WHITEPAPER

ForClassmates™

Humanly by students

Version 1.5 (23 July 2021)

What do we do?	Who are we?	How and why did it all come about?	Why a silent partner?	Vision
Problems and solutions	Finished products	Results so far	Media	Events
Awards	Sponsors	What do we want to create?	Marketing	Business
Strategy	Investment	Financial plan	Valuation	Silent partner
SWOT analysis	Cryptocurrencies	Contacts		

What do we do?

ForClassmates™
Humanly by students

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We create

We started with printed textbooks and workbooks, and examples on the web. We added collections and the first version of online learning. **Our goal is to build the best educational online platform.**

We educate

We want to present schoolwork to students in a clear, organised and fun form, tailored to everyone.

We modernise

We no longer just publish printed textbooks but also make use of today's technologies and implement them in education.

Who are we?

ForClassmates™
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WHO WE ARE

Elevator pitch

You must have experienced the feeling at school when you just don’t get what you’re studying. When you’re confused, bored, and don't even know why you have to learn this. We know the feeling. That's why we came up with our own online solution, which describes the school material step by step, in easy-to-understand language written by students themselves.. Our application adapts to your needs, using enjoyable content that will not only give you the education you need, but will make you think outside of the box..

www.forclassmates.io

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Company management

Lukáš Král

CEO | Co-owner

Marek Liška

CVO | Founder | Co-owner

Radek Lekeš

CRO | Co-owner

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Lukáš Král
CEO | Co-owner

TEAM

Story and results

In October 2015, I learned about the Maths for Classmates project. I came for an interview and a presentation of the project, where I met Marek. I started collaborating on examples on the web and other modifications of the “Equations and Inequations” textbook on a casual basis.

In the summer of 2016, Marek offered me the opportunity to co-author textbooks and workbooks. In December, Marek and I started talking about online learning, and in the spring of 2017 we created the first designs and a description of an educational application. In the meantime, at the end of 2018, we managed to complete a comprehensive series of Maths for Classmates textbooks and workbooks for secondary schools.

I took over the development of ForClassmates online learning and subsequently became the Director of Development of the entire company. In October 2020, we released the MVP version of the ForClassmates online learning, and now I have a clear vision of how I want to run the company as the CEO.

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Marek Liška

CVO | Founder | Co-owner

TEAM

Story and results

In 2012, thanks to the tutoring of my classmates, I came up with the idea of writing a procedure for solving maths problems in a clearer way. This idea gradually developed into a startup, which allowed me to publish in 2015 the first official textbook of mathematics written by students.

Since then, I have run the company as the CEO, at the same time being the author of a complete line of maths textbooks and workbooks and guiding the company's vision.

Now, I will focus on developing the company's vision as a Chief Visionary Officer, ensuring compliance with the vision across all our products and establishing cooperation with foreign partners. I want to extend our method not only to other subjects but also to more countries, so that it can help other students who have troubles with mathematics, among other subjects, as my classmates and I used to have.

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Radek Lekeš
CRO | Co-owner

TEAM

Story and results

In March 2016, I received an offer to become a sales representative and creator of distribution for the Czech Republic within the Maths for Classmates project. At the beginning, I had to design a complete solution to address schools and process orders.

During the 3 years of my work in the project, as a sales representative and later a sales director, I was able to build a network of 134 secondary schools (10% of the market) and negotiate partners in the field of book distribution. In September 2018, I worked my way up to the position of executive director and was in charge of the expansion into Slovakia.

I want to use my skills in the field of negotiation and communication in the position of Chief Relationship Officer. I will arrange strategic partners and look for opportunities for the whole project not only in the Czech Republic but also abroad. I still want to be available as a consultant for the CEO and Sales Director.

Team experience

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At the beginning of 2019, an amendment to the Trademark Act came into force, which required each trademark owner to guard their own trademark. It occurred to us that this verification could take place automatically in a web application, so **MoniMark s.r.o.** was established.

Due to our internal needs and demand from clients, we decided that we will use all our experience from development and start building a digital agency **Royal Fox s.r.o.**

In 2018, we got together a team of people with many years of experience in the field of subsidy programs and related administration, so we founded the company **Dotace bez starostí s.r.o.**

MoniMark®

www.monimark.eu

Royal Fox

www.royal-fox.cz

DOTACE
BEZ STAROSTÍ

www.dotacebezstarosti.cz

How and why did it all come about?

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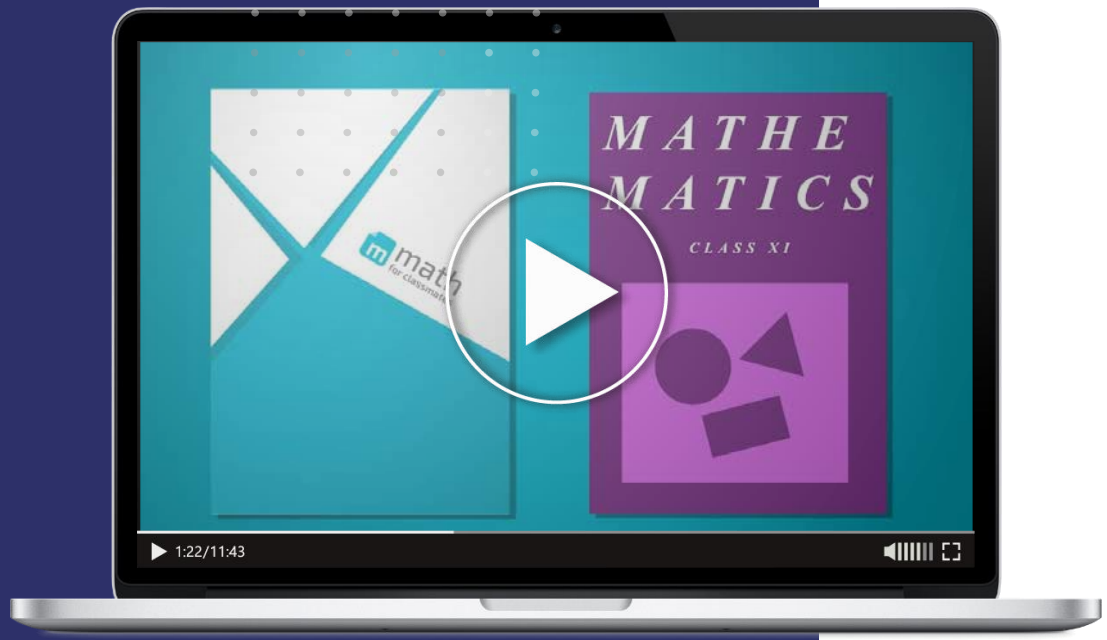

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HISTORY

Math for classmates

In 2017, we created our first video translated into English describing our vision. You can compare what we planned to what we have created since then.

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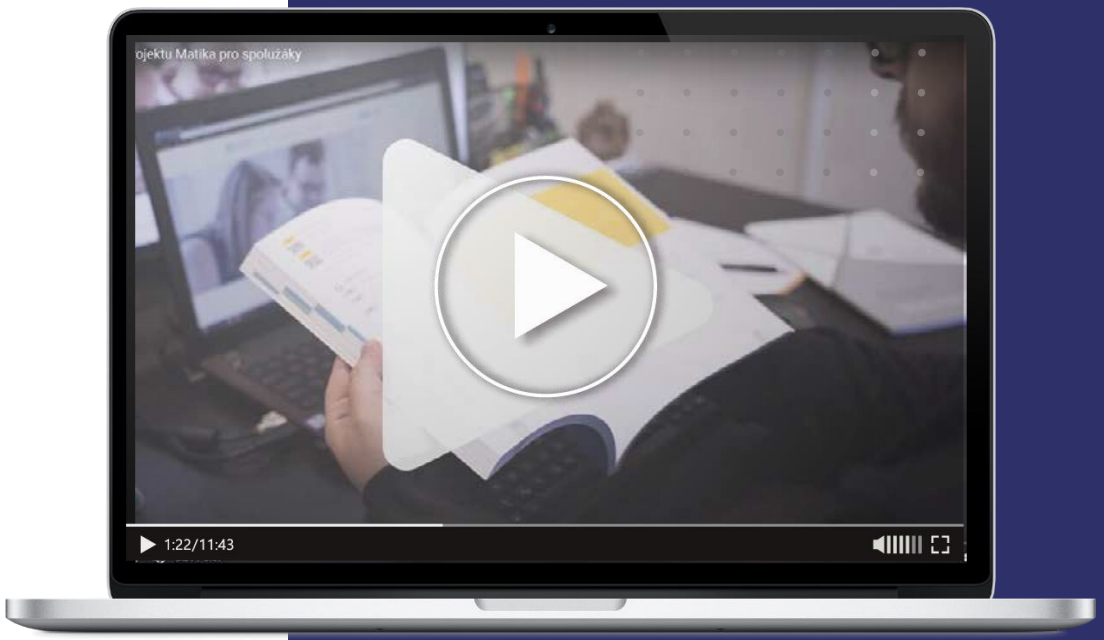
HISTORY

Filmed story

In **2018** , we made a short video describing the important moments that led to the creation of the ForClassmates project.



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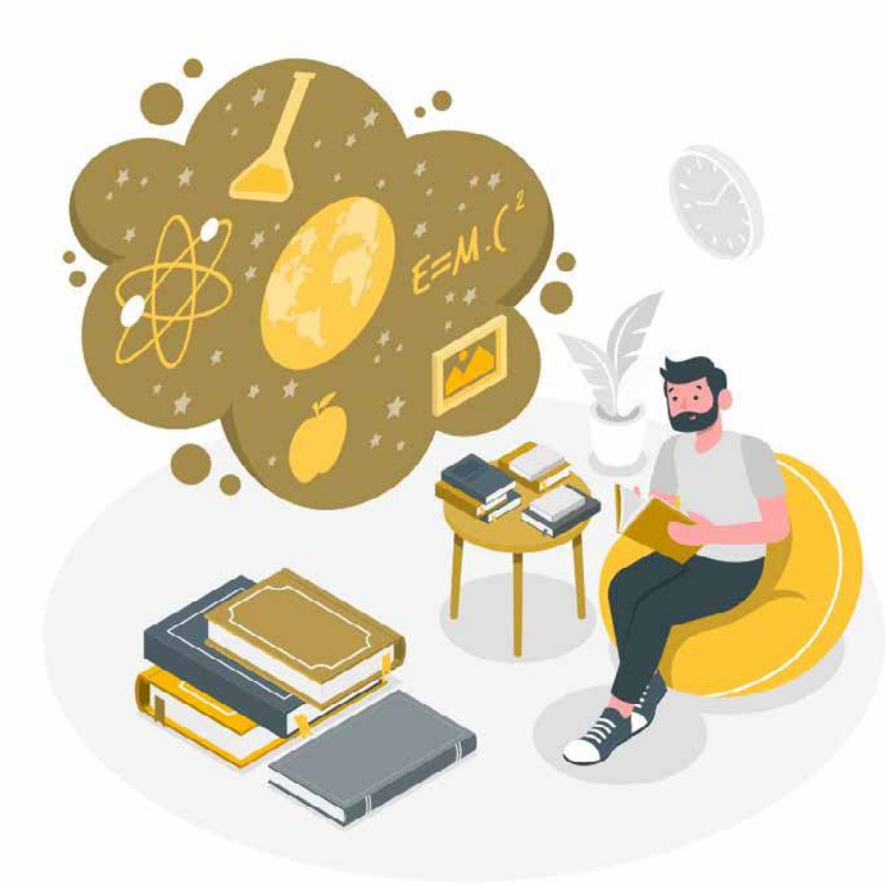
PRINTED PRODUCTS

What makes our textbooks unique?



- The textbooks are **written by** students **themselves**.
- Written **in the students' own language** so that everyone can really understand them.
- All examples are solved **step by step**.
- **Colourful easy-to-follow design** compared to existing textbooks.

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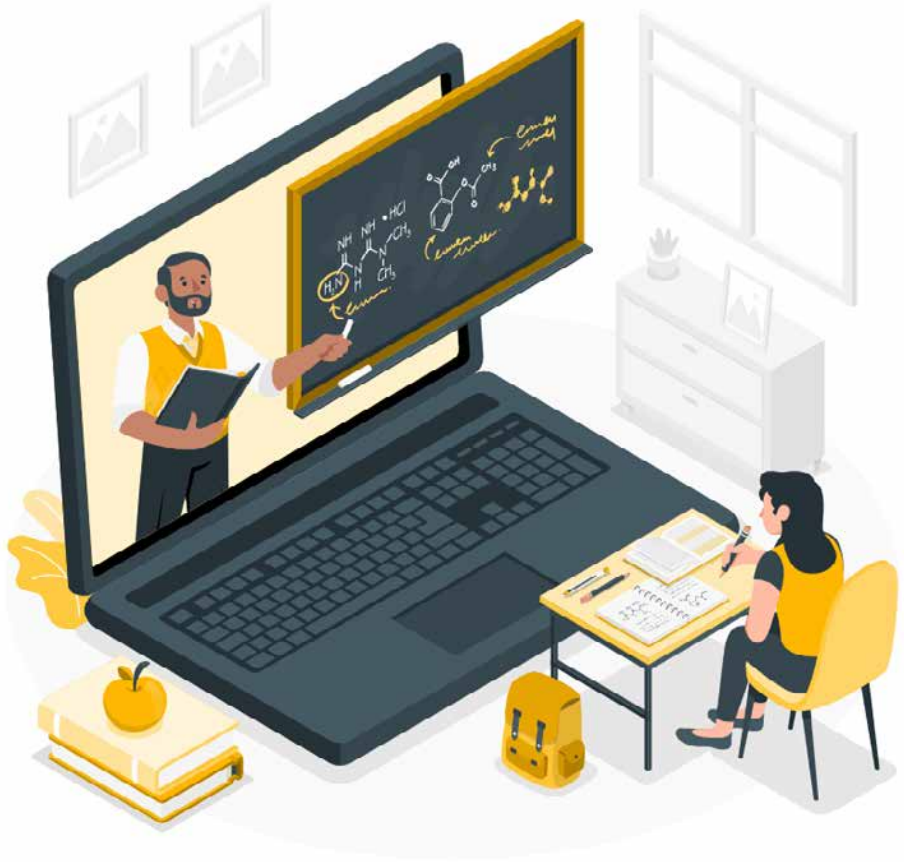
ONLINE PRODUCTS

What makes our online learning unique?



- All content **is created by students**, who know their own generation.
- Examples solved **step by step**, it does not happen that a student can't manage to solve a problem.
- **Tailoring** not only content but also applications.
- **Interactivity** is the best tool to understand a subject (interactive graphs or videos).

Why a silent partner?

WHY A SILENT PARTNER?

Simple project financing

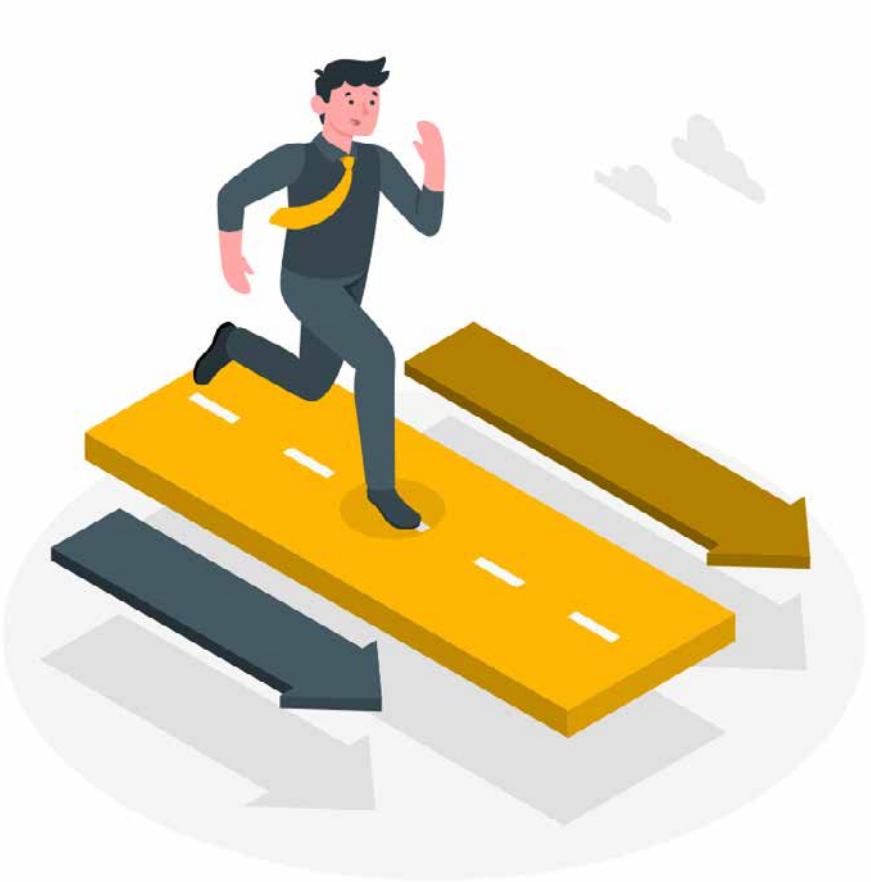
We really liked the unique possibility of financing through a silent partner as no one will be busy with any administration or lengthy process. **An investor can buy a share of the profits through our investor platform from anywhere.**

WHY A SILENT PARTNER?

Perfect timing for online education

There has never been a better time to invest in online education than now in the coronavirus era, when most students have to be locked up at home and learn remotely. Due to coronavirus, student performance is deteriorating, and their knowledge level is falling. **Students have not been at school for more than a year in most countries**.

We have the potential to **expand** abroad with our learning and to conquer the world as we endeavour to pass subject matter on in a comprehensible student-based language.



SILENT PARTNER

More details

You will learn more details **about the silent partnership, financial plan and company structure** in the second half of this presentation.

Vision

ForClassmates™
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Everything is being modernised, why not education?

The world is changing every day. The only thing left behind in most places is education. Education is the basis of everything, but at the same time its quality is far behind. We want to change that. Everyone spends a lot of time at school, so don't let that time **be wasted.**

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Marek Liška
CVO | Founder | Co-owner

Lukáš Král
CEO | Co-owner

VISION

Fun, meaningfulness and individuality

"We want education to be taken as something valued in our society. So that one remembers school fondly, likes to encourage his/her children to be educated themselves and to make pupils and students happy to go to school and know that the time spent there is a very good investment in their own future. Our vision is based on three basic pillars – fun, meaningfulness and individuality. If we achieve an individual approach to education that makes sense and entertains the student, then we will be on the path to truly changing the world.

Vision 2021 – 2030

ForClassmates™
Humanly by students

VISION

Tailor-made

Our vision is tailor-made to each user. **The content can be set automatically according to gender**, **age** (slang and number of technical words) or **location** (e.g. in the Czech Republic a student will have the task of travelling between Prague and Brno, but in Slovakia between Bratislava and Košice). **The level of complexity of tasks** and **the types of content** are also **adapted**. (Some pupils learn better from videos and sound, others from text and practising, and still others from graphs and illustrations.) Each one prefers a different method.

To do all this, we will use modern **Machine Learning** and **Artificial Intelligence technologies**.

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VISION

Own schools

One day we would like to have our own school where all students will use our methods and materials. This will give us a space where we can really test and improve online learning in schools. We will get results and evaluate the company's brand.

We will teach things needed in real life, such as critical thinking or financial literacy.

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VISION

System for schools

We plan to create **a fully fledged system for schools** to have **everything in one place**. A single application will be enough for the school for teaching and administration. We will give schools **lessons**, **attendance**, **schedule**, **grading**, **contracts**, **statistical data**, **test results**, **comparing** among classes and other schools.

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VISION

Community of teachers and their training

Creating a community of teachers who **help each other and share experiences, materials and teaching methods**. They will be able to participate in editing the content in the system with their notes.

We will **organise training sessions for teachers and show them how to teach with our application**. We will connect them and together we will be able to change education.

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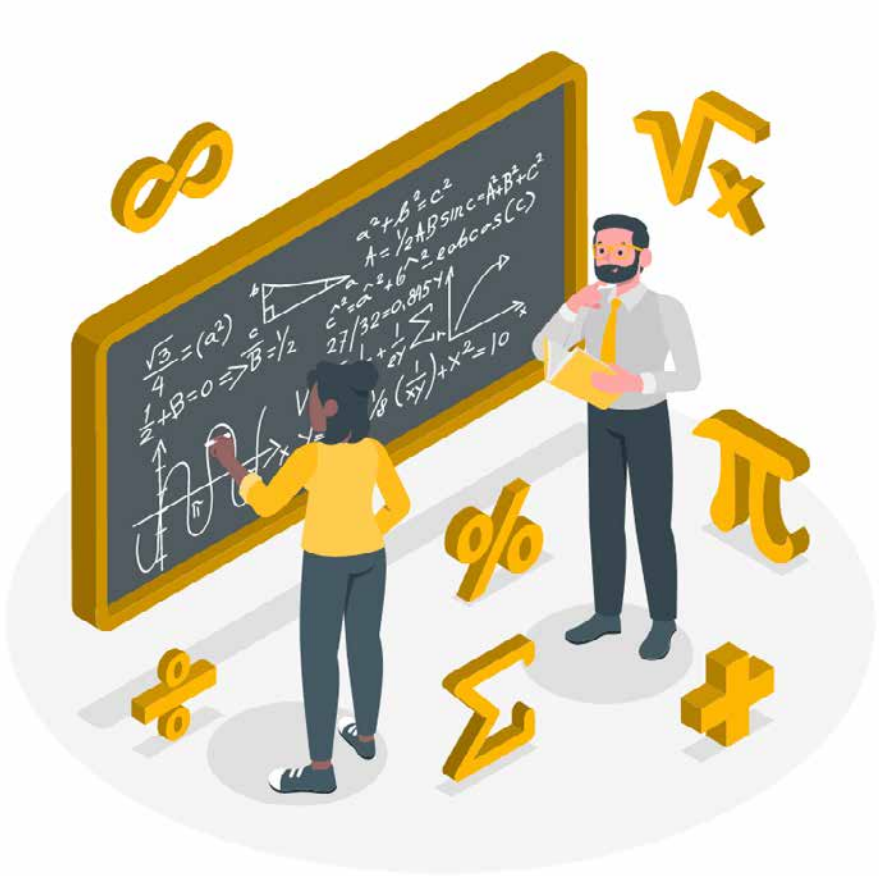

VISION

Teacher as a mentor

Our goal is not to replace teachers but to give them a tool to become **a mentor and guide for students**. They will spend less time with administration, test corrections, grading and, conversely, more time will be devoted to individual students.

ForClassmates™
Humanly by students

VISION

Portal for parents

Parents lack an overview of their child's learning and easy communication between them and the school. We will make providing a letter of excuse more efficient for them. They will have a tool for helping their child learn and an overview of grades. **They will see what their treasured child is good at, what he/she could study in the future and areas that need work**.

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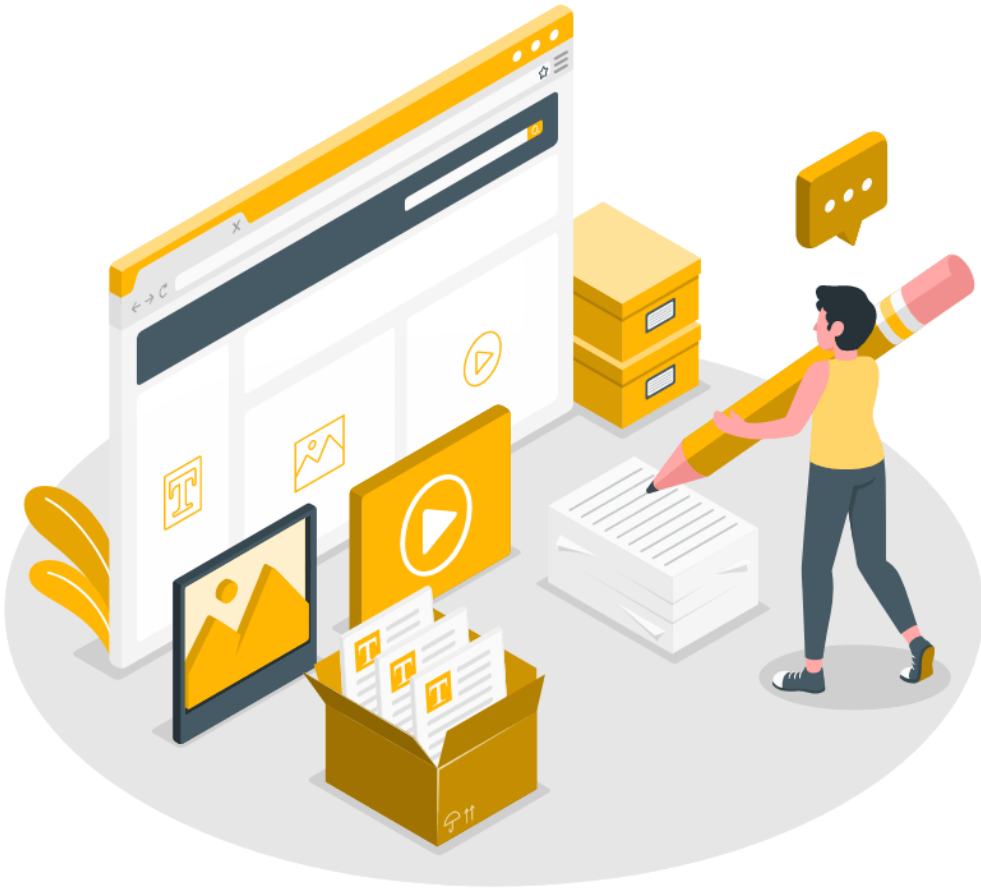

VISION

Special content

In our opinion, today's education lacks teaching of other subjects, such as financial**literacy, first aid or the development of critical thinking**. Students miss out on lessons in things **they will need in real life**.

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VISION

Translation into other world languages

In addition to translations into Czech, English and Spanish, we want to translate our education into other world languages, such as **Portuguese**, **French**, **German** or **Polish**.

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VISION

Identifying strengths and weaknesses

In the future, the system should say what a student's strengths and weaknesses are, what he/she should work on and what he/she can further improve. It will help students to get to know themselves and study further.

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VISION

Available education for everyone

Our strategy is to help as many students as possible with their education, which is why **we want to offer our application with its main functions to everyone for free, but we are not neglecting the premium version with extra functions**.

Problems and solutions

Problem No. 1

Teachers used to be straight-A-students

“

Usually, a teacher or even a professor (academic at a university) is a person who has not had problems with the subject at school. He or she was good at it without much effort, so he or she decided to continue his/her studies at university and make a living from it throughout all his/her life. But then it is difficult for him/her to understand a person who does not enjoy the subject, has no talent for it, does not want to pay attention to it in the future and takes it as one of the ten subjects that must be learned at school.

Solution No. 1

Teachers used to be straight-A-students

“

The content is written by students who enjoy the subject but are not at the top of the class. We are looking for people who can learn and understand particular subject matter but at the same time had to devote some time and energy to it, which means put some effort into it.

Problem No. 2

Lack of time

In today's hectic life, students do not want to spend their free time learning and doing tedious tasks. The teachers' situation is the same. Instead of spending time with family or friends, they have to correct and evaluate tests, check homework, prepare for the next day or deal with unnecessary administration.

Solution No. 2

Lack of time

The online system that is tailored to each student will help a teacher pinpoint a student's weaknesses, while the system will gradually work to overcome the weaknesses and consolidate where he or she is doing well. A teacher thus has more time to devote to the problematic topic. The vision is that a teacher will not be a teacher, but a guide. The main teaching component will be our online system. Test generation and auto-correction, including automatic homework correction, save the teacher time.

Problem No. 3

The old generation teaches the young one

The subject is often explained very technically in the teaching materials or in the teacher's presentation because it is explained by people at least 15 years after the time when they studied the subject themselves. At the same time, the teaching profession is one of the oldest professions in terms of average age, which is about 47 years. This means that the age difference from a 15-year-old ninth grader is 32, which is almost two generations.

Solution No. 3

The old generation teaches the young one

It is written by students, i.e. peers who have relatively recently learnt the subject matter they are explaining. They are the same age group and are much closer, so they can include current topics, jokes, technology, etc. in the teaching.

Problem No. 4

Low motivation and concentration

Our society has reached a stage where it does not appreciate the opportunity to go to school. Most students go to school because of their parents, because of their social status and because of the so-called paper (school-leaving exam or academic degree). The motivation to study is decreasing, not only because of the outdated curriculum, where people have to learn a lot of information that is nowadays easy to find anywhere, but also because people have an impaired capacity to concentrate due to the amount of information, news, advertising and everything. Each of us has several thousand stimuli every day that vie for our attention, and we are used to doing more than one thing at a time, so focusing on one thing, such as studying particular subject matter, is almost impossible.

Solution No. 4

Low motivation and concentration

We are going to motivate users primarily through gamification. What can you imagine under that? A playful form of learning, where a student will no longer simply listen to what a teacher is saying or read what is written in the textbook glassy-eyed, but will be fully involved in learning through games or competitions. At the same time, he/she will gain experience, advance to the next levels and collect rewards. The learning will incorporate certain elements such as an interactive video that will not just let him/her watch, but during the course it will pause and the student will have to answer questions from the video.

Problem No. 5

Missing data

Organisations are nor the only ones lacking data on education. Above all, it is students themselves who do not really know if they are good at a given topic or type of task or need to work on it. A user is not aware of how much time he/she spends learning, which subjects, topics or types of tasks he/she does well or not. The state does not have exact data on whether students will manage the state school leaving exam or how it needs to be set. We do not know if more students are good at maths or chemistry and which schools have poor results in the subjects. Furthermore, there is a great deal of even more important data that is lacking.

Solution No. 5

Missing data

We will have an application that will collect this data. It will gather it anonymously and will adapt the subject matter to students according to their knowledge. They will finally know how well they are doing, and the system will immediately guide them to a specific subject matter that they should go through and practice again.

They will be able to look at the statistics page where they will see an overview of their learning. Likewise, data will be available for teachers and principals to see what a class or school is doing well and what needs to be worked on.

Problem No. 6

Incomprehensibility of presentation

In current textbooks and online educational courses, it often happens that students miss part of a explanation, do not understand where they made a mistake and have difficulties finding the right course of action. There are a lot of video-only courses, or you will only find examples with results, but that's not enough.

Solution No. 6

Incomprehensibility of presentation

The content is written by students who have experience with learning setbacks. We supplement theory with visual elements, such as illustrations or pictures, and we also use interactive videos where a user learns with immediate feedback whether he/she has really understood certain subject matter. We explain each task step by step. We try to change the types of tasks so that a student does not get used to just choosing from options “a), b), c)”.

Finished products

ForClassmates™
Humanly by students

COMPARE YOURSELVES

Social impact award 2015

Watch a video from the **Social Impact Award 2015**. **Compare for yourself** what our textbook looked like before and what our plans were with **how we have moved in that time and what we have created**. You will see the finished products on the following pages.

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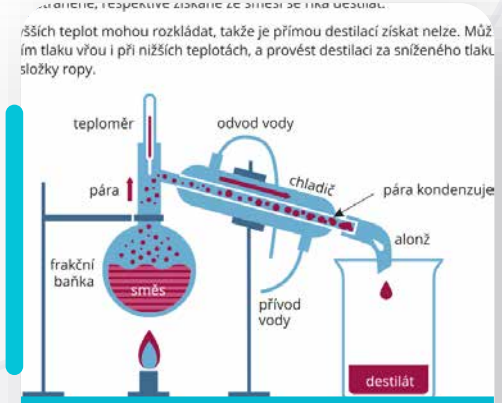
FINISHED PRODUCTS

Printed books

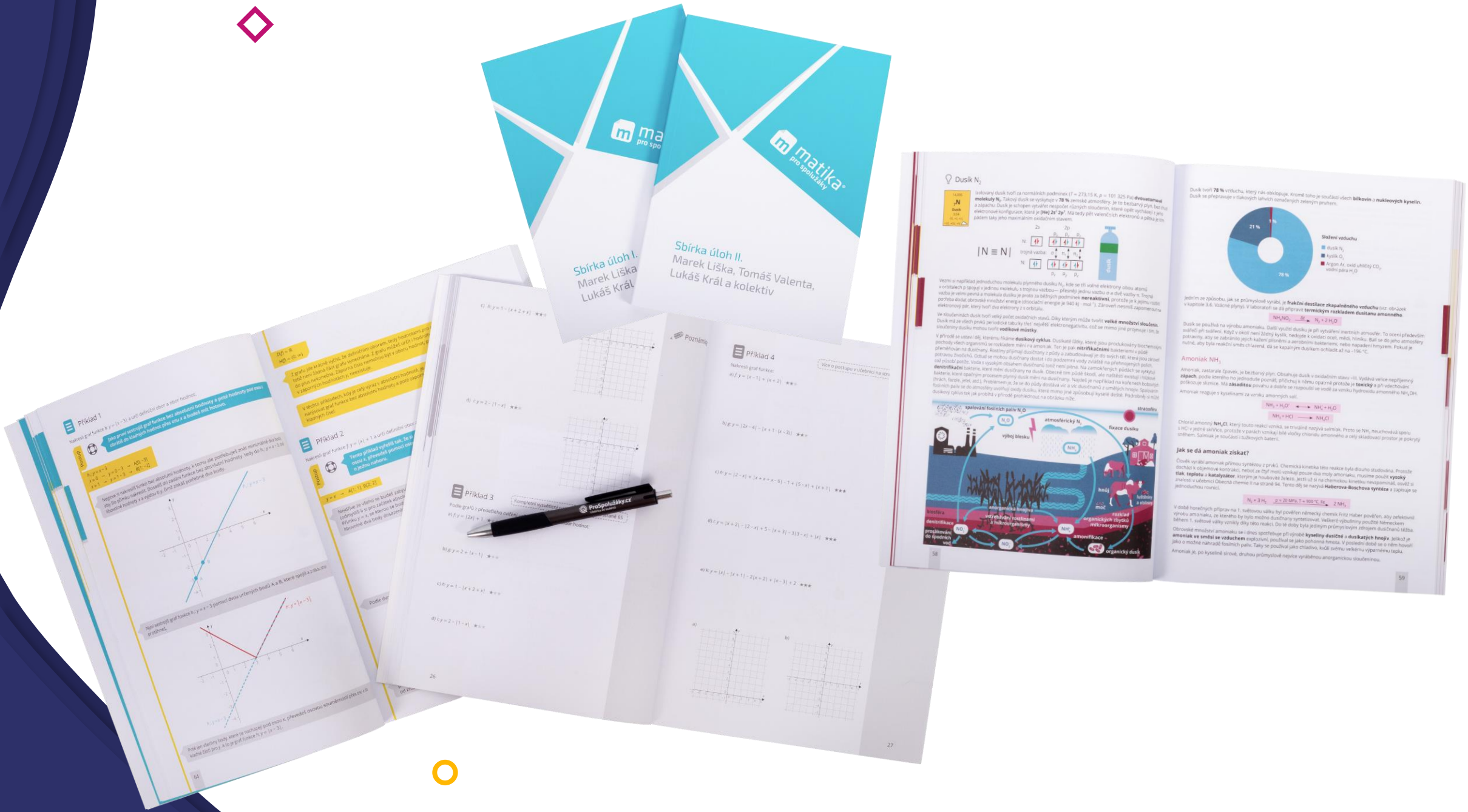
MATHEMATICS

CHEMISTRY

EXPERIMENTS



RECAPS


matika pro spolužáky
Sbírka úloh I.
Marek Liška
Lukáš Král
Sbírka úloh II.
Marek Liška, Tomáš Valenta,
Lukáš Král a kolektiv
Příklad 1
Příklad 2
Příklad 3
Příklad 4
Poznámky
ProSpolužáky.cz
Dusík N_2
$|N \equiv N|$
trojná vazba
dusík
spalování fosilních paliv N_2O
atmosférický N_2
fixace dusíku
výboj blesku
stratosféra
hnůj
moč
rozklad organických zbytků mikroorganismy
amonifikace
organický dusík
denitrifikace
prosakování do spodních vod
Složení vzduchu
dusík N_2
kyslík O_2
Argon Ar, oxid uhličitý CO_2, vodní pára H_2O
21 %
78 %
1 %
Amoniak NH_3
Jak se dá amoniak získat?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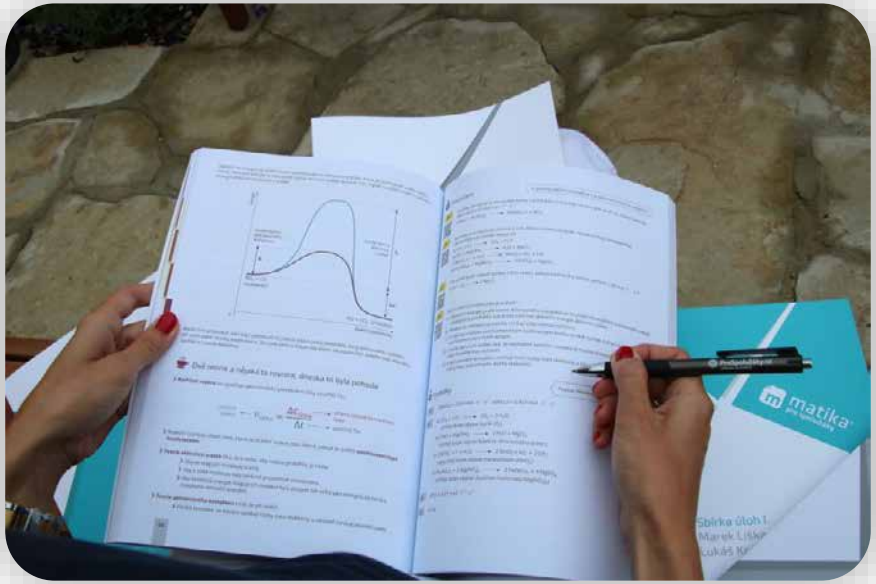
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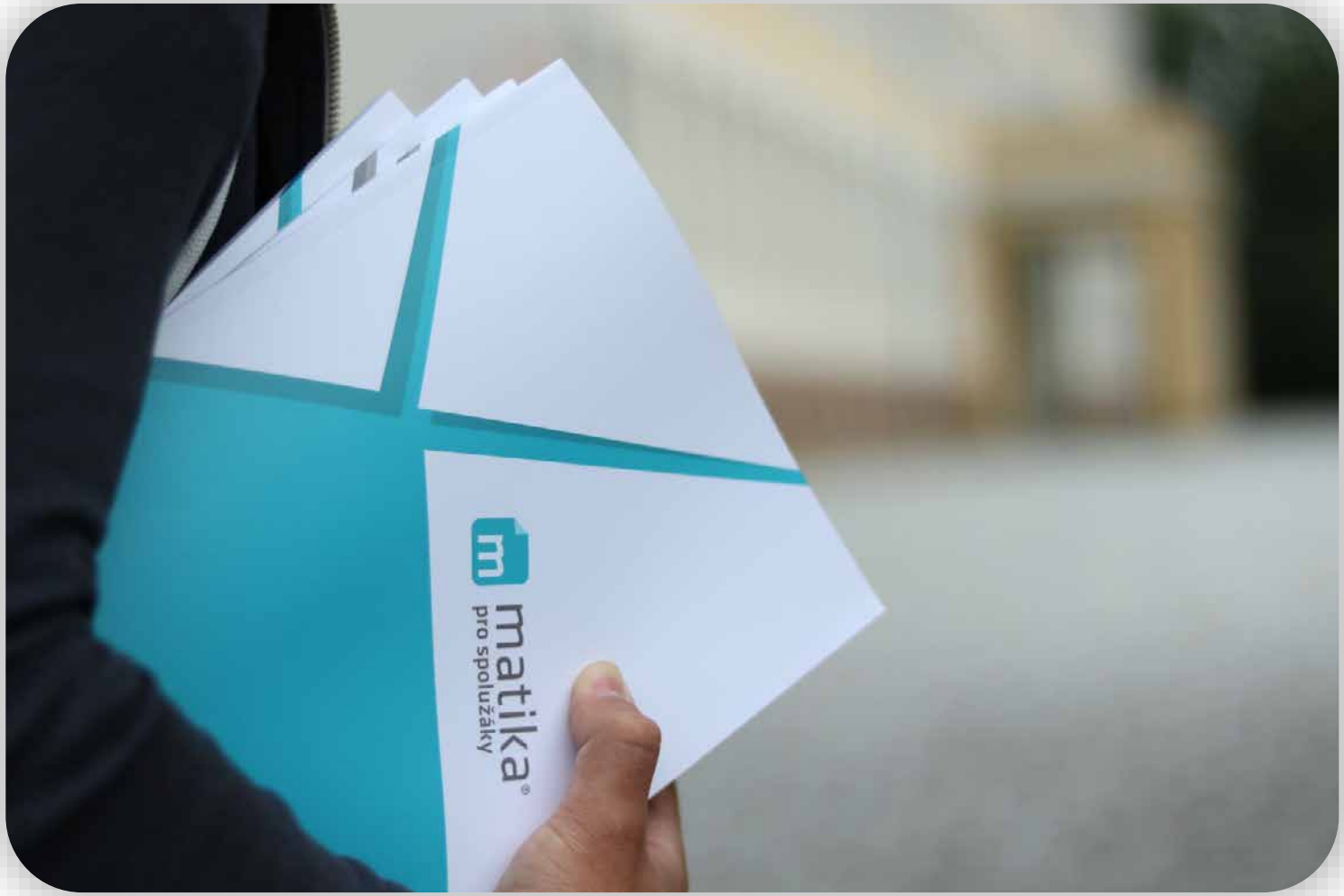
Kombinatorika
Pravděpodobnost
Statistika



Textbook of maths and its structure

matika®
pro spolužáky

Textbook

Textbook title	ISBN
Maths for Classmates: Basic knowledge (textbook)	978-80-88255-44-4
Maths for Classmates: Equations and inequations (textbook)	978-80-88255-46-8
Maths for Classmates: Planimetry (textbook)	978-80-88255-52-9
Maths for Classmates: Functions (textbook)	978-80-88255-50-5
Maths for Classmates: Goniometry (textbook)	978-80-88255-48-2
Maths for Classmates: Stereometry (textbook)	978-80-88255-28-4
Maths for Classmates: Analytical geometry (textbook)	978-80-88255-54-3
Maths for Classmates: Sequences and series (textbook)	978-80-88255-30-7
Maths for Classmates: Differential and integral calculus (textbook)	978-80-88255-32-1
Maths for Classmates: Combinatorics, Probability and Statistics (textbook)	978-80-88255-39-0
Maths for Classmates: Complex numbers (textbook)	978-80-88255-37-6

154
topics

1,662
pages

2,734
examples

matika®
pre spolužiakov

Textbook

Textbook title	ISBN
Maths for Classmates: Basic knowledge (textbook)	978-80-89960-00-2
Maths for Classmates: Equations and inequations (textbook)	978-80-89960-02-6
Maths for Classmates: Planimetry (textbook)	978-80-89960-04-0
Maths for Classmates: Functions (textbook)	978-80-89960-06-4
Maths for Classmates: Goniometry (textbook)	978-80-89960-08-8
Maths for Classmates: Stereometry (textbook)	978-80-89960-11-8
Maths for Classmates: Analytical geometry (textbook)	978-80-89960-13-2
Maths for Classmates: Sequences and series (textbook)	978-80-89960-15-6

122
topics

1,342
pages

2,272
examples


kapitola 2

část 3

Intervaly

Základní poznatky › Teorie množin

Co po tobě budu dneska chtít?

