Thanks to Thegreenj, published at Wikimedia Commons

Booklet

Reality-based tasks for school

Index

Index

Introduction

Dear Colleague,

This booklet has been designed as a support for your teaching. During the LEMA professional development course you had the opportunity of working with many different modelling tasks. You also considered how to develop new tasks from different resources and had the opportunity of developing your own tasks with colleagues.

As always, your ability to develop new tasks will improve as you try to create them - possibly with the support of colleagues. Meanwhile, we offer you this collection of tasks to support your work in the classroom.

As you will see, we have decided, for each task, to distinguish between "the situation" and "possible task(s)". The reason is quite straightforward: this booklet is addressed to a huge variety of teachers across Europe, working in different educational systems with different curricula, school cultures and traditions, and students at many different levels (from lower primary to upper secondary), it is, therefore, more than probable that almost every task in the booklet will need adaptation before any teacher will be able to use it in their particular classroom. So, we offer you some rich contexts and one or two resulting tasks you may want to use or adapt before using with students. Moreover, our decision is consistent with the ideas that underpin the LEMA philosophy and experience.

Enjoy the booklet and modelling in your classroom!

Sincerely,

The LEMA team

Task 1: Bulb prices

The situation

The lamp life of an ordinary bulb is 1000 hours. These bulbs can be bought as a set of 4 at 100 W, 4 at 75 W and 2 at 60 W and costs 550 Ft.

Osram Eco strip light	Osram energy-saving set of strip lights
12 Watt	**21w=100w everyday bulb=8000 hours of lamplife**
8000 hours	**17w=75w everyday bulb= 6000 hours of lamplife**

Possible tasks

1 If a family decides to replace all the traditional bulbs in a three bedroom flat, how much money will they save?

2 Search for current prices and technical data of similar bulbs in your country and consider how it would affect the results of the previous task.

Task 2: Collecting lids

The situation

In a recent campaign for a certain brand of yoghurt, the name of the days of the week could be read on the inner side of the lid of each carton of fruit yoghurt. The point was to collect all lids from all seven days, and send them to a given address. From among those who entered the campaign the winners were selected in a draw. The first prize was a car, but food tokens of high value were also given away.

Possible task

If you want to participate in the draw, how many yoghurts should you buy in order to collect the seven days of the week?

Task 3: Saving water

The situation

Providing drinking water for domestic use is a major problem in many countries. Therefore water saving habits are needed to ensure that there will be a plentiful supply of non-contaminated water for future generations.

Possible tasks

Make a guess: how much water do you consume per day?

Try to record in a table your daily water consumption. How much water do you use per day?

Could you reduce your daily water consumption? Explain how and try to quantify how much water you might be able to save.

Task 4: Low cost holidays

The situation

PRE-BOOKING SALE
At ..... travel agency.
Up to 28th February, when paying the entire price you save 7%
Up to 25th March when paying a deposit you save 4%

For frequent travellers an additional saving of +3%

Choose from the offers of our 2001 summer catalogue

Some words: “hét” means “week”; “FP” means “half board”; “szálloda” means “hotel”.

2001. ÉVI NYARALÓPROGRAMOK:

Olaszország	1 hét apartman	18.900 Ft/fő-től
É-Görögország	1 hét apartman	18.900 Ft/fő-től
Stavros	1 hét apartman	18.900 Ft/fő-től
Korfu	1 hét apartman	26.900 Ft/fő-től
	1 hét szálloda + FP	42.900 Ft/fő-től
Costa Brava	1 hét apartman	29.900 Ft/fő-től
	1 hét szálloda + FP	44.900 Ft/fő-től
Rodosz	1 hét apartman	55.900 Ft/fő-től
Korfu	2 hét apartman	45.900 Ft/fő-től
	2 hét szálloda + R	74.900 Ft/fő-től
Kréta	2 hét apartman	54.900 Ft/fő-től
	2 hét szálloda + FP	76.900 Ft/fő-től
Mallorca	1 hét szálloda + FP	88.900 Ft/fő-től
Costa del Sol	1 hét apartman	84.900 Ft/fő-től
Costa Blanca	1 hét szálloda + FP	94.900 Ft/fő-től
Ibiza	1 hét szálloda + FP	109.900 Ft/fő-től
Málta	1 hét apartman	77.900 Ft/fő-től
Török Riviéra	1 hét szálloda + TP	95.900 Ft/fő-től

