

# MATHCITYMAP GENERIC TASKS OBJECTS IN PORTUGAL AND IN SLOVAKIA

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**Abstract.** *Portal MathCityMap is the technical support and database of tasks and trails within the Europe and the whole world. Every composed task is based on exploitation of some real object and is identified with several attributes: real object characteristics, key words of mathematics topic which the solution of the tasks can be placed in, school grade which mathematical competences should allow to solve the task. Generic tasks represent grouping the single tasks about almost the same objects into one category. Five categories of MathCityMap generic tasks are introduced and illustrated by real objects localized in tasks in Portugal and in Slovakia.*

*Key words:* MathCityMap portal, Mobile Math Trails in Europe project, generic task.

## MATHCITYMAP GENERIC TASKS

MathCityMap portal (MCM - <https://mathcitymap.eu/en/>) is a math trail management system, where users can create tasks and trails and share them amongst themselves or with the public to run through its App. It is a very important tool to be used by mathematic teachers, as it brings together an important recipe for the success of their students: outdoor education and technology.

The concept of math trails lately has been greatly enriched thanks to the possibilities offered by mobile devices to provide automatic feedback and provide guidance throughout the route. However, this requires theoretical and empirical considerations, provided by **Mobile Math Trails in Europe** (MoMaTrE, [www.momatre.eu](http://www.momatre.eu)) (see for example: Ludwig & Jablonski, 2019; Cahyono & Ludwig, 2019; Gurjanow et al., 2019 and the references in it). The MoMaTrE project is an Erasmus + project started in 2017, lasting three years. Five countries are partners in this project: Slovakia, France, Spain, Portugal and Germany.

One of the project MoMaTrE outputs is categorizing tasks into **generic tasks** categories. A mathematical topic indicator characterizes each category of generic tasks. A generic tasks is a mathematical tasks which is very typical but also very general, for example, to calculate the slope of a ramp or a handrail of a stairway you can find them everywhere in Europe in different styles. Generic tasks are the most frequent tasks in MCM trails. In different locations on planet Earth, we can find the same objects or have the same scenario. Five generic tasks categories are introduced and illustrated with the most interesting MCM tasks objects localized in Portugal and Slovakia.

Table 1 shows some examples of generic tasks in Slovakia and Portugal. These tasks can be found everywhere: the ramp slope, the building height or statue height, a bicycle stand, etc.

Generic tasks categories

- Counting/Combinatory;
- Quantities;
- Height;

- Slope;
- Volume.











	Slovakia	Portugal
Counting/Combinatory	 <p><b>Stairs</b></p> <p>How many possibilities exist to go upstairs if one can take one or two steps within each move? The step sequences can be combined?</p>	 <p><b>Parking a bicycle</b></p> <p>Three bicycles will park at this location. Each rim can only have one bicycle (it does not matter whether it is parked on the left or right of the rim, facing the street or not). How many possibilities are there to park three bikes?</p>
Quantities	 <p><b>Information board</b></p> <p>How many posters in A5 format (15 cm x 21 cm) can be placed on the information board? All the posters must be visible and they cannot overlap each other.</p>	 <p><b>Footbridge</b></p> <p>It is intended to pave the passage. All slabs (with dimensions of 42x60 cm) must be placed in the same orientation and, in the case of being cut, the leftovers are wasted. What is the minimum number of slabs needed to pave the passage?</p>
Height	 <p><b>Staircase height</b></p> <p>How deep (high) is the staircase on the left side of the music pavilion? Give the result in centimetres.</p>	 <p><b>Statue height</b></p> <p>How tall is the statue? (Give the result in meters)</p>
Slope	 <p><b>Railing</b></p> <p>Determine the slope of the railing. Give the result in percentage!</p>	 <p><b>Ramp</b></p> <p>In order to know if the ramp can be comfortably used by a wheelchair person, determine an approximate value for the ramp slope (in percentage).</p>
Volume	 <p><b>Flowers container</b></p> <p>How many cubic meters of soil are there in a big concrete area/field for planting flowers?</p>	 <p><b>Mass of a tree trunk</b></p> <p>Determine the volume/mass of the tree trunk.</p>

Table 1: Examples of generic tasks in Slovakia and in Portugal.

In the counting /combinatory category, we can use, for example, stairs or bicycle stand, and use counting techniques - come up with an enumeration strategy and compute. Here we can use any collection not too large of well identified objects (steps in a staircase) or calculate how many possible combinations exist for different situations, or ... . In the quantities category we can use an information board or a footbridge and we can apply our knowledge about polygons areas - decomposition of a polygon into several polygons and calculation of areas. In the height category, we can use stairs, or a statue or even a building

to calculate their height. We can calculate a distance through scaling, through counting number of some patterns or we can measure two non-corresponding distances in order to establish a scale. In the slope category, we can use a railing or a ramp to calculate slopes – a constant slope with easy horizontal and vertical segments. In the volume category, we can use a flowers container or a tree trunk. It is necessary to identify a cuboid, measure its sides or identify a cylinder, its base and height, and choose the correct units for the volume or mass of the object calculation

## CONCLUSIONS

The aim of this work was to show that, with the support of generic tasks, available in MCM, is much easier for a math teacher to quickly create tasks for their students because there is a range of ideas and best-practice examples. The generic tasks can inspire teachers to create local tasks or even textbook tasks for regular mathematics lessons. Generic task description and examples, as the project MoMaTrE output, is a very useful tool, available on the project web page to download.

## References

- Cahyono, A. N., Ludwig, M. (2019). Teaching and Learning Mathematics around the City Supported by the Use of Digital Technology. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(1), em1654. <https://doi.org/10.29333/ejmste/99514>
- Gurjanow, I., Oliveira, M., Zender, J., Santos, P. A., & Ludwig, M. (2019). Shallow and deep gamification in mathematics trails. In M. Gentile, M. Allegra & H. Söbke (Eds.), *Games and learning Alliance - 2019: 7th International conference, GALA 2018, Palermo, Italy, December 5-7, 2018, Proceedings* (pp. 364–374). Springer International Publishing.
- Ludwig, M. & Jablonski, S. (2019). Haciendo matemáticas al aire libre con MathCityMap. Presented at Jornadas para el Aprendizaje y la Enseñanza de las Matemáticas (19JAEM), 3 a 5 julio 2019, A Coruña, Spain.
- MCM portal. (2020, March 20). *Tutorials*. Retrieved from <https://mathcitymap.eu/en/portal-en/>
- Mobile Math Trials in Europe. (2020, March 20). *Downloads*. Retrived from <http://momatre.eu/downloads/>



## MathCityMap Generic Tasks Objects in Portugal and in Slovakia

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### References

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- Mobile Math Trails in Europe. (2020, March 20). Downloads. Retrieved from <http://momatre.eu/downloads/>

