



Lesson Plan

Module:	Nomograms 1		
Teaching Hours:	60 minutes		
Grade Level/Age Range:	Grade 10-12		
Brief Description:	First introduction to nomograms. The students first explore nomograms as embodied sensorimotor tasks. Then this is formalized by connecting graphs and formulas to the nomograms. In conclusion we revisit the embodied task and mathematize the earlier findings by connecting each nomogram to a linear formula		
Design Principles:	Inquiry		
	Situatedness		
	Digital tools		
	Embodiment		
Functional Thinking:	Input – Output		
	Covariation		
	Correspondence		
	Object		
Learning Goals:	<ul style="list-style-type: none"> ✓ The student can explain what a nomogram represents for a given function ✓ The student is able to predict the if the slope of a linear function is either zero, greater than one or less than one by looking at the nomogram. 		

This material is provided by the [FunThink Team](#), responsible institution: Utrecht University



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Activities

Lesson no. 1.

Engage / Explore

Activity 1.

The student assignment (identical with the one in the student handout).

Take a tablet or smartphone, Scan the QR code and answer the questions below: Or on a computer use this url: <https://www.geogebra.org/m/kjs873gk>



1. While moving the point look at the arrow. When does the arrow become green?
2. Try different exercises using the forward and backward buttons. What can you remark about the movement of the point and the way the black arrows are pointing?
Fill out the table.

Exercise	Description of the movement in relation to the black arrows: <i>Upward, downward, horizontal</i>	Description of the black arrows: <i>Pointing towards a single point, parallel, pointing up, pointing down, pointing towards each other, pointing away from each other</i>
1		
2		
3		
4		
5		
6		
7		

- *In the activity the students discover the relation between a nomogram and a coordinate system through embodied sensorimotor experiences.*
- *The teacher introduces the assignment and let the students explore the applet. If necessary, the teacher can clarify what is expected of the students while they make the exercises. At the end of this phase the teacher discusses the different answers the students gave in a classroom discourse.*

Suggested tools/materials: Tablet

Estimated duration: 20 minutes

Explain / Extend

Activity 2.

The student assignment (identical with the one in the student handout).

Take a tablet or smartphone, Scan the QR code and answer the questions below: Or on a computer use this url: <https://www.geogebra.org/m/vgqwcwe4>



1. Move the point around, what can you say about the relation between the position of the point and the position of the arrow?
2. Push the trace button and move the point horizontally, what can you remark about the trace of the arrow. Explain your findings.
3. Attach the point to the graph of $f(x) = 0,5x$ and examine the trace, then try: $f(x) = 2x$, what is the difference? Explain your findings.
4. Suppose all the arrows are horizontal, what linear formula would fit? Check your solution using the applet.
5. Examine the trace of $f(x) = x + 1$ and $f(x) = x - 1$. What can you remark about the differences?
6. The two vertical number lines, together with the trace of arrows is called a nomogram. Explain what a nomogram represents for a given function. What is the role of the first number line? And what is the role of the second?
 - *In this activity the students extend their notion of nomograms using formulas and graphs. They will discover the connection between the nomogram and the slope and y-intercept of a linear formula.*
 - *At the end of this phase the teacher discusses the different answers the students gave in a classroom discourse.*

Suggested tools/materials: tablet

Estimated duration: 20 minutes

Explain / Extend

Activity 3.

The student assignment (identical with the one in the student handout).

Take a tablet or smartphone, Scan the QR code and answer the question below: Or on a computer use this url: <https://www.geogebra.org/m/kjs873gk>



For each of the 7 nomograms write down a linear formula, assume that the space between the gridlines is equal to one.

Exercise	formula
1	
2	
3	
4	
5	
6	
7	

- *The students revisit the embodied sensorimotor task from phase 1, they now try to mathematize their initial experiences by writing down a formula for each of the exercises*
- *A At the end of this phase the teacher discusses the different answers the students gave in a classroom discourse.*

Suggested tools/materials: tablet

Estimated duration: 20 minutes