KÖRUTAZÁSOK, VÁROSNÉZÉSEK:

Prága	4 nap panzió + R	29.900 Ft/fő
Párizs-Versailles -Eurodisney	6 nap szálloda+R	44.900 Ft/fő
Párizsi városnézés	7 nap szálloda+R	54.900 Ft/fő
Kis olasz körút	5 nap szálloda+R	73.900 Ft/fő
Tell Vilmos földjén	6 nap szálloda+FP	79.900 Ft/fő
Toscana és Elba szigete	5 nap szálloda+FP	84.900 Ft/fő
Benelux államok	7 nap szálloda+R	89.900 Ft/fő
Nagy francia körút	10 nap szálloda+R	129.900 Ft/fő
Szardínia-Korzika	12 nap szálloda+FP	239.900 Ft/fő
Andalúzia	8 nap szálloda+FP	149.900 Ft/fő
Máltai körutazás	8 nap szálloda+FP	179.900 Ft/fő
Ciprus-Egyiptom	8 nap szálloda+FP	225.900 Ft/fő
Portugália	10 nap szálloda+FP	229.900 Ft/fő
Marokkó	8 nap szálloda+FP	262.900 Ft/fő

Possible task

In Mid –March the Kovács family decides to spend one week in Corfu during the summer holiday.

How much will it cost?

Task 5: Make'em flat

The situation

Recycling is important to reduce pollution and an over-exploitation of natural resources. Your contribution is important! That's why in many countries advertising campaigns to increase recycling habits have been promoted by local, regional and even national authorities.

One of these campaigns is about reducing the volume of bottles, cans, tetra packs and other containers before you throw them into the appropriate recycling bin.




Possible tasks

1) Calculate the following measures after you make them flat:
   a) a 1 litre drinks carton.
   b) a 1.5 litre bottle of water.
2) How could the volume of a 1 litre carton and a 1.5 litres bottle be measured after they are flattened?
3) How many times more cartons and bottle can be put into the dustbin if you flatten them first?

Task 6: Redecoration

The situation

You are about to buy a new flat. Congratulations! Your flat is 66 m^2 and changes inside are allowed: you can relocate walls and change the distribution of rooms but be careful with windows.

We have copied the original floor-plan here. You can use it for your work ("ilyen volt" means "previous floor-plan").

Possible task

Design your new flat. Give the exact dimensions of each room and write down the criteria you have followed.

Thanks to P.Charpiat, published at Wikimedia Commons

Task 7: Buying fruit

The situation

Dora is a 4th grade student. She likes helping her parents but the thing she likes most is going to a little market close to her house to buy fruit and vegetables. Normally, her mother gives her the shopping list and some money.

Possible task

Dora is quite responsible and she likes to check if her mother has given her enough money to buy everything. But she doesn't like to go to the market with too much money.

3 kg potatoes

1,5 kg oranges

1,5 kg tomatoes

4 bananas

Carrots

2 kg apples

½ kg strawberries

How much money should Dora's mother give her?

Task 8: Hungarian paprika

The situation

The red paprika is the most popular spice in Hungarian Cuisine. It gives nice colour and taste to the dishes without any artificial additives.

70-90 cm long Paprika strings

Possible task

The paprika is on average 12-16 cm long and it weights 25-35gr. It is dried in strings.

Before drying the paprika contains 80-81% water, it will reduce up to 8-10%. Then you can grind it.

Traditionally a string is 80-100 cm long and you need 5 pieces of them to make 15kg of ground paprika.

What do you think, is this observation realistic?

Task 9: Skiing in Austria

The situation

Zettersfeld is a very famous Ski resort located in Austria. The picture shows a map of the different ski slopes and the distance of each. Skilifts run from 9 am to 4 pm.

