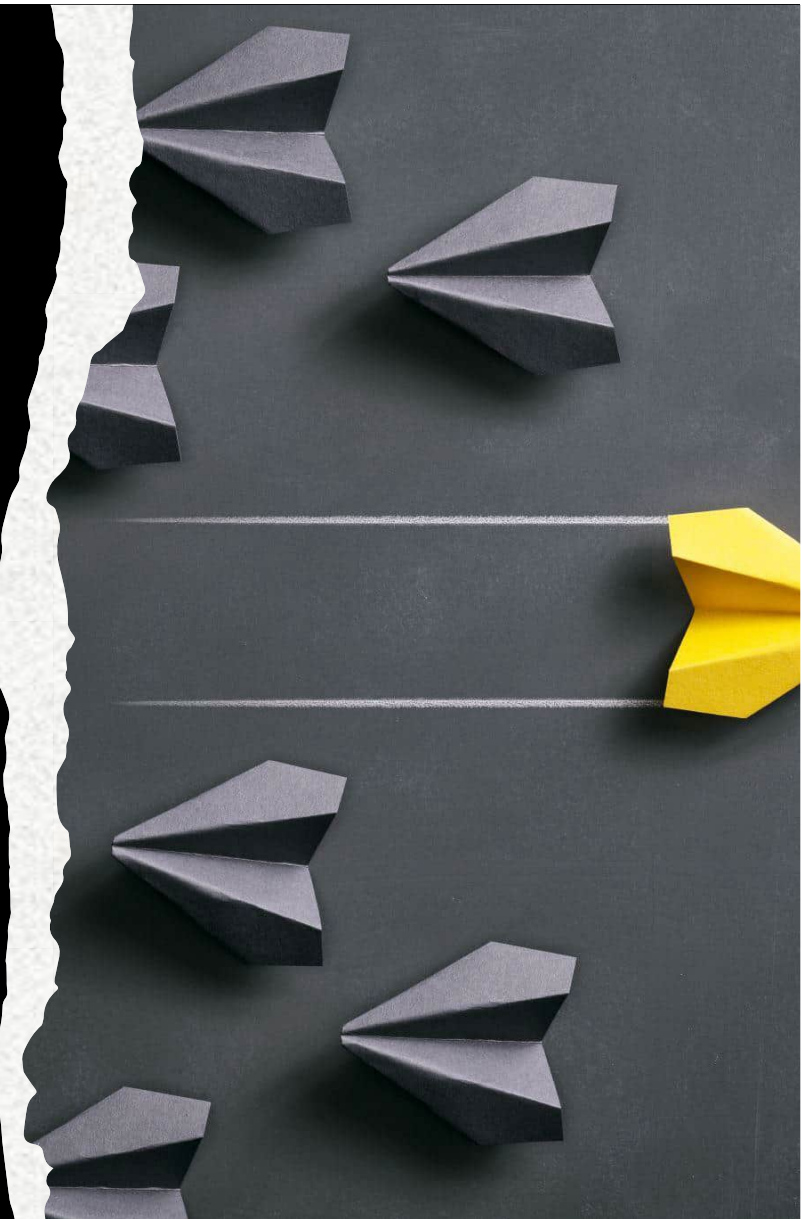
Goals

Technical goals:

- The students learn how to work with a 3D printer
- The students learn how to model different objectives (e.g.: with GeoGebra)

Specialist goals:

- The students learn how a plane can fly
- The students learn which influence different factors (e.g.: mass of the plane, surface, air conditions, ...) have on the flight trajectory



Work Assignment



Form groups of 3-4 students



Your goal is to model a small plane which flies as far as possible



Think about how your plane should look like to have the best aerodynamics effect

Work Assignment



Model the different parts of the plane with a software or have a look on [Tinkercad](#) and search for parts you could need



Print all your plane parts



Assemble your plane

Work Assignment



Let your printed plane fly 5 times



Measure the flight time, the height of the plane and the distance the plane travelled



Show your results in diagrams and calculate the mean values and variances

Lesson 1

Time	Subject / topic	Social form
10 min	Teacher explains the project for the next 4 lessons	Plenary
5 min	Group findings (3 – 4 students per group)	Plenary
25 min	Students discuss in their group what is necessary that a plane can fly as “good” as possible (low air resistance) Maybe including a drawing of the plane on paper	Group Work
10 min	Discussing the ideas with the groups	Plenary
End of the first lesson		

Lesson 2

Time	Subject / topic	Social form
15-20 min	Teacher explains to the students the programs where models for 3D printing could be made including showing the website Tinkercad (to get some ideas)	Plenary
30-35 min	Groups working on their plane model	Group Work
End of the second lesson		