V této podkapitole tě naučím pracovat s intervaly, správně je zapisovat a zakreslovat na číselnou osu. Budeš vědět, jaké typy intervalů existují a jaký je mezi nimi rozdíl. Nakonec ti ukážu, jak udělat průnik a sjednocení dvou intervalů, protože tahle dovednost je opravdu velmi důležitá, tak tuto látku nepodceň.

Na co to budeš jednou potřebovat?

Odpověď na tuto otázku můžeš nalézt na konci této podkapitoly, kde ti řeknu, v jakých konkrétních případech v životě se s intervaly setkáš, tak dočkej času jako husa klasu.

S čím to bude v matematice souviset?

Intervaly se používají opravdu téměř všude a jejich znalost je tedy nutná. Setkáš se s nimi například u určování podmínek pro neznámou v Rovnicích a nerovnicích nebo při řešení soustav lineárních nerovnic.

Co je to interval?

Definice říká, že interval je podmnožina množiny všech **reálných čísel**, která je z obou stran **ohraničena** dvěma krajními body (krajní bod může být i nekonečno).

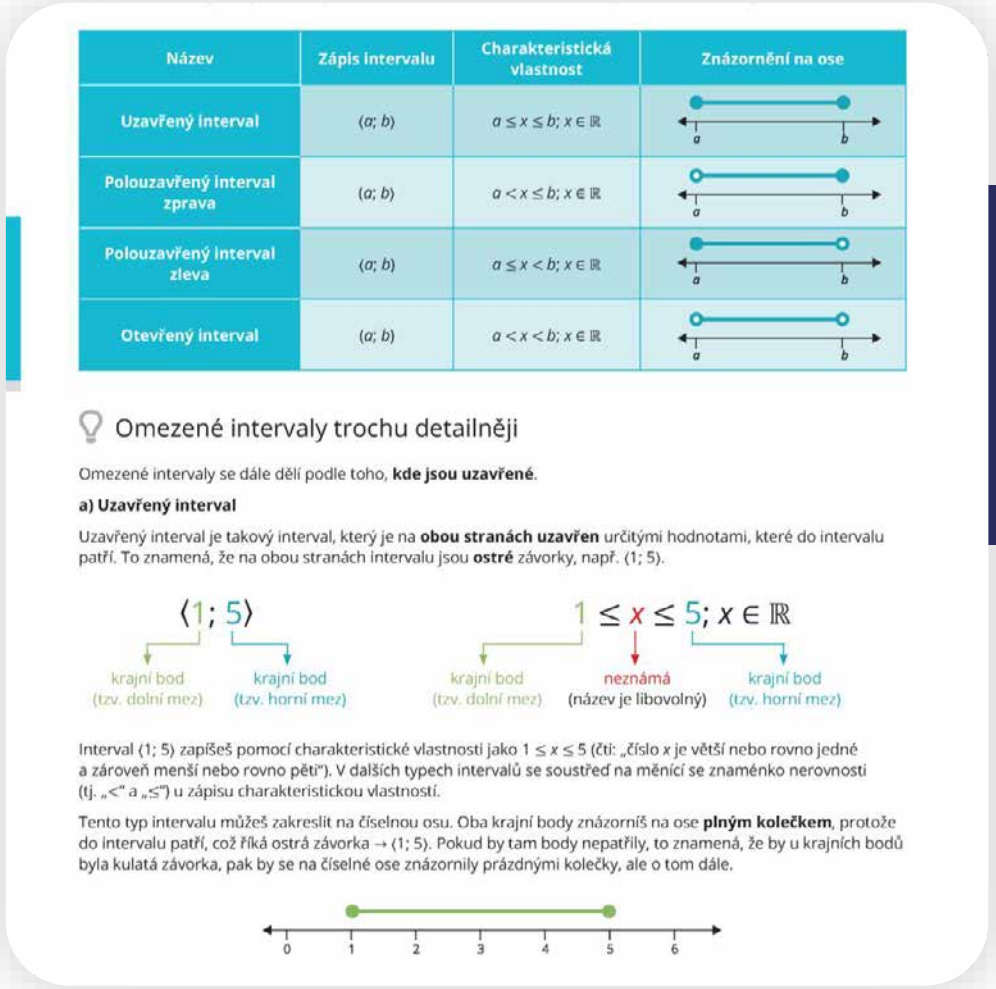
Interval je tedy soubor reálných čísel, která jsou **větší** (nebo rovna) danému číslu (či minus nekonečnu) a zároveň **menší** (nebo rovna) **jinému** číslu (či plus nekonečnu), například větší než 5 a menší nebo rovno 17, v matematičtině jako (5; 17). Nezapomeň především na to, že interval existuje pouze v reálných číslech.

matika pro spolužáky

INTRODUCTION

What's the use of it for me?

At the beginning of each subchapter there is an introduction that answers the most common question of a student: “What use will this have for me one day?” It also describes how the subject matter will be related to other subject matter at school and what will be learned in the given part of the textbook.



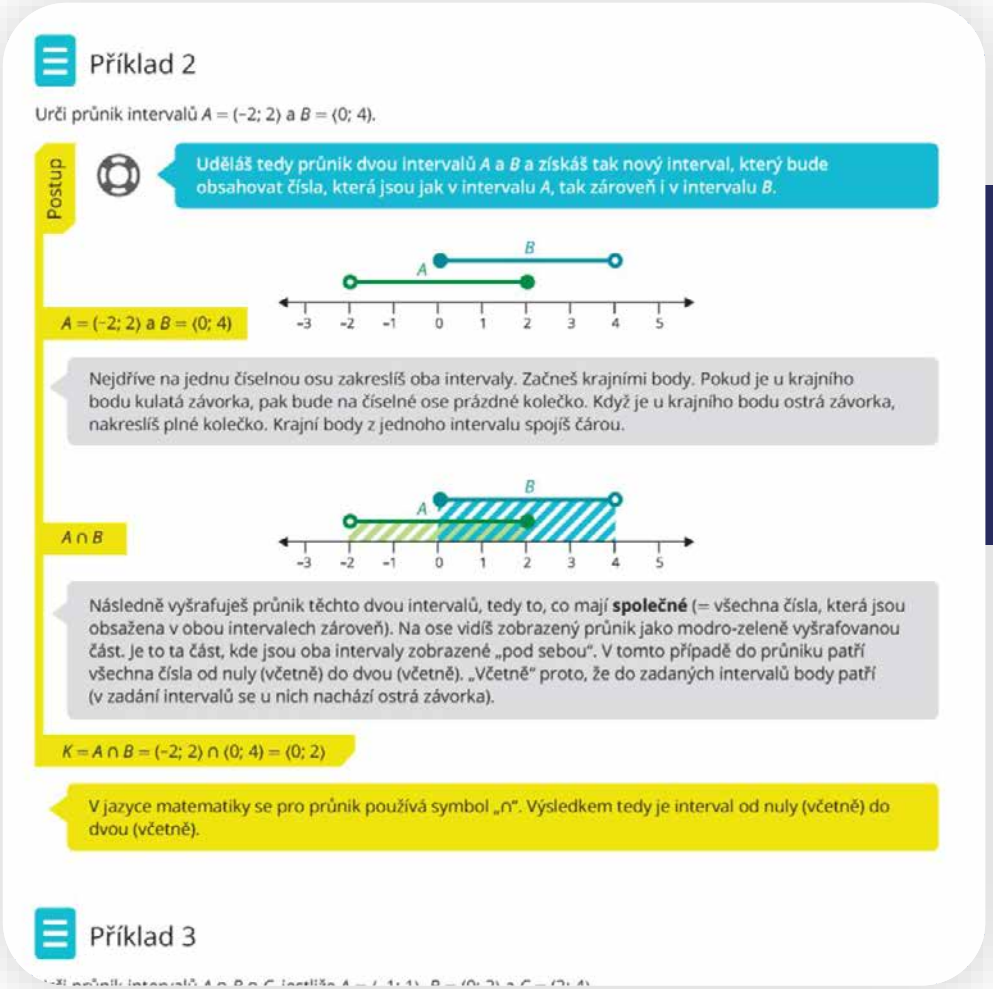
Název	Zápis intervalu	Charakteristická vlastnost	Znázornění na ose
Uzavřený interval	$(a; b)$	$a \leq x \leq b; x \in \mathbb{R}$	
Polouzavřený interval zprava	$(a; b)$	$a < x \leq b; x \in \mathbb{R}$	
Polouzavřený interval zleva	$(a; b)$	$a \leq x < b; x \in \mathbb{R}$	
Otevřený interval	$(a; b)$	$a < x < b; x \in \mathbb{R}$	

matika pro spolužáky

THEORY

Visually and approachably

A textbook without theory would not be a textbook, so the necessary theory can be found in our books as well. But it is written in an approachable manner so that everyone can really understand it. We supplement the professional theory with as many illustrative diagrams and tables as possible.



Příklad 2

Urči průnik intervalů $A = (-2; 2)$ a $B = \langle 0; 4)$.

Postup

Uděláš tedy průnik dvou intervalů A a B a získáš tak nový interval, který bude obsahovat čísla, která jsou jak v intervalu A, tak zároveň i v intervalu B.

$A = (-2; 2)$ a $B = \langle 0; 4)$

Nejdříve na jednu číselnou osu zakreslíš oba intervaly. Začneš krajními body. Pokud je u krajního bodu kulatá závorka, pak bude na číselné ose prázdné kolečko. Když je u krajního bodu ostrá závorka, nakreslíš plné kolečko. Krajní body z jednoho intervalu spojíš čárou.

$A \cap B$

Následně vyšrafuješ průnik těchto dvou intervalů, tedy to, co mají **společné** (= všechna čísla, která jsou obsažena v obou intervalech zároveň). Na ose vidíš zobrazený průnik jako modro-zeleně vyšrafovanou část. Je to ta část, kde jsou oba intervaly zobrazené „pod sebou". V tomto případě do průniku patří všechna čísla od nuly (včetně) do dvou (včetně). „Včetně" proto, že do zadaných intervalů body patří (v zadání intervalů se u nich nachází ostrá závorka).

$K = A \cap B = (-2; 2) \cap \langle 0; 4) = \langle 0; 2)$

V jazyce matematiky se pro průnik používá symbol „∩". Výsledkem tedy je interval od nuly (včetně) do dvou (včetně).

Příklad 3

matika pro spolužáky

SAMPLE EXAMPLES

Step by step

Each example is solved in detail in the textbook with a clear commentary on each step. So if a student does not know why a step is performed, he/she will look at the grey field where there is an explanation of what is happening there and why. If he/she understands everything, he/she is guided by a yellow line that shows only the mathematical steps.

„Otevírací doba je od 9:00 do 18:00."

Znamená to, že můžeš přijít v tomto časovém intervalu. Matematicky zapsáno: ⟨9; 18), (9; 18), ⟨9; 18) nebo (9; 18), záleží, jestli obchod zavřou a otevřou přesně.

„Děti do 15 let mají vstup zdarma."

Opět závisí na tom, jestli pořadatelé mysleli, zda i děti, kterým je přesně 15 let, mají vstup zdarma, tedy matematicky zapsáno: (0; 15⟩ nebo (0; 15). Také je i možnost, že pokud je někomu 15 let a 5 měsíců, tak mu je právně stále 15 let, tudíž i na něho by se sleva mohla vztahovat. Pak by se to matematicky zapsalo následovně: (0; 16).

„Nosnost plošiny je 1 000 kg."

Unese plošina ještě 1000 kg, nebo jen maximálně 999,99... kg. Matematicky to musí být přesně určeno, tedy buď ⟨0; 1000), anebo ⟨0; 1000). V reálném životě je například nosnost výtahu o mnoho vyšší, než je udáváno, protože je třeba počítat s různými fyzikálními faktory, a proto v běžném životě platí varianta ⟨0; 1000), takže se neboj, že by tě výtah neunesl.

„Zákaz vjezdu vozidel, jejichž výška přesahuje 3,5 m."

U tohoto příkladu už **nezáleží** na domluvě lidí, zde není počítáno s velkou rezervou (na ceduli je napsáno 3,5 m, tak skutečná výška mostu je jen o malinko vyšší, maximálně v řádech centimetrů), tudíž by zde byl použit interval s ostrými závorkami, tedy ⟨0; 3,5).

Vždy záleží, jak se lidé dohodnou, ale minimálně v matematice to musí být jasně dané, a proto jsou závorky u intervalů velmi **důležité**, tak na to prosím dávej pozor.

Neboj, už tě brzy nechám být!

Interval je soubor reálných čísel, která jsou větší (nebo rovna) danému číslu (či minus nekonečnu) a zároveň menší (nebo rovna) jinému číslu (či nekonečnu).

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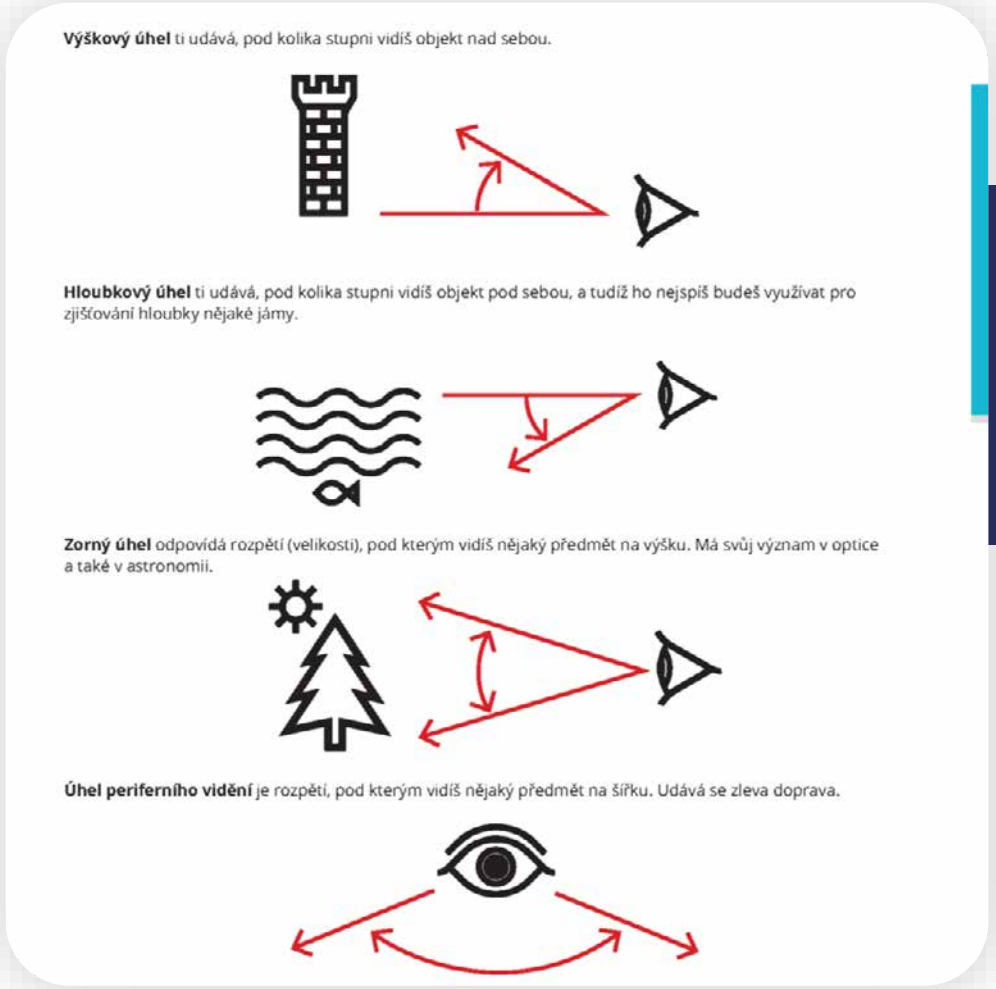
REAL-LIFE EXAMPLES

Where do I see that?

Almost every subject matter finds application in practice, and we try to show this with the help of various examples. If certain subject matter has no relevance in everyday life, it can be used for another subject matter that is already used in practice or to simply "merely" train the logical thinking that is used every day.



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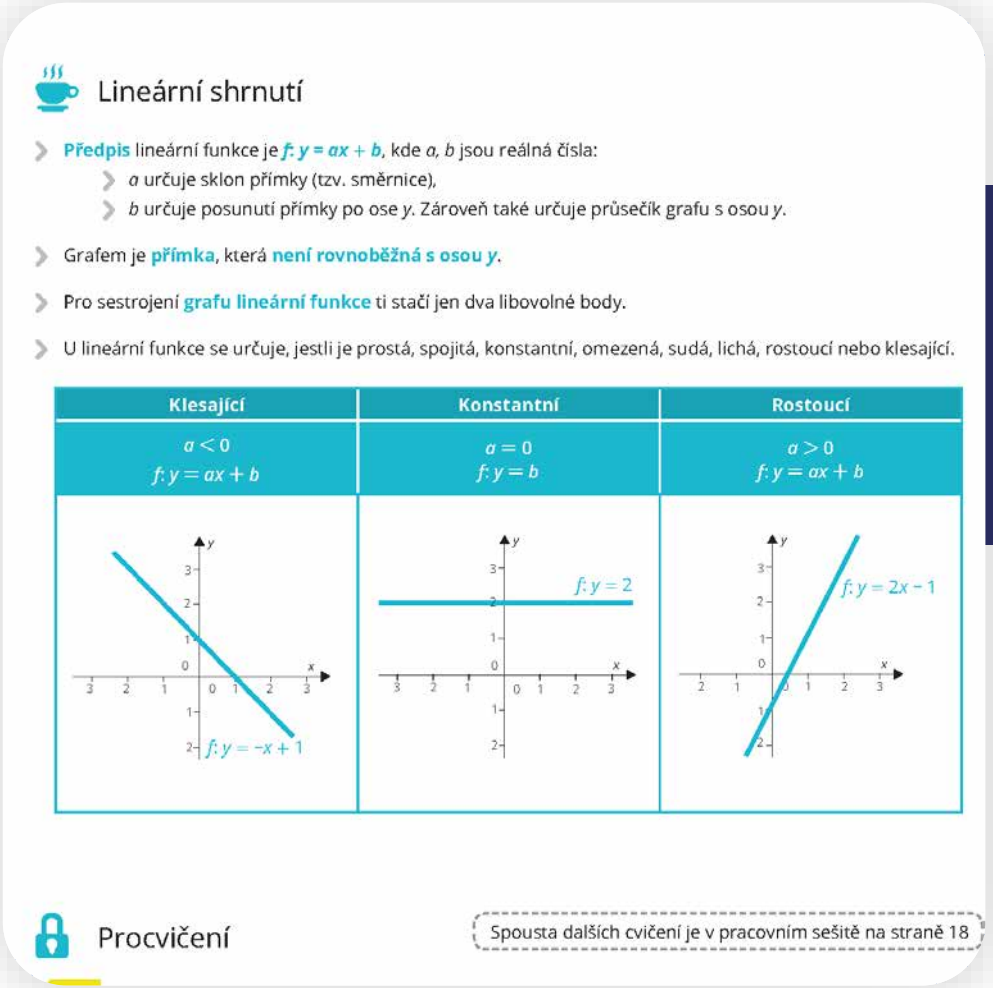
EXPLANATORY ILLUSTRATIONS

How to imagine it?

We supplement professional theory with as many explanatory illustrations as possible, which can explain a given situation much better than words. We emphasise simplicity, modernity and, of course, fidelity to our brand concept.



Lineární shrnutí

- **Předpis** lineární funkce je $f: y = ax + b$, kde a, b jsou reálná čísla:
  - a určuje sklon přímky (tzv. směrnice),
  - b určuje posunutí přímky po ose y. Zároveň také určuje průsečík grafu s osou y.
- Grafem je **přímka**, která **není rovnoběžná s osou y**.
- Pro sestrojení **grafu lineární funkce** ti stačí jen dva libovolné body.
- U lineární funkce se určuje, jestli je prostá, spojitá, konstantní, omezená, sudá, lichá, rostoucí nebo klesající.

Klesající	Konstantní	Rostoucí
$a < 0$ $f: y = ax + b$	$a = 0$ $f: y = b$	$a > 0$ $f: y = ax + b$

Procvičení

Spousta dalších cvičení je v pracovním sešitě na straně 18

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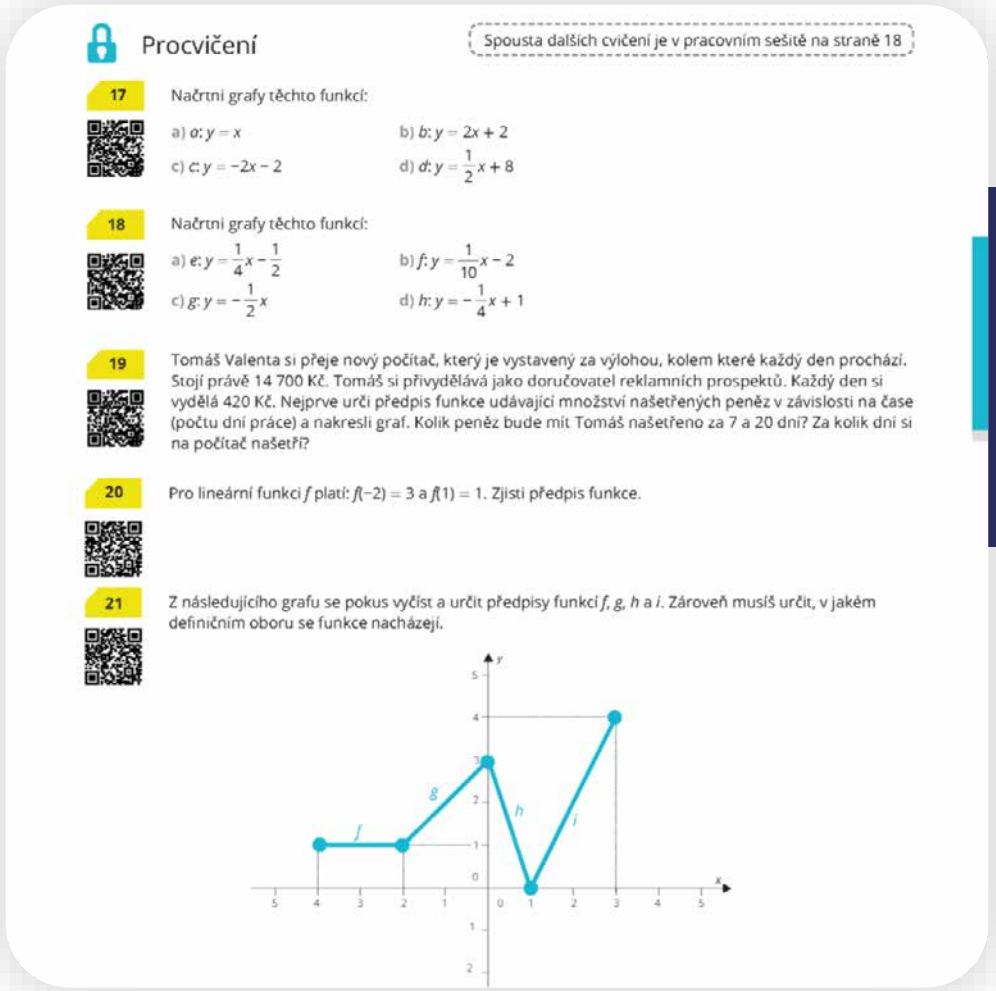
SUMMARY

What to take away from it?

Each subchapter at the end contains a brief summary of the whole subject matter. This summary is especially useful when preparing for a certain type of exam at school or as a check whether a student has passed the complete subject matter in the subchapter.



Procvičení

Spousta dalších cvičení je v pracovním sešitě na straně 18

17 Načrtni grafy těchto funkcí:

a) $a: y = x$ b) $b: y = 2x + 2$

c) $c: y = -2x - 2$ d) $d: y = \frac{1}{2}x + 8$

18 Načrtni grafy těchto funkcí:

a) $e: y = \frac{1}{4}x - \frac{1}{2}$ b) $f: y = \frac{1}{10}x - 2$

c) $g: y = -\frac{1}{2}x$ d) $h: y = -\frac{1}{4}x + 1$

19 Tomáš Valenta si přeje nový počítač, který je vystavený za výlohou, kolem které každý den prochází. Stojí právě 14 700 Kč. Tomáš si přivydělává jako doručovatel reklamních prospektů. Každý den si vydělá 420 Kč. Nejprve urči předpis funkce udávající množství našetřených peněz v závislosti na čase (počtu dní práce) a nakresli graf. Kolik peněz bude mít Tomáš našetřeno za 7 a 20 dní? Za kolik dní si na počítač našetří?

20 Pro lineární funkci f platí: $f(-2) = 3$ a $f(1) = 1$. Zjisti předpis funkce.

21 Z následujícího grafu se pokus vyčíst a určit předpisy funkcí f, g, h a i. Zároveň musíš určit, v jakém definičním oboru se funkce nacházejí.

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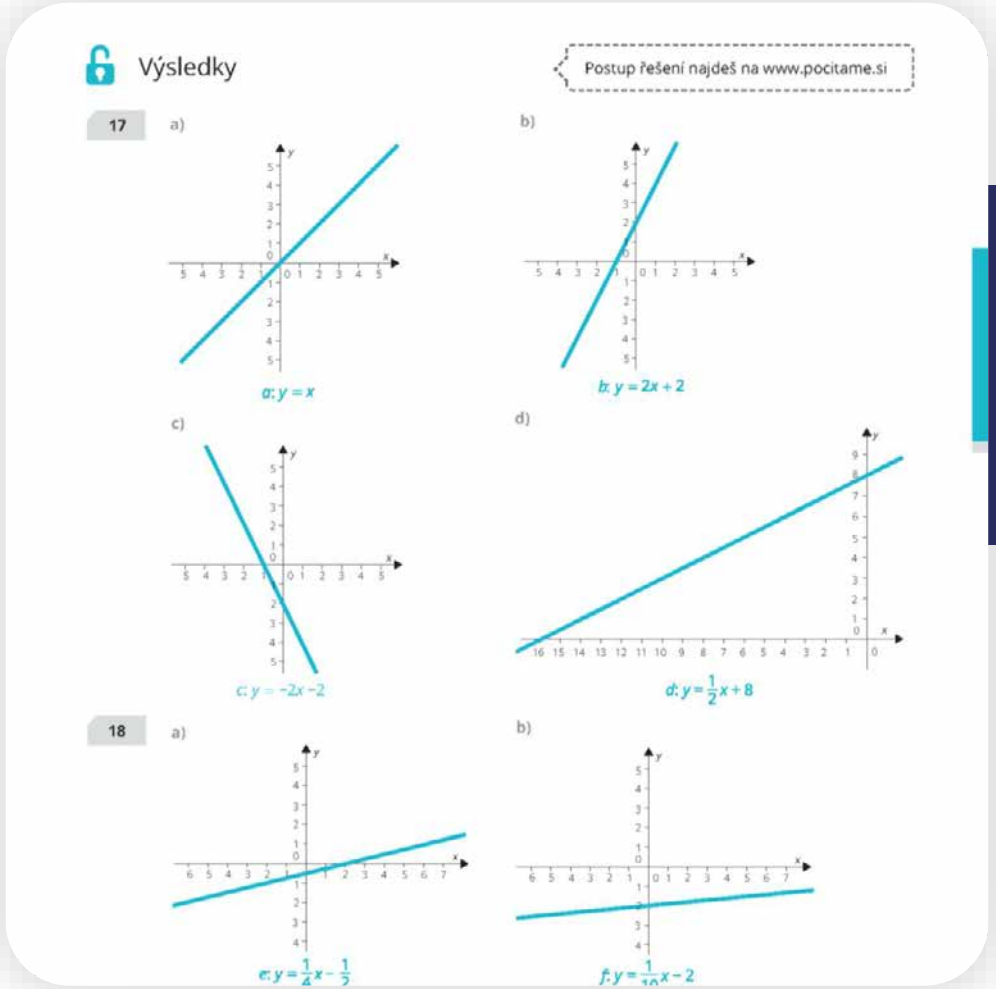
PRACTISING

Practice makes perfect

In addition to a correct understanding of a theory, mathematics is also about practice, and therefore there are enough examples to practice at the end of each subchapter. Each example has a special QR code that redirects a user to our website where he/she will find the example solved in detail, including a human explanation.



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RESULTS

Why it didn't work out?

Tasks are followed by their correct results. If a student's result is not correct, he/she can use a QR code or find a way to get to the result through our website. It cannot happen that someone does not know how to solve an example correctly in our textbooks.

Textbook of chemistry and its structure

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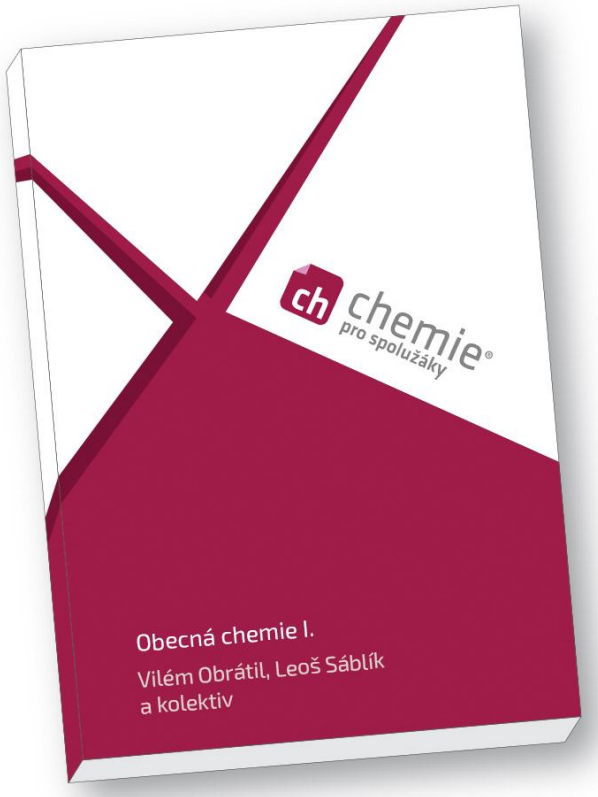
Textbook



Textbook title	ISBN
Chemistry for Classmates: General Chemistry I. (textbook)	978-80-88255-16-1
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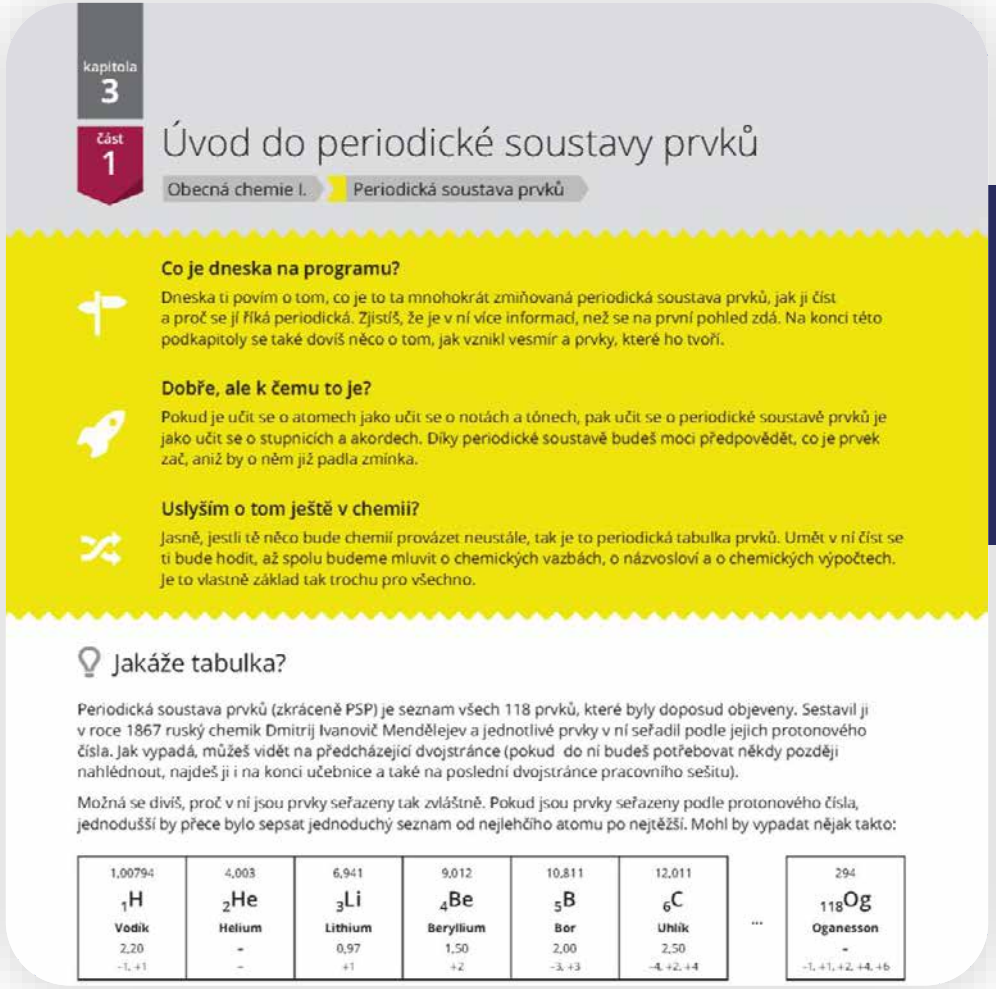
Chemistry for Classmates: Inorganic Chemistry (textbook)	978-80-88255-42-0

75
topics

532
pages

1,150
examples



kapitola 3

část 1

Úvod do periodické soustavy prvků

Obecná chemie I. › Periodická soustava prvků

Co je dneska na programu?

Dneska ti povím o tom, co je to ta mnohokrát zmiňovaná periodická soustava prvků, jak ji číst a proč se jí říká periodická. Zjistíš, že je v ní více informací, než se na první pohled zdá. Na konci této podkapitoly se také dovíš něco o tom, jak vznikl vesmír a prvky, které ho tvoří.

Dobře, ale k čemu to je?

Pokud je učit se o atomech jako učit se o notách a tónech, pak učit se o periodické soustavě prvků je jako učit se o stupnicích a akordech. Díky periodické soustavě budeš moci předpovědět, co je prvek zač, aniž by o něm již padla zmínka.

Uslyším o tom ještě v chemii?

Jasně, jestli tě něco bude chemií provázet neustále, tak je to periodická tabulka prvků. Umět v ní číst se ti bude hodit, až spolu budeme mluvit o chemických vazbách, o názvosloví a o chemických výpočtech. Je to vlastně základ tak trochu pro všechno.

Jakáže tabulka?

Periodická soustava prvků (zkráceně PSP) je seznam všech 118 prvků, které byly doposud objeveny. Sestavil ji v roce 1867 ruský chemik Dmitrij Ivanovič Mendělejev a jednotlivé prvky v ní seřadil podle jejich protonového čísla. Jak vypadá, můžeš vidět na předcházející dvojstránce (pokud do ní budeš potřebovat někdy později nahlédnout, najdeš ji i na konci učebnice a také na poslední dvojstránce pracovního sešitu).

Možná se diviš, proč v ní jsou prvky seřazeny tak zvláštně. Pokud jsou prvky seřazeny podle protonového čísla, jednodušší by přece bylo sepsat jednoduchý seznam od nejlehčího atomu po nejtěžší. Mohl by vypadat nějak takto:

1,00794	4,003	6,941	9,012	10,811	12,011	...	294
$_1$H	$_2$He	$_3$Li	$_4$Be	$_5$B	$_6$C		$_{118}$Og
Vodík	Helium	Lithium	Beryllium	Bor	Uhlík		Oganesson
2,20	-	0,97	1,50	2,00	2,50		-
-1, +1	-	+1	+2	-3, +3	-4, +2, +4		-1, +1, +2, +4, +6

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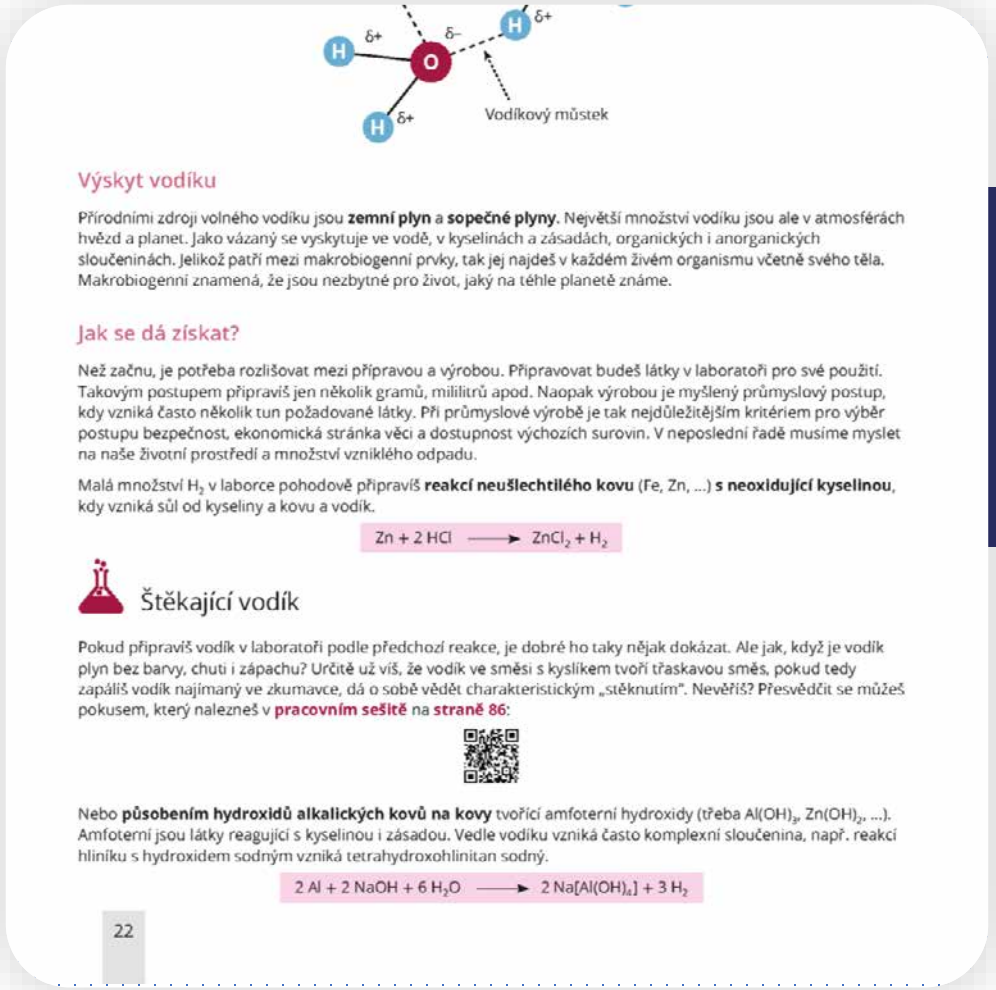
INTRODUCTION

What's the use of it for me?

At the beginning of each subchapter there is an introduction that answers the most common question of a student: "What use will this have for me one day?" It also describes how the subject matter will be related to other subject matter at school and what will be learned in the given part of the textbook.



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THEORY

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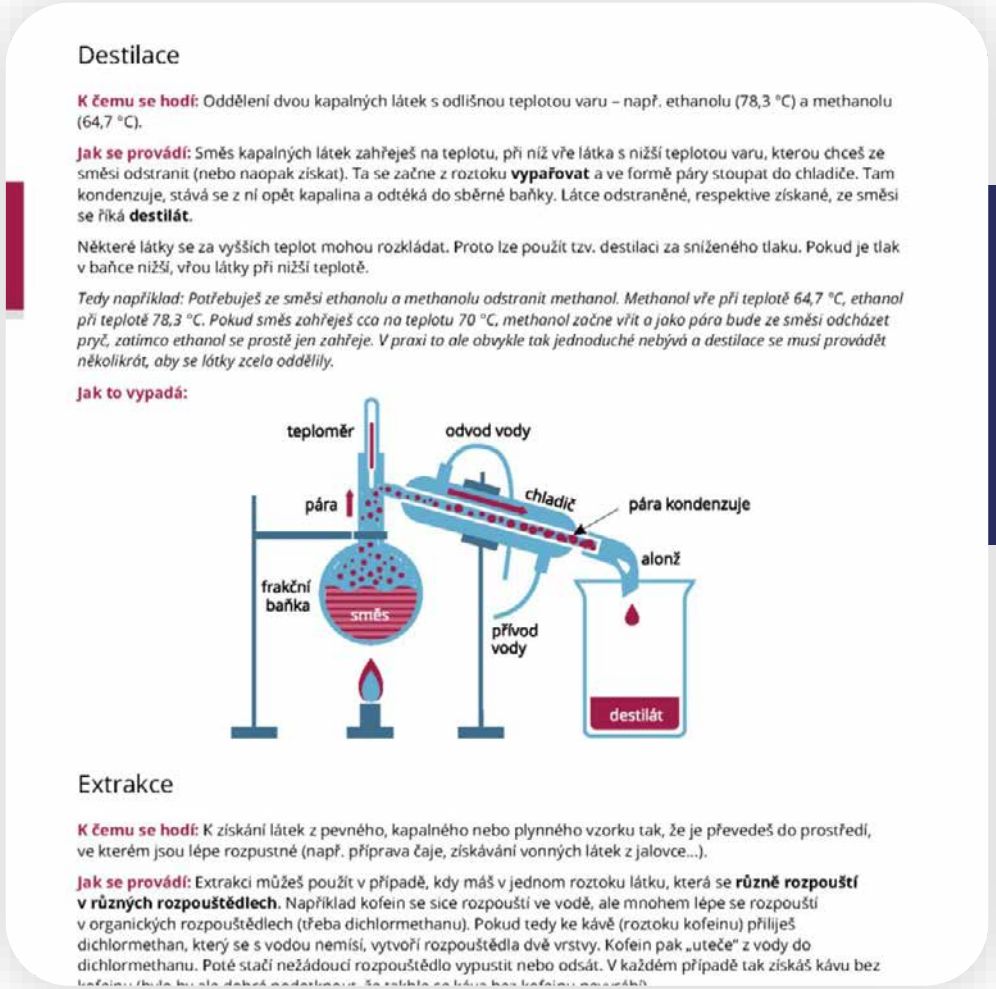

Destilace

K čemu se hodí: Oddělení dvou kapalných látek s odlišnou teplotou varu – např. ethanolu (78,3 °C) a methanolu (64,7 °C).