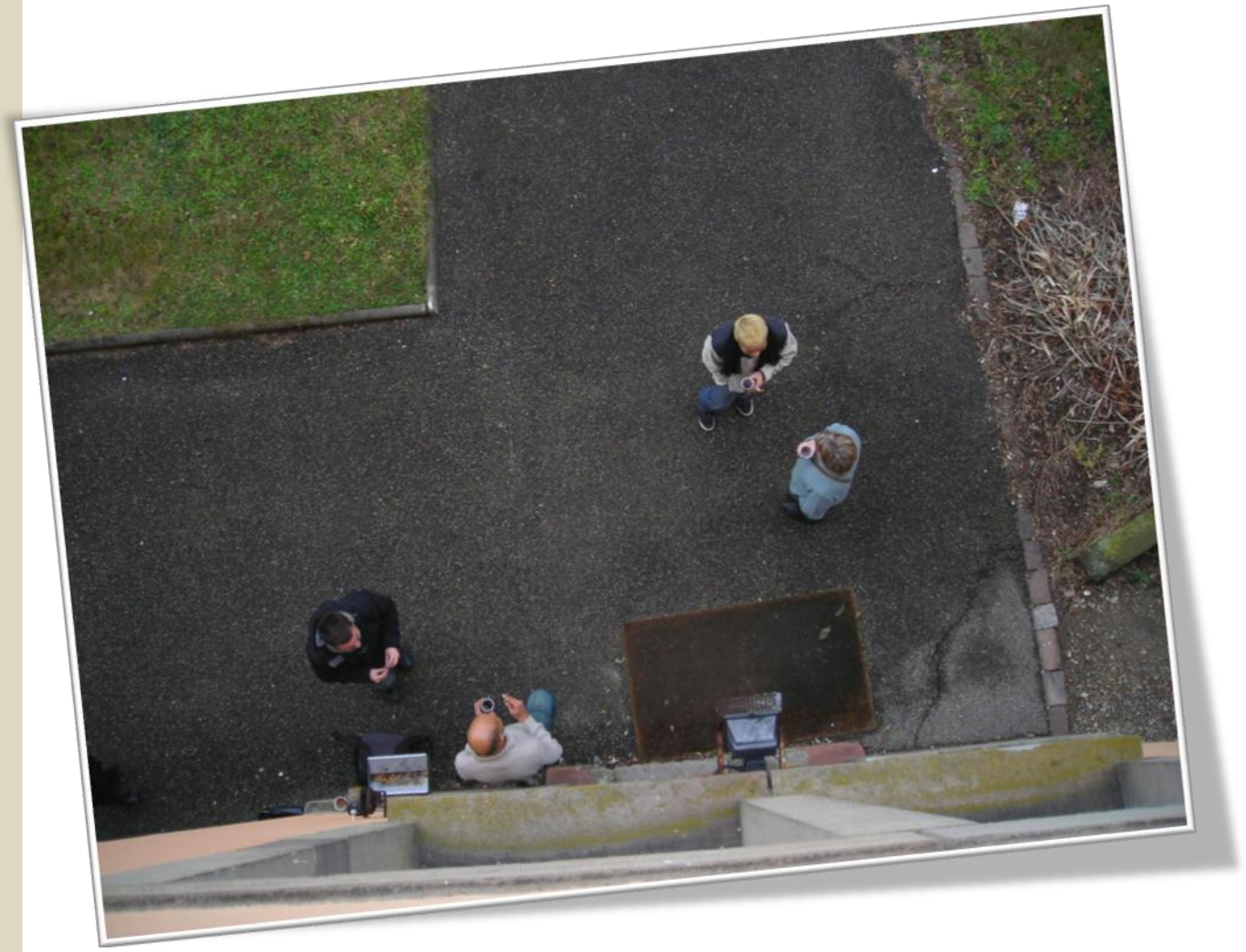
Possible task

You like skiing and your are excited about a day of skiing tomorrow in Zettersfeld. Your plan is to be on the ski slopes quite early in the morning and to ski the whole day until the skilifts close. Obviously, you will stop for lunch. How many kilometers will you ski tomorrow?

Task 10: Estimating the height

The situation

The next picture was taken in Strasbourg (France) in a meeting with teachers.



Possible task

From what height is the photograph taken?

Task 11: School parking

The situation

The picture shows a school car park in Strasbourg (France) early in the morning before teaching has started.

Possible task

How many school teachers have already arived? What advice could you give?

Task 12: In the market

The situation

You are in a street market with only 20€ in your pocket.

Possible task

What is the most interesting way to spend your money?