Lesson 3

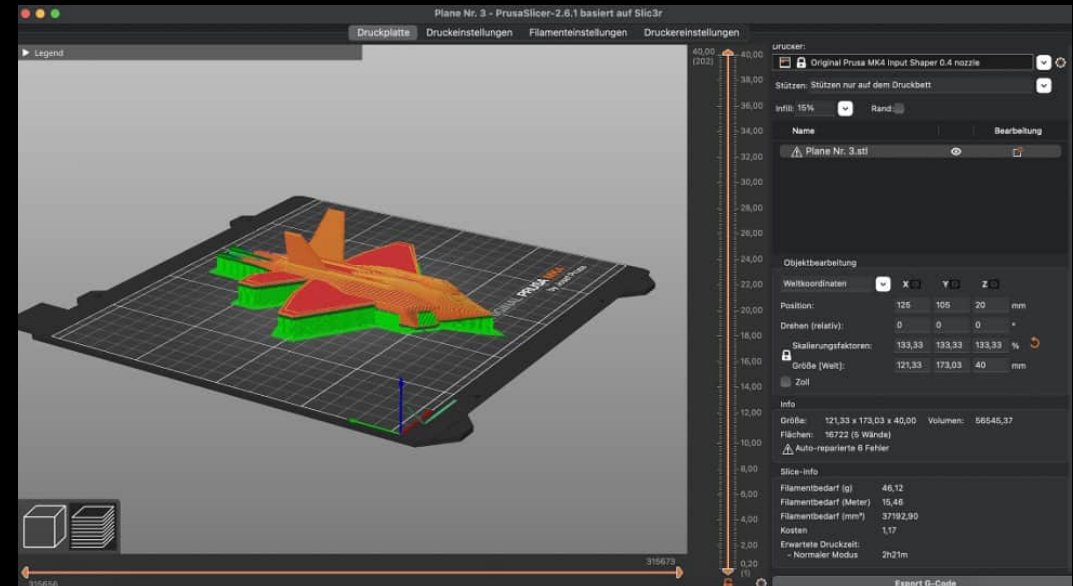
Time	Subject / topic	Social form
30 min	Groups working on their plane model	Group Work
10 min	Teacher explains how to export the G-Codes needed to print their model Exporting the G-Codes	Plenary
10 min	Testing the codes if they work (printer should start printing)	Plenary
After lesson	Printer finishes students printing projects (Teacher should have a look at the printer so everything works fine)	
End of the third lesson		

Lesson 4

Time	Subject / topic	Social form
5 min	Teacher hands out the planes that the groups designed and printed	Plenary
10 min	Teacher explains the upcoming task: - Students should let the plane fly - They have to measure the time of the flight, the height (where they plane starts his flight) and the distance	Plenary
	- The students then should draw 3 diagrams (height – distance, height – time & height – distance) from their “best” flight - They should measure at least 5 flights and calculate the mean value and the variance	
25 min	Groups doing the task	Group Work
10 min	Speaking about the results and reflecting the modeling task (What went well, what did make difficulties, ...)	Plenary

End of the fourth lesson and project

Model and printed object (plane)

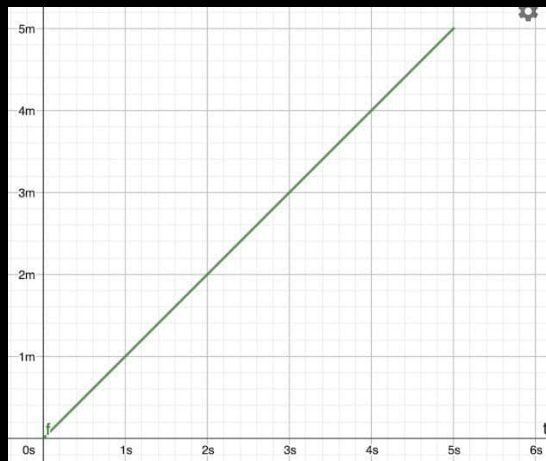


Results

Flight 1	Flight 2	Flight 3	Flight 4	Flight 5
Time:	Time:	Time:	Time:	Time:
Distance:	Distance:	Distance:	Distance:	Distance:

Diagrams

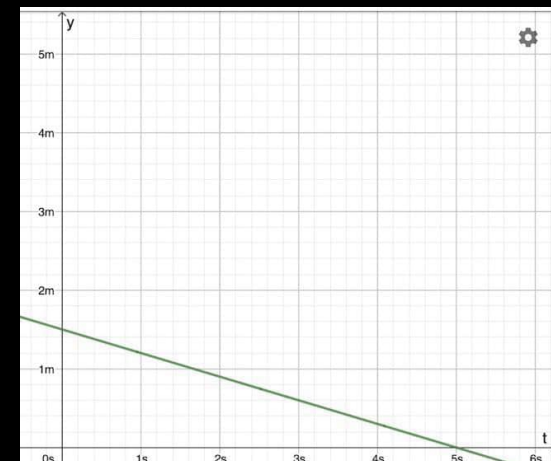
s – t
diagram



h – s
diagram



h – t
diagram





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