Jak se provádí: Směs kapalných látek zahřeješ na teplotu, při níž vře látka s nižší teplotou varu, kterou chceš ze směsi odstranit (nebo naopak získat). Ta se začne z roztoku **vypařovat** a ve formě páry stoupat do chladiče. Tam kondenzuje, stává se z ní opět kapalina a odtéká do sběrné baňky. Látce odstraněné, respektive získané, ze směsi se říká **destilát**.

Některé látky se za vyšších teplot mohou rozkládat. Proto lze použít tzv. destilaci za sníženého tlaku. Pokud je tlak v baňce nižší, vřou látky při nižší teplotě.

Tedy například: Potřebuješ ze směsi ethanolu a methanolu odstranit methanol. Methanol vře při teplotě 64,7 °C, ethanol při teplotě 78,3 °C. Pokud směs zahřeješ cca na teplotu 70 °C, methanol začne vřít a jako pára bude ze směsi odcházet pryč, zatímco ethanol se prostě jen zahřeje. V praxi to ale obvykle tak jednoduché nebývá a destilace se musí provádět několikrát, aby se látky zcela oddělily.

Jak to vypadá:

Extrakce

K čemu se hodí: K získání látek z pevného, kapalného nebo plynného vzorku tak, že je převedeš do prostředí, ve kterém jsou lépe rozpustné (např. příprava čaje, získávání vonných látek z jalovce...).

Jak se provádí: Extrakci můžeš použít v případě, kdy máš v jednom roztoku látku, která se **různě rozpouští v různých rozpouštědlech**. Například kofein se sice rozpouští ve vodě, ale mnohem lépe se rozpouští v organických rozpouštědlech (třeba dichlormethanu). Pokud tedy ke kávě (roztoku kofeinu) přiliješ dichlormethan, který se s vodou nemísí, vytvoří rozpouštědla dvě vrstvy. Kofein pak „uteče" z vody do dichlormethanu. Poté stačí nežádoucí rozpouštědlo vypustit nebo odsát. V každém případě tak získáš kávu bez

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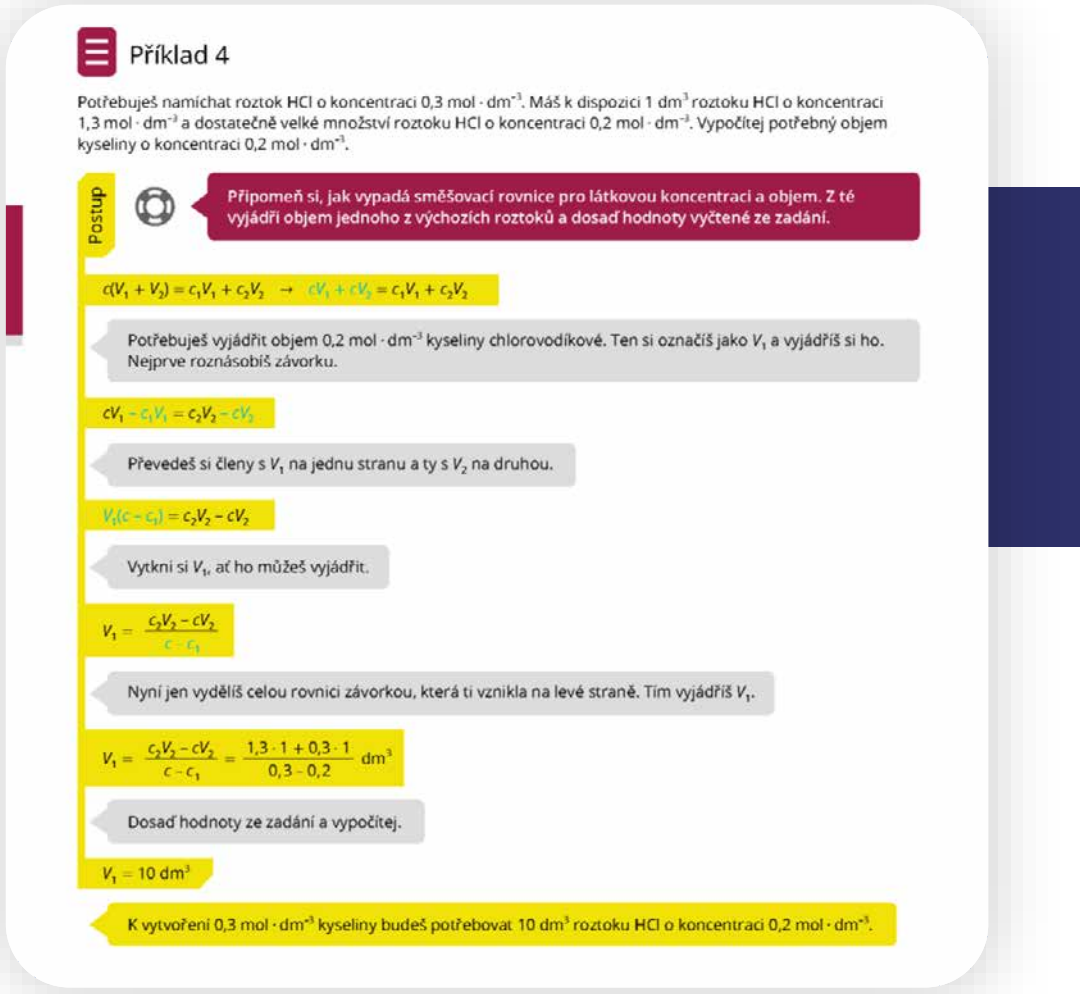
EXPERIMENTS

How about an experiment?

In our chemistry textbooks, we have not forgotten one very important element, which is doing experiments. We refer to specific experiments directly from the textbook to our website and, of course, also to the workbook, where a so-called report is found.



Příklad 4

Potřebuješ namíchat roztok HCl o koncentraci 0,3 mol · dm^{-3}. Máš k dispozici 1 dm^3 roztoku HCl o koncentraci 1,3 mol · dm^{-3} a dostatečně velké množství roztoku HCl o koncentraci 0,2 mol · dm^{-3}. Vypočítej potřebný objem kyseliny o koncentraci 0,2 mol · dm^{-3}.

Postup

Připomeň si, jak vypadá směšovací rovnice pro látkovou koncentraci a objem. Z té vyjádři objem jednoho z výchozích roztoků a dosaď hodnoty vyčtené ze zadání.

$c(V_1 + V_2) = c_1V_1 + c_2V_2 \rightarrow cV_1 + cV_2 = c_1V_1 + c_2V_2$

Potřebuješ vyjádřit objem 0,2 mol · dm^{-3} kyseliny chlorovodíkové. Ten si označíš jako V_1 a vyjádříš si ho. Nejprve roznásobíš závorku.

$cV_1 - c_1V_1 = c_2V_2 - cV_2$

Převedeš si členy s V_1 na jednu stranu a ty s V_2 na druhou.

$V_1(c - c_1) = c_2V_2 - cV_2$

Vytkni si V_1, ať ho můžeš vyjádřit.

$V_1 = \frac{c_2V_2 - cV_2}{c - c_1}$

Nyní jen vydělíš celou rovnici závorkou, která ti vznikla na levé straně. Tím vyjádříš V_1.

$V_1 = \frac{c_2V_2 - cV_2}{c - c_1} = \frac{1{,}3 \cdot 1 + 0{,}3 \cdot 1}{0{,}3 - 0{,}2}$ dm^3

Dosaď hodnoty ze zadání a vypočítej.

$V_1 = 10$ dm^3

K vytvoření 0,3 mol · dm^{-3} kyseliny budeš potřebovat 10 dm^3 roztoku HCl o koncentraci 0,2 mol · dm^{-3}.

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SAMPLE EXAMPLES

Step by step

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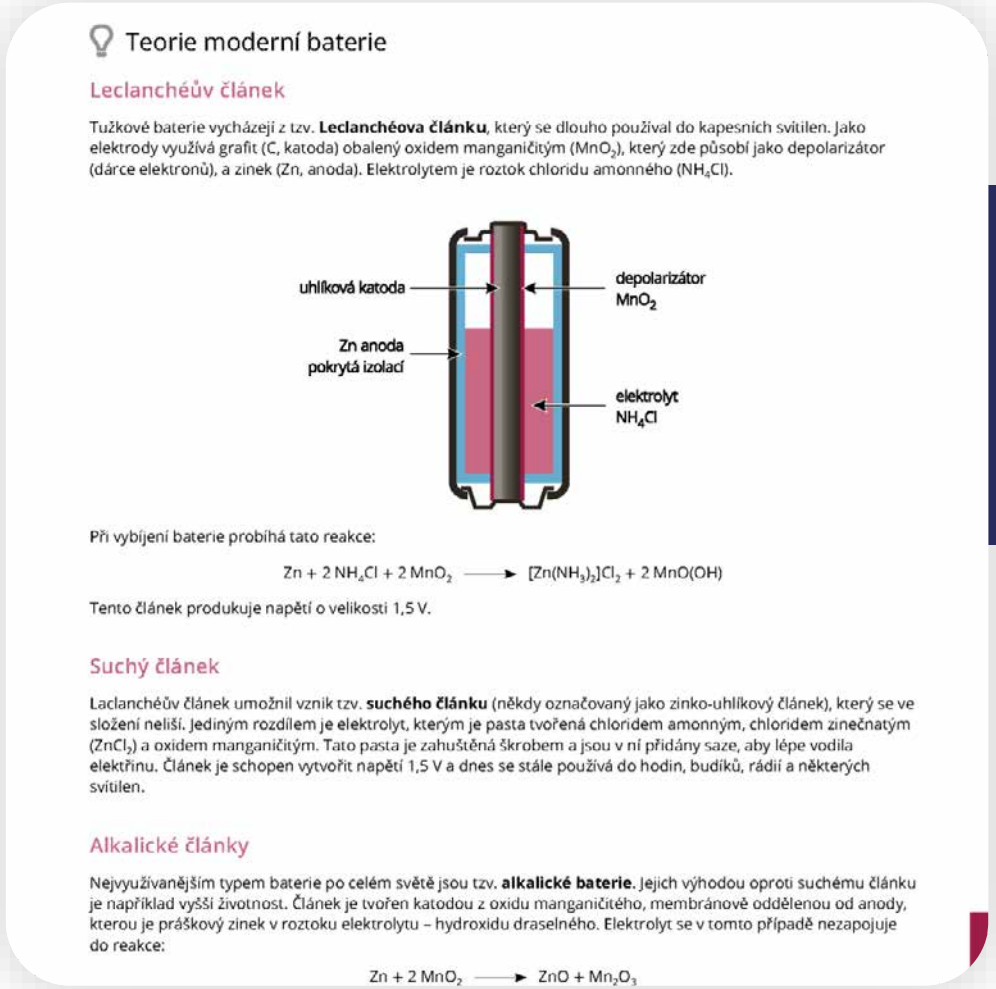

Teorie moderní baterie

Leclanchéův článek

Tužkové baterie vycházejí z tzv. **Leclanchéova článku**, který se dlouho používal do kapesních svítilen. Jako elektrody využívá grafit (C, katoda) obalený oxidem manganičitým (MnO_2), který zde působí jako depolarizátor (dárce elektronů), a zinek (Zn, anoda). Elektrolytem je roztok chloridu amonného (NH_4Cl).

Při vybíjení baterie probíhá tato reakce:

$$Zn + 2\,NH_4Cl + 2\,MnO_2 \longrightarrow [Zn(NH_3)_2]Cl_2 + 2\,MnO(OH)$$

Tento článek produkuje napětí o velikosti 1,5 V.

Suchý článek

Laclanchéův článek umožnil vznik tzv. **suchého článku** (někdy označovaný jako zinko-uhlíkový článek), který se ve složení neliší. Jediným rozdílem je elektrolyt, kterým je pasta tvořená chloridem amonným, chloridem zinečnatým ($ZnCl_2$) a oxidem manganičitým. Tato pasta je zahuštěná škrobem a jsou v ní přidány saze, aby lépe vodila elektřinu. Článek je schopen vytvořit napětí 1,5 V a dnes se stále používá do hodin, budíků, rádií a některých svítilen.

Alkalické články

Nejvyužívanějším typem baterie po celém světě jsou tzv. **alkalické baterie**. Jejich výhodou oproti suchému článku je například vyšší životnost. Článek je tvořen katodou z oxidu manganičitého, membránově oddělenou od anody, kterou je práškový zinek v roztoku elektrolytu – hydroxidu draselného. Elektrolyt se v tomto případě nezapojuje do reakce:

$$Zn + 2\,MnO_2 \longrightarrow ZnO + Mn_2O_3$$

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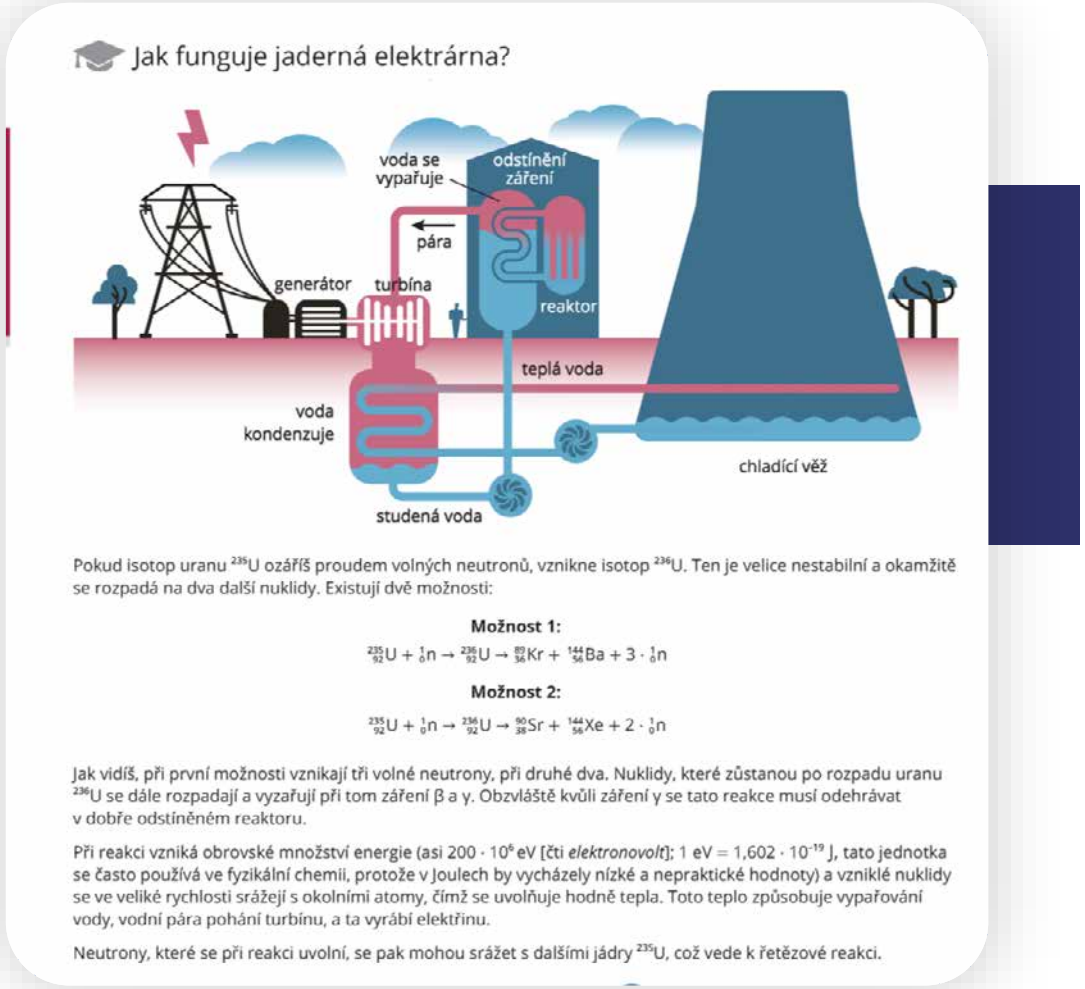
REAL-LIFE EXAMPLES

Where do I see that?

Almost every subject matter finds application in practice, and we try to show this with the help of various examples. If certain subject matter has no relevance in everyday life, it can be used for another subject matter that is already used in practice or to simply “merely” train the logical thinking that is used every day.



Jak funguje jaderná elektrárna?

Pokud isotop uranu ^{235}U ozáříš proudem volných neutronů, vznikne isotop ^{236}U. Ten je velice nestabilní a okamžitě se rozpadá na dva další nuklidy. Existují dvě možnosti:

Možnost 1:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{236}_{92}U \rightarrow ^{89}_{36}Kr + ^{144}_{56}Ba + 3 \cdot ^{1}_{0}n$$

Možnost 2:

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{236}_{92}U \rightarrow ^{90}_{38}Sr + ^{144}_{56}Xe + 2 \cdot ^{1}_{0}n$$

Jak vidíš, při první možnosti vznikají tři volné neutrony, při druhé dva. Nuklidy, které zůstanou po rozpadu uranu ^{236}U se dále rozpadají a vyzařují při tom záření β a γ. Obzvláště kvůli záření γ se tato reakce musí odehrávat v dobře odstíněném reaktoru.

Při reakci vzniká obrovské množství energie (asi $200 \cdot 10^6$ eV [čti *elektronovolt*]; 1 eV = $1{,}602 \cdot 10^{-19}$ J, tato jednotka se často používá ve fyzikální chemii, protože v Joulech by vycházely nízké a nepraktické hodnoty) a vzniklé nuklidy se ve veliké rychlosti srážejí s okolními atomy, čímž se uvolňuje hodně tepla. Toto teplo způsobuje vypařování vody, vodní pára pohání turbínu, a ta vyrábí elektřinu.

Neutrony, které se při reakci uvolní, se pak mohou srážet s dalšími jádry ^{235}U, což vede k řetězové reakci.

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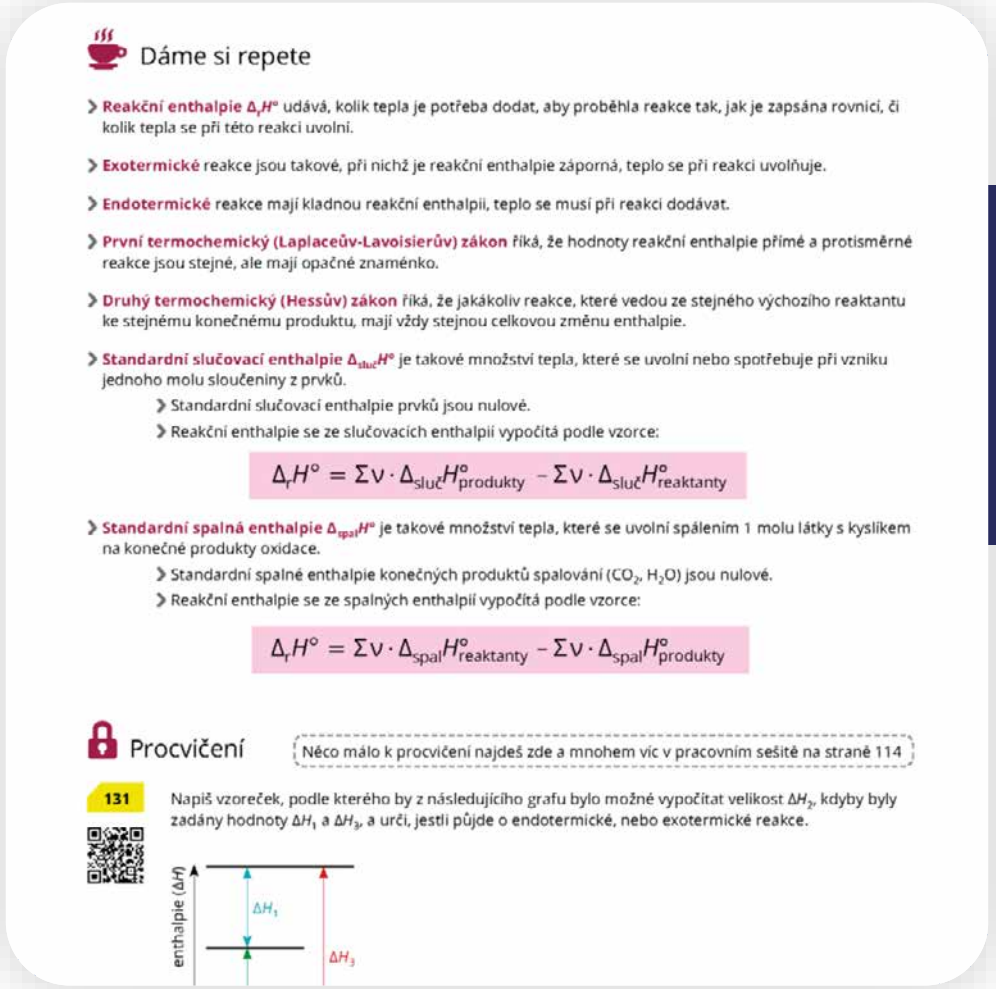
EXPLANATORY ILLUSTRATIONS

How to imagine it?

We supplement professional theory with as many explanatory illustrations as possible, which can explain a given situation much better than words. We emphasise simplicity, modernity and, of course, fidelity to our brand concept.



Dáme si repete

- **Reakční enthalpie** $\Delta_r H^\circ$ udává, kolik tepla je potřeba dodat, aby proběhla reakce tak, jak je zapsána rovnicí, či kolik tepla se při této reakci uvolní.
- **Exotermické** reakce jsou takové, při nichž je reakční enthalpie záporná, teplo se při reakci uvolňuje.
- **Endotermické** reakce mají kladnou reakční enthalpii, teplo se musí při reakci dodávat.
- **První termochemický (Laplaceův-Lavoisierův) zákon** říká, že hodnoty reakční enthalpie přímé a protisměrné reakce jsou stejné, ale mají opačné znaménko.
- **Druhý termochemický (Hessův) zákon** říká, že jakákoliv reakce, které vedou ze stejného výchozího reaktantu ke stejnému konečnému produktu, mají vždy stejnou celkovou změnu enthalpie.
- **Standardní slučovací enthalpie** $\Delta_{sluč}H^\circ$ je takové množství tepla, které se uvolní nebo spotřebuje při vzniku jednoho molu sloučeniny z prvků.
  - Standardní slučovací enthalpie prvků jsou nulové.
  - Reakční enthalpie se ze slučovacích enthalpií vypočítá podle vzorce:

$$\Delta_r H^\circ = \Sigma\nu \cdot \Delta_{sluč}H^\circ_{produkty} - \Sigma\nu \cdot \Delta_{sluč}H^\circ_{reaktanty}$$

- **Standardní spalná enthalpie** $\Delta_{spal}H^\circ$ je takové množství tepla, které se uvolní spálením 1 molu látky s kyslíkem na konečné produkty oxidace.
  - Standardní spalné enthalpie konečných produktů spalování (CO_2, H_2O) jsou nulové.
  - Reakční enthalpie se ze spalných enthalpií vypočítá podle vzorce:

$$\Delta_r H^\circ = \Sigma\nu \cdot \Delta_{spal}H^\circ_{reaktanty} - \Sigma\nu \cdot \Delta_{spal}H^\circ_{produkty}$$

Procvičení

Něco málo k procvičení najdeš zde a mnohem víc v pracovním sešitě na straně 114

131 Napiš vzoreček, podle kterého by z následujícího grafu bylo možné vypočítat velikost ΔH_2, kdyby byly zadány hodnoty ΔH_1 a ΔH_3, a urči, jestli půjde o endotermické, nebo exotermické reakce.

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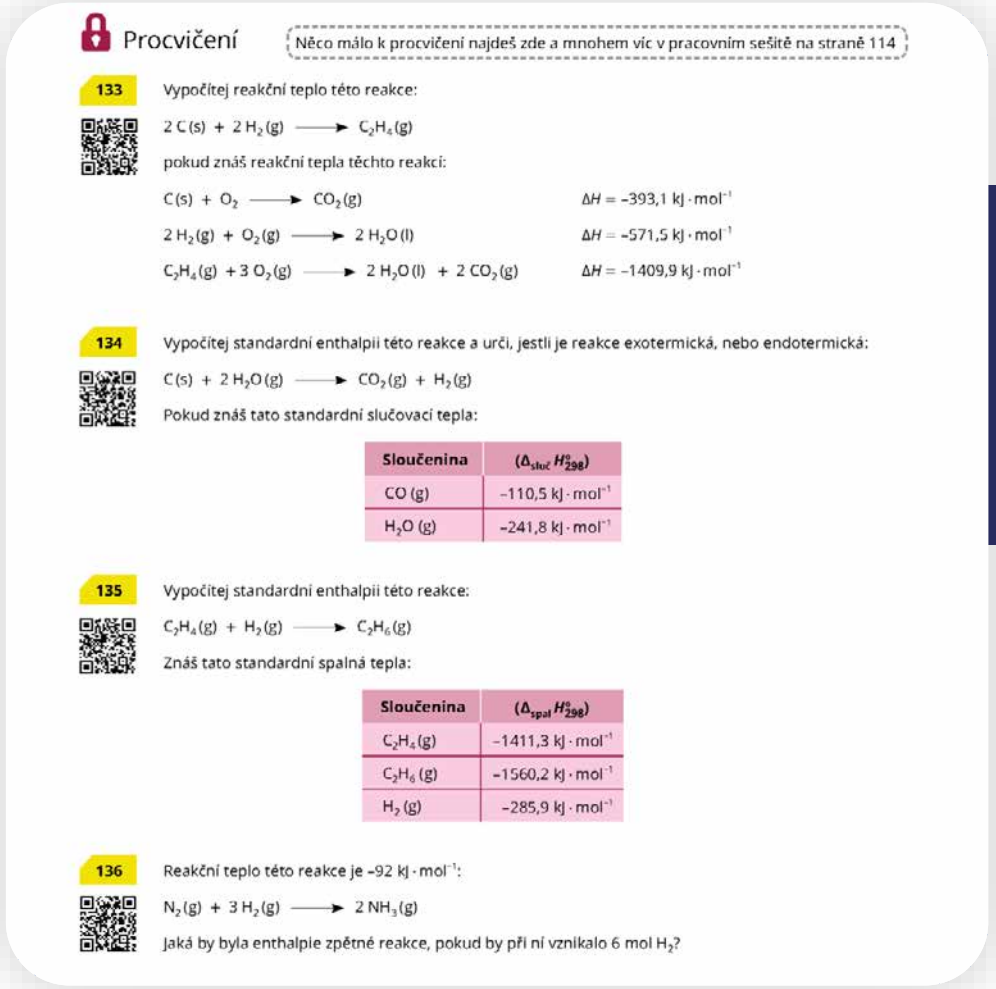
SUMMARY

What to take away from it?

Each subchapter at the end contains a brief summary of the whole subject matter. This summary is especially useful when preparing for a certain type of exam at school or as a check whether a student has passed the complete subject matter in the subchapter.



Procvičení

Něco málo k procvičení najdeš zde a mnohem víc v pracovním sešitě na straně 114

133 Vypočítej reakční teplo této reakce:

$2\,C(s) + 2\,H_2(g) \longrightarrow C_2H_4(g)$

pokud znáš reakční tepla těchto reakcí:

$C(s) + O_2 \longrightarrow CO_2(g)$ $\quad \Delta H = -393{,}1\ kJ \cdot mol^{-1}$

$2\,H_2(g) + O_2(g) \longrightarrow 2\,H_2O(l)$ $\quad \Delta H = -571{,}5\ kJ \cdot mol^{-1}$

$C_2H_4(g) + 3\,O_2(g) \longrightarrow 2\,H_2O(l) + 2\,CO_2(g)$ $\quad \Delta H = -1409{,}9\ kJ \cdot mol^{-1}$

134 Vypočítej standardní enthalpii této reakce a urči, jestli je reakce exotermická, nebo endotermická:

$C(s) + 2\,H_2O(g) \longrightarrow CO_2(g) + H_2(g)$

Pokud znáš tato standardní slučovací tepla:

Sloučenina	$(\Delta_{sluč} H^\circ_{298})$
CO (g)	$-110{,}5\ kJ \cdot mol^{-1}$
H_2O (g)	$-241{,}8\ kJ \cdot mol^{-1}$

135 Vypočítej standardní enthalpii této reakce:

$C_2H_4(g) + H_2(g) \longrightarrow C_2H_6(g)$

Znáš tato standardní spalná tepla:

Sloučenina	$(\Delta_{spal} H^\circ_{298})$
$C_2H_4(g)$	$-1411{,}3\ kJ \cdot mol^{-1}$
$C_2H_6(g)$	$-1560{,}2\ kJ \cdot mol^{-1}$
$H_2(g)$	$-285{,}9\ kJ \cdot mol^{-1}$

136 Reakční teplo této reakce je $-92\ kJ \cdot mol^{-1}$:

$N_2(g) + 3\,H_2(g) \longrightarrow 2\,NH_3(g)$

Jaká by byla enthalpie zpětné reakce, pokud by při ní vznikalo 6 mol H_2?

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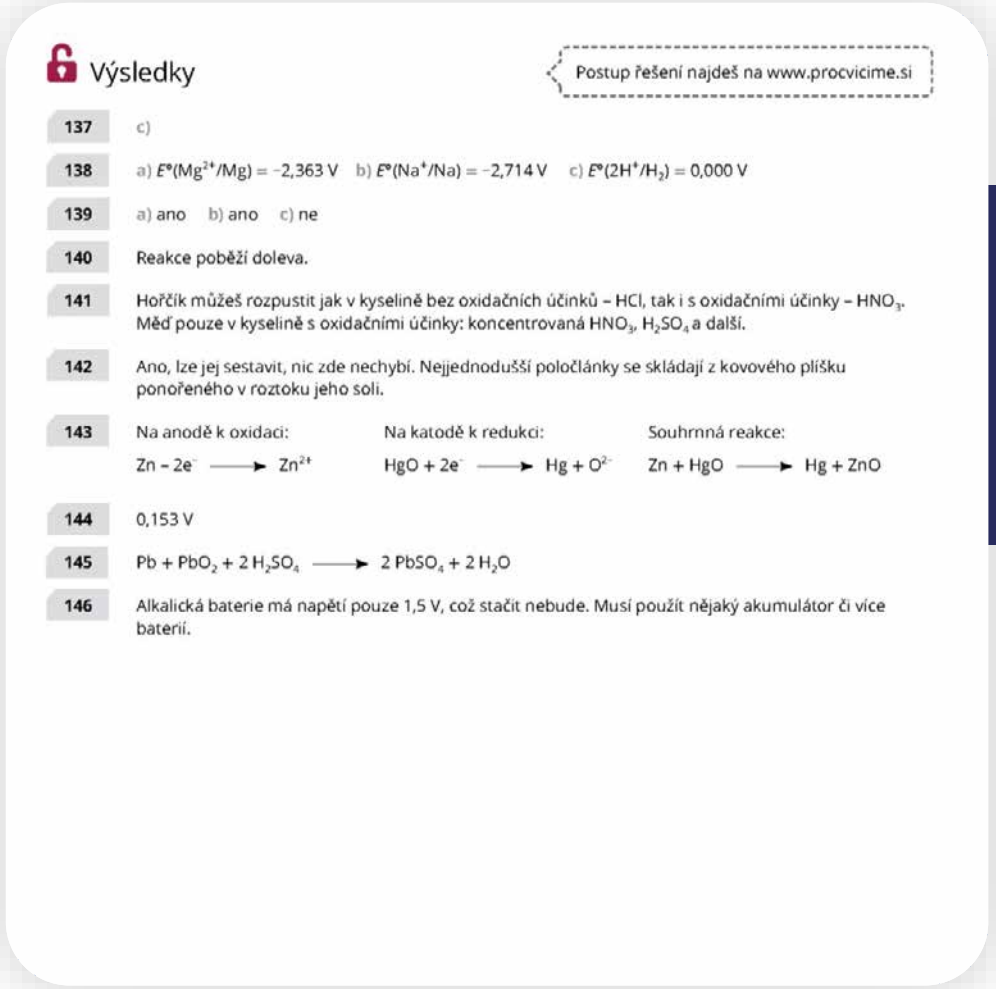
PRACTISING

Practice makes perfect

In addition to the correct understanding of a theory, chemistry is also about practice, so there are enough examples to practice at the end of each subchapter. Each example has a special QR code that redirects a user to our website where he/she will find the example solved in detail, including a human explanation.



Výsledky

Postup řešení najdeš na www.procvicime.si

137 c)

138 a) $E^{\circ}(Mg^{2+}/Mg) = -2{,}363\ V$ b) $E^{\circ}(Na^{+}/Na) = -2{,}714\ V$ c) $E^{\circ}(2H^{+}/H_2) = 0{,}000\ V$

139 a) ano b) ano c) ne

140 Reakce poběží doleva.

141 Hořčík můžeš rozpustit jak v kyselině bez oxidačních účinků – HCl, tak i s oxidačními účinky – HNO_3. Měď pouze v kyselině s oxidačními účinky: koncentrovaná HNO_3, H_2SO_4 a další.

142 Ano, lze jej sestavit, nic zde nechybí. Nejjednodušší poločlánky se skládají z kovového plíšku ponořeného v roztoku jeho soli.

143

Na anodě k oxidaci:	Na katodě k redukci:	Souhrnná reakce:
$Zn - 2e^- \longrightarrow Zn^{2+}$	$HgO + 2e^- \longrightarrow Hg + O^{2-}$	$Zn + HgO \longrightarrow Hg + ZnO$

144 0,153 V

145 $Pb + PbO_2 + 2\,H_2SO_4 \longrightarrow 2\,PbSO_4 + 2\,H_2O$

146 Alkalická baterie má napětí pouze 1,5 V, což stačit nebude. Musí použít nějaký akumulátor či více baterií.

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RESULTS

Why it didn’t work out?

Tasks are followed by their correct results. If a student’s result is not correct, he/she can use a QR code or find a way to get to the result through our website. It cannot happen that someone does not know how to solve an example correctly in our textbooks.

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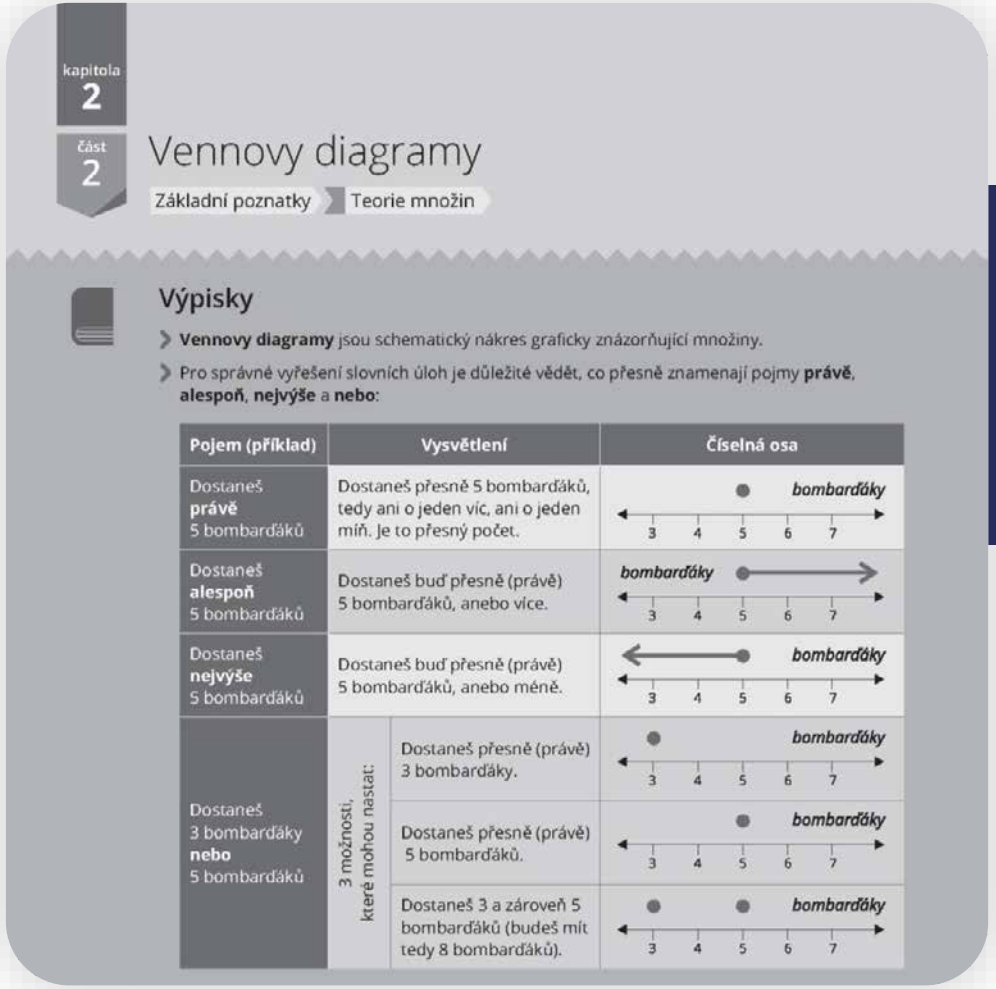

kapitola 2

část 2

Vennovy diagramy

Základní poznatky › Teorie množin

Výpisky

› **Vennovy diagramy** jsou schematický nákres graficky znázorňující množiny.

› Pro správné vyřešení slovních úloh je důležité vědět, co přesně znamenají pojmy **právě**, **alespoň**, **nejvýše** a **nebo**:

Pojem (příklad)	Vysvětlení		Číselná osa
Dostaneš **právě** 5 bombardáků	Dostaneš přesně 5 bombardáků, tedy ani o jeden víc, ani o jeden míň. Je to přesný počet.		bombardáky 3 4 5 6 7
Dostaneš **alespoň** 5 bombardáků	Dostaneš buď přesně (právě) 5 bombardáků, anebo více.		bombardáky 3 4 5 6 7
Dostaneš **nejvýše** 5 bombardáků	Dostaneš buď přesně (právě) 5 bombardáků, anebo méně.		bombardáky 3 4 5 6 7
Dostaneš 3 bombardáky **nebo** 5 bombardáků	3 možnosti, které mohou nastat:	Dostaneš přesně (právě) 3 bombardáky.	bombardáky 3 4 5 6 7
		Dostaneš přesně (právě) 5 bombardáků.	bombardáky 3 4 5 6 7
		Dostaneš 3 a zároveň 5 bombardáků (budeš mít tedy 8 bombardáků).	bombardáky 3 4 5 6 7

matika pro spolužáky

NOTES

What to remember?

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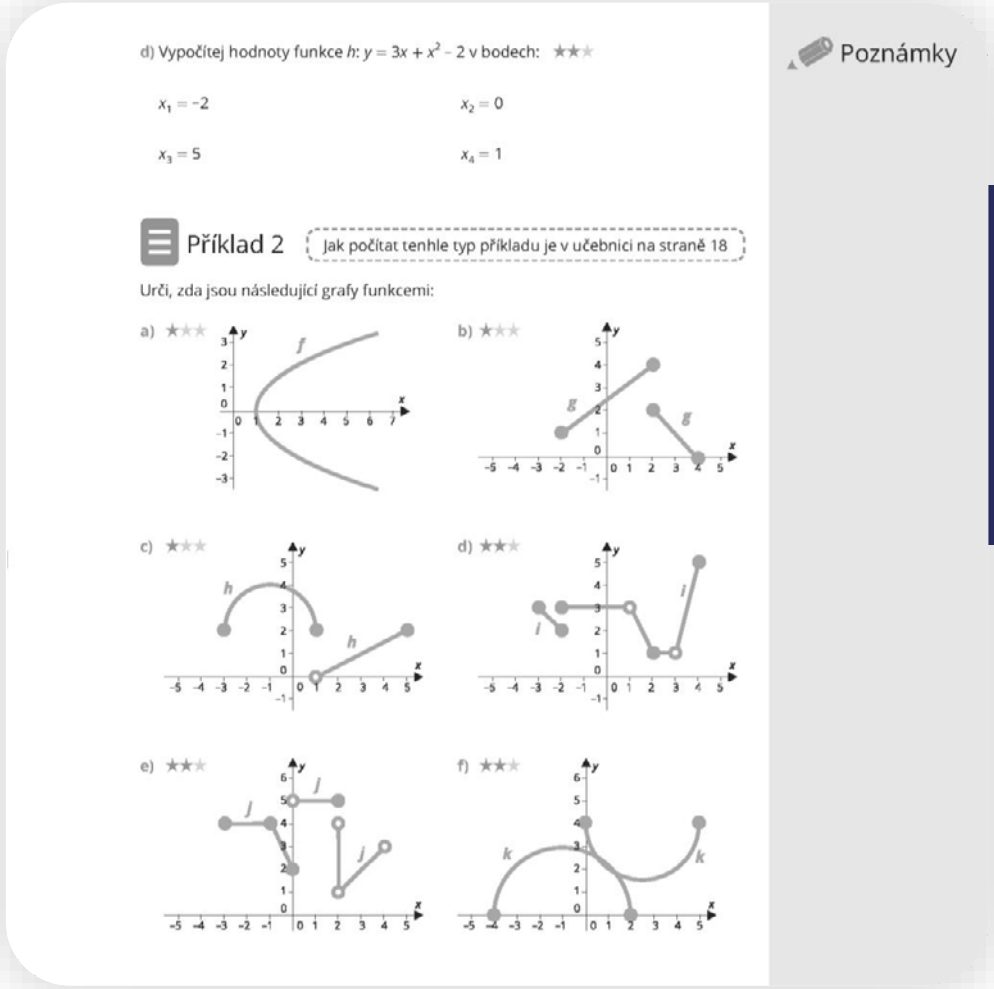


d) Vypočítej hodnoty funkce h: $y = 3x + x^2 - 2$ v bodech: ★★☆

$x_1 = -2$ $x_2 = 0$

$x_3 = 5$ $x_4 = 1$

Příklad 2 Jak počítat tenhle typ příkladu je v učebnici na straně 18

Urči, zda jsou následující grafy funkcemi:

a) ★☆☆ b) ★☆☆ c) ★☆☆ d) ★★☆ e) ★★☆ f) ★★☆

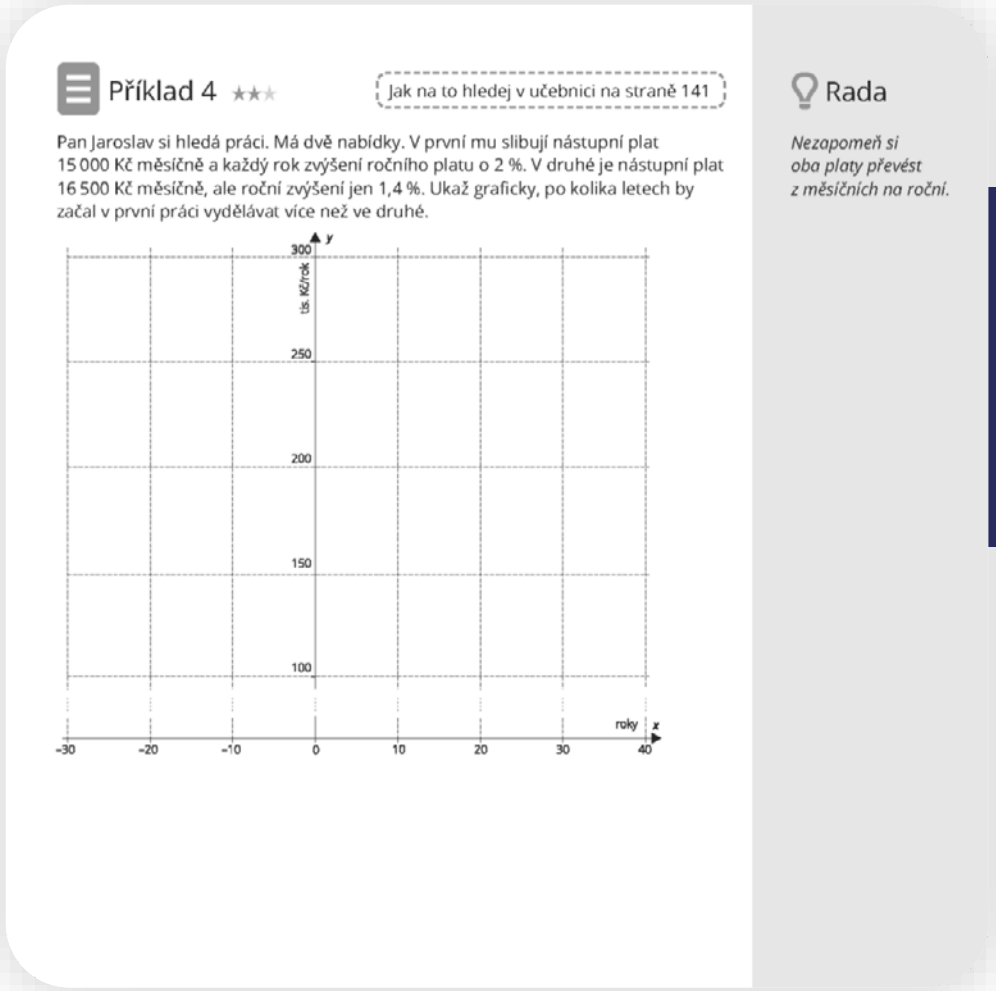
Poznámky

matika pro spolužáky

EXAMPLES

Count and count

The workbook is mainly about examples and practicing. Each example is evaluated by its difficulty and, if necessary, a link to a specific page in the textbook can be used, where there is a similar example with a detailed procedure.