Task 13: Milk

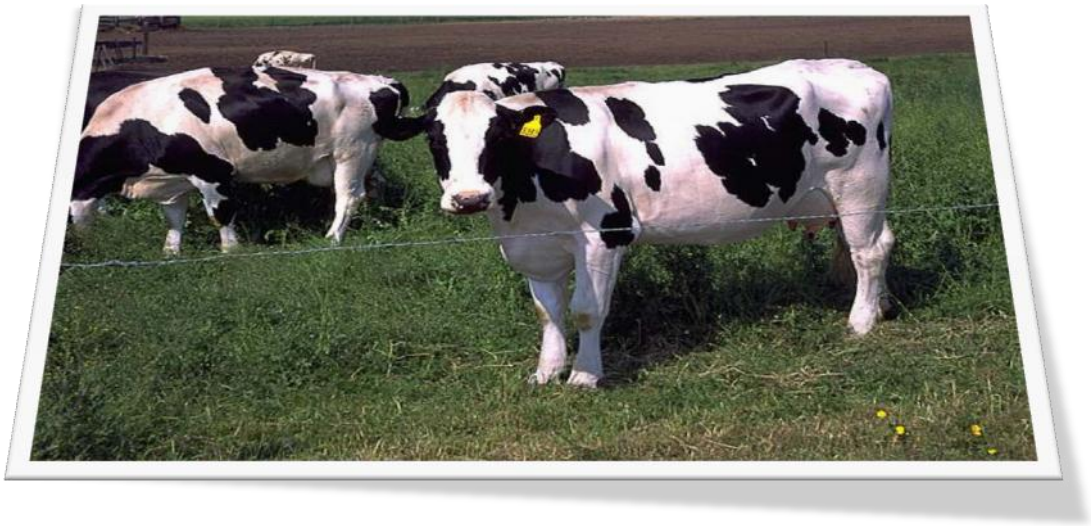
The situation*

Milk is a very healthy food, which has been used by humans for 5,000 years. Apart from high-quality protein, it contains minerals, in particular calcium, and vitamins.

A sufficient nourishment of calcium is very important for children and adolescents, because it is crucial for growing bones and teeth.

It is recommended that children aged between 2 and 12 drink 2 glasses of milk a day.

Thanks to David Monniaux, published at Wikimedia Commons



Possible tasks

How many cows are needed to supply every child at your school with the amount of milk recommended?

Would all these cows fit into your classroom?

* Idea from Jennifer Judith, Freiburg

Task 14: Bus tickets

The situation*

A monthly bus ticket for the centre of Berlin costs 26 € for a student. If you buy an annual subscription you have to pay for only 10 months. To further promote the use of public transport, the transport company invented the sibling-ticket. Brothers and sisters of a student who already has a monthly ticket or an annual subscription pay 10 € less per month. Berlin at the moment has 327,800 students

Possible tasks

How much money will the transport company of Berlin "lose" with this special offer?

* Idea from Thomas David

Task 15: Calendars for Christmas

The situation*

In Germany many children get advent calendars for Christmas. They start on the 1st of December. Every day – until Christmas Eve – children can open one door and find a piece of chocolate or a small gift behind it. You can buy these calendars in the shop or sometimes children make them themselves and their parents fill them.

In the picture you can see a Christmas calendar Nina wants to have. It is made out of felt and has 24 bags to fill. The originality of this particular calendar is that the bags get bigger until the 24th of December. As you can see the bag for the December 1st is quite small, while the one for the 24th is quite big.

Possible tasks

How much felt will Nina need? Reflect on an appropriate size for the calendar and think about how big the bags will be.

* Idea from Natalya Matlakhova

Task 16: Smoking

The situation

Smoking is a very unhealthy habit. Many studies have proven that smokers are more likely to develop cancers and other serious diseases than non-smokers. That is the main reason why people shouldn't smoke.

But smoking is also an expensive habit. And that is another good reason not to smoke!

Picture retrieved from http://www.periodistadigital.com under a Copyleft licence

Possible tasks

How much money could a smoker save if he or she decides to stop their damaging habit? Could you make a convincing argument to a smoker you know well to stop?

Task 17: Wheelchair accessibility

The situation

In many countries, authorities are making big efforts to ensure that accessibility to public buildings is possible for any person in a wheelchair. There are some standards which have to be observed in order to design access ramps:

- For independent users of manual wheel chairs: Max. gradient 1:7.
- For manual wheelchairs pushed by a helper and for electric wheel chairs: Max. gradient 1:5.
- A gradient of 1:12 is desirable where possible.