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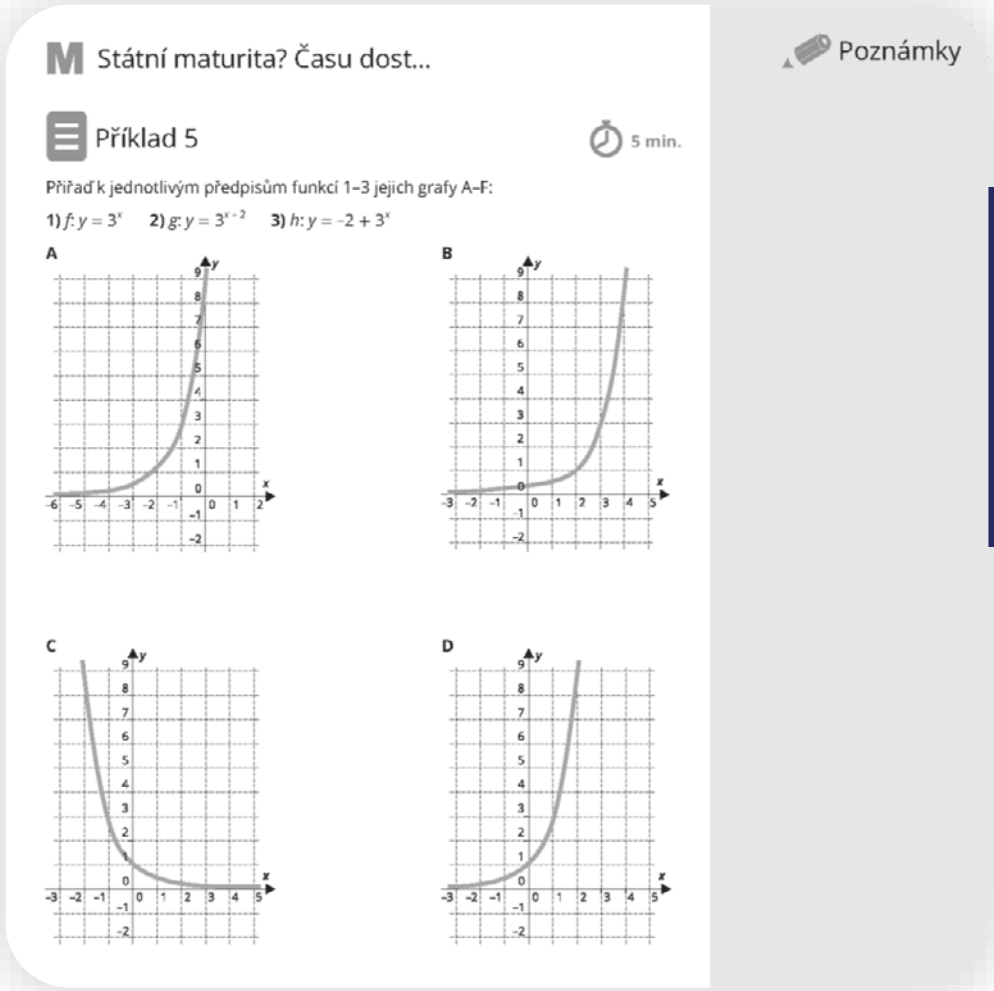
HINTS

Good advice is better than gold

For some examples, where mistakes are often made, we have gradually added hints that can help students not to make a mistake in the solution process right at the beginning. Sometimes a problem requires knowledge of subject matter from previous grades, so a hint is designed to remind a student of important information.

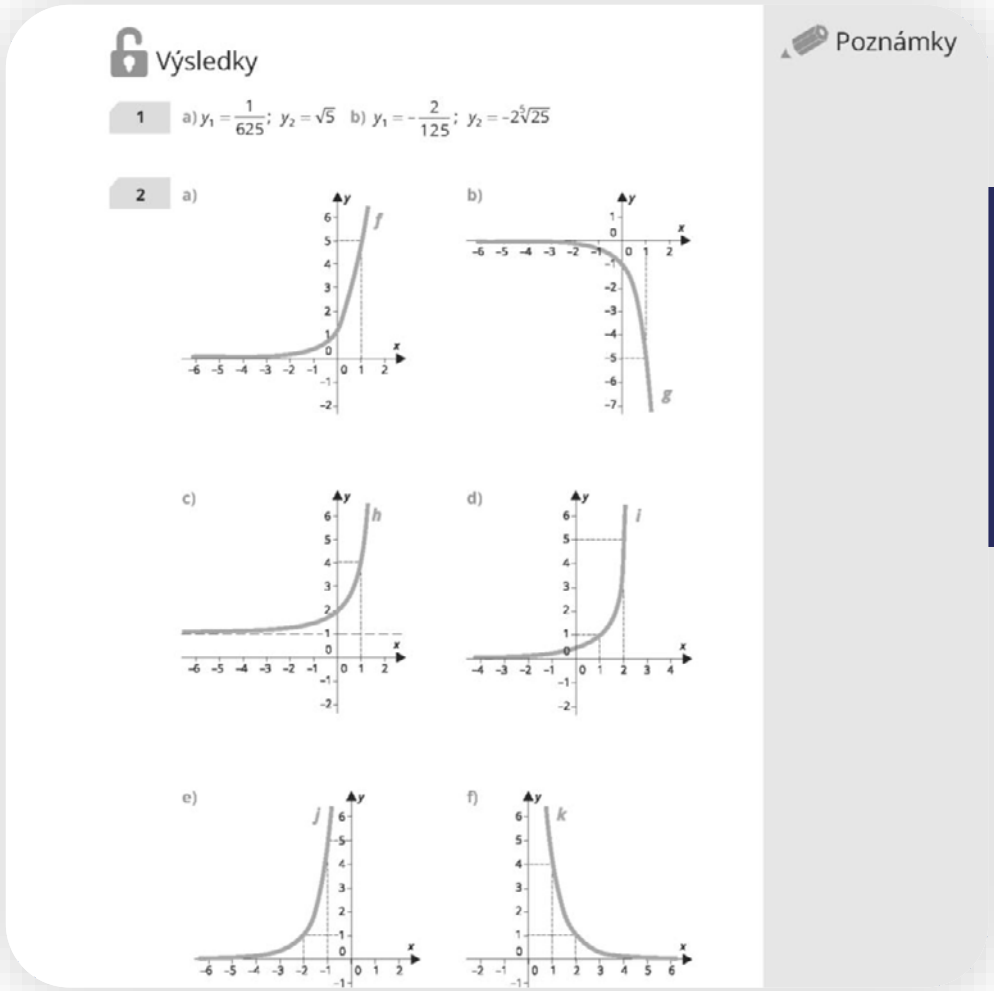


matika pro spolužáky

PREPARATION FOR THE SCHOOL LEAVING EXAM

Continuous preparation

Each subchapter, which is also a part of the state school leaving exam, contains model problems from this final exam. It is important to prepare for these problems continuously from the first grade, and therefore these problems appear in all our workbooks.



matika pro spolužáky

RESULTS

What's the result?

Correct results of all problems are at the end of each subchapter. If a student did not work anything out correctly, he/she will find a link to the textbook in the instructions of each problem, where there is an explanation of a similar type of problem, in which he/she can understand how to work out the problem correctly.

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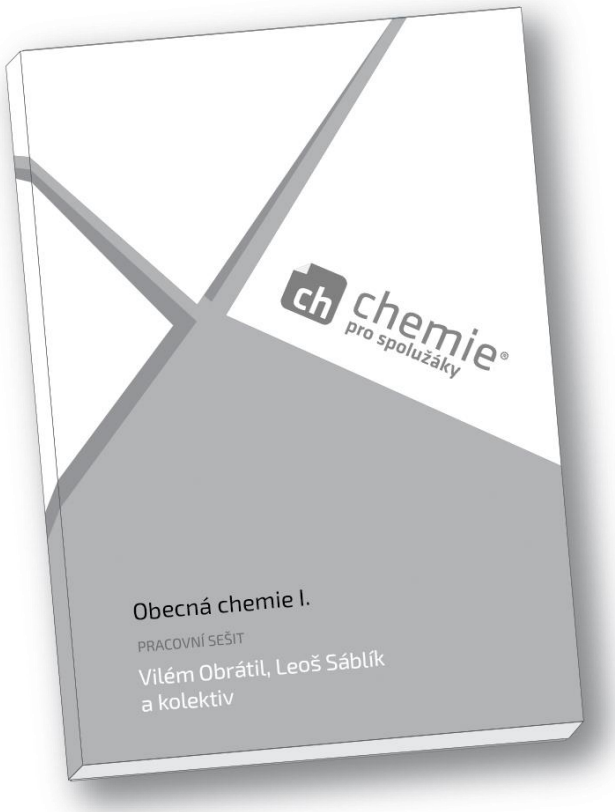

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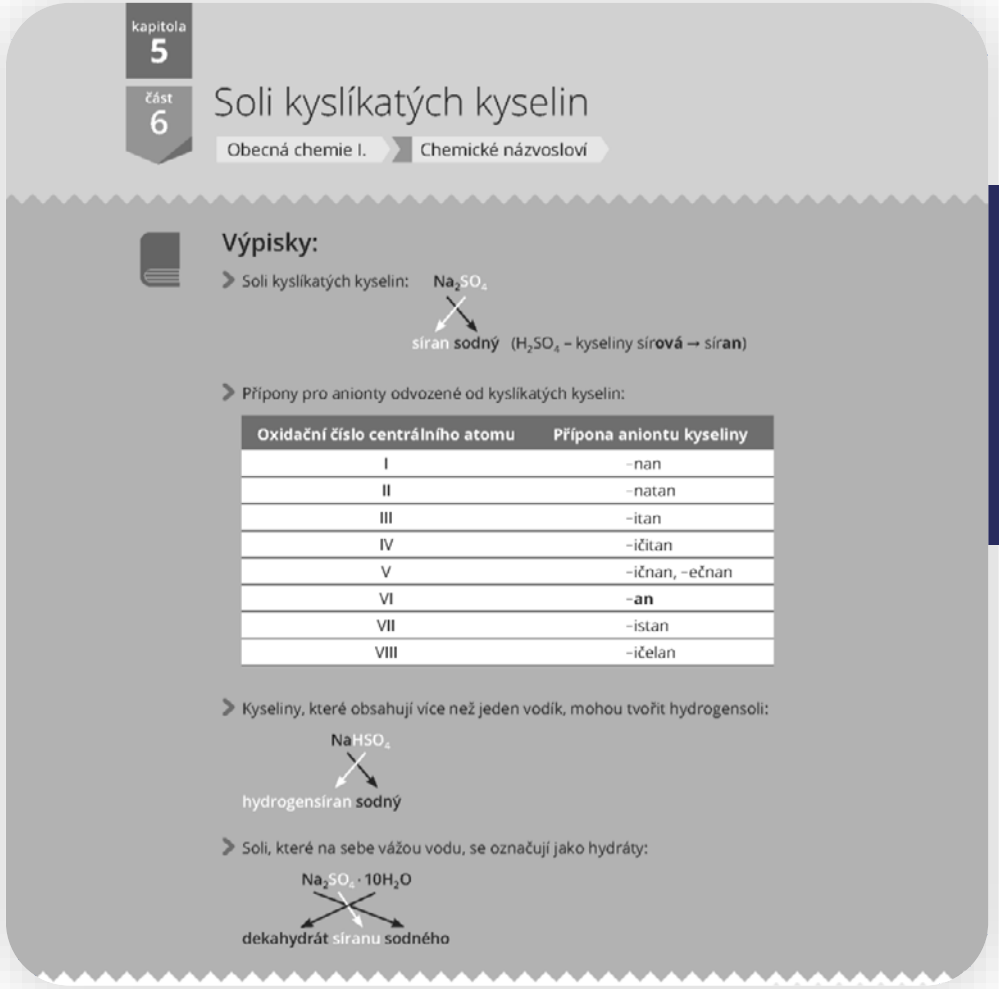
75
topics

392
pages

1,533
examples



kapitola 5

část 6

Soli kyslíkatých kyselin

Obecná chemie I. › Chemické názvosloví

Výpisky:

› Soli kyslíkatých kyselin: Na_2SO_4

síran sodný (H_2SO_4 – kyseliny sírová → síran)

› Přípony pro anionty odvozené od kyslíkatých kyselin:

Oxidační číslo centrálního atomu	Přípona aniontu kyseliny
I	-nan
II	-natan
III	-itan
IV	-ičitan
V	-ičnan, -ečnan
VI	**-an**
VII	-istan
VIII	-ičelan

› Kyseliny, které obsahují více než jeden vodík, mohou tvořit hydrogensoli:

$NaHSO_4$

hydrogensíran sodný

› Soli, které na sebe vážou vodu, se označují jako hydráty:

$Na_2SO_4 \cdot 10H_2O$

dekahydrát síranu sodného

NOTES

What to remember?

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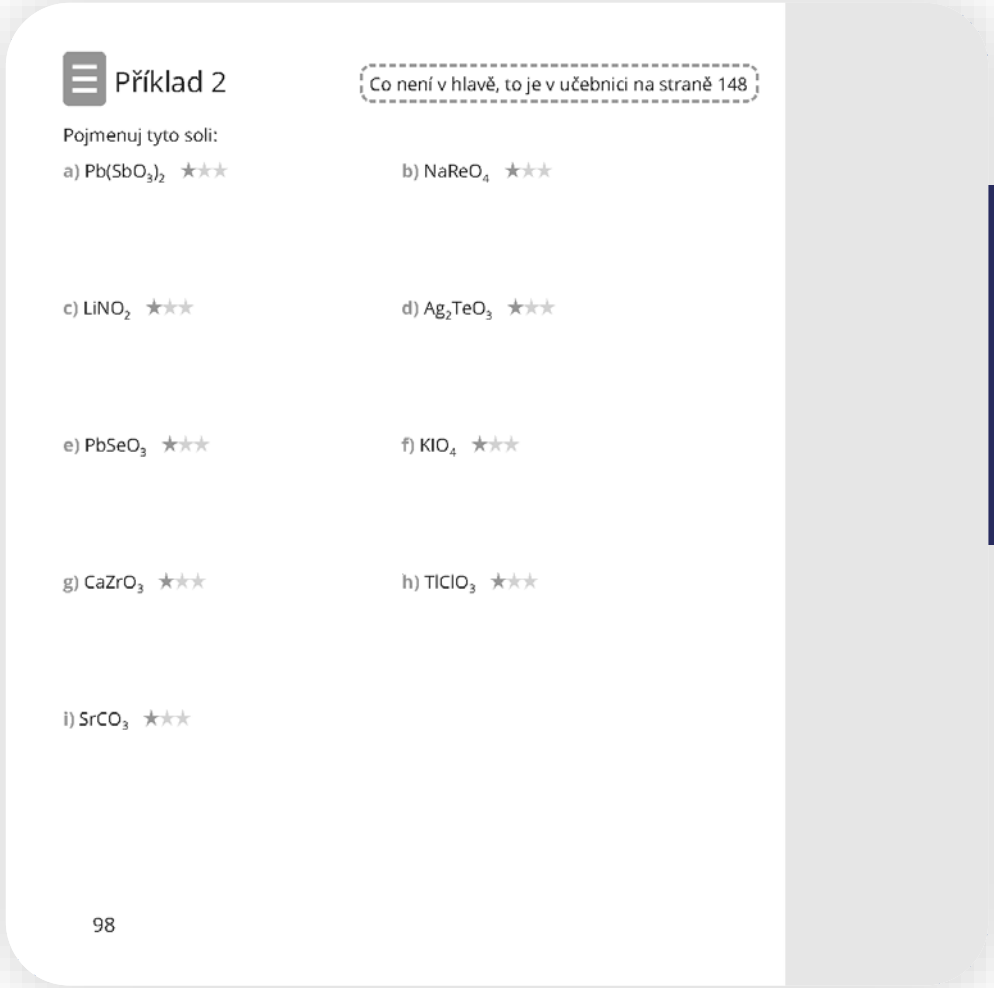

Příklad 2

Co není v hlavě, to je v učebnici na straně 148

Pojmenuj tyto soli:

a) $Pb(SbO_3)_2$ ★☆☆

b) $NaReO_4$ ★☆☆

c) $LiNO_2$ ★☆☆

d) Ag_2TeO_3 ★☆☆

e) $PbSeO_3$ ★☆☆

f) KIO_4 ★☆☆

g) $CaZrO_3$ ★☆☆

h) $TlClO_3$ ★☆☆

i) $SrCO_3$ ★☆☆

98

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EXAMPLES

Count and count

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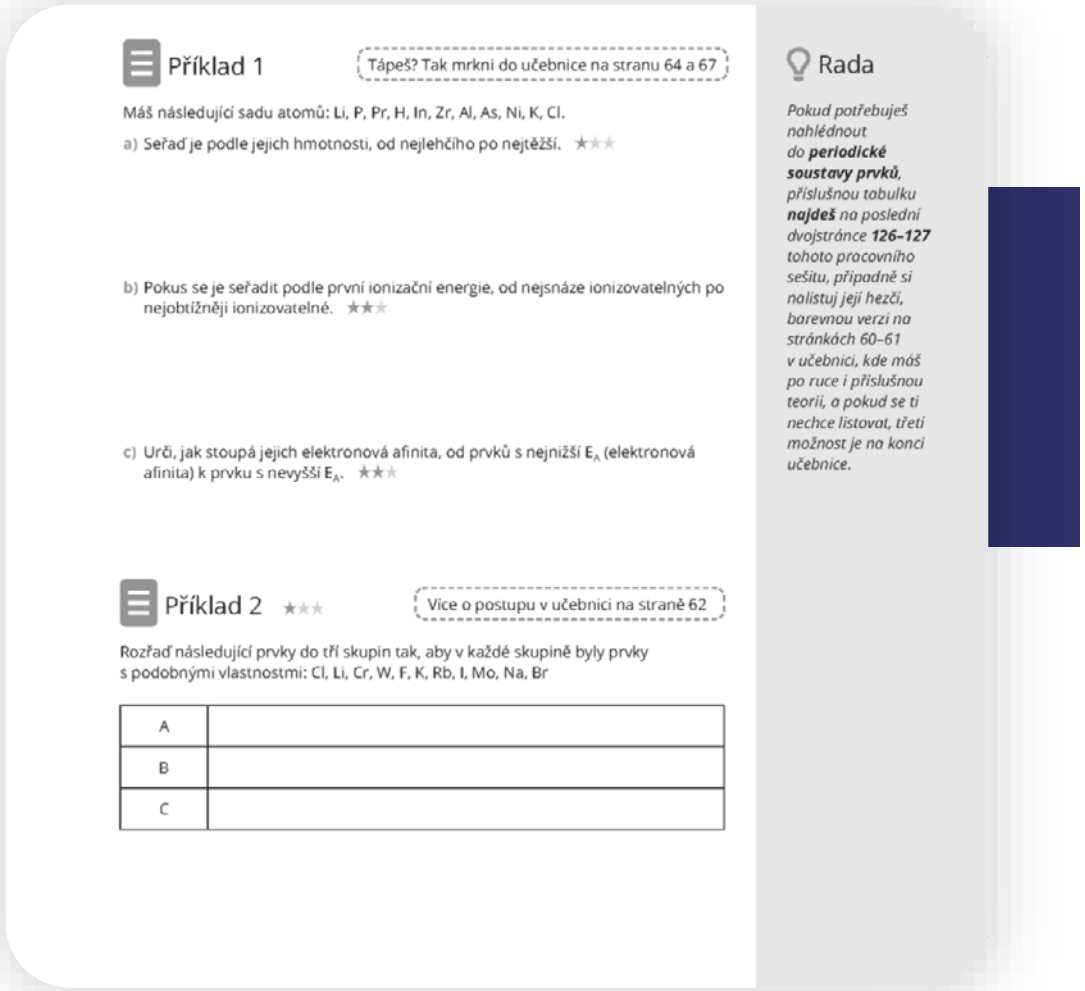

Příklad 1

Tápeš? Tak mrkni do učebnice na stranu 64 a 67

Máš následující sadu atomů: Li, P, Pr, H, In, Zr, Al, As, Ni, K, Cl.

a) Seřaď je podle jejich hmotnosti, od nejlehčího po nejtěžší. ★☆☆

b) Pokus se je seřadit podle první ionizační energie, od nejsnáze ionizovatelných po nejobtížněji ionizovatelné. ★★☆

c) Urči, jak stoupá jejich elektronová afinita, od prvků s nejnižší E_A (elektronová afinita) k prvku s nevyšší E_A. ★★☆

Příklad 2 ★☆☆

Více o postupu v učebnici na straně 62

Rozřaď následující prvky do tří skupin tak, aby v každé skupině byly prvky s podobnými vlastnostmi: Cl, Li, Cr, W, F, K, Rb, I, Mo, Na, Br

A	
B	
C	

Rada

*Pokud potřebuješ nahlédnout do **periodické soustavy prvků**, příslušnou tabulku **najdeš** na poslední dvojstránce **126–127** tohoto pracovního sešitu, případně si nalistuj její hezčí, barevnou verzi na stránkách 60–61 v učebnici, kde máš po ruce i příslušnou teorii, a pokud se ti nechce listovat, třetí možnost je na konci učebnice.*

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HINTS

Good advice is better than gold

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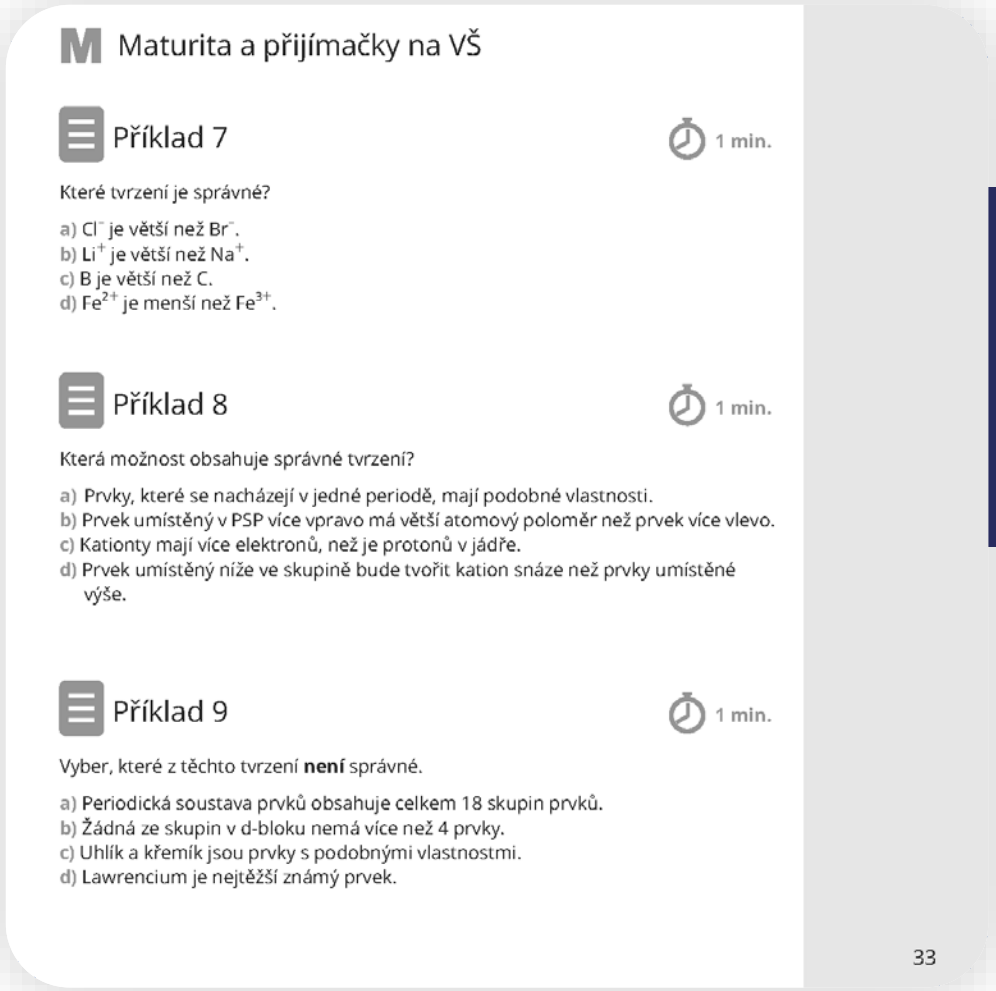

Maturita a přijímačky na VŠ

Příklad 7 — 1 min.

Které tvrzení je správné?

a) Cl^- je větší než Br^-.
b) Li^+ je větší než Na^+.
c) B je větší než C.
d) Fe^{2+} je menší než Fe^{3+}.

Příklad 8 — 1 min.

Která možnost obsahuje správné tvrzení?

a) Prvky, které se nacházejí v jedné periodě, mají podobné vlastnosti.
b) Prvek umístěný v PSP více vpravo má větší atomový poloměr než prvek více vlevo.
c) Kationty mají více elektronů, než je protonů v jádře.
d) Prvek umístěný níže ve skupině bude tvořit kation snáze než prvky umístěné výše.

Příklad 9 — 1 min.

Vyber, které z těchto tvrzení **není** správné.

a) Periodická soustava prvků obsahuje celkem 18 skupin prvků.
b) Žádná ze skupin v d-bloku nemá více než 4 prvky.
c) Uhlík a křemík jsou prvky s podobnými vlastnostmi.
d) Lawrencium je nejtěžší známý prvek.

33

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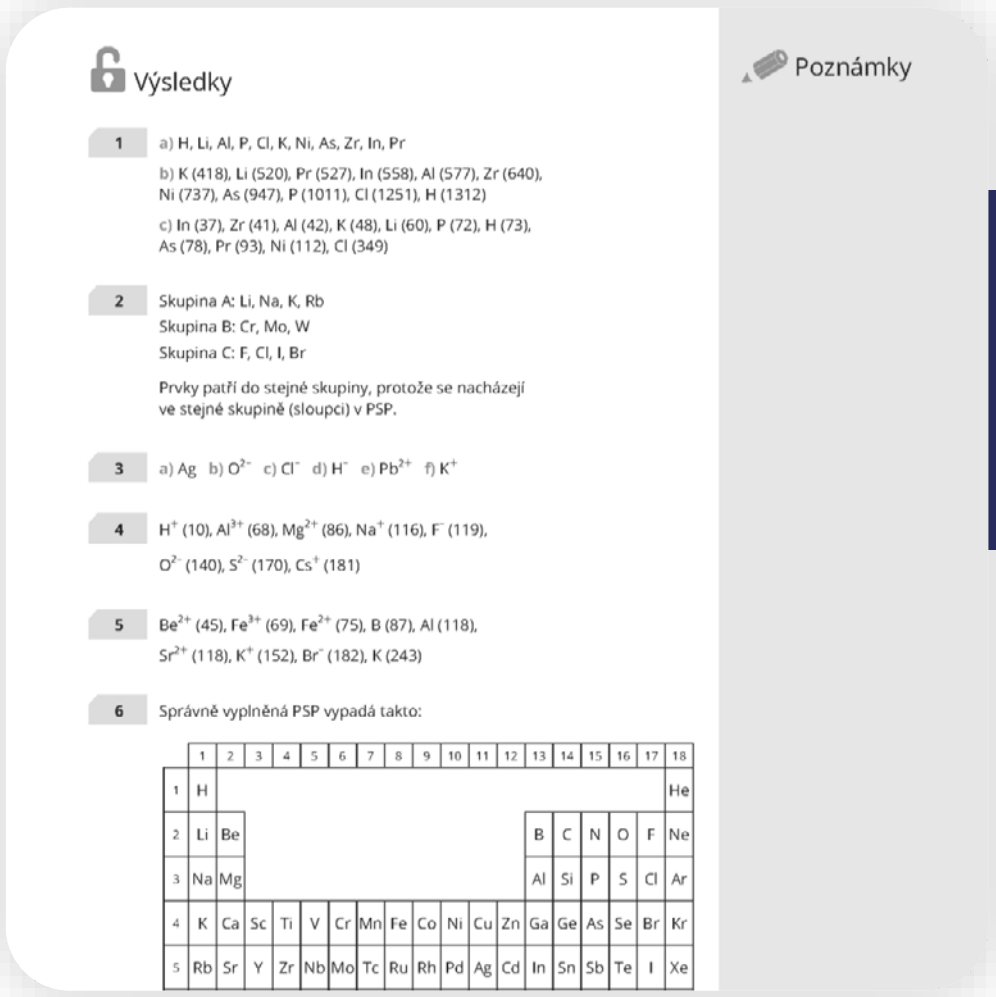
PREPARATION FOR MATURITA EXAM AND TO UNIVERSITY

Continuous preparation

Each subchapter, which is also a part of the school leaving exam or entrance exam to a university, contains model problems from this final exam. It is important to prepare for these problems continuously from the first grade, and therefore these problems appear in all our workbooks.



Výsledky

Poznámky

1 a) H, Li, Al, P, Cl, K, Ni, As, Zr, In, Pr

b) K (418), Li (520), Pr (527), In (558), Al (577), Zr (640), Ni (737), As (947), P (1011), Cl (1251), H (1312)

c) In (37), Zr (41), Al (42), K (48), Li (60), P (72), H (73), As (78), Pr (93), Ni (112), Cl (349)

2 Skupina A: Li, Na, K, Rb
Skupina B: Cr, Mo, W
Skupina C: F, Cl, I, Br

Prvky patří do stejné skupiny, protože se nacházejí ve stejné skupině (sloupci) v PSP.

3 a) Ag b) O^{2-} c) Cl^- d) H^- e) Pb^{2+} f) K^+

4 H^+ (10), Al^{3+} (68), Mg^{2+} (86), Na^+ (116), F^- (119), O^{2-} (140), S^{2-} (170), Cs^+ (181)

5 Be^{2+} (45), Fe^{3+} (69), Fe^{2+} (75), B (87), Al (118), Sr^{2+} (118), K^+ (152), Br^- (182), K (243)

6 Správně vyplněná PSP vypadá takto:

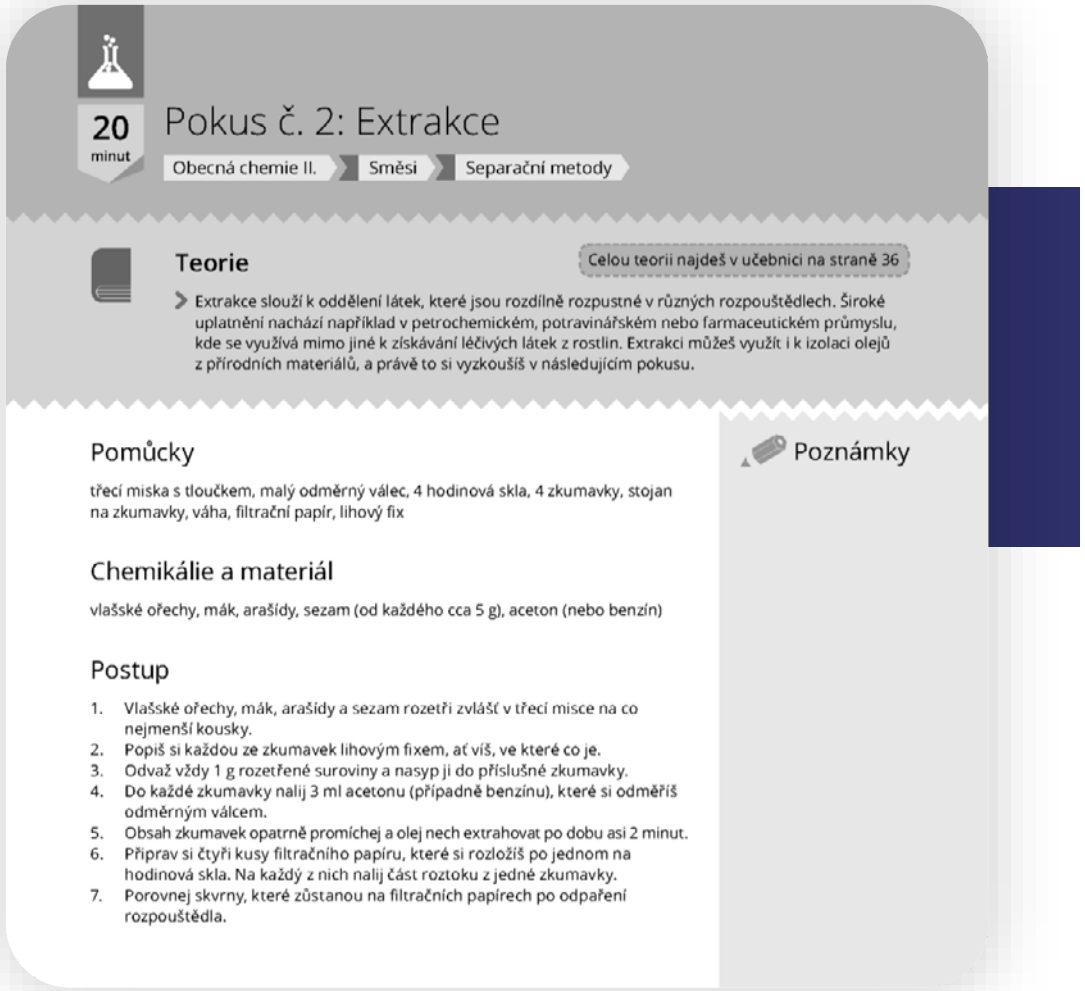
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H																	He
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe

chemie pro spolužáky

RESULTS

What's the result?

Correct results of all problems are at the end of each subchapter. If a student did not work anything out correctly, he/she will find a link to the textbook in the instructions of each problem, where there is an explanation of a similar type of problem, in which he/she can understand how to work out the problem correctly.



20 minut

Pokus č. 2: Extrakce

Obecná chemie II. › Směsi › Separační metody

Teorie

Celou teorii najdeš v učebnici na straně 36

Extrakce slouží k oddělení látek, které jsou rozdílně rozpustné v různých rozpouštědlech. Široké uplatnění nachází například v petrochemickém, potravinářském nebo farmaceutickém průmyslu, kde se využívá mimo jiné k získávání léčivých látek z rostlin. Extrakci můžeš využít i k izolaci olejů z přírodních materiálů, a právě to si vyzkoušíš v následujícím pokusu.

Pomůcky

třecí miska s tloučkem, malý odměrný válec, 4 hodinová skla, 4 zkumavky, stojan na zkumavky, váha, filtrační papír, lihový fix

Chemikálie a materiál

vlašské ořechy, mák, arašídy, sezam (od každého cca 5 g), aceton (nebo benzín)

Postup

1. Vlašské ořechy, mák, arašídy a sezam rozetři zvlášť v třecí misce na co nejmenší kousky.
2. Popiš si každou ze zkumavek lihovým fixem, ať víš, ve které co je.
3. Odvaž vždy 1 g rozetřené suroviny a nasyp ji do příslušné zkumavky.
4. Do každé zkumavky nalij 3 ml acetonu (případně benzínu), které si odměříš odměrným válcem.
5. Obsah zkumavek opatrně promíchej a olej nech extrahovat po dobu asi 2 minut.
6. Připrav si čtyři kusy filtračního papíru, které si rozložíš po jednom na hodinová skla. Na každý z nich nalij část roztoku z jedné zkumavky.
7. Porovnej skvrny, které zůstanou na filtračních papírech po odpaření rozpouštědla.

Poznámky

chemie® pro spolužáky

EXPERIMENTS

With your own eyes!

In each textbook there is a link to an experiment in the workbook. Experiments in the workbook contain a basic theory of what aids and chemicals or materials a student will need and finally the procedure. Furthermore, a record contains calculations, conclusion, additional questions and a QR code referring to a video of the experiment, which is on the project website.

Chemistry experiments

chemie pro spolužáky

Chemistry experiments

18
experiments

2,617
seconds of videos

Experiment name	Link
Mayonnaise	https://youtu.be/Eixg3nOo41g
Laboratory volcano	https://youtu.be/vk-2TXgk_9c
Volumetric analysis	https://youtu.be/t8pXqb-3uvc
Silver out of copper	https://youtu.be/o4OlihJ3xis
Oxidising properties of chlorine	https://youtu.be/L2fQzElDX64
Barking hydrogen	https://youtu.be/tM093En01Co
Bengal fire	https://youtu.be/kI97qMcyLIg
Aluminothermy	https://youtu.be/q7f6YI6PA5s
Test tube hell	https://youtu.be/BBVMhUrz848
Test tube reactions	https://youtu.be/tY_U-acvr68
Distillation	https://youtu.be/Rk1PKg4XnnI
Extraction	https://youtu.be/chNvwk32NMI
Filtration and chromatography	https://youtu.be/1FxA0XteJzI
Catalytic decomposition of hydrogen peroxide	https://youtu.be/65h9axegWYw
Household indicators	https://youtu.be/m4LZf6AUgFw
Endothermic reaction	https://youtu.be/X7K8SAKML4E
Preparation and dilution of solutions	https://youtu.be/Ul-9uhZ6EsU
Soap production	https://youtu.be/gzWfPv1cuXE

Collection of tasks of maths and its structure

matika®
pro spolužáky

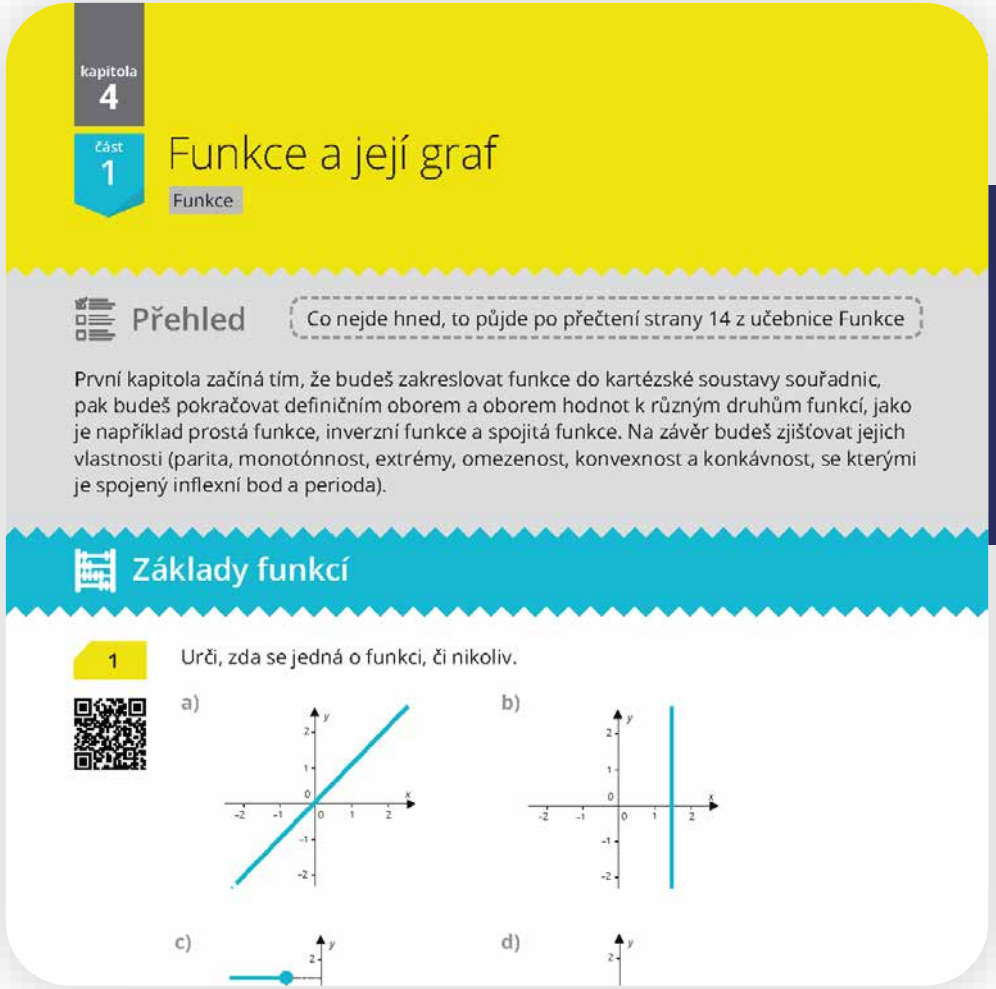
Collection of tasks

Name of the collection of tasks	ISBN
Maths for Classmates: Collection of tasks I.	978-80-88255-36-9
Maths for Classmates: Collection of tasks II.	978-80-88255-41-3
Maths for Classmates: Collection of tasks I.	978-80-89960-10-1

72
topics

492
pages

3,274
examples


kapitola 4

část 1

Funkce a její graf

Funkce

Přehled

Co nejde hned, to půjde po přečtení strany 14 z učebnice Funkce

První kapitola začíná tím, že budeš zakreslovat funkce do kartézské soustavy souřadnic, pak budeš pokračovat definičním oborem a oborem hodnot k různým druhům funkcí, jako je například prostá funkce, inverzní funkce a spojitá funkce. Na závěr budeš zjišťovat jejich vlastnosti (parita, monotónnost, extrémy, omezenost, konvexnost a konkávnost, se kterými je spojený inflexní bod a perioda).