Thanks to BrokenSphere, published at Wikimedia Commons

Possible tasks

Is your school adapted for people in a wheelchair?

- If the answer is yes, do the ramps in your school observe the standards?
- If the answer is no, could you make a report to the headmaster to solve the problem, if possible?

Do you know any public building in your city with accessibility problems? Make a brief report with suggestions (drawings included) to help the authorities to solve the problem.

Task 18: Human pyramid

The situation

Pictures show different ways of making a human pyramid.

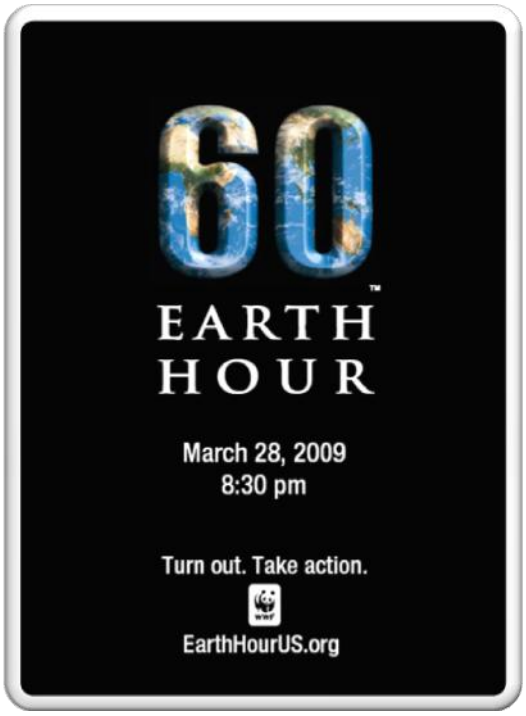
Possible task

How many people would it take to produce a human pyramid 12m tall? (Try three different methods)

Task 19: The earth hour

The situation

The Non-Governmental Organization World Wildlife Foundation (WWF) promoted, for the third time, a worldwide event on March 28th, 2009. The name was "the Earth Hour" and the idea was "*asking individuals, businesses, governments and organizations around the world to turn off their lights for one hour – **Earth Hour** – to make a global statement of concern about climate change and to demonstrate commitment to finding solutions*" (text and picture retrieved from http://www.earthhourus.org).



Possible tasks

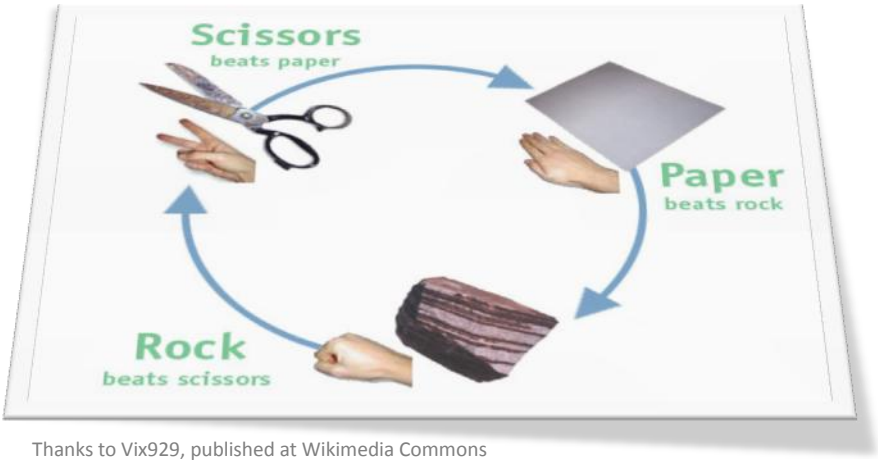
How much energy could you save if your turn off all the lights at your home for this hour? How much energy could be saved if all the pupils in your class do the same? How much money are you saving?

On the internet you can find different calculators to find the equivalence between the Kwh you are consuming and the amount of CO_2 you are emitting to the atmosphere. How much CO_2 are you saving during Earth Hour? Discuss the different data given by different calculators and try to find out why data are so different.

Task 20: Paper, scissors, stone

The situation

The game "paper, scissors, stone" is a popular two-person hand game. The game is often used as a selection method in a similar way to coin flipping, drawing straws, or throwing dice to randomly select a person for some purpose.



Thanks to Vix929, published at Wikimedia Commons

The rules of the game are:

- Paper beats Stone because paper wraps up stone.
- Stone beats Scissors because stone blunts scissors.
- Scissors beats Paper because scissors cuts paper.

You can simulate the game at
http://www.weebls-stuff.com/games/Scissors+Paper+Stone/

Possible tasks

- Is this a fair game?
- Is there a way to win more often?
- What happens if you have a 4th element (for instance, a match that strikes stone and burns paper but is cut by scissors)?

Task 21: In the cinema

The situation

At the end of the year our class will present a show in the cinema hall. Here is the picture of the cinema hall, taken from the back row.

Thanks to Fernando de Sousa, published at Wikimedia Commons

Possible tasks

- How many people can each child in our class invite?
- Can all the children of the school attend the show?
- Today we have to start the invitations, is it possible for every child (in our class? In our school?) to invite his family?

Task 22: Selling cakes

The situation

The parents of the pupils in the class will organize a charity shop on Saturday. They agreed to prepare some cakes that could be sold at 50 cents per portion.

Thanks to David Monniaux and Hannes Grobe, published at Wikimedia Commons

Possible task

How much money can they make?

Task 23: Dual-flush cisterns

The situation*

Paul's family has moved to a new flat. They like the new flat and especially the new bath room is much nicer.

The new toilet has a 3/6 litres dual-flush cistern, something that is new for them.

Possible task

How much water could they save with the correct use of the dual-flush cistern?

* Idea: Dorothea Dorgathen

Task 24: Dish washing

The situation*

After leaving school Judith and Regina want to share a flat. While Judith thinks it is better to use a dish washer, Regina does not want to have a dish washer because she thinks that it needs far more water than washing dishes by hand.

Possible task

What do you think? Which way of dish washing needs more water?

* Idea y fotografías: Uschi Linzmeier.

Task 25: A sure thing?

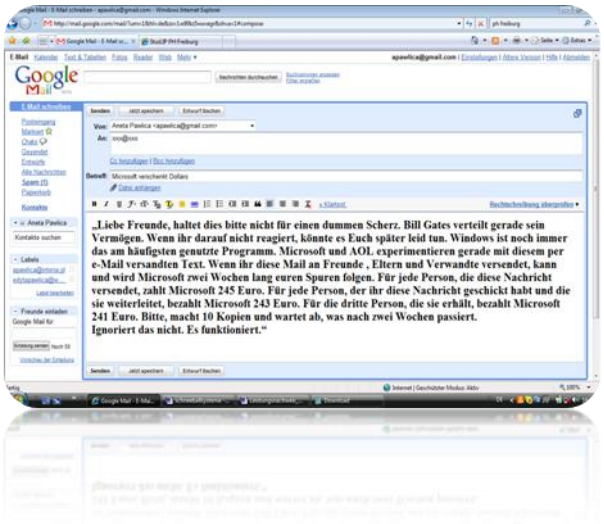
The situation*

Maybe you have already got an email as the one which was received by a German student:

Dear Friends,

Please do not take this for a junk letter. Bill Gates is sharing his fortune. If you ignore this you will repent later. Microsoft and AOL are now the largest Internet companies and in an effort to make sure that Internet Explorer remains the most widely used program, Microsoft and AOL are running an e-mail beta test.

When you forward this e-mail to friends, Microsoft can and will track it (if you are a Microsoft Windows user) for a two week time period. For every person that you forward this e-mail to, Microsoft will pay you $245.00, for every person that you sent it to that forwards it on, Microsoft will pay you $243.00 and for every third person that receives it, you will be paid $241.00. Within two weeks, Microsoft will contact you for your address and then send you a cheque.



I thought this was a scam myself, but two weeks after receiving this e-mail and forwarding it on, Microsoft contacted me for my address and within days, I received a cheque for US$24,800.00. You need to respond before the beta testing is over. If anyone can afford this Bill Gates is the man. It's all marketing expense to him. Please forward this to as many people as possible.

Possible task

What do you think? Is this a real sure thing? Will the receiver of this email really gain money easily? (How much?)