Základy funkcí

1 Urči, zda se jedná o funkci, či nikoliv.

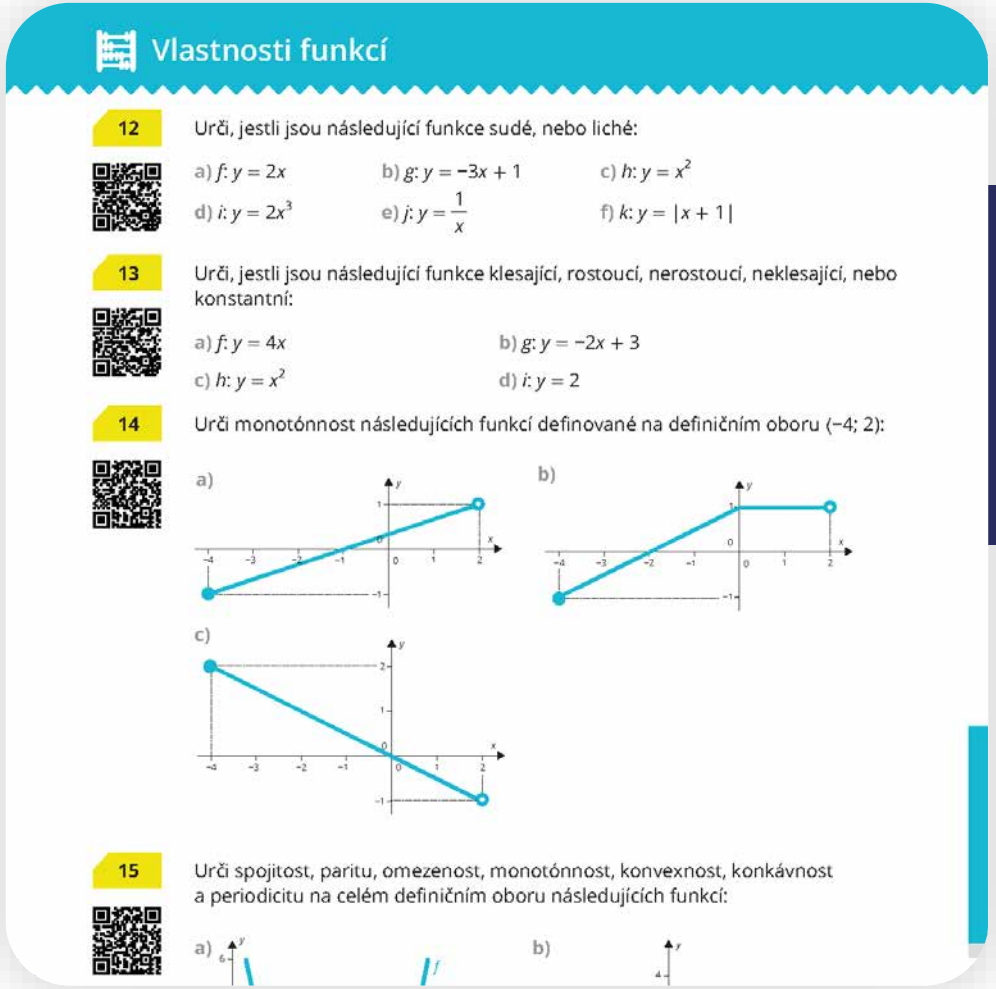
a) b) c) d)

matika pro spolužáky

OVERVIEW

What can you expect?

At the beginning of each chapter, there is a list of types of examples that will be solved on the following pages. At the same time, the overview contains a link to a specific page of the relevant textbook where examples are solved in detail alongside the necessary theory.



Vlastnosti funkcí

12 Urči, jestli jsou následující funkce sudé, nebo liché:

a) $f: y = 2x$ b) $g: y = -3x + 1$ c) $h: y = x^2$

d) $i: y = 2x^3$ e) $j: y = \frac{1}{x}$ f) $k: y = |x + 1|$

13 Urči, jestli jsou následující funkce klesající, rostoucí, nerostoucí, neklesající, nebo konstantní:

a) $f: y = 4x$ b) $g: y = -2x + 3$

c) $h: y = x^2$ d) $i: y = 2$

14 Urči monotónnost následujících funkcí definované na definičním oboru $(-4; 2)$:

a) b)

c)

15 Urči spojitost, paritu, omezenost, monotónnost, konvexnost, konkávnost a periodicitu na celém definičním oboru následujících funkcí:

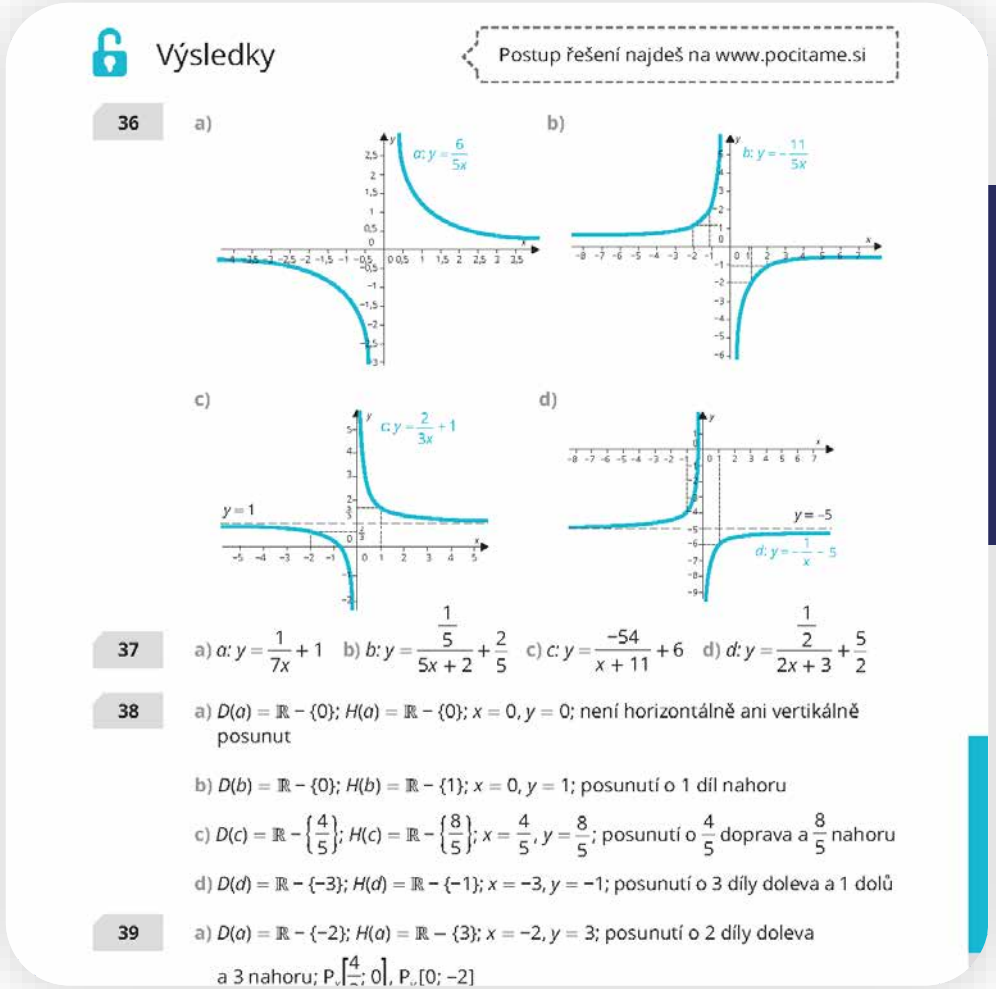
a) b)

matika pro spolužáky

EXAMPLES

Practice makes perfect

The collection is mainly about a large number of examples to practice. Each example has a special QR code that redirects a user to our website where he/she will find the example solved in detail, including a human explanation.



Výsledky

Postup řešení najdeš na www.pocitame.si

36 a)

b)

c)

d)

37 a) $a: y = \frac{1}{7x} + 1$ b) $b: y = \frac{\frac{1}{5}}{5x + 2} + \frac{2}{5}$ c) $c: y = \frac{-54}{x + 11} + 6$ d) $d: y = \frac{\frac{1}{2}}{2x + 3} + \frac{5}{2}$

38 a) $D(a) = \mathbb{R} - \{0\}$; $H(a) = \mathbb{R} - \{0\}$; $x = 0$, $y = 0$; není horizontálně ani vertikálně posunut

b) $D(b) = \mathbb{R} - \{0\}$; $H(b) = \mathbb{R} - \{1\}$; $x = 0$, $y = 1$; posunutí o 1 díl nahoru

c) $D(c) = \mathbb{R} - \left\{\frac{4}{5}\right\}$; $H(c) = \mathbb{R} - \left\{\frac{8}{5}\right\}$; $x = \frac{4}{5}$, $y = \frac{8}{5}$; posunutí o $\frac{4}{5}$ doprava a $\frac{8}{5}$ nahoru

d) $D(d) = \mathbb{R} - \{-3\}$; $H(d) = \mathbb{R} - \{-1\}$; $x = -3$, $y = -1$; posunutí o 3 díly doleva a 1 dolů

39 a) $D(a) = \mathbb{R} - \{-2\}$; $H(a) = \mathbb{R} - \{3\}$; $x = -2$, $y = 3$; posunutí o 2 díly doleva a 3 nahoru; $P_v\left[\frac{4}{-}; 0\right]$, $P_v[0; -2]$

matika pro spolužáky

RESULTS

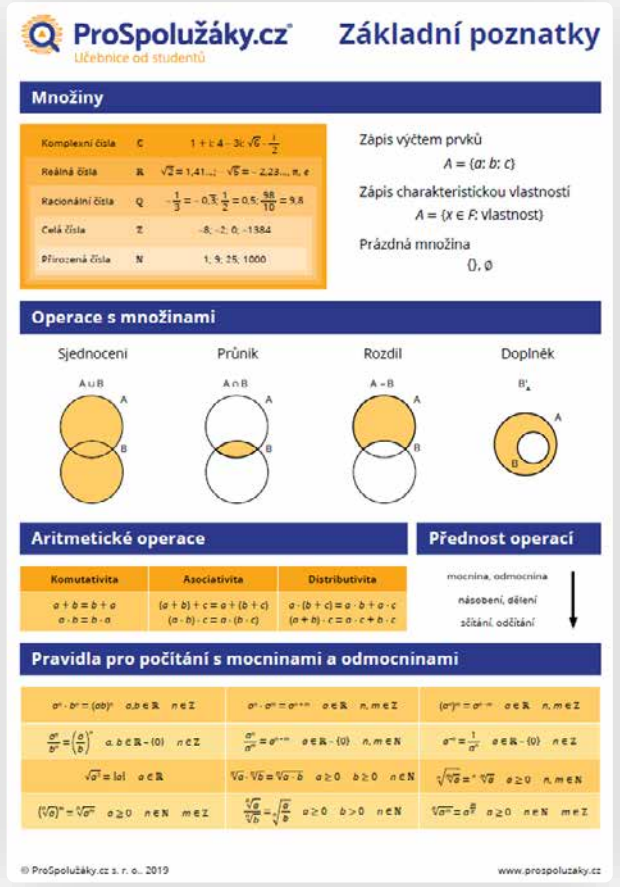
Why it didn’t work out?

Tasks are followed by their correct results. If a student’s result is not correct, he/she can use a QR code or find a way to get to the result through our website. It cannot happen that someone does not know how to solve an example correctly in our collections of tasks.

Recap of maths

matika®
pro spolužáky

Recap


ProSpolužáky.cz
Učebnice od studentů

Základní poznatky

Množiny

Komplexní čísla	$\mathbb{C}$	$1+i$; $4-3i$; $\sqrt{6}$; $\frac{1}{2}$
Reálná čísla	$\mathbb{R}$	$\sqrt{2}=1{,}41\ldots$; $-\sqrt{5}=-2{,}23\ldots$; π; e
Racionální čísla	$\mathbb{Q}$	$-\frac{1}{3}=-0{,}\overline{3}$; $\frac{1}{2}=0{,}5$; $\frac{98}{10}=9{,}8$
Celá čísla	$\mathbb{Z}$	-8; -2; 0; -1384
Přirozená čísla	$\mathbb{N}$	1; 9; 25; 1000

Zápis výčtem prvků
$A = \{a; b; c\}$
Zápis charakteristickou vlastností
$A = \{x \in F;$ vlastnost$\}$
Prázdná množina
$\{\}, \emptyset$

Operace s množinami

Sjednocení $A \cup B$ · Průnik $A \cap B$ · Rozdíl $A - B$ · Doplněk B'_A

Aritmetické operace

Komutativita	Asociativita	Distributivita
$a+b=b+a$ $a \cdot b = b \cdot a$	$(a+b)+c=a+(b+c)$ $(a \cdot b) \cdot c = a \cdot (b \cdot c)$	$a \cdot (b+c)=a \cdot b+a \cdot c$ $(a+b) \cdot c = a \cdot c+b \cdot c$

Přednost operací

mocnina, odmocnina
násobení, dělení
sčítání, odčítání

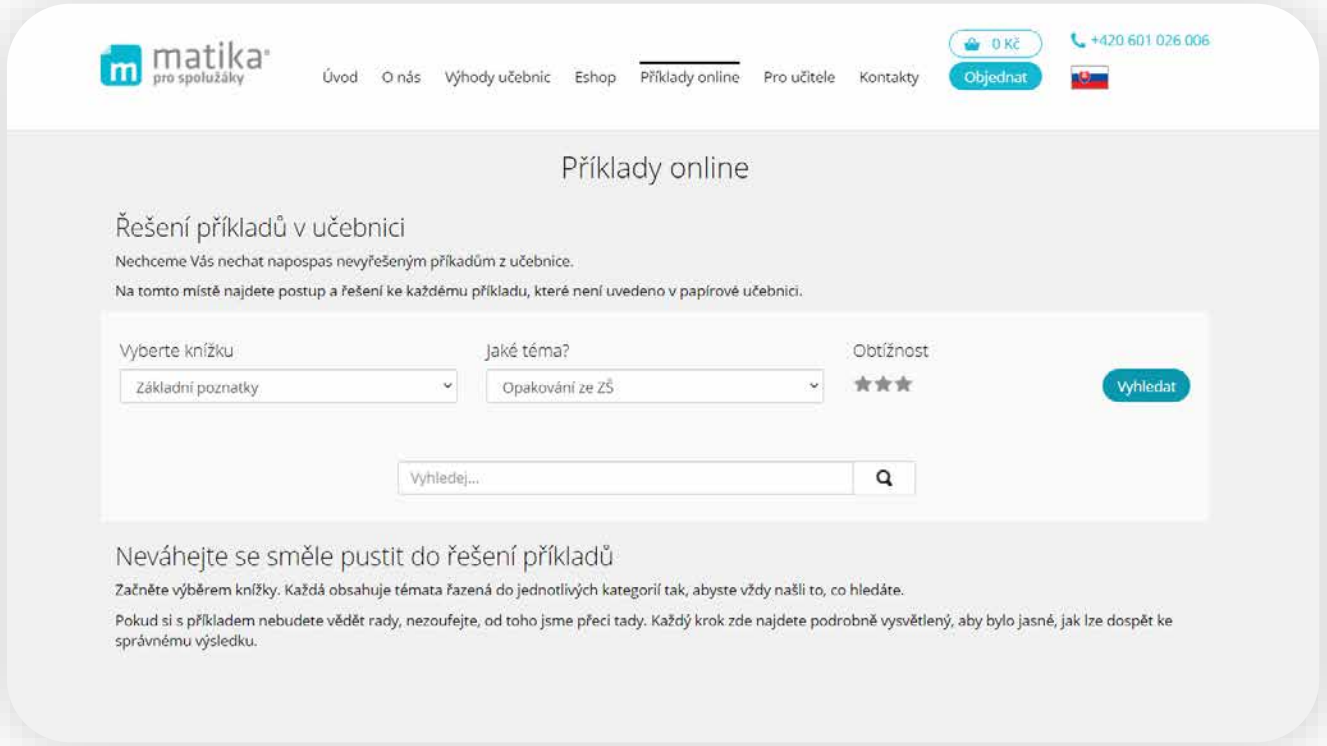
Pravidla pro počítání s mocninami a odmocninami

$a^n \cdot b^n=(ab)^n$ $a,b \in \mathbb{R}$ $n \in \mathbb{Z}$	$a^n \cdot a^m=a^{n+m}$ $a \in \mathbb{R}$ $n,m \in \mathbb{Z}$	$(a^n)^m=a^{n \cdot m}$ $a \in \mathbb{R}$ $n,m \in \mathbb{Z}$
$\frac{a^n}{b^n}=\left(\frac{a}{b}\right)^n$ $a,b \in \mathbb{R}-\{0\}$ $n \in \mathbb{Z}$	$\frac{a^n}{a^m}=a^{n-m}$ $a \in \mathbb{R}-\{0\}$ $n,m \in \mathbb{N}$	$a^{-n}=\frac{1}{a^n}$ $a \in \mathbb{R}-\{0\}$ $n \in \mathbb{Z}$
$\sqrt{a^2}=\lvert a \rvert$ $a \in \mathbb{R}$	$\sqrt[n]{a} \cdot \sqrt[n]{b}=\sqrt[n]{a \cdot b}$ $a \geq 0$ $b \geq 0$ $n \in \mathbb{N}$	$\sqrt[n]{\sqrt[m]{a}}=\sqrt[n \cdot m]{a}$ $a \geq 0$ $n,m \in \mathbb{N}$
$(\sqrt[n]{a})^m=\sqrt[n]{a^m}$ $a \geq 0$ $n \in \mathbb{N}$ $m \in \mathbb{Z}$	$\frac{\sqrt[n]{a}}{\sqrt[n]{b}}=\sqrt[n]{\frac{a}{b}}$ $a \geq 0$ $b > 0$ $n \in \mathbb{N}$	$\sqrt[n]{a^n}=a^{\frac{n}{n}}$ $a \geq 0$ $n \in \mathbb{N}$ $m \in \mathbb{Z}$

www.prospoluzaky.cz

The recap summarises the subject matter from a given textbook. This is the **first product connected to our augmented reality (AR) mobile application.** It is no longer just a piece of paper, but an interactive teaching aid.

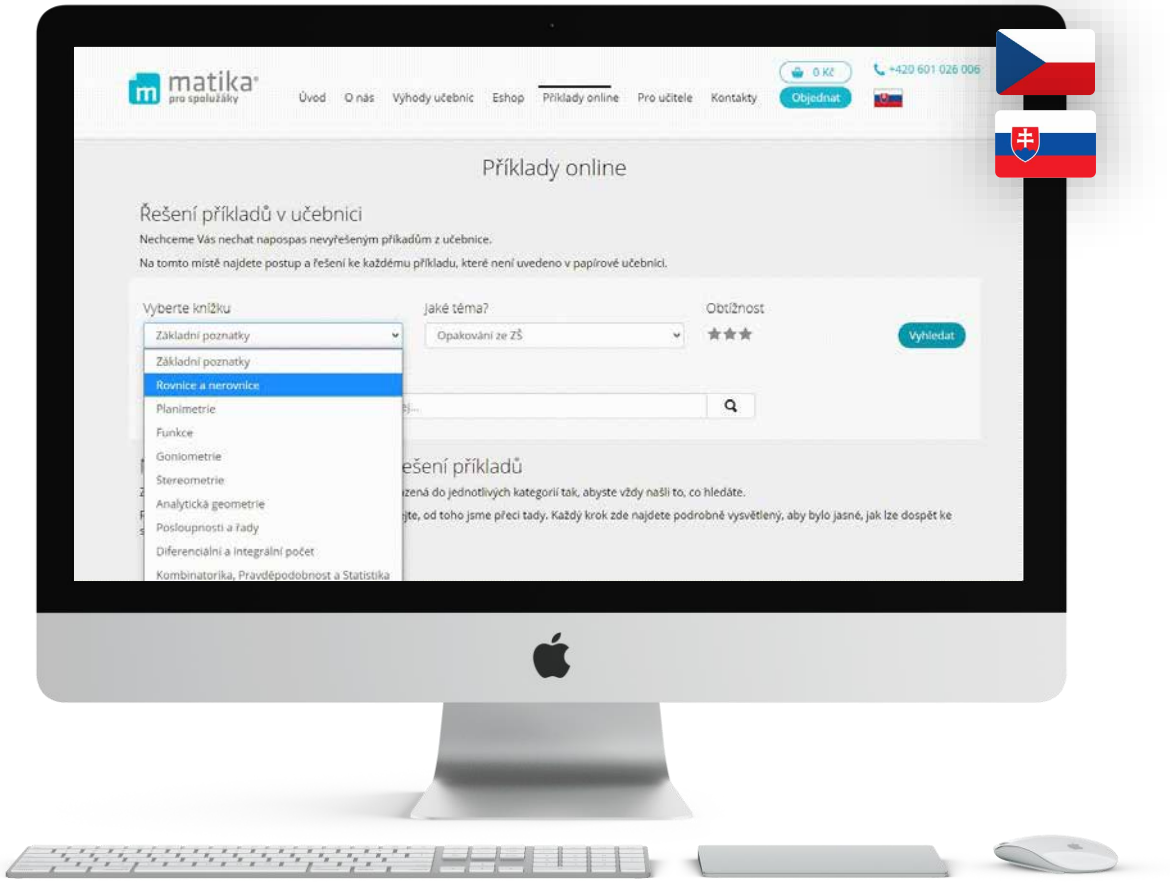
Recap name	Format
ForClassmates.cz: Basic knowledge (recap)	PDF
ForClassmates.cz: Equations and inequations (recap)	PDF
ForClassmates.cz: Planimetry (recap)	PDF
ForClassmates.cz: Goniometry (recap)	PDF
ForClassmates.cz: Functions (recap)	PDF
ForClassmates.cz: Stereometry (recap)	PDF
ForClassmates.cz: Analytical geometry (recap)	PDF
ForClassmates.cz: Sequences and series (recap)	PDF
ForClassmates.cz: Combinatorics, Probability and Statistics (recap)	PDF
ForClassmates.cz: Differential and integral series (recap)	PDF



Examples on the web

matika pro spolužáky

matikaprospoluzaky.cz/priklady



EXAMPLES FROM TEXTBOOKS

Examples on the web

All our examples from textbooks can be found by a student on our website with a detailed approachable explanation. A user can always get to a specific example either by **reading a QR code in the textbook** or via our website, completely free of charge.

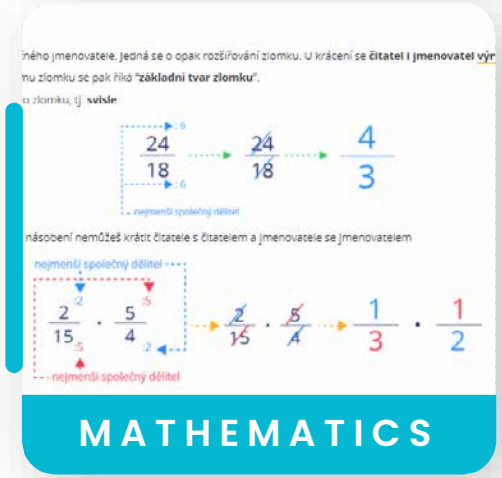
3,678
examples

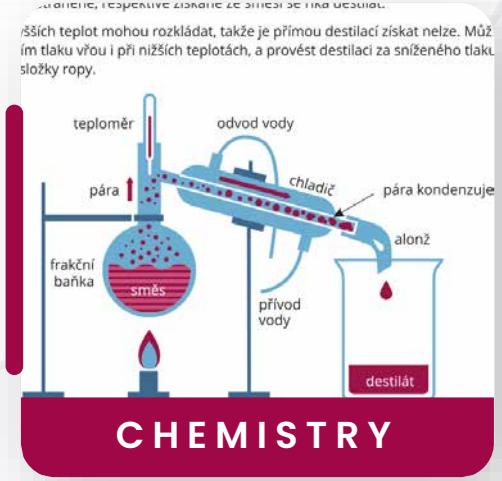
ForClassmates™
Humanly by students

FINISHED PRODUCTS

Online learning

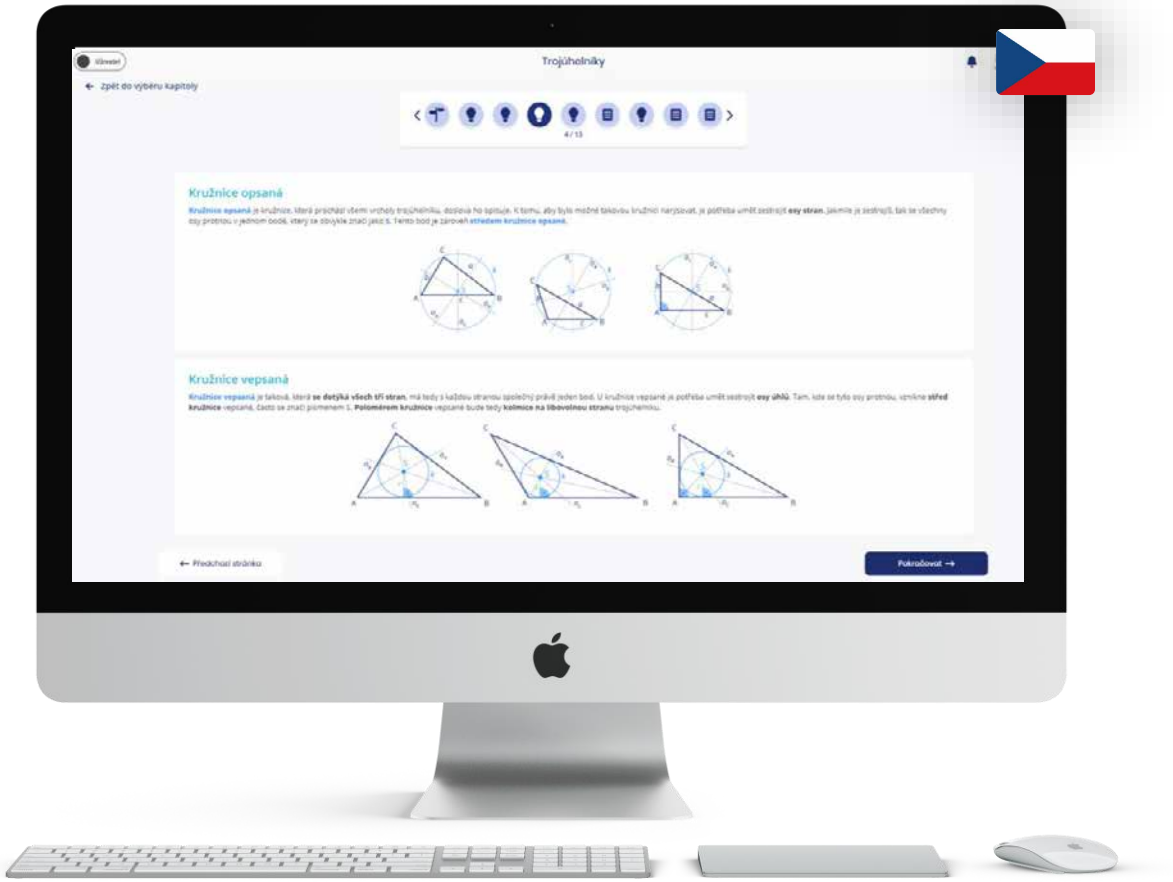
4
courses





forclassmates.online

matika®
pro spolužáky

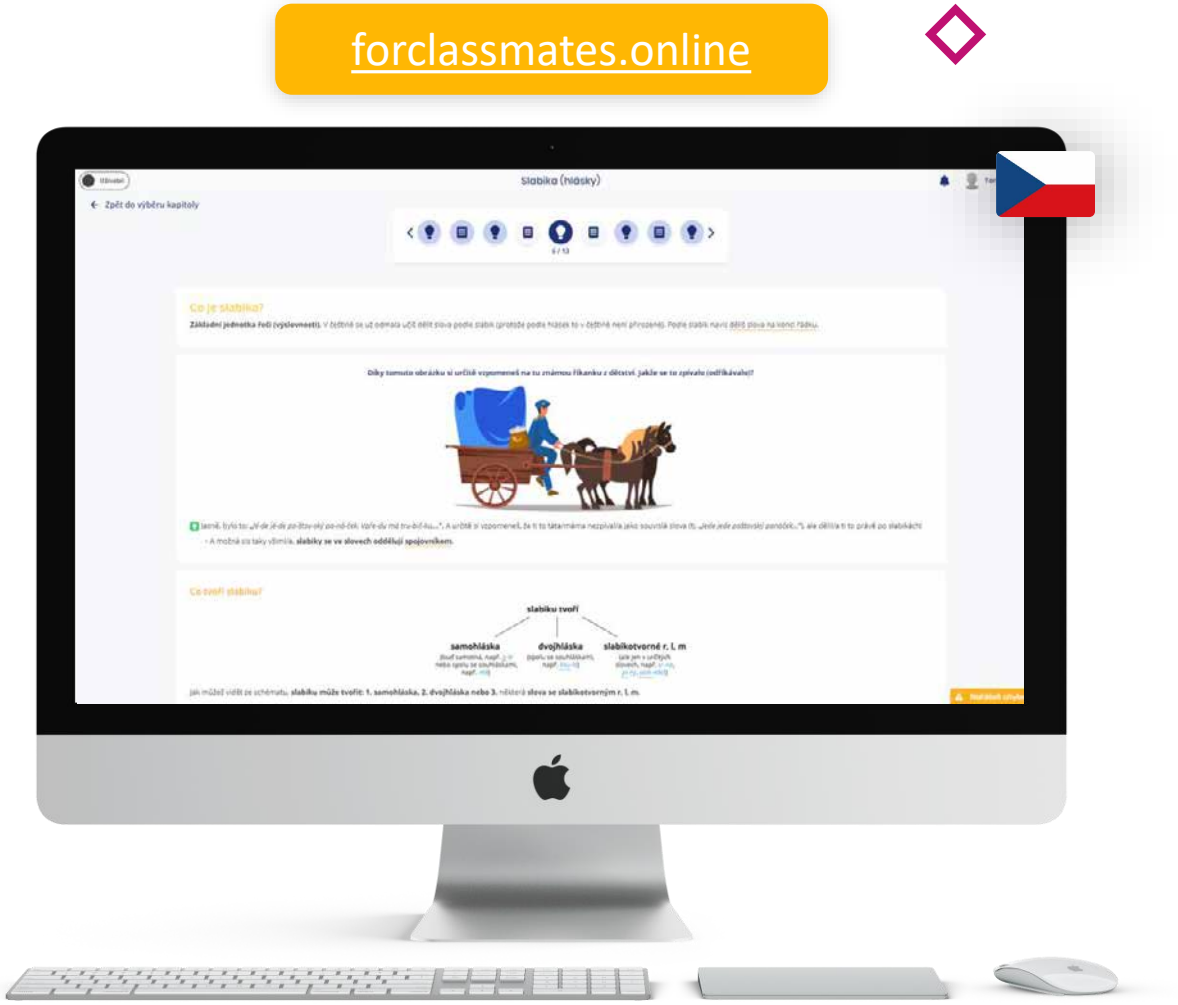


ONLINE LEARNING

Preparation for entrance exams in mathematics

This is one of our first online courses, which allows **9th grade students** to prepare for entrance exams and get into their dream secondary school. It contains all the topics that are part of the exams from CERMAT, which organises this type of exam.

forclassmates.online



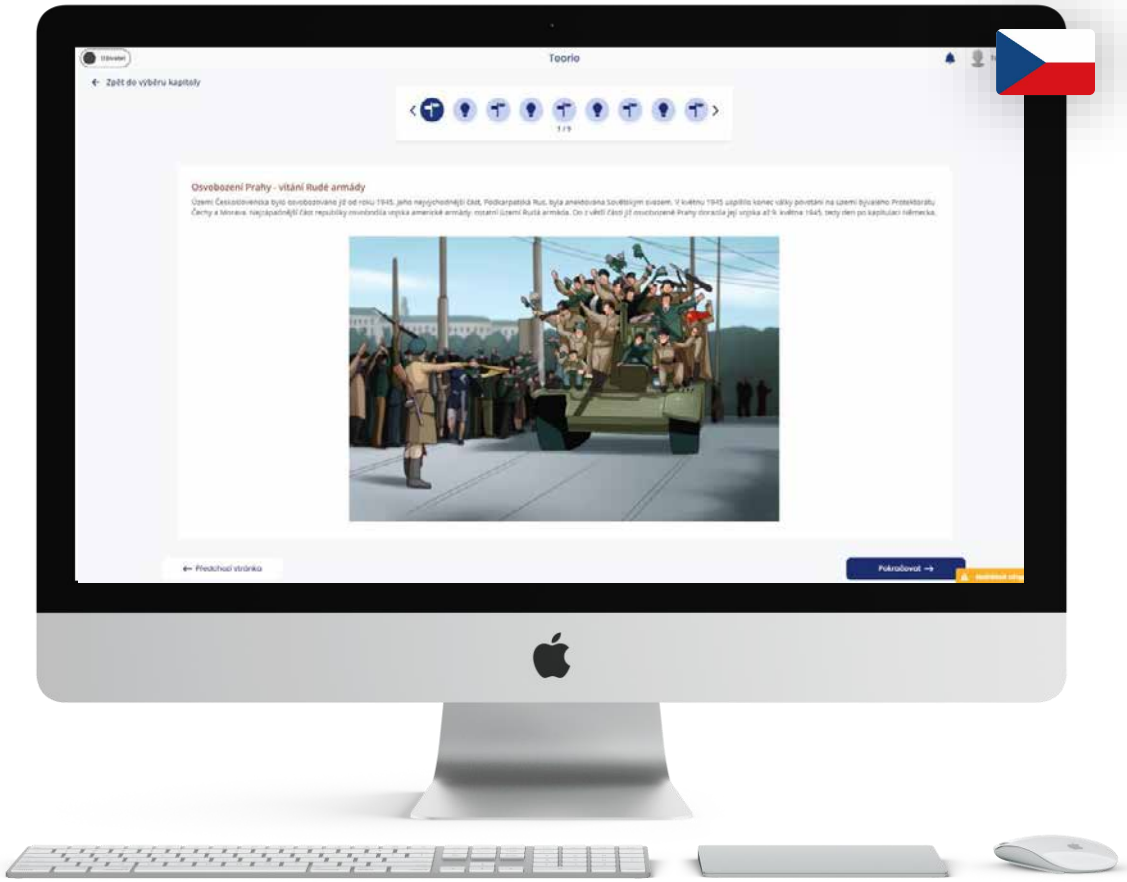
čeština pro spolužáky

ONLINE LEARNING

Preparation for entrance exams in Czech

This is one of our first online courses, which allows **9th grade students** to prepare for entrance exams and get into their dream secondary school. It contains all the topics that are part of the exams from CERMAT, which organises this type of exam.

forclassmates.online



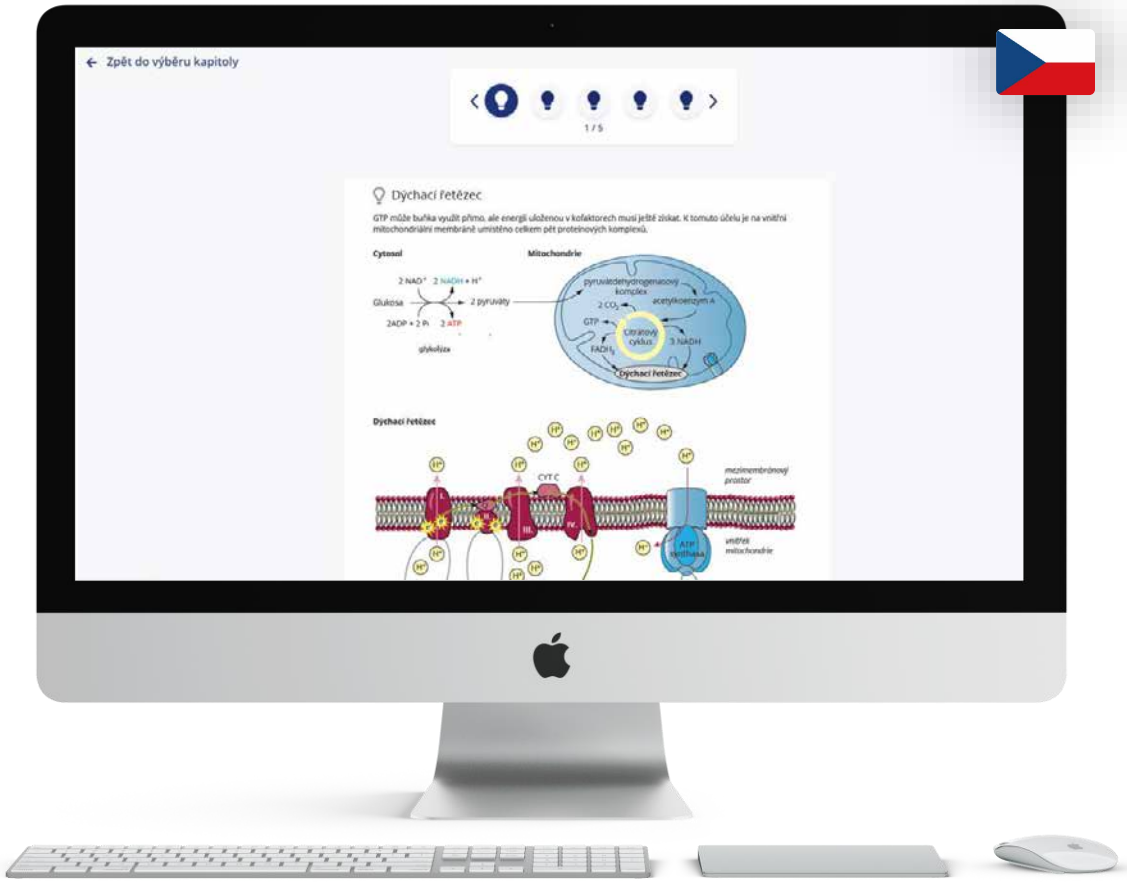
víme.to
ProSpolužáky.cz

ONLINE LEARNING

Czech century

The Czech Century (České století) historical course will introduce users to **the most important milestones and personalities from Czech history**. They will gain context and become well versed in the history of our nation. This course is intended **for the general public**.

forclassmates.online



chemie® pro spolužáky

ONLINE LEARNING

Basics of secondary school chemistry

Our **first online textbook**. The textbook contains **the basics of all four areas of secondary school chemistry** (general, inorganic, organic and biochemistry). In this way, this textbook is intended **for all types of secondary schools**.

Results so far

ForClassmates™
Humanly by students

RESULTS SO FAR

Business and marketing

We have also summarised **important data on business and marketing** for you, what we have achieved and what we have learned so far thanks to our experience in selling printed textbooks.

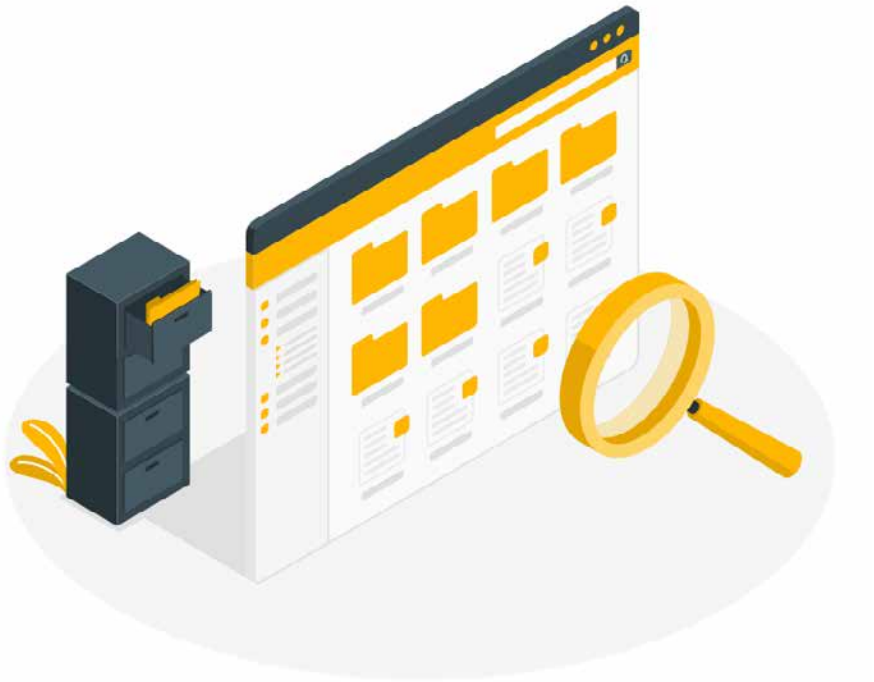
Databases in CRM

ForClassmates™
Humanly by students

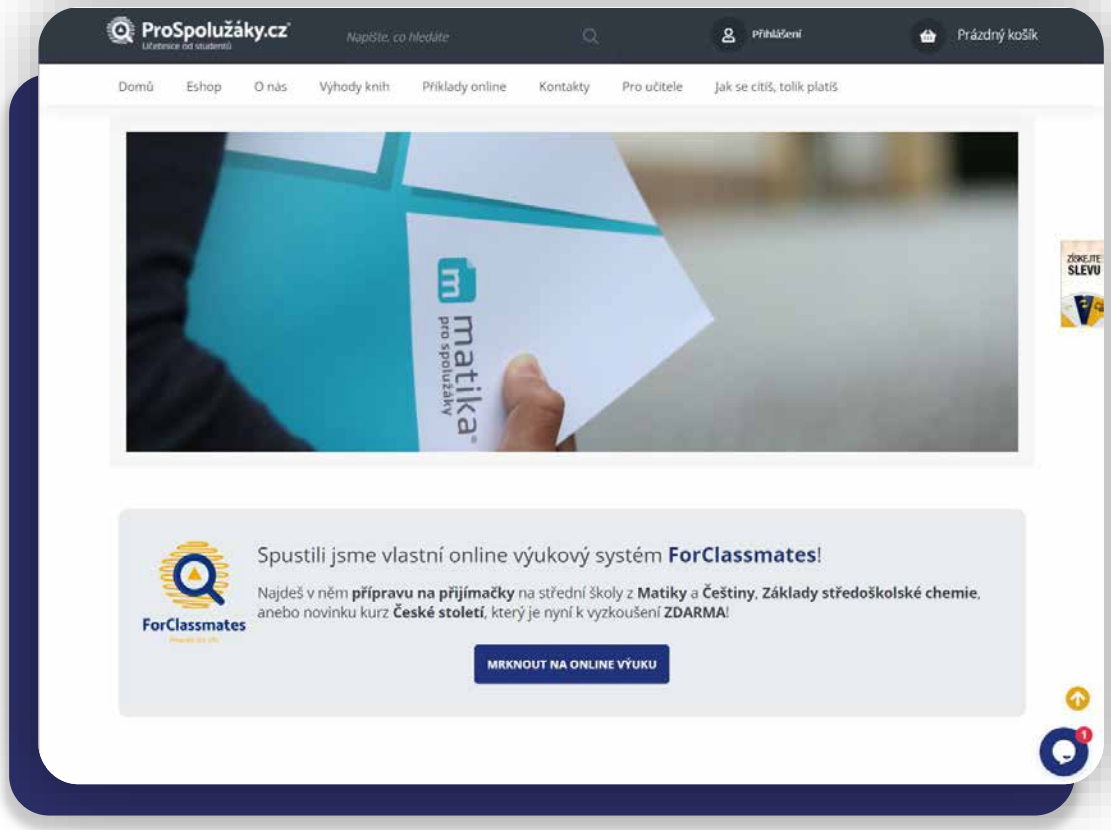
6,455
schools

40,000+
calls

5,5
average calls per school



Number of visitors on the web



Year	Number of visitors
2016	**2,656**
2017	**20,876**
2018	**28,954**
2019	**33,462**
2020	**42,229**

Social media

6,212
“Likes”

1,555
“Likes”

1,085
followers

51
followers

Interesting data from the survey

In 2018, Response Now, s.r.o. created a marketing survey for us in which we learned more about the differences in the market between online and offline learning.

Specification

- Quantitative research – analysis of the brand and attitudes to the product through interviews with defined target groups.
- The target group were secondary school students, parents of secondary school students, secondary school teachers up to the age of 50 and secondary school principals throughout the Czech Republic.
- 649 respondents took part in the survey, of which: 310 were secondary school students, 204 parents of secondary school students, 104 teachers at secondary school, and 31 principals.

Data

1) Equipment used for preparation for lessons (students)

- **92%** smartphone
- **86%** laptop
- **15%** tablet

2) Over 80% of respondents (principals, teachers and parents) think that online SW should be fully financed or co-financed by school.

3) In 91% of classes, at most 5 students in a class do not have a smartphone.

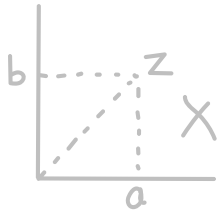
Data

4) Almost 75% of teachers have sometimes invested their own money in preparation for their lessons. Women do that above the average.

5) Resources used on the Internet to prepare for lessons (students):

- **69%** Wikipedia
- **26%** Google
- **10%** YouTube

Media



WROTE ABOUT US

Articles in media

Since 2013, more than 100 articles describing our project have appeared in dozens of media outlets. On the following pages, we provide links to the most interesting ones, in chronological order from the oldest ones.

$$c^2 = a^2 + b^2$$

$$c = \sqrt{a^2 + b^2}$$

$$a = \sqrt{c^2 + b^2}$$

$$b = \sqrt{c^2 + a^2}$$

HOSPODÁŘSKÉ NOVINY

26 August 2016

"Already as a secondary school student, he wrote a textbook of mathematics. And now schools will start using it for teaching."

https://archiv.ihned.cz/c1-65415030-uz-jako-stredoskolak-napsal-ucebnici-matematiky-prodava-se-dobre-a-ted-podle-ni-skoly-zacnou-ucit

Česká televize

22 September 2017

We presented our Maths for Classmates project in Studio 6 on Czech Television.

https://youtu.be/yAS0J9J0Y2E

Novinky.cz

3 March 2017

"Successor of Hejný? A student wrote a textbook of mathematics"

https://www.novinky.cz/veda-skoly/clanek/nastupce-hejneho-student-napsal-ucebnice-matematiky-40026342

ROZHLAS A TELEVÍZIA SLOVENSKA

13 October 2018

We talked about textbooks in the AUPARK shopping center in Bratislava with the Slovak television station RTVS.

https://park.rtvs.sk/archiv/169175-park

HOSPODÁŘSKÉ NOVINY

12 March 2019

"The non-traditional textbooks of mathematics and chemistry are written by students. Already 168 secondary schools use them for teaching"

https://archiv.ihned.cz/c1-66516400-netradicni-ucebnice-matematiky-a-chemie-pisi-studenti-uci-podle-nich-uz-168-strednich-skol

ČT24

10 March 2019

Talking about our project and the Startupper of 2019 competition on Czech Television in Studio ČT24.

https://www.facebook.com/prospoluzaky.cz/videos/261229281494286/

euro

19 March 2019

"Liška, startupper of the year: Education is based on memorisation, but mathematics cannot be memorised"

https://www.euro.cz/byznys/marek-liska-deti-maji-odpor-ke-skole-nejen-k-matematice-1443912

euro

21 August 2019

"Author of innovative textbooks Liška: We want children to like going to school"

https://www.euro.cz/tv/autor-inovativnich-ucebnic-liska-chceme-aby-deti-chodily-do-skoly-rady-1463161

Český rozhlas

9 June 2019

"ProSpolužáky.cz textbooks by students are already used in more than 180 schools. An application should also be created within a year"

https://www.irozhlas.cz/zpravy-domov/prospoluzakycz-skola-uceni-cesko-ucebnice-matematika-maturita_1906090857_dok

Česká televize

8 October 2020

Interview about online education and teaching using the student-language method.

https://youtu.be/4qJekwdZd7A

CZECHCRUNCH

11 December 2020

"His innovative textbooks are used by over 30,000 students. Now Marek Liška wants to improve online learning"

https://www.czechcrunch.cz/2020/12/jeho-inovativni-ucebnice-pouziva-pres-30-tisic-studentu-ted-chce-marek-liska-vylepsit-online-vyuku/

Pardubice Český rozhlas

7 December 2020

"Are you struggling to stay afloat in maths? The students themselves came up with an application for younger classmates"

https://pardubice.rozhlas.cz/topis-se-v-matice-sami-studenti-vymysleli-aplikaci-pro-mladsi-spoluzaky-8378198

Nuly a jedničky

Marek appeared on the Nuly a jedničky *(Zeros and ones)* programme on Czech Television, where they talked about mathematics.

https://youtu.be/n7bAFj0WWRE

Ulice

Our textbooks also appeared in the well-known Czech series "Ulice" *(Street)*, where they had their famous moment. They were to help one of the students when he had problems with mathematics.

https://www.facebook.com/523975477639272/videos/713247709092980

Overview of other selected articles

29/ 04/2013	He is writing a textbook. For classmates. 'It's a big bite,' he admits
02/ 02/2015	A maths textbook that students enjoy! How is it possible?
25/ 10/2015	Learn to count on everything!
17/ 12/2015	Maths for Classmates. Students write a textbook
09/ 01/2016	Week in the regions: Maths for Classmates
09/ 02/2016	Fokus Václava Moravce: Society of (non-)education
07/ 04/2016	Maths textbook heading abroad. Maybe even Americans will learn from it
22/ 04/2016	Snídaně s Novou (Breakfast with TV Nova): Maths for Classmates
21/ 06/2017	A student decided to fight the incomprehension of Czech textbooks and wrote his own ones from his notes. Dozens of secondary schools use them for teaching
11/ 07/2017	"Even teachers themselves are against changes," say students and the authors of new textbooks
28/ 10/2017	They didn't want to come to the party because of maths, so he wrote a fun textbook for them
01/ 11/2017	He wrote Maths for Classmates. A textbook that students enjoy. And thanks to it, they no longer write crib sheets
01/ 02/2018	Gejzír: Maths for Classmates
19/ 02/2018	Students have published a chemistry textbook. They wrote it as secondary school students speak
22/ 02/2018	Events in the Regions: Chemistry for Classmates
28/ 02/2018	Students who are behind their own teaching texts for their classmates, publish a new chemistry textbook
04/ 03/2018	Junior radio: Maths for Classmates
25/ 03/2018	Another inspirational MashUp evening is behind us!
16/ 09/2018	More than 120 schools are using Maths for Classmates for teaching, now it wants to conquer Slovakia
20/ 09/2018	TA3: PreSpolužiakov.sk
01/ 03/2019	The winner of the Startupper of the Year competition is Marek Liška with the ProSpolužáky.cz project. Lucie Částková is the businesswoman of the year under 35
02/ 03/2019	THE WINNER OF THE STARTUPPER OF THE YEAR COMPETITION IS MAREK LIŠKA WITH PROSPOLUŽÁKY.CZ
04/ 03/2019	The winner of the Startupper of the Year competition is Marek Liška with the Prospolužáky.cz project
05/ 03/2019	The Startupper of the Year is Marek Liška with the Prospolužáky.cz project
11/ 03/2019	He set up a publishing house for textbooks written by students. Now he has won an award
12/ 03/2019	The winning project of the Startupper of the Year competition – Prospolužáky.cz, succeeded in the European final
20/ 03/2019	Startupper of the Year Liška: Education is based on memorizing, but mathematics cannot be learn by heart
27/ 03/2019	How to make unpopular science easy for pupils? Marek Liška scores with the original textbook
07/ 06/2019	A maths textbook made for students by students
09/ 06/2019	Maturita exam from maths without stress? Prospolužky.cz textbook is written by students themselves
11/ 05/2020	Hradec students published successful textbooks. They want to help with the preparation of Maturita graduates
24/ 08/2020	That children lack financial literacy and learn it only through experience bothers a young author of textbooks
13/ 10/2020	Půlhodinovka: Marek Liška: We are going to change the school system, but it will take some time yet.
11/ 11/2020	Learn in a different way, learn online... with Prospolužáky.cz – Press Release
25/ 11/2020	Evropa 2 advertising spot: ProSpolužáky.cz
01/ 12/2020	ProSpolužáky.cz way up. An online platform just in time

Events

TEDx Budweis

x = independently organized TED event

5 November 2016

We presented the project in front of more than 150 people at a well-known presentation event, which was held in České Budějovice.

https://youtu.be/g_YeUxbfS60

Radiožurnál

Český rozhlas

19 June 2019

On the occasion of a special event called Welcome to Life 4.0, we presented our vision of how people should be educated in the future.

https://youtu.be/TBKUKhXzbbo

Fuckup

- ZLÍN -

12 December 2018

We also accepted the invitation to the FuckUp Nights event, which focuses on the failures that occur during the development of projects.

Awards

HOME REGION OF HRADEC KRÁLOVÉ

Recognition of the Governor

In 2014, our idea was awarded with a commemorative plaque by the Governor of the Hradec Králové region.

http://www.kr-kralovehradecky.cz/cz/kraj-volene-organy/tiskove-centrum/aktuality1/den-kraje:-oceneni-za-statecnost-i-za-rozvoj-a-reprezentaci-kraje-69787/

HOME TOWN OF HRADEC KRÁLOVÉ

City medal

In 2017, we received a medal from the mayor of Hradec Králové for popularising secondary school mathematics with a completely unique approach, and we became the youngest holders of this award.

https://www.hradeckralove.org/assets/File.ashx?id_org=4687&id_dokumenty=65900

SOČ
středoškolská odborná činnost

5th place
in the national round

The first public presentation of the beta version of the textbook at the secondary school work competition, which was attended by 132 students in 2013.

IMPACT HUB Praha

1st place

In 2018, we participated in the Mashup networking event, which consists of presenting interesting projects in just 200 seconds.

https://slideslive.com/38906294

T-Mobile rozjezdy

1st place in the region
in the student category

In 2014, we won a competition for fledgeling entrepreneurs organised by T-Mobile.

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FINALIST OF THE

SDGs 2018

In June 2018, we were selected from more than 150 projects among the TOP 5 that meet the goals of sustainable development of the **UN** in the Czech Republic. Our project met the goal of better education free of discrimination for everyone.

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NATIONAL AND EUROPEAN WINNER

Startupper of the year by Total Challenge 2019

In March 2019, we participated in an international competition for startups where we placed in the TOP 6 out of more than **13,000 projects** from around the world and at the same time were outright winners in all of Europe. The prize included an invitation to Paris for a week of mentoring and a presentation of our project to employees and management of Total.

youtu.be/qEelifYvwjw

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HONORARY INVITATION

One Young World 2019 London

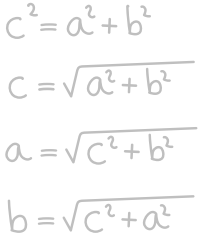
In October 2019, Total invited us, as winners of the Startupper of the year competition, to London for a global forum for young leaders under 30 from around the world, with the aim of raising awareness of today's problems and disseminating solutions across their countries.

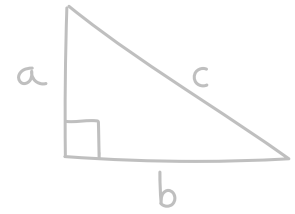
youtu.be/ymlinsMc664

Sponsors

Who has supported us in the past?

27 partners





KRÁLOVÉHRADECKÝ KRAJ

HRADEC KRÁLOVÉ

thhk
TEPELNÉ HOSPODÁŘSTVÍ HRADEC KRÁLOVÉ, a.s.

charvát®

Continental

LESY ČR

Glatt® spol. s r.o. Pharma

ROTARY INTERNATIONAL

ZOOT.
UDĚLEJTE SI RADOST. JEN TAK.

TROTINA Auto

Nadace pro rozvoj vzdělání

JULI

CZE+

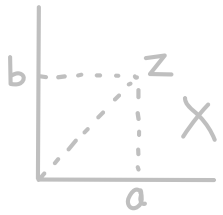
italinox
nerez ocel

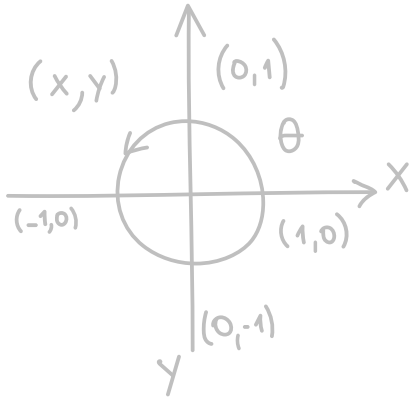
ITFutuRe s.r.o.

[jhv-engineering]

Select-JMC s.r.o.
VELKOOBCHOD OBALŮ

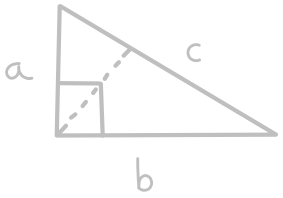
kamerov.cz





Total amount of support

USD 193,254.4



$$x = \frac{1}{1+y}$$

What do we want to create?

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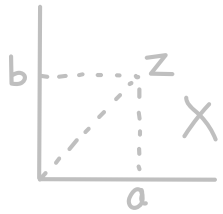


Content

The most challenging will be the creation of content, which will consist of five subjects: **Maths**, **Chemistry**, **Physics**, **Biology** and **Geography**. We want to create these subjects in **Czech** and translate them into other three world languages, **English**, **Spanish** and **Portuguese**. Subsequently, we would like to extend the translations to **Polish**, **French** and **German**.

The content will be created in the same form as the previous textbooks, i.e. **in an understandable form using the students' own language**. Tasks will be solved **step by step** with clear commentary on each step. We want the materials to be created by young people who understand the generation of current students.

Maths

For primary and secondary school

🇨🇿	07/2021	06/2023
🇺🇸	07/2022	06/2023
🇪🇸 + 🇧🇷	07/2023	06/2024
🇫🇷 + 🇩🇪 + 🇵🇱	07/2024	06/2025

Basic knowledge of mathematics, numerical fields

Combinatorics, Probability and Statistics

Goniometry and Trigonometry

Functions

Complex numbers

Stereometry

Algebra

Sequences

Planimetry

Analytical geometry on the plane and in space

Differential and integral calculus

Observation, experiment and work safety

Mixtures

Particle composition of substances and chemical elements

General Chemistry

Chemical reactions

Chemical calculations

Inorganic chemistry

Biochemistry

Organic chemistry

Chemistry

For primary and secondary school

CZ	11/2021	10/2023
EN	09/2022	10/2023
ES + PT	11/2023	10/2024
FR + GE + PL	11/2024	10/2025

Physics

For primary and secondary school

CZ	03/2022	02/2024
EN	01/2023	02/2024
ES + PT	03/2024	02/2025
FR + GE + PL	03/2025	02/2026

- Introductory concepts
- Mass point mechanics
- Energy
- Gravitational field
- Hydromechanics
- Thermal physics
- Vibration
- Waves
- Electric field
- Magnetic field
- Electromagnetism
- Optics
- Atomic and nuclear physics
- Theory of relativity
- Quantum physics
- Astrophysics

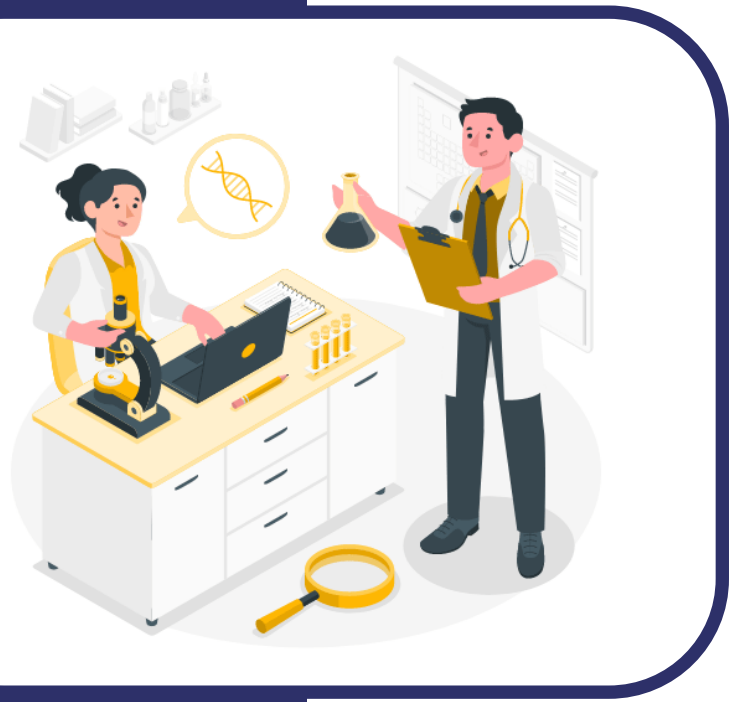
General biology and genetics

Mushooms

Animals

Plants

Lifeless nature



Human

Ecology

Viruses

Algae

Genetics

Bacteria

Practical knowledge of nature

Biology

For primary and secondary school

CZ	07/2022	06/2024
EN	05/2023	06/2024
ES + PT	07/2024	06/2025
FR + GE + PL	07/2025	06/2026

Geography

For primary and secondary school

CZ	11/2022	10/2024
EN	09/2023	10/2024
ES + PT	11/2024	10/2025
FR + GE + PL	11/2025	10/2026

Planet Earth

Globe and map

Natural image of the Earth

Geography of continents and oceans

Landscape and environment

Political geography of the world

Introduction to geography

People on Earth

Eurasia

Earth as an astronomical object

Non-European regions of the world

Social and economic components of the landscape

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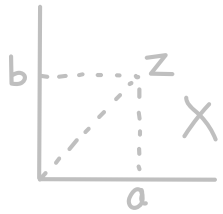


Application

An integral component of development is the creation of a quality educational application, which consists of basic pillars and additional functions. We divide it into **user** and **admin** interfaces.

The basic pillars of the **user interface** are **interactive tailor-made learning**, **practice** and **statistics**. To ensure the constant motivation of students, **gamification** must be included so that they enjoy learning. In addition, the application must adapt its resolution to specific devices (so-called **responsivity**).

In **the admin interface**, we will mainly focus on the development **of the editor**, in which all **content** will be created (texts, translations, mathematical equations, interactive videos, interactive graphs, etc.), as well as on **order management** or **online technical support**.

Technologies

We will mainly use the NuxtJS framework, which is based on the Vue.js JavaScript framework, for **presentation websites**. We will use Vue.js and React technology on the **frontend of the application's web interface**, while we will write **mobile applications** in React Native.
We will build the **backend** on Python technology, which we will make great use of in the implementation of Machine Learning and artificial intelligence. **The database** will be created by a robust PostgreSQL database system.

Presentation webs

NUXTJS

Frontend

Vue.js

React

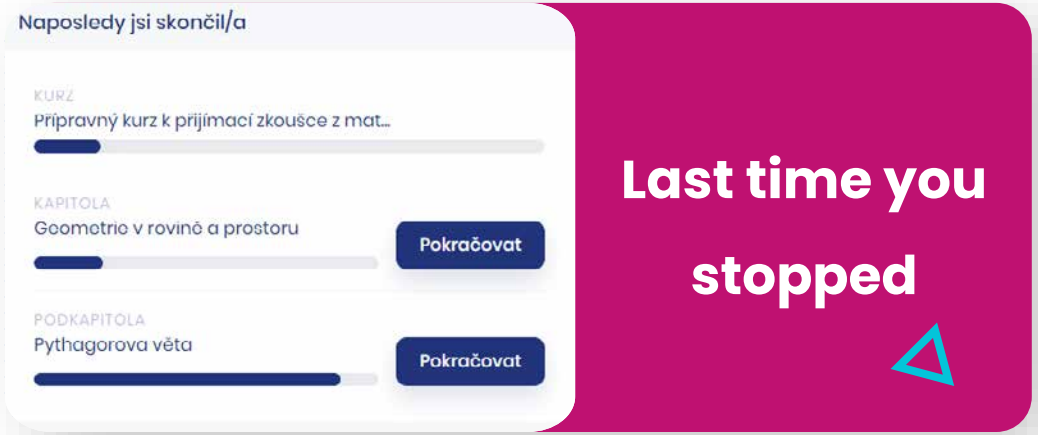
Backend

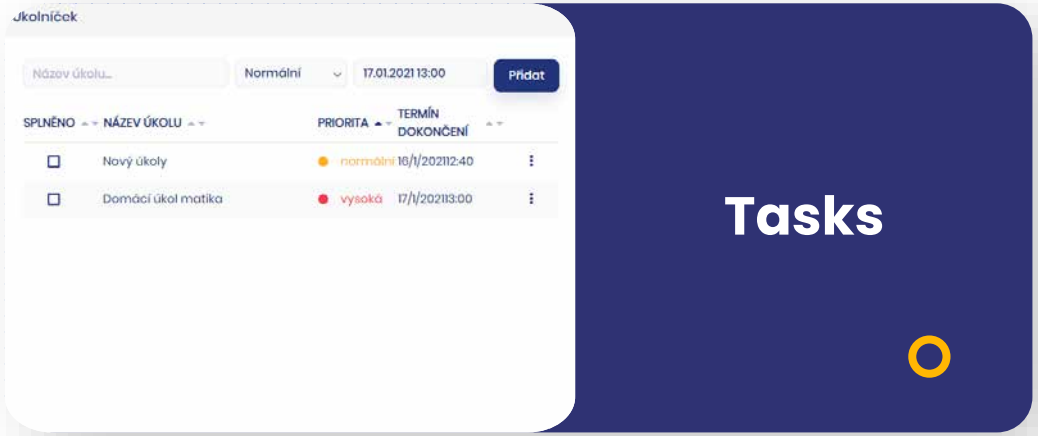
python™

PostgreSQL

Dashboard

The dashboard is the first page in the application with a summary of the main elements. In the "**Where did you stop last time**" widget, a student will be able to go straight to the last opened subject matter and continue studying. There will also be **activity statistics** and an **overview of tasks** on the dashboard.

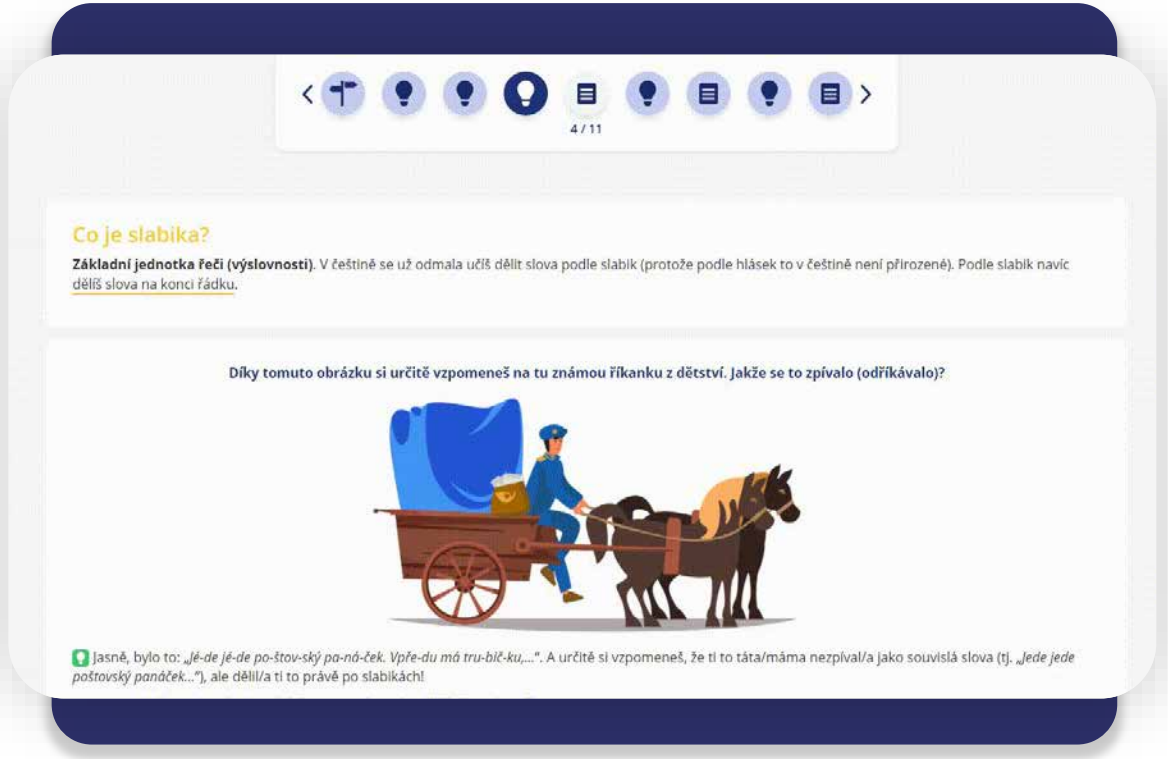




Teaching theory

We divide the subject matter into individual blocks and explain it with the help of **pictures**, **illustrations** or **coloured text**. We try to **structure** everything and **visually describe** the theory so that a student sees the most important or less important items at a glance.

We describe everything **in an approachable manner** (**in the students' own language**) **without definitions** and show everything on **specific model situations**.



Tailor-made

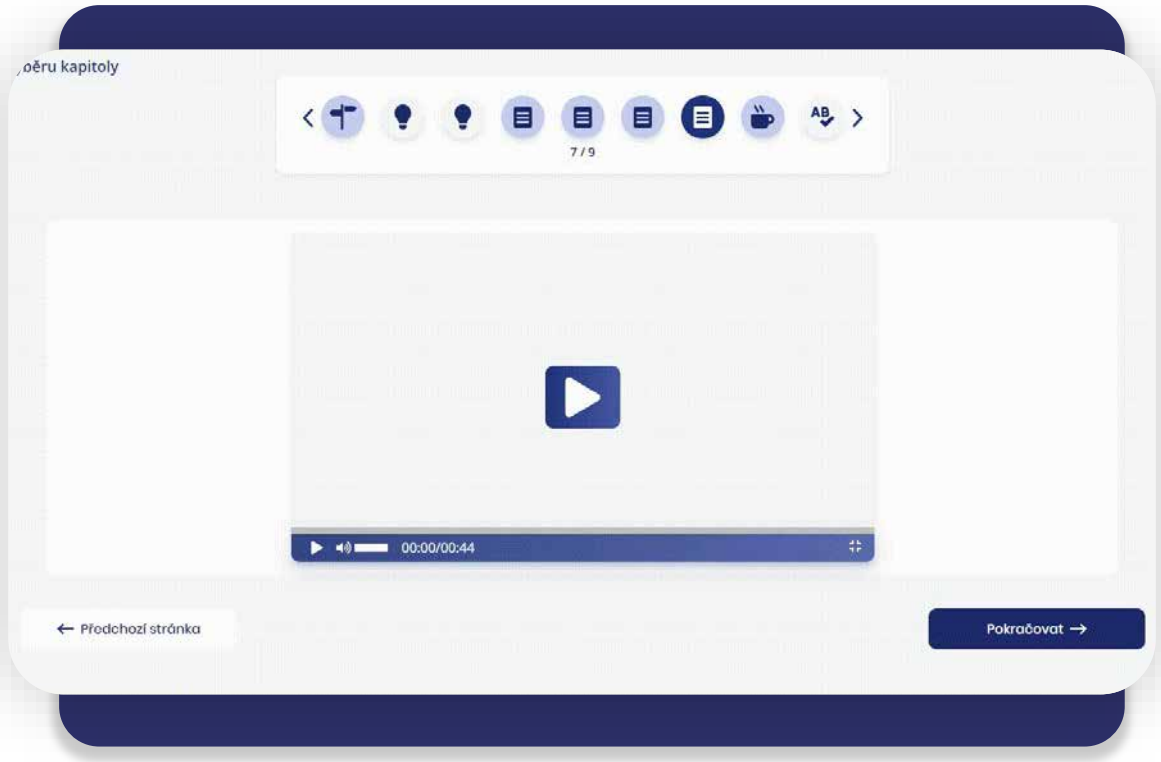
According to us, today's education **lacks a personalised style of teaching**. We want to build the system so that it is **tailored to each student** using modern technologies.

A student who does not catch up well at school will be able to practice more, whereas a fast student will be able to further expand his/her knowledge and improve more.

Everyone will learn at their own pace and with the methods that suit them best (for example, some learn better through pictures and videos, and some through practice and text).

Entrance test

The entrance test will appear when the system needs to **find out the current state of knowledge of the** user in order to adapt to him/her so that the learning is effective.

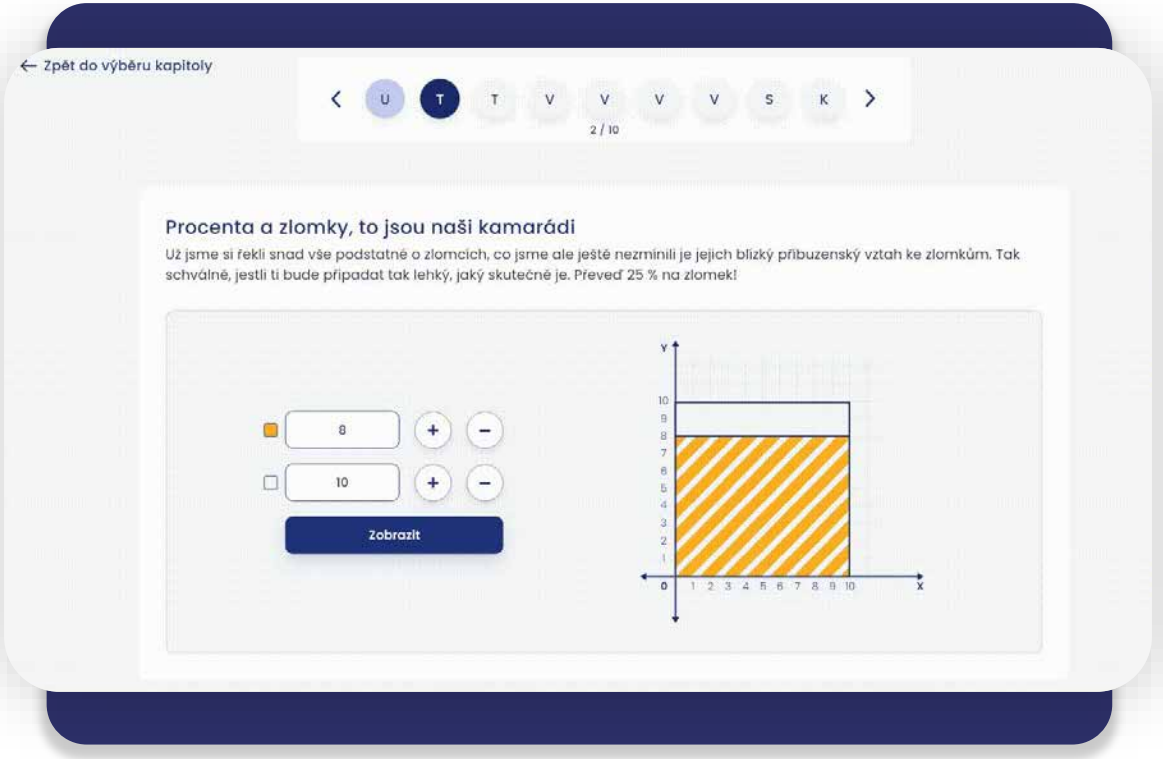


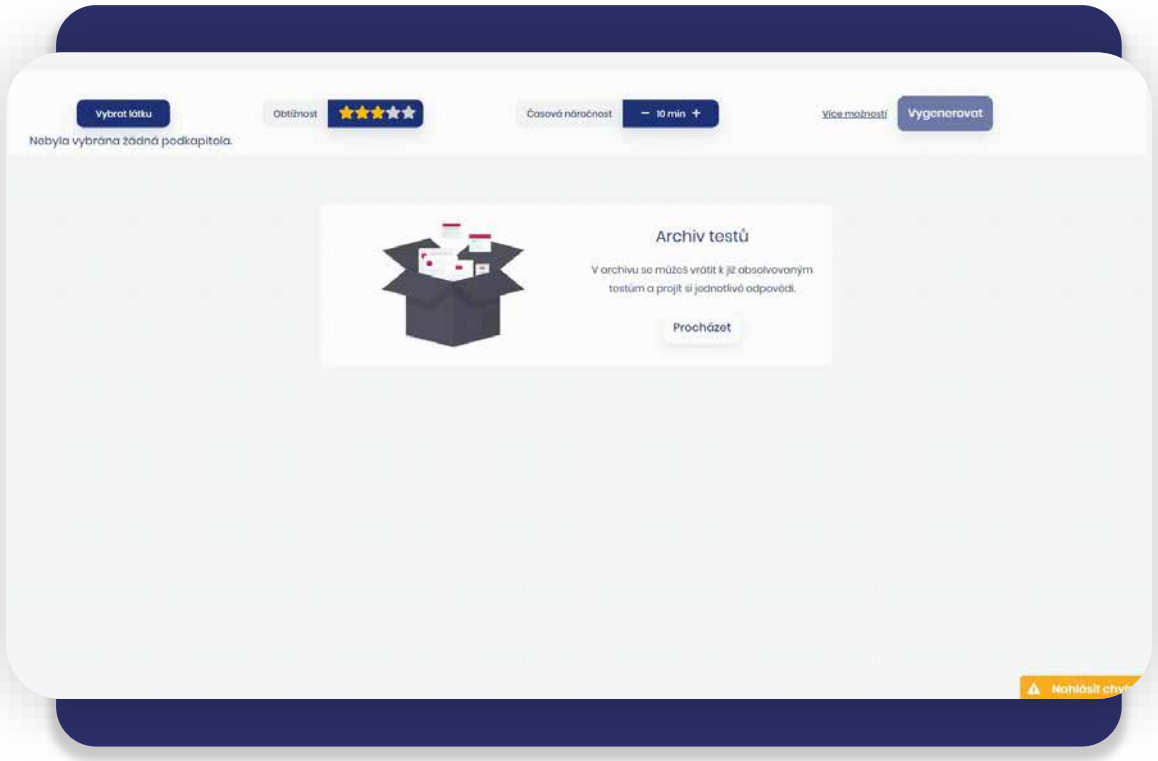
Interactive videos

Interactive videos are different from ordinary ones in that they **hold a student's attention**. During the video, **questions pop up** and ask questions about the subject matter just explained.

Interactive graphs

On interactive graphs, a student can **practice questions** in an interactive way. He/she can **try** rules on a specific example and **better understand** how given subject matter works.



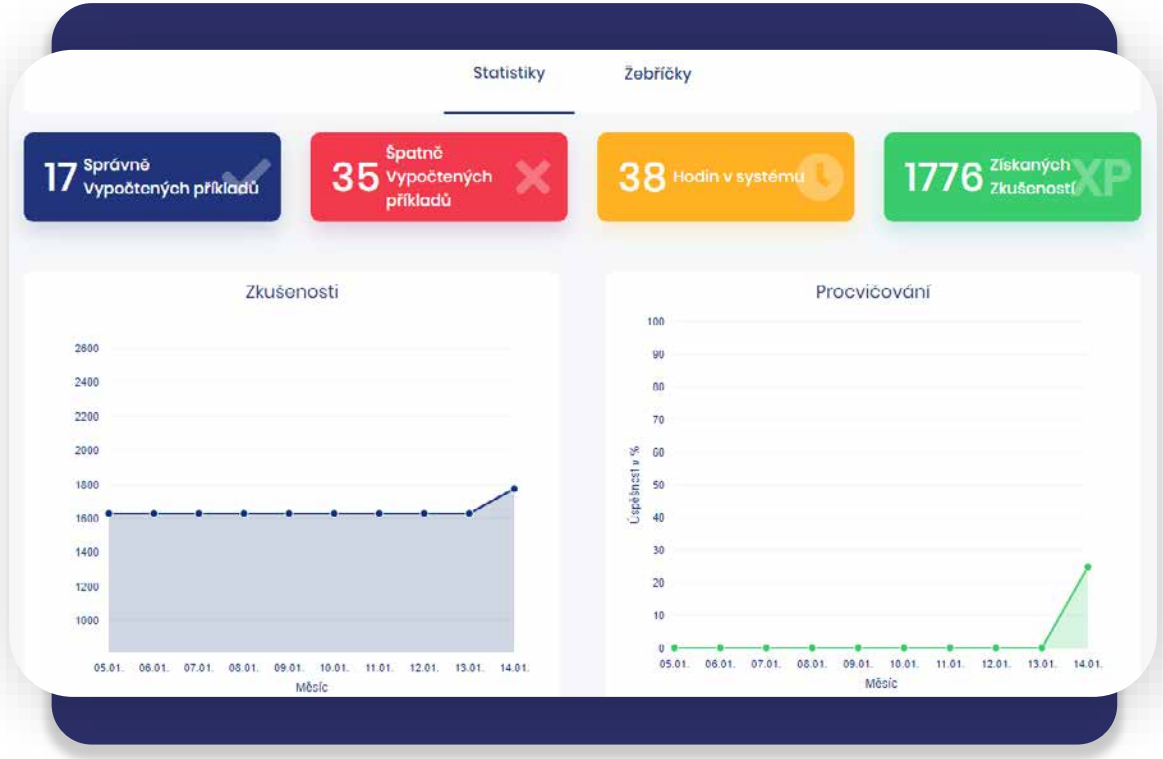


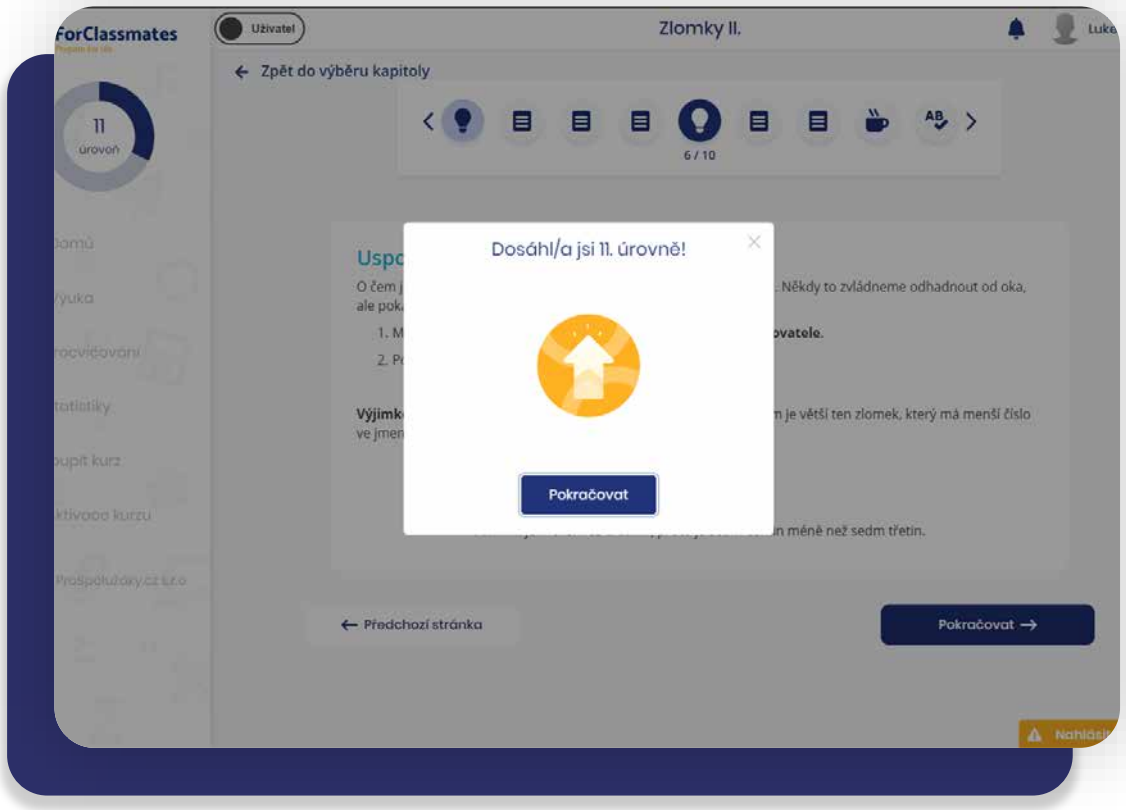
Practising

Practising is a special section where a user can **practice specific subject matter of his/her choice** or have it **randomly generated** by the system. He/she can also **enter specific parameters** such as a subject, topic, chapter or subchapter he/she wants to practice, a time interval and a level of difficulty. After starting, the **system will automatically generate a test for him/her**.