* Idea and picture: Pawlica Aneta

Task 26: How far is the horizon?

The situation

Imaging you are enjoying a nice day in the seaside. Your go for a walk along the seashore and you can observe a beautiful sunset in the horizon.

Possible tasks*

How far is the horizon line?

Is there any difference if you observe the horizon line standing on the seashore or from a cliff like in the picture?

* Task adapted from Chevallard, Y., Bosch, M. and Gascón, J. (1997), *Estudiar matemáticasEl eslabón perdido entre la enseñanza y el aprendizaje*. Barcelona: Editorial Horsori.

Task 27: Fountains

The situation

The Alhambra in Granada (Spain) is one of the most beautiful places in the world. Among many other things, it is famous for its wonderful buildings, gardens and fountains. Particularly, in the Sultans' summer palace, called the "Generalife", visitors can find gorgeous fountains like the one in the picture.

Possible tasks

Could you find a mathematical model to describe the water curve?

Which are the main variables to control the shape of the water curve?

Imaging you have to regulate the fountains so that each pair of water jets lands on the same spot. How could you do that?

What is the "limit" of regulation so that the water jets do not fall outside the fountain?

Task 28: Hotel entrance

The situation

In many hotels, as well as in other public buildings, it is usually to find revolving doors like the one in the picture, which was taken in a hotel in Valencia (Spain). This door is divided into three sectors but, for instance in Barcelona airport; you can find also revolving doors that are divided into two sectors.

Possible tasks

Why are these doors often used in hotels instead of sliding doors?

What is the difference in choosing a three sector as opposed to a two sector door?

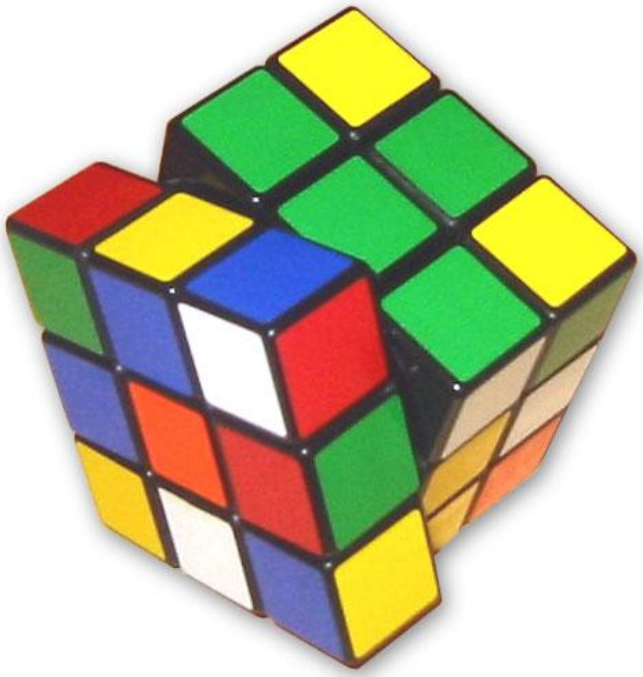
What is the best number of sectors for one of these doors? What is the best size of door?

Is it possible to find a relation between the number of people that could go through a door and its size?

Task 29: Broken Rubik's cube

The situation

The Rubik's Cube is a 3-D mechanical puzzle invented in 1974 by a Hungarian sculptor and professor of architecture Ernő Rubik. It was commercialised ion 1980 and it has become world's top-selling puzzle game.



Thanks to AndyHedges, published at Wikimedia Commons

Possible tasks

How many cubes do I need to make a Rubik's cube?

How many have got 1 red side?

How many have 3 sides coloured in?

How many cubes of each kind do I need to make a 4 by 4 by 4 Rubik's cube?

Task 30: A sweet cake

The situation

Andrew enjoys baking his owns biscuits: it is the only way he has found to have different biscuits every week!!! He also likes to try different toppings and decorations.

Tomorrow is Andrew's birthday and he is decorating 20 new biscuits. He has decided to line them up and put icing on every second biscuit. Then he puts a cherry on every third biscuit. Later, he puts a chocolate button on every fourth biscuit.

Possible tasks

Following Andrew's decoration strategy, there is nothing on the first biscuit.

How many other biscuits had no decoration?

Did any biscuits get all three decorations?

What happens if he decides to bake more biscuits?