Statistics

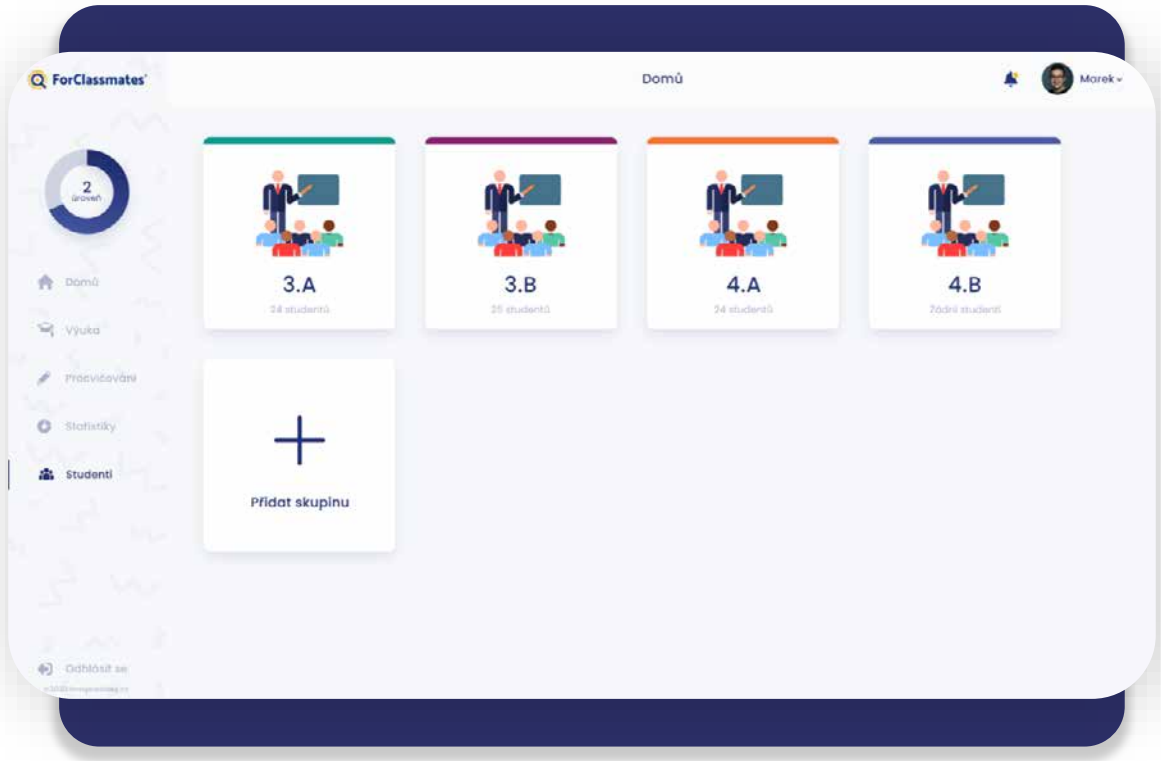
We haven't forgotten about statistics. It is very important for a student to know how much time he/she spends with learning and its individual elements. How much he/she calculated correctly, and how much he/she got wrong. **Today, students lack that. They cannot look back and find out what needs to be worked on.** We will use data to **improve our application and** teaching methods. We will also use them anonymously for raising public awareness so that we could change education and school systems around the world. **We want to deliver data reports that no one else has.**





Gamification

Gamification is one of our vision pillars. **Fun**. In today's world, children constantly play games because they can have fun, earn rewards and awards, grow with their character and gain experience. We want to apply this in learning. **To motivate students**, to create lessons in a playful way, to draw them into a story. **Every (not only) child likes to play.**

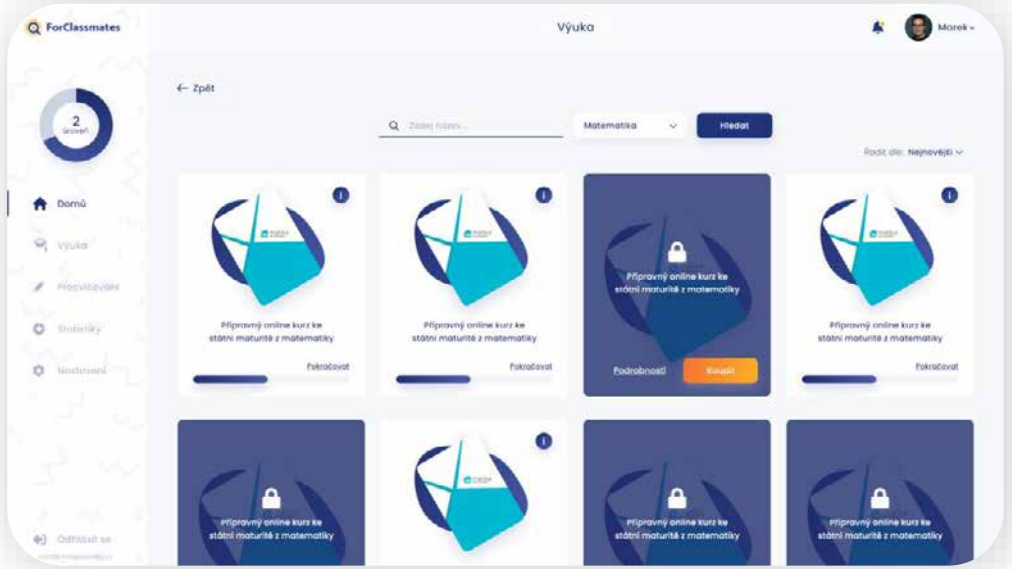


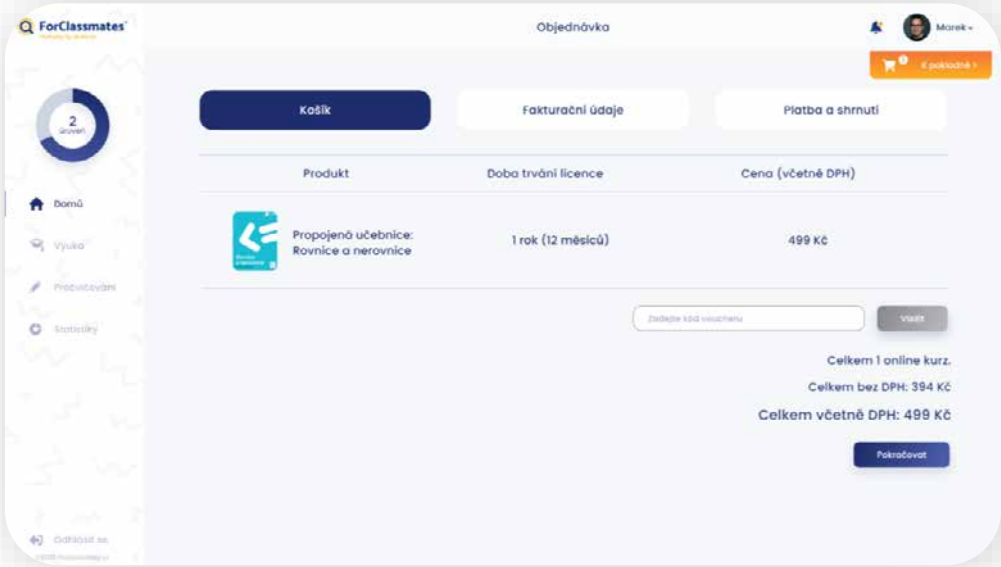
Features for teachers

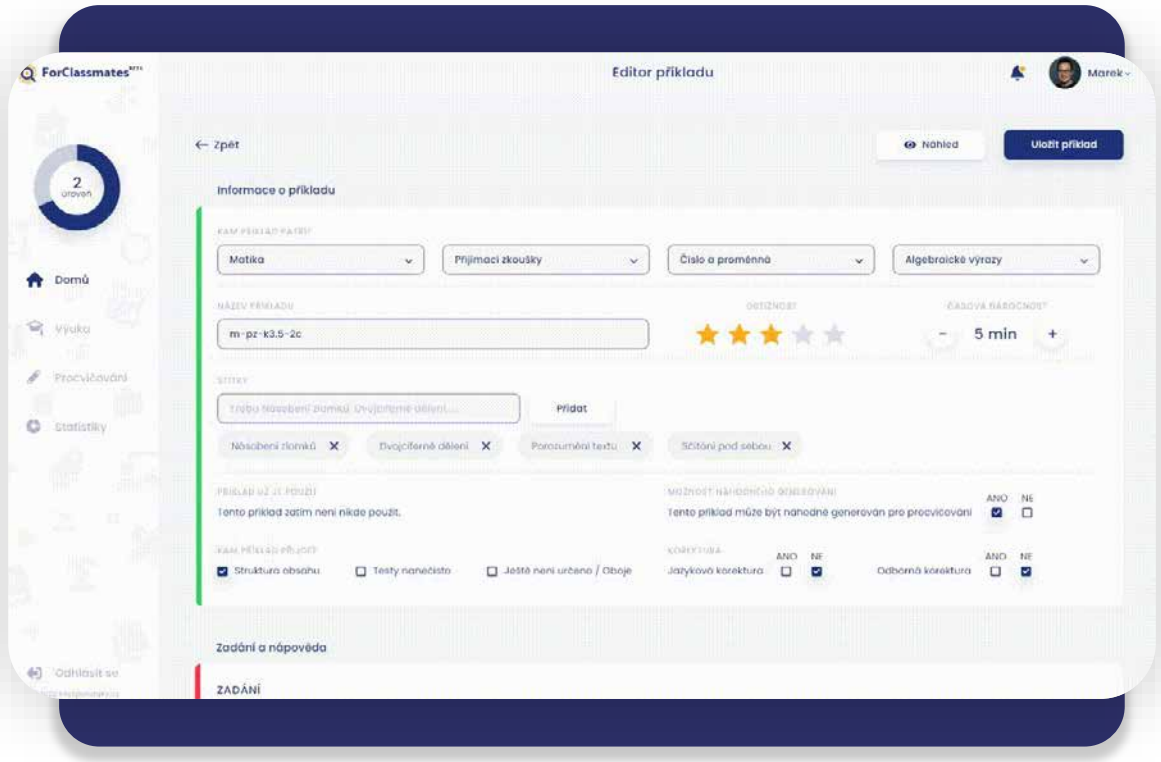
An essential component in the education process is, of course, a teacher, and we want him/her to become a guide in education. That is an assistant for a student when he/she gets lost in the application. At the same time, we are aware that the application (so far) cannot simulate humanity, and that is where our guide, a teacher, is here.

List of courses and ordering process

We want the selection of the right course to be as comfortable as possible for users and, above all, as fast as possible. To do this, we use not only experienced UX designers but also test the given functions directly with the target group.





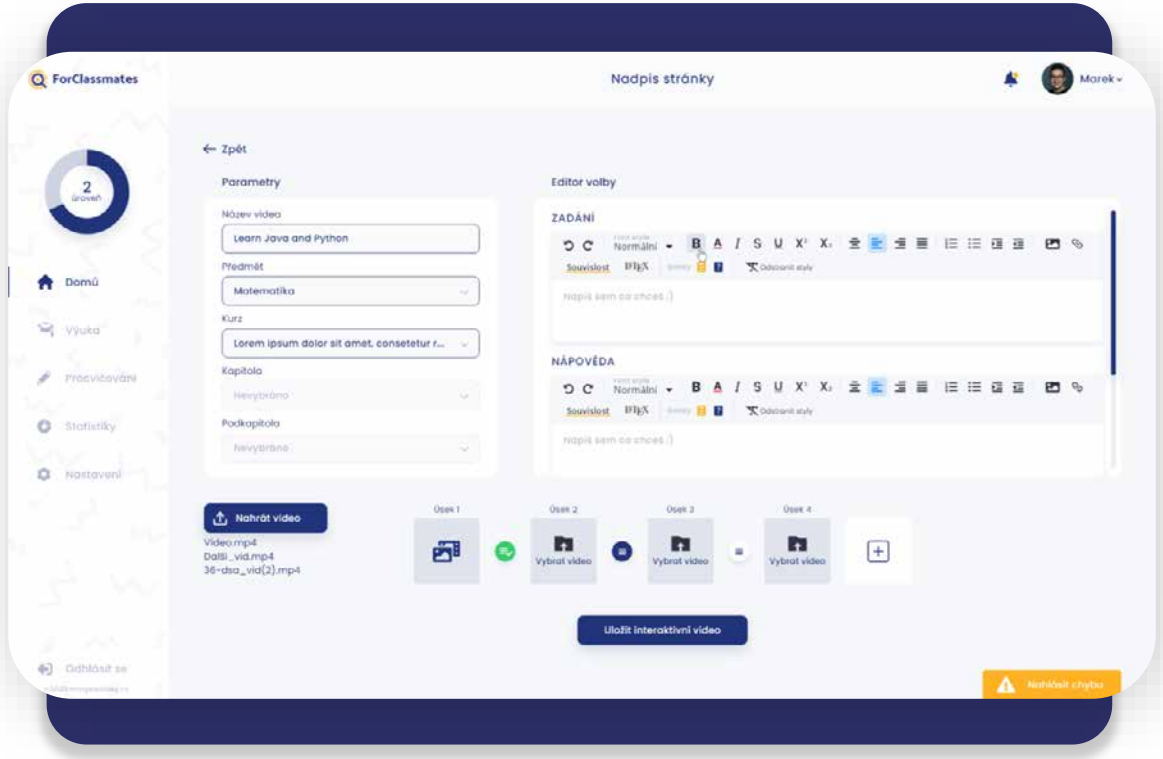


Content editor

The creation of content for our application represents a substantial sum in our budget. In order to reduce this item as effectively as possible, we need to have the best possible way to upload content to our system. An editor for specially tailored content will help us with this, ensuring our system will be far ahead of any competition.

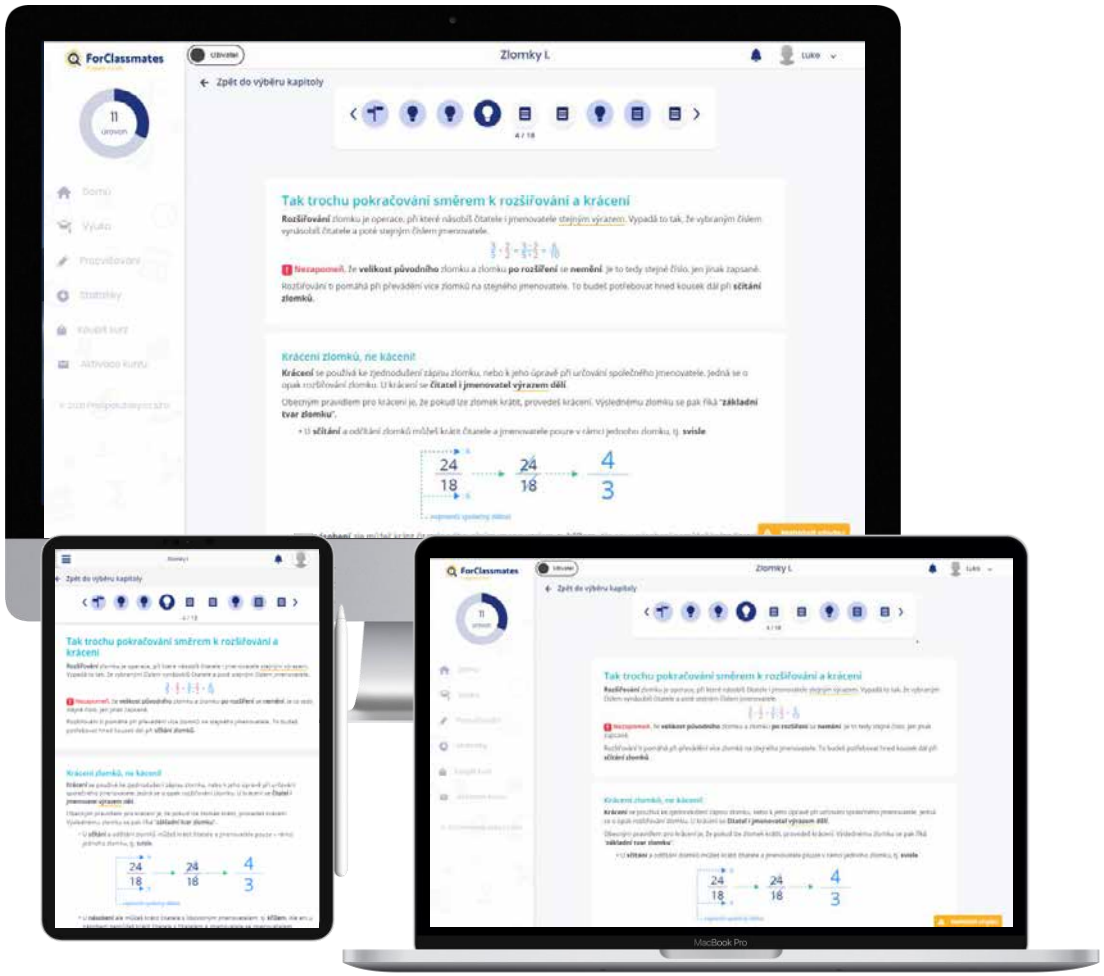
Interactive video editor

The major innovation, which has no equal on the European market, is interactive video. To create it effectively, we need to develop our own editor, who will save our team a huge amount of time and provide the user with a convenient way of learning that will keep his/her attention.



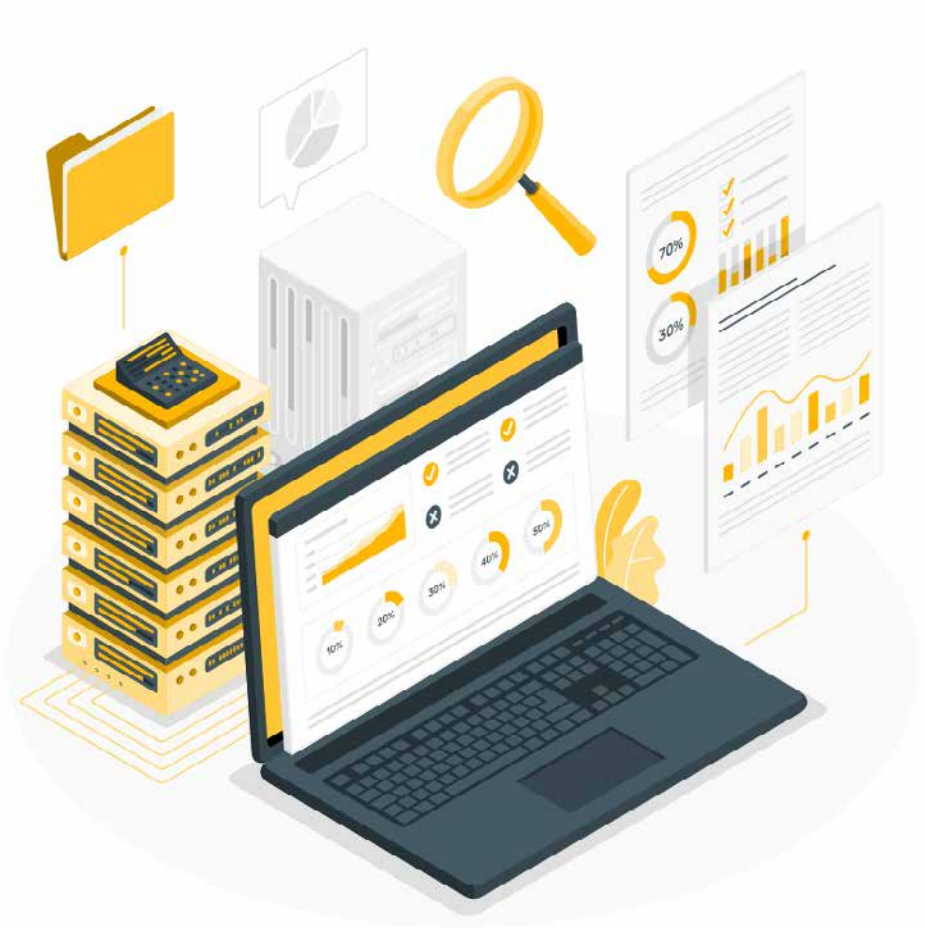
Responsiveness

Our application must be responsive, which means that it works well for every user on all devices in all resolutions in different browsers.



Mobile and desktop application

It is very important for our growth to use the application from anywhere. We will create a mobile and desktop application. Everyone has a mobile phone full of applications. The first thing users do is search for a mobile application.

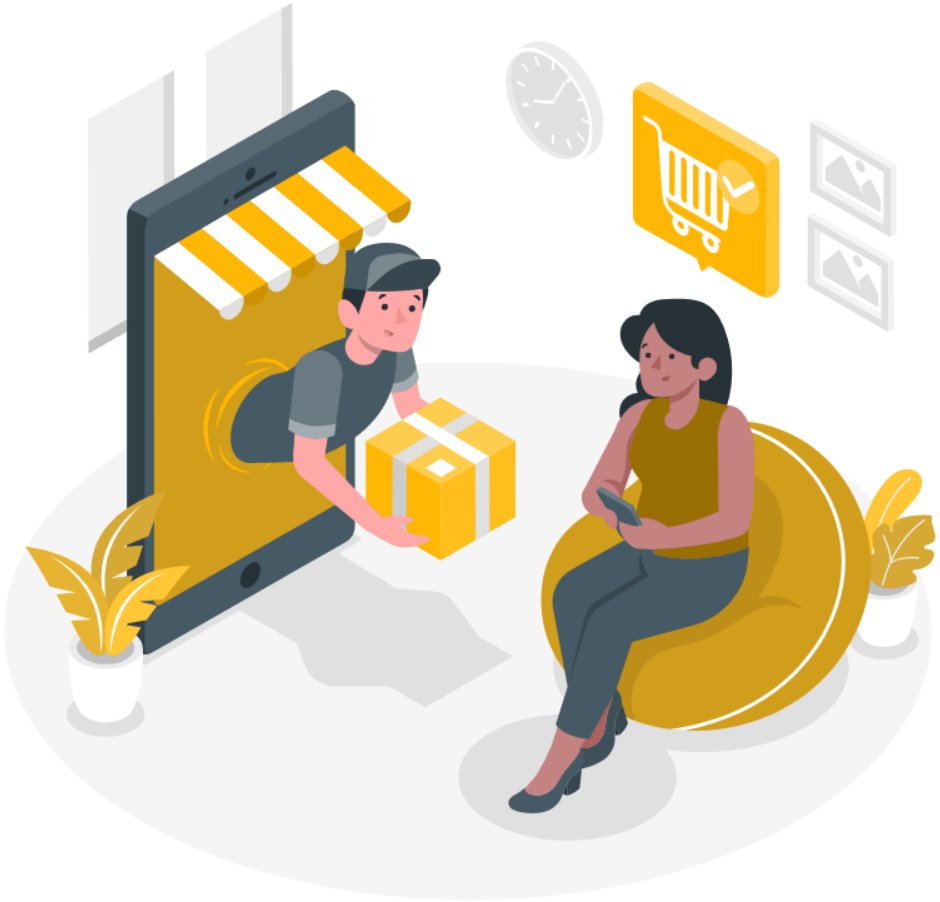


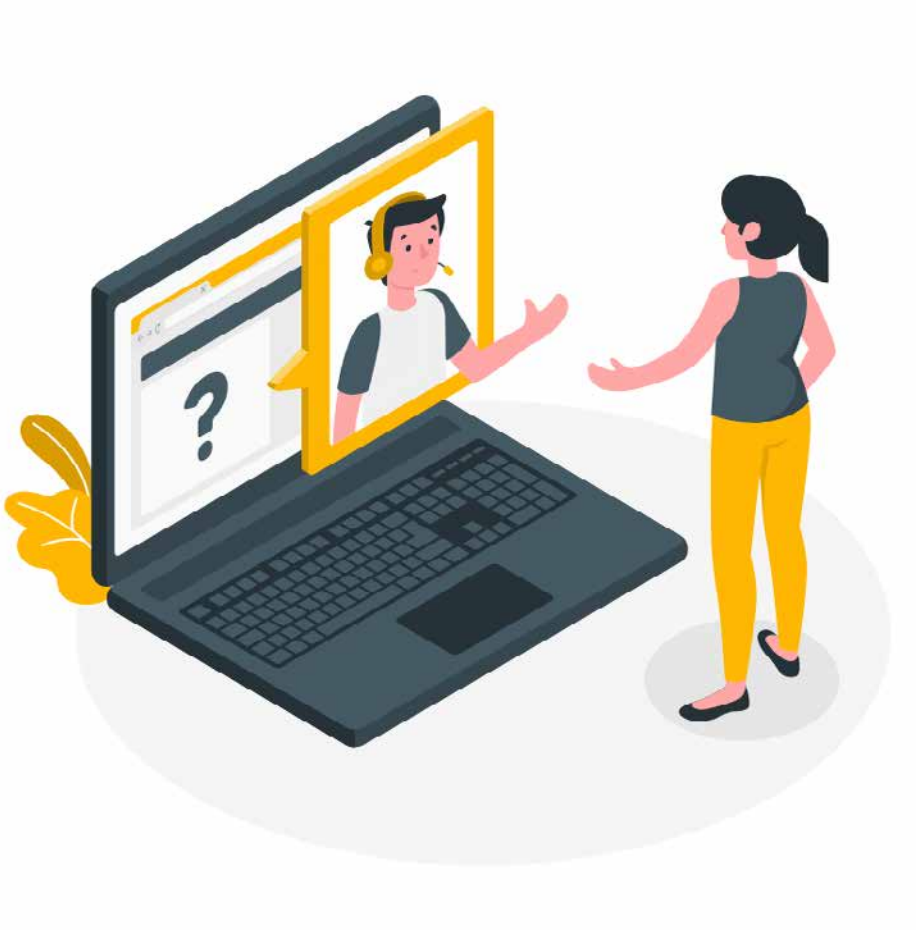
Product management

There will be product management in the admin interface so that we can **easily adapt the courses to the given markets** and create labels of what each course contains.

Order and user management

We need a comprehensive order and user management interface **so that our customer support can easily serve and assist our users in any situation**. For example, if they want to change an already selected subscription, can't sign in, don't understand something, or teachers don't know how to edit a billing address.





Online support and chatbot

Online support will initially be based on people, but over time most problems should be solved through a chatbot that will automatically offer advice to users in any situation. Likewise, the chatbot will help solve tasks and answer questions about learning.

Marketing

TARGET GROUPS

Primary school student

The youngest target group is primary school students, i.e. the age group 9-15.

TARGET GROUPS

Secondary school student

A slightly older target group comprises secondary school students, who are mostly aged 15–19.

TARGET GROUPS

Parent

We will create an account directly for parents so that they can better communicate with the school and have control over their children.

TARGET GROUPS

Tutor

There are many tutoring centres and individuals around the world who help in their surroundings.

TARGET GROUPS

Teacher

Teachers are one of the main pillars for us. Through them we reach a large number of students.

TARGET GROUPS

Principal

Furthermore, we have not forgotten principals, who, thanks to our system, will gain data and control over the method of teaching in their schools.

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TARGET GROUPS

Ministry of Education

The last target group, which is the least understandable for us and so far difficult to cooperate with, is the Ministry of Education. In many countries, we will have to communicate with officials, but providing we improve education in individual countries, we will make the necessary efforts.

Time plan

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Marketing channels	8/21	9/21	10/21	11/21	12/21	1/22	2/22	3/22	4/22	5/22	6/22	7/22	8/22	9/22	10/22	11/22	12/22	1/23	2/23	3/23	4/23	5/23	6/23	7/23
Social media	ForClassmates CZ/SK																							
PPC	Maths CZ/SK, Chemistry CZ, Entrance exams CZ																							
Emailing	Ma+Ch CZ/SK		PZ Ma + CZL				Ma+Ch CZ/SK						Ma+Ch CZ/SK	FCO Pilot	PZ Ma + CZL				Ma+Ch CZ/SK					

Time plan

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Marketing channels	8/23	9/23	10/23	11/23	12/23	1/24	2/24	3/24	4/24	5/24	6/24	7/24
Social media	ForClassmates CZ/SK | EN-GB | EN-US											
PPC	Ma, Ch, Phy CZ/SK | EN-GB | EN-US											
Emailing	Ma+Ch CZ/SK		PZ Ma + CZL	FCO CZ/EN-GB/EN-US								
	FCO CZ/GB/US											
YouTube advertising	PZ CZ, Ma, Ch & Phy CZ | EN-GB | EN-US											
Influencers	CZ | EN-GB | EN-US											
Twitch	CZ | EN-GB | EN-US											
Prepaid cards	CZ | EN-GB | EN-US											
Online “board” game	CZ | EN-GB | EN-US											
Competitions	CZ | EN-GB | EN-US											
Advertising module for advertisers	CZ | EN-GB | EN-US											
Affiliate for users	CZ | EN-GB | EN-US											
ForClassmates Foundation												

Time plan

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Marketing channels	8/24	9/24	10/24	11/24	12/24	1/25	2/25	3/25	4/25	5/25	6/25	7/25	8/25	9/25	10/25	11/25	12/25	1/26	2/26	3/26	4/26	5/26	6/26	7/26	8/26	9/26	10/26	11/26	12/26	1/27	2/27	3/27	4/27	5/27	6/27
Social media	ForClassmates CZ/SK | EN-GB | EN-US | ES | PT												ForClassmates CZ/SK | EN-GB | EN-US | ES | PT | FR | GE | PL																						
PPC	Ma, Ch, Phy, Bi, Geog CZ/SK | EN-GB | EN-US & Ma, Ch, Phy ES | PT												Ma, Ch, Phy, Bi, Geog CZ/SK | EN-GB | EN-US | ES | PT & Ma, Ch, Phy FR | GE | PL												Ma, Ch, Phy, Bi, Geog CZ/SK | EN-GB | EN-US | ES | PT | FR | GE | PL											
Emailing	FCO CZ/EN-GB/EN-US/ES/PT												FCO CZ/EN-GB/EN-US/ES/PT												FCO CZ/EN-GB/EN-US/ES/PT										
YouTube advertising	Ma, Ch, Phy, Bi, Geog CZ | EN-GB | EN-US & Ma, Ch, Phy ES | PT												Ma, Ch, Phy, Bi, Geog CZ/SK | EN-GB | EN-US | ES | PT & Ma, Ch, Phy FR | GE | PL												Ma, Ch, Phy, Bi, Geog CZ/SK | EN-GB | EN-US | ES | PT & Ma, Ch, Phy FR | GE | PL											
Influencers	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
Twitch	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
Prepaid cards	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
Online "board" game	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
Competitions	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
Advertising module for advertisers	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
Affiliate for users	CZ | EN-GB | EN-US | ES | PT												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL												CZ | EN-GB | EN-US | ES | PT | FR | GE | PL										
ForClassmates Foundation	Support of education for socially disadvantaged children, single mothers, support of sports for children and youth, creation of international competitions, prevention of crime (and bullying in general, etc.), cooperation with companies (excursions, internships, HR recruitment), career counselling, organising events for children from 9 years, tutoring, CSR																																		

Business

BUSINESS STRATEGY

Call centre

As a teacher's decision-making process is more demanding than that of a student's, it is necessary to devote more attention to it in the form of a **specialised call centre**, with which we have **more than 5 years of experience**. The support of schools and teachers is very important to us, both in terms of sales, where one teacher represents an average of 60 purchased licences, and in terms of marketing, where we gain expertise and confidence in our project with the public.

Market size

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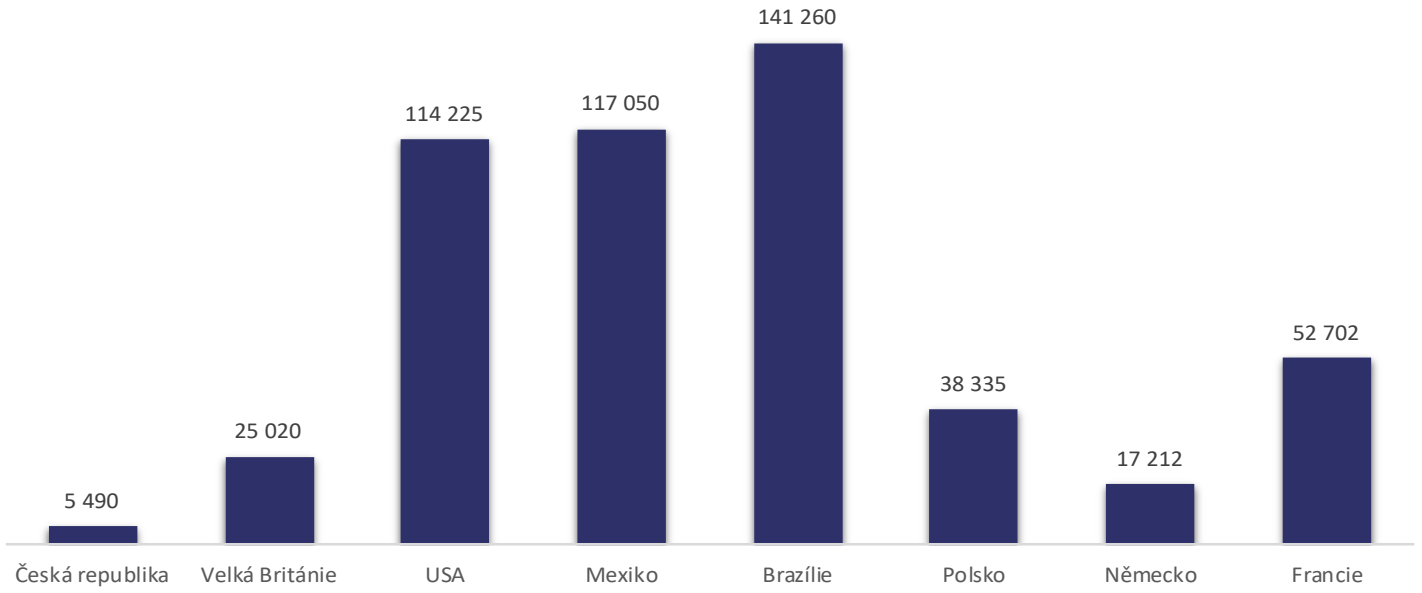
Počet základních a středních škol



Source:
https://stats.oecd.org/Index.aspx?DataSetCode=RENRLAGE#

Time plan

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Call Centres/Customer Care	8/21	9/21	10/21	11/21	12/21	1/22	2/22	3/22	4/22	5/22	6/22	7/22	8/22	9/22	10/22	11/22	12/22	1/23	2/23	3/23	4/23	5/23	6/23
Printed textbooks CZ	Maths & Chemistry						Maths & chemistry						Maths & Chemistry						Maths & chemistry				
Printed textbooks SK	Maths						Maths						Maths						Maths				
Entrance exams CZ			Maths & Czech												Maths & Czech								
Online learning CZ															Pilot schools								

Time plan

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Call Centres/Customer Care	7/23	8/23	9/23	10/23	11/23	12/23	1/24	2/24	3/24	4/24	5/24	6/24	7/24	8/24	9/24	10/24	11/24	12/24	1/25	2/25	3/25	4/25	5/25	6/25
Printed textbooks CZ		Maths & Chemistry																						
Printed textbooks SK		Maths																						
Entrance exams CZ				Maths & Czech												Maths & Czech								
Online learning CZ		Maths, Chemistry & Physics												Maths, Chemistry, Physics, Biology & Geography										
Online learning UK		Maths, Chemistry & Physics												Maths, Chemistry, Physics, Biology & Geography										
Online learning US		Maths, Chemistry & Physics												Maths, Chemistry, Physics, Biology & Geography										
Online learning South America														Maths, Chemistry & Physics										
Online learning Brazil														Maths, Chemistry & Physics										

Time plan

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Call Centres/Customer Care	7/25	8/25	9/25	10/25	11/25	12/25	1/26	2/26	3/26	4/26	5/26	6/26	7/26	8/26	9/26	10/26	11/26	12/26	1/27	2/27	3/27	4/27	5/27	6/27
Entrance exams CZ				Maths & Czech												Maths & Czech								
Online learning CZ		Maths, Chemistry, Physics, Biology & Geography												Maths, Chemistry, Physics, Biology & Geography										
Online learning UK		Maths, Chemistry, Physics, Biology & Geography												Maths, Chemistry, Physics, Biology & Geography										
Online learning US		Maths, Chemistry, Physics, Biology & Geography												Maths, Chemistry, Physics, Biology & Geography										
Online learning South America		Maths, Chemistry, Physics, Biology & Geography												Maths, Chemistry, Physics, Biology & Geography										
Online learning Brazil		Maths, Chemistry, Physics, Biology & Geography												Maths, Chemistry, Physics, Biology & Geography										
Online learning France		Maths, Chemistry & Physics												Maths, Chemistry, Physics, Biology & Geography										
Online learning Germany		Maths, Chemistry & Physics												Maths, Chemistry, Physics, Biology & Geography										
Online learning Poland		Maths, Chemistry & Physics												Maths, Chemistry, Physics, Biology & Geography										

Market size

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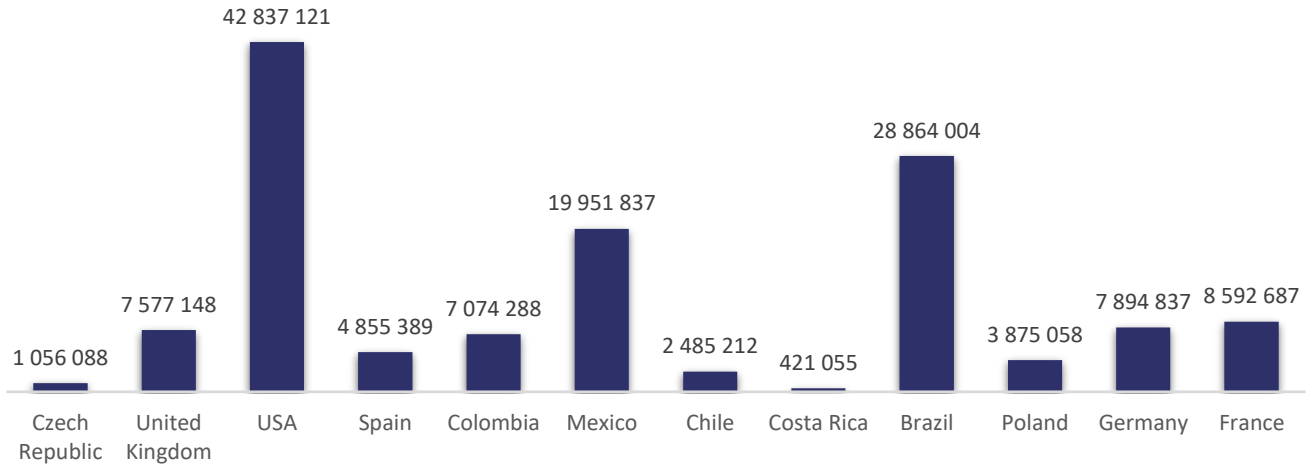
Number of pupils aged 9 to 19



Source:
https://stats.oecd.org/Index.aspx?DataSetCode=RENRLAGE#

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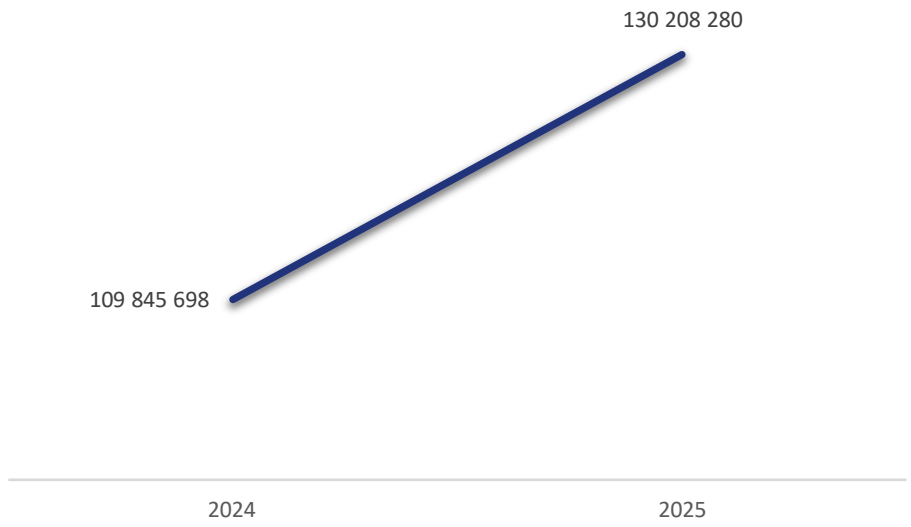
MARKET POTENTIAL

Number of students

The graph shows the size of the market with regard to language versions of our content in online learning. The assumption is that from 2025 we will have almost all content translated into 6 foreign languages (English, Spanish, Portuguese, French, German and Polish).



Source:
https://stats.oecd.org/Index.aspx?DataSetCode=RENRLAGE#

Strategy

Development

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Content

- Each subject consists of a special team composed of authors, proofreaders, graphic designers and content testers, and there is a representation of the target group as well.
- We will use a translation agency in cooperation with our partner school, which teaches the language.
- We create the subjects according to topics so that we can tailor them to each country or school and thus correspond to the curriculum.

System

- The team that develops our application consists of UX and UI designers, frontend and backend developers and testers.
- For effective development management, we will use the SCRUM method with an emphasis on monthly evaluation and daily stand-up meetings.
- We will program our own environment for creating and editing the content directly in the application (text editor, interactive video editor, project management, etc.).

Specialities

- We will set up a special "Research and Innovation" department that will work with data on user behaviour in our system, and we will design system optimisation, examine efficiency, analyse the market and create surveys.
- To keep students in the application and maintain their motivation, we will develop a simple but sophisticated gamification system. We will make learning fun.
- We will create a "Visionary Team", whose task will be the vision and methodology of learning, control of its implementation into the system and teacher training.

Business

Call centre

- We will set up a **call-centre** that will contact teachers and explain to them the benefits of our system and how we will save them time.
- We will **evaluate the effectiveness of salespeople** on a monthly basis using key performance indicators (**KPIs**).
- We will motivate salespeople with **quarterly rewards** in the case of fulfilling above-standard performances.

Specific activities

- We determine a **potential market** based on publicly available data in **UNESCO and OECD** databases.
- We will participate in and organise **international conferences** of teachers and principals.

Marketing

Users

- Student will be able to invite their classmates to the application and get special features for free (a so-called referral link).
- We will have a community of students, teachers and parents communicating and collaborating through our special platform.
- We will create our own database of schools and teachers and address them regularly via e-mail or directly through the application.

Pricing policy

- We are preparing a special pricing policy. The application will be available for free with ads for everyone or, after a payment, users will receive a premium version without ads.
- We will develop an ad insertion module. We will offer advertising space especially for companies in the gaming industry since we have the same target group.

Company management

Management

- To manage the company, we will use the **OKR method**, through which we will effectively prioritise goals and maintain **awareness** across individual departments.
- Communication in the company will take place mainly **online**, not only for COVID reasons, but also for **greater flexibility** of individual teams from different parts of the world.

Team

- Team members can earn a **dividend from the company** in the form of quarterly bonuses.
- We have set up a **corporate culture** that will keep us motivated and guarantee us satisfied employees who will enjoy working with us.

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Company structure

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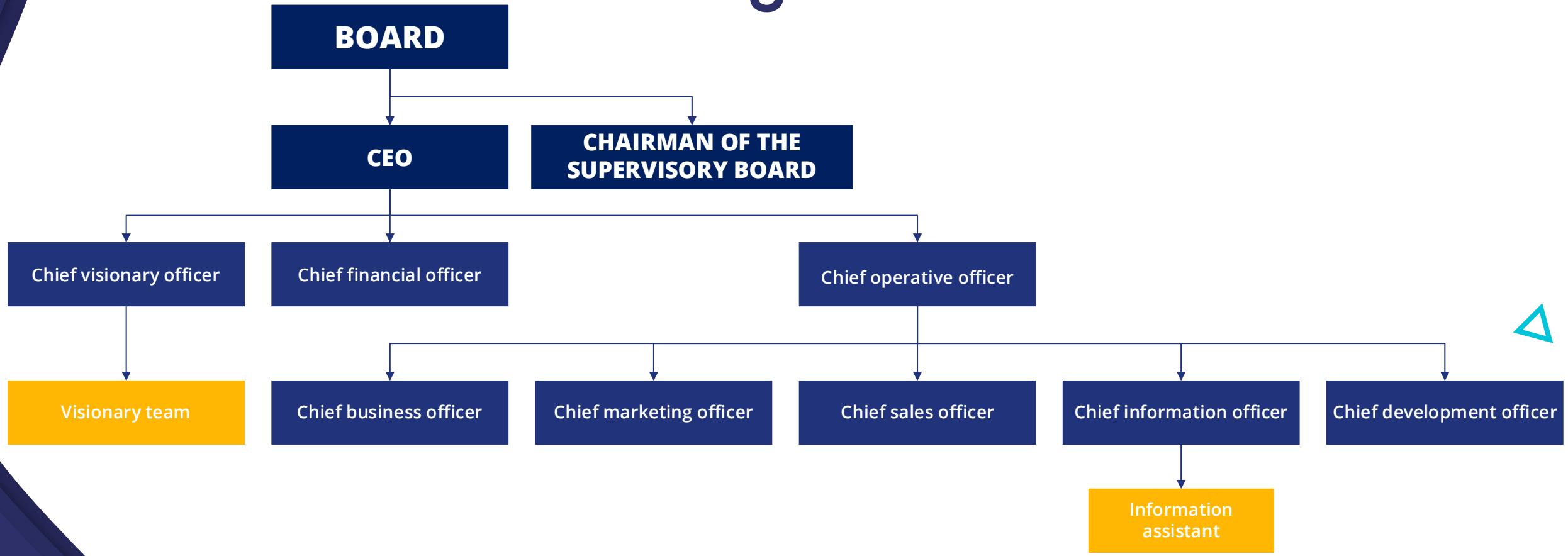
Company management



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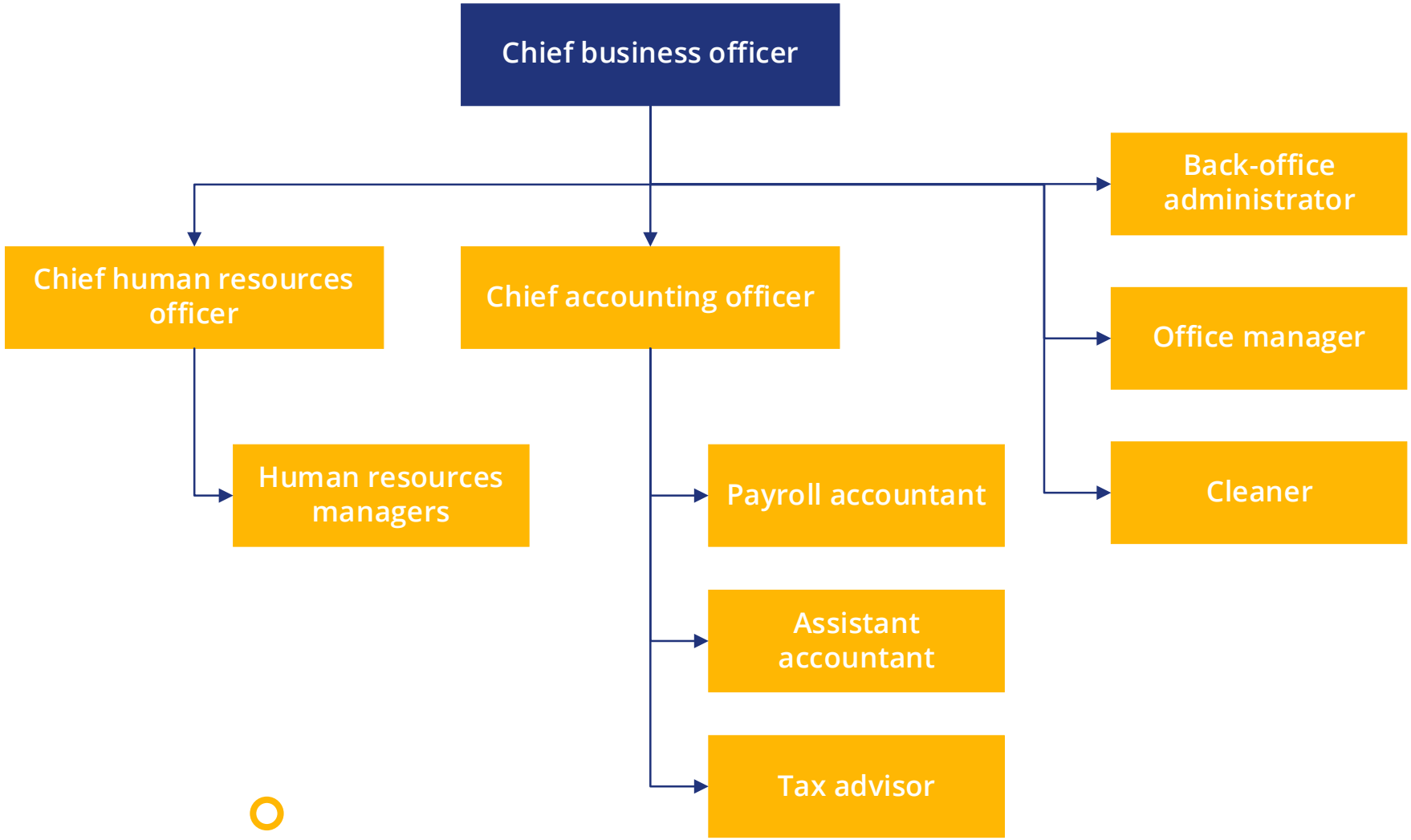
Administration



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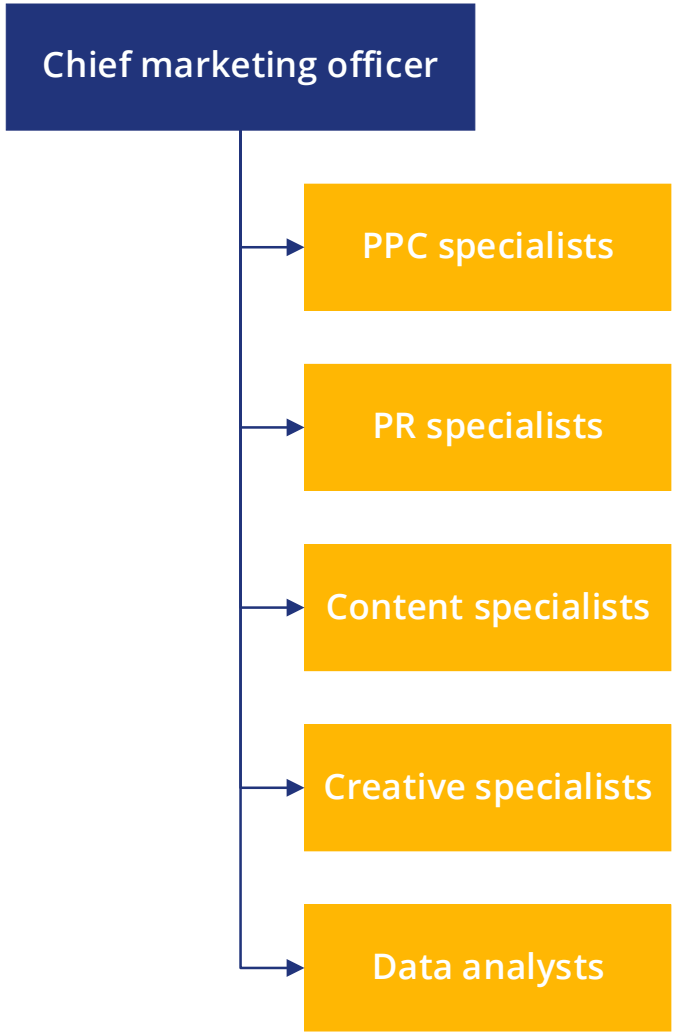
Marketing



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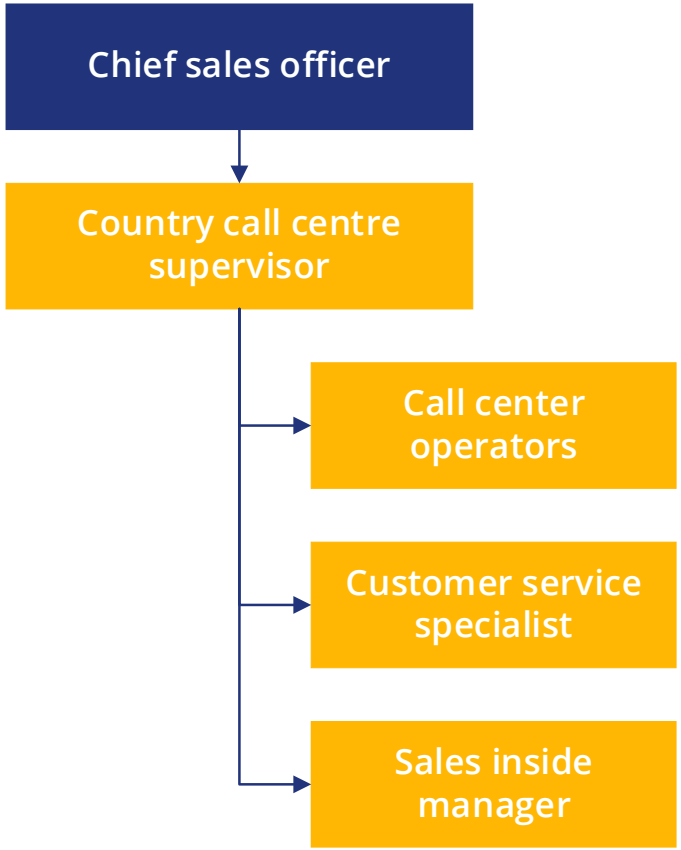
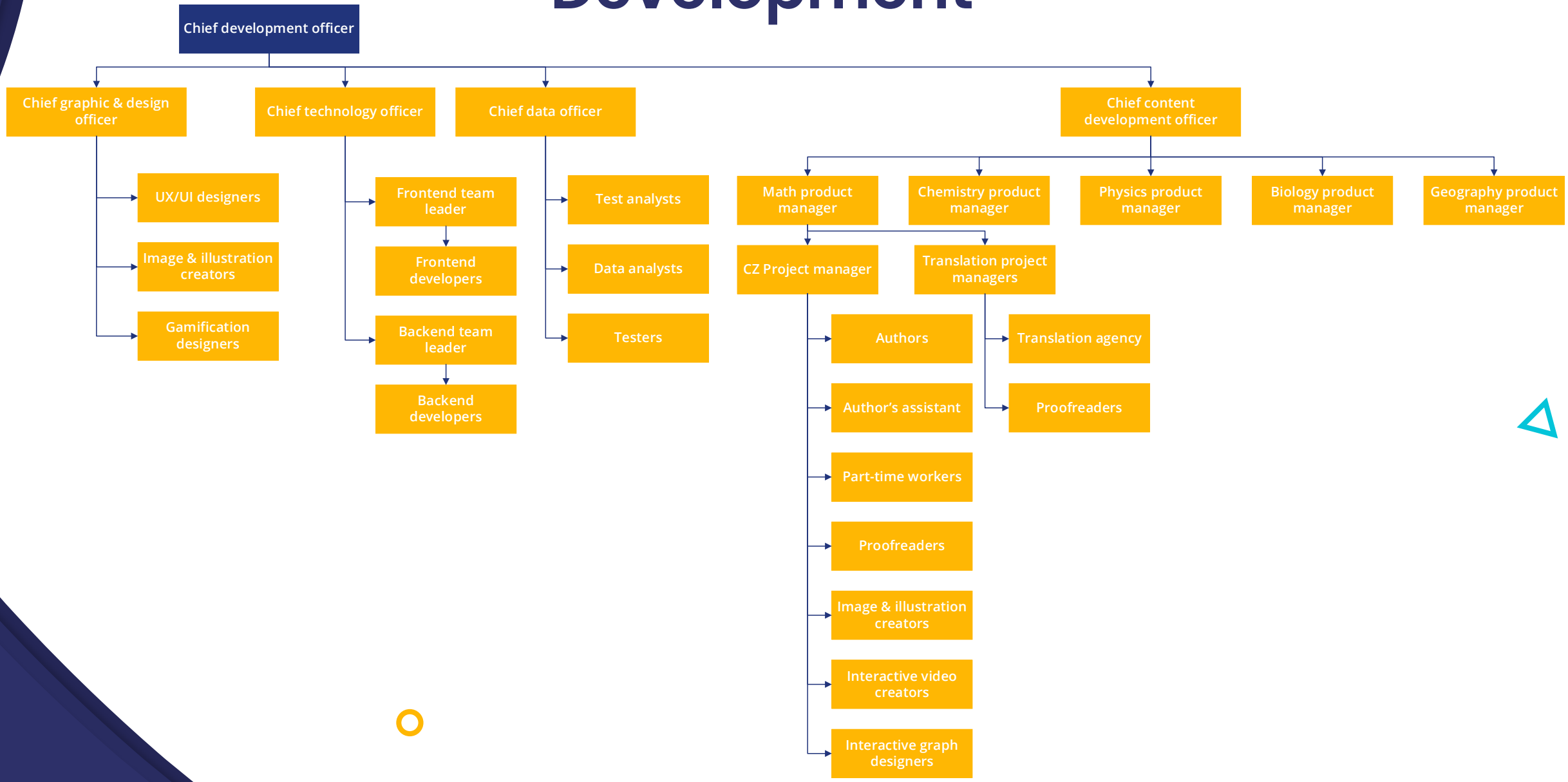
Business

A special team will be created for each country.



Development



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Expansion abroad

The following 4 slides show which countries we will target according to the development phase. The individual phases are not sequential in time, rather they overlap.

- **Phase 1:** mathematics, chemistry and physics are created in Czech and gradually translated into British and American English
- **Phase 2:** biology and geography are created in Czech and gradually translated into British and American English
- **Phase 3:** all subjects are translated into Spanish and Portuguese
- **Phase 4:** all subjects are translated into French, German and Polish

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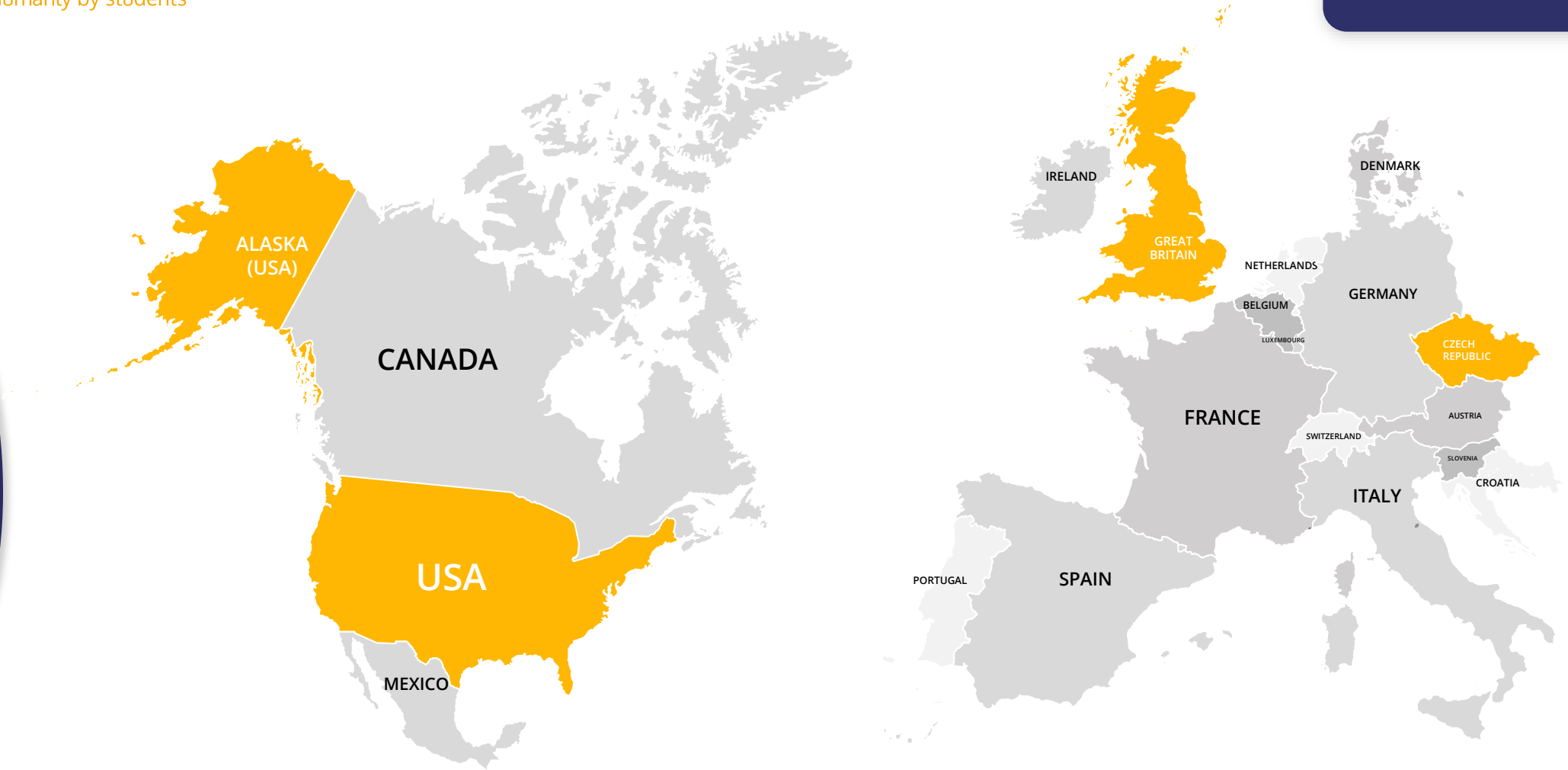
Phase 1



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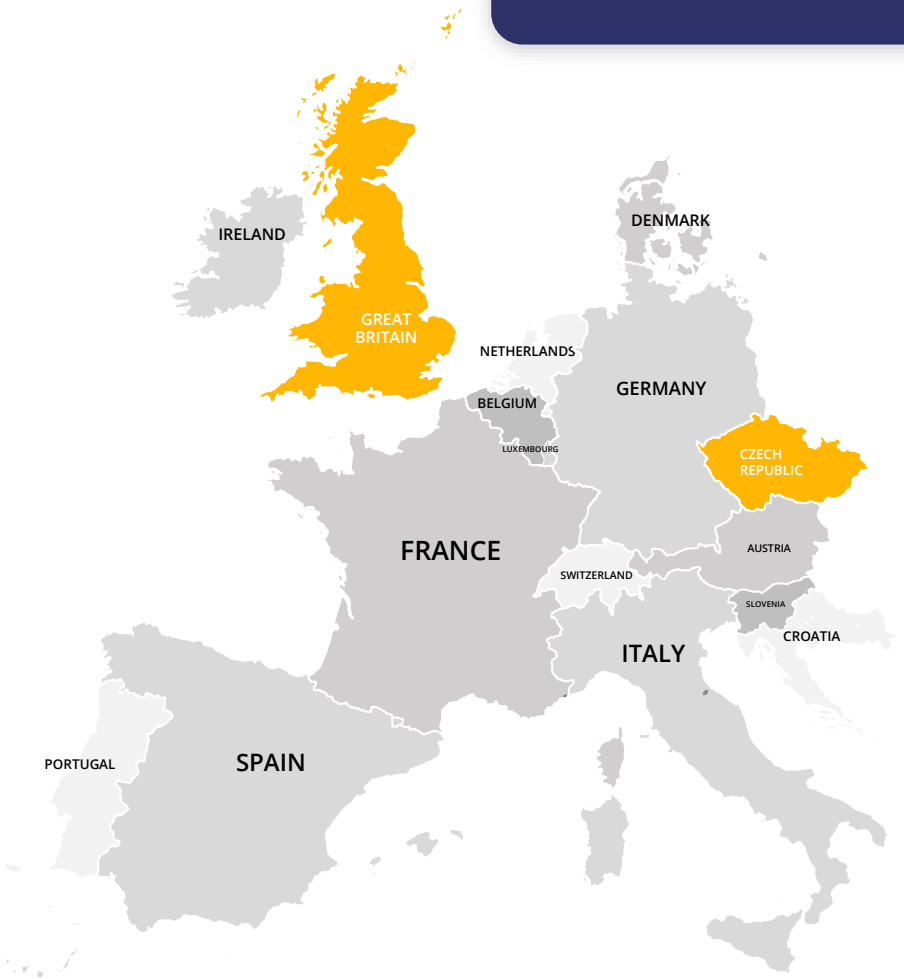
Phase 2



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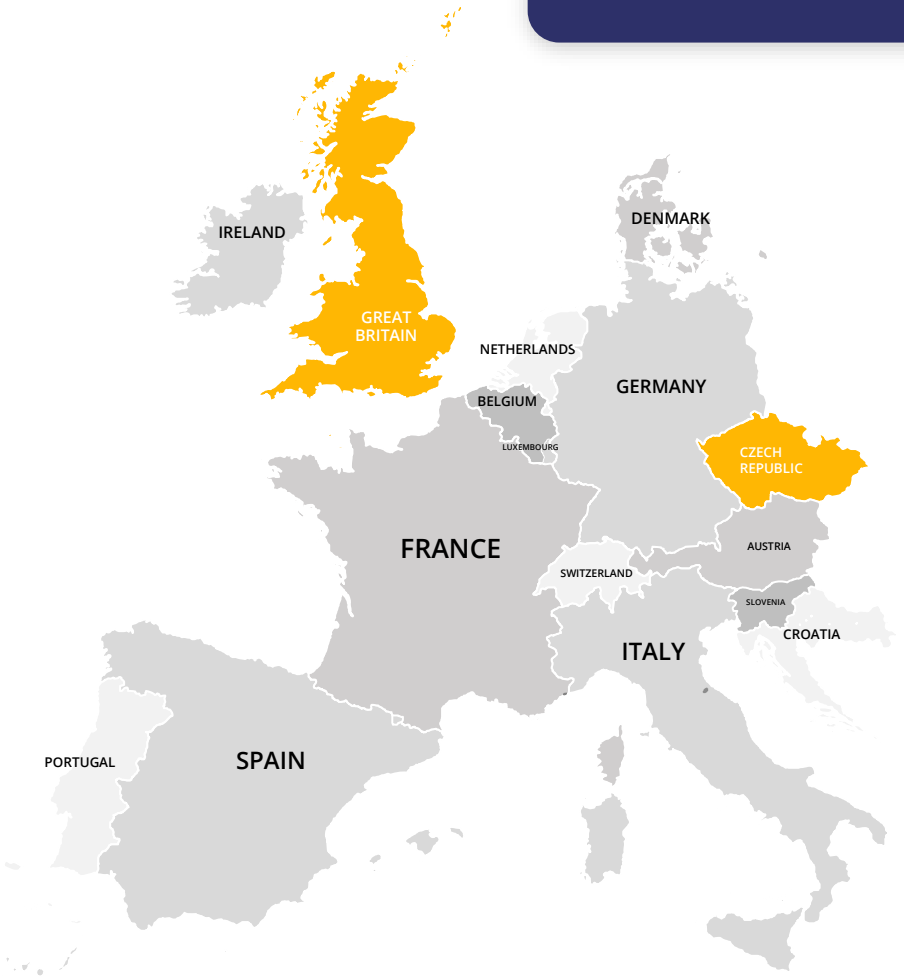
Phase 3



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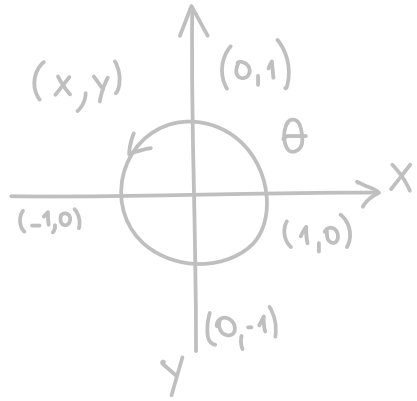
Phase 4

Investment

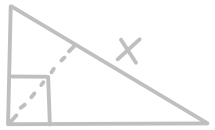
$$x = \frac{1}{1+y}$$



Investment rounds

1st round	2nd round	3rd round	4th round	5th round	6th round
USD 190K	USD 1.71M	USD 5.24M	USD 7.14M	USD 10.48M	USD 15.24M

$$y + 3 = \frac{1}{1+y}$$



$(2 \times b \times y)$

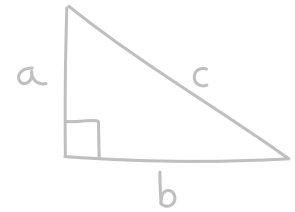
$c^2 = a^2 + b^2$

$c = \sqrt{a^2 + b^2}$

$a = \sqrt{c^2 + b^2}$

$b = \sqrt{c^2 + a^2}$

What is the expected appreciation?



Deposit: 4 550 $

	3. round	4. round	5. round	6. round
Share in distributed profit:	0,025 %	0,016 %	0,010 %	0,008 %
Profit of ForClassmates Finance s.r.o.:	44 818 $	28 665 $	17 927 $	14 333 $
Appreciation:	985 %	630 %	394 %	315 %
In total, the following will be paid:	49 367 $	33 215 $	22 477 $	18 882 $

The model calculation assumes proper fulfilment of the Whitepaper of ForClassmates s.r.o. The model calculation does not guarantee reaching the selected appreciation from the deposit. The expected appreciation will be paid out in a 7-year horizon.

I want to invest

$c^2 = a^2 + b^2$

$c = \sqrt{a^2 + b^2}$

$a = \sqrt{c^2 + b^2}$

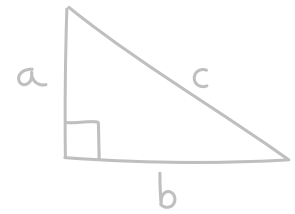
$b = \sqrt{c^2 + a^2}$

1st investment round

Completed

1. investment round

- The first mathematics textbook published
- Approaching the first schools
- The first 1,000 textbooks sold



$c^2 = a^2 + b^2$

$c = \sqrt{a^2 + b^2}$

$a = \sqrt{c^2 + b^2}$

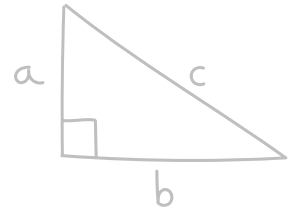
$b = \sqrt{c^2 + a^2}$

2nd investment round

Completed

2. investment round

- 11 textbooks and 11 mathematics workbooks published
- A website with solutions for all examples from the textbooks was created
- 70,000 mathematics textbooks and workbooks sold
- More than 240 secondary schools involved
- 8 mathematics textbooks and 8 mathematics workbooks published in Slovak
- Another 110,000 textbooks and workbooks of mathematics and chemistry were sold
- 3 collections of exercises in mathematics were published in Czech and Slovak
- MVP version of online learning was published containing preparation for entrance exams for secondary school in mathematics and in Czech
- An online course The Czech Century and Basics of Secondary School Chemistry in Czech were published



$c^2 = a^2 + b^2$

$c = \sqrt{a^2 + b^2}$

$a = \sqrt{c^2 + b^2}$

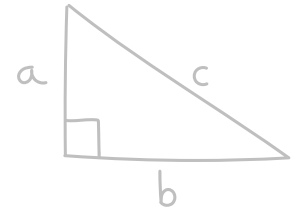
$b = \sqrt{c^2 + a^2}$

3rd investment round

Ongoing

3. investment round

- Maths, chemistry and physics for primary and secondary school students in Czech
- Maths, chemistry and physics translated into English
- Fully functional MVP version of ForClassmates
- Editor of content, interactive videos and graphs
- Gamification, competitions, games and an affiliate program
- Click-through tutorial
- Ordering process and free version with advertising module
- Web and mobile application



$c^2 = a^2 + b^2$

$c = \sqrt{a^2 + b^2}$

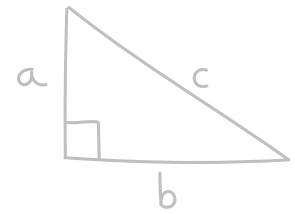
$a = \sqrt{c^2 + b^2}$

$b = \sqrt{c^2 + a^2}$

4th investment round

4. investment round

- Biology and geography for primary and secondary school students in Czech
- Biology and geography translated into English
- Maths, chemistry and physics translated into Spanish and Portuguese
- Tailor-made teaching with machine learning and artificial intelligence
- The first version of the module for teachers
- Dry run tests and IQ tests
- Forum and chatbot to strengthen the community and improve the quality of the client centre

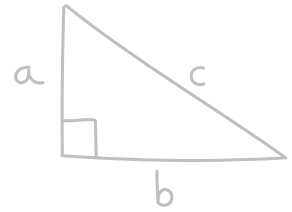


$$c^2 = a^2 + b^2$$
$$c = \sqrt{a^2 + b^2}$$
$$a = \sqrt{c^2 + b^2}$$
$$b = \sqrt{c^2 + a^2}$$

5th investment round

5. investment round

- Maths, chemistry and physics translated into French, German and Polish
- Biology and geography translated into Spanish and Portuguese
- School administration, tools for distance learning and tutoring
- Inclusion support
- Unique certificates of successful completion of courses
- Implementation of augmented reality (AR) and 3D models in content
- Desktop application



$c^2 = a^2 + b^2$

$c = \sqrt{a^2 + b^2}$

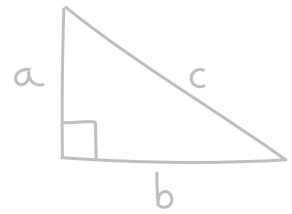
$a = \sqrt{c^2 + b^2}$

$b = \sqrt{c^2 + a^2}$

6th investment round

6. investment round

- Biology and geography translated into French, German and Polish
- Expansion of learning administration, customer management and client support
- Improved customisation and chatbot for user queries
- Full version of the module for schools and teachers

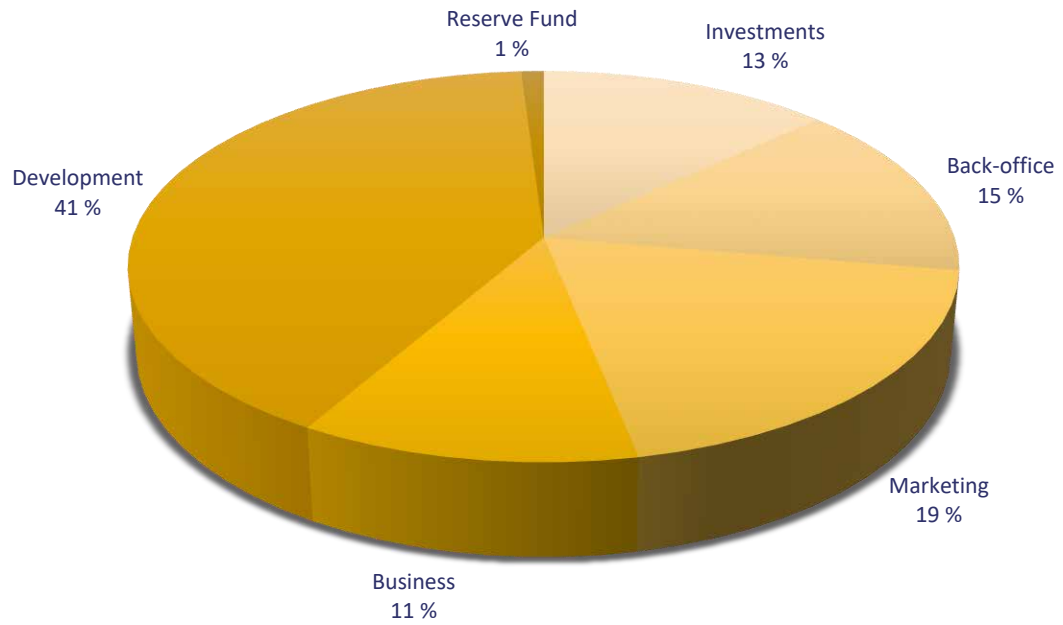


Financial plan

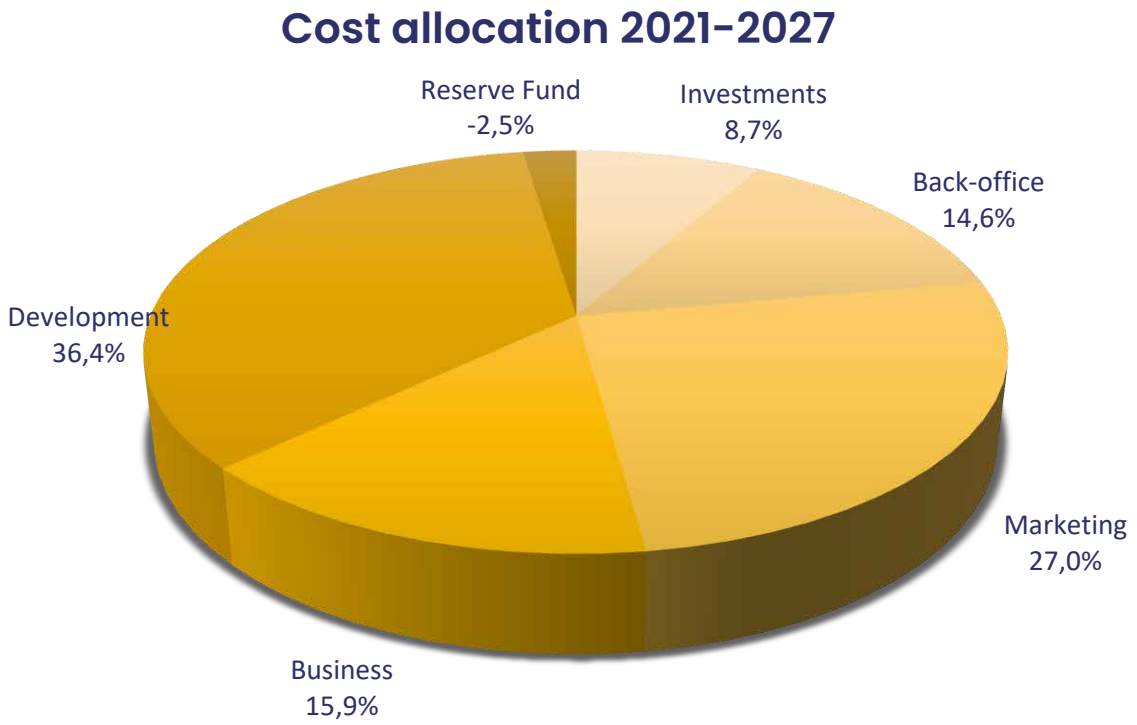
USD 38.1M

Budget

Cost allocation 2021-2025



Budget 2021-2027



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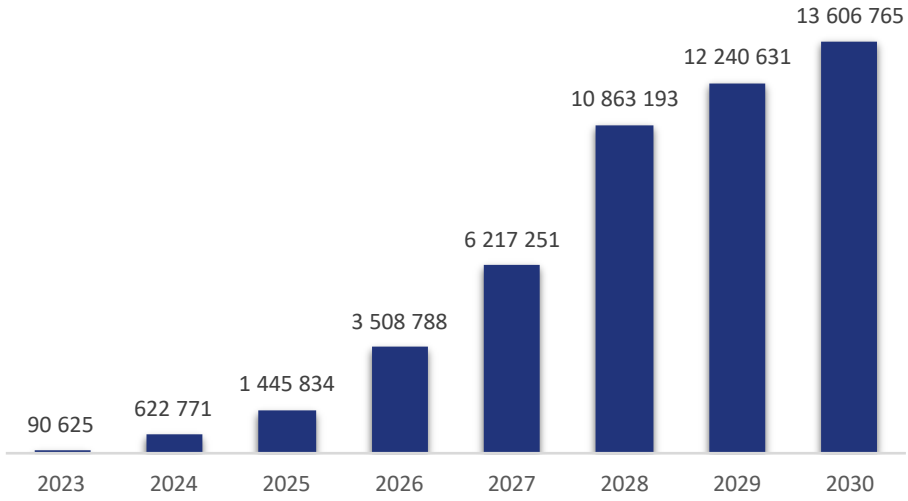
SET GOALS

Expected number of users

In the graph on the right, you can see what increase in users we expect, whether paying or those who have a free version of our application. In 2026 to 2028, the growth should be the greatest, as we enter more countries through translations and will have created all 5 subjects. **The number of users can be even higher** because we target all social classes, from the more socially disadvantaged to the richer. All they need is a smartphone and internet access.



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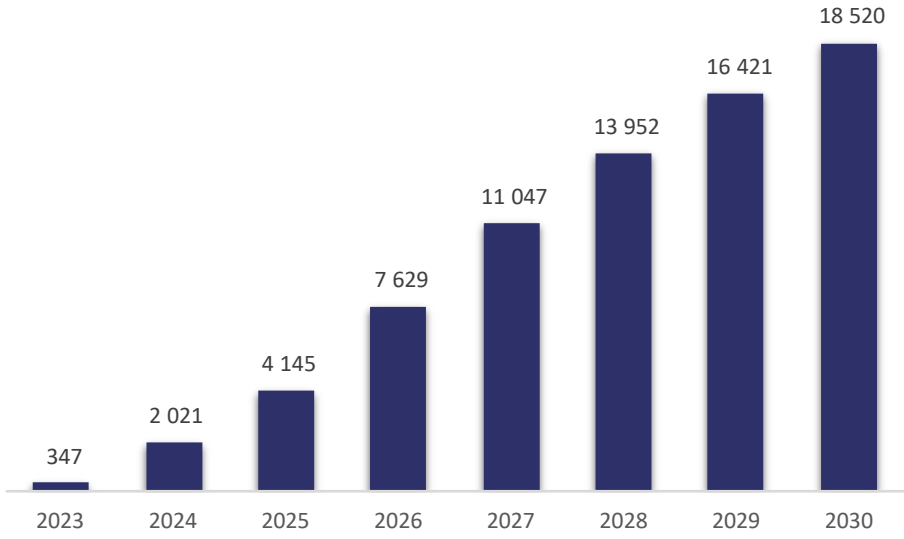
SET GOALS

Expected number of teachers

A teacher is important to us, through him/her we reach a large number of students at once. **Initially, we will address teachers and schools for testing** to tailor the application to school use. When our call centre expands in **2026** we will be able to communicate with more teachers, and at the same time we will have a customised system for them.



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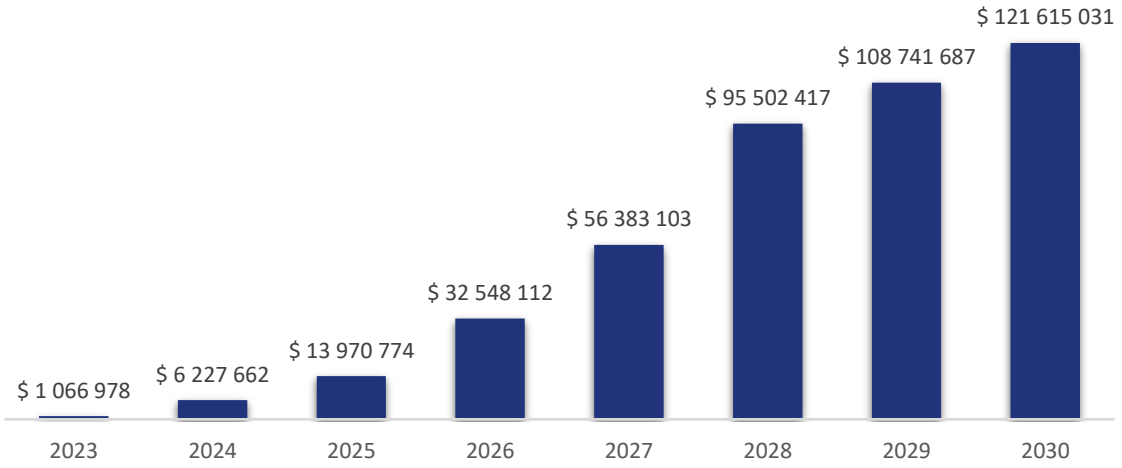
MARKET POTENTIAL

Expected revenue

Revenue will come not only from the subscription, but especially from advertising for users who use the free version. For now, the price for an annual subscription is only USD 71, incl. VAT. We will further adjust the price to individual markets and, of course, to demand.



Revenue overview

Products	2024	2025	2026	2027	2028	2029	2030
Market size - number of students	109 845 698	130 208 280	130 208 280	130 208 280	130 208 280	130 208 280	130 208 280
Market coverage	0,57%	1,11%	2,69%	4,77%	8,34%	9,40%	10,45%
Numbers of our users							
Schools	674	1 211	1 942	2 563	3 091	3 540	3 921
Teachers	2 021	4 145	7 629	11 047	13 952	16 421	18 520
Users - school licences	73 542	143 751	253 581	357 878	446 531	521 886	585 937
Users - individual licences	49 431	117 187	292 969	527 344	937 500	1 054 687	1 171 875
Users - free version (advertising)	499 798	1 184 895	2 962 238	5 332 029	9 479 163	10 664 058	11 848 953
Turnover							
Users - school licences	$ 2 853 119	$ 3 287 496	$ 5 260 062	$ 5 770 927	$ 5 792 822	$ 5 793 760	$ 5 793 800
Users - individual licences	$ 2 898 526	$ 6 871 677	$ 17 179 192	$ 30 922 545	$ 54 973 413	$ 61 845 090	$ 68 716 766
Users - free version (advertising)	$ 428 398	$ 1 354 166	$ 5 078 123	$ 10 664 058	$ 21 666 658	$ 24 374 990	$ 27 083 322
Printed products	$ 47 619	$ 11 905	$ 11 905	$ -	$ -	$ -	$ -
Total							
Total	**$ 6 227 662**	**$ 11 525 243**	**$ 27 529 281**	**$ 47 357 530**	**$ 82 432 892**	**$ 92 013 840**	**$ 101 593 889**

All amounts are exclusive of VAT.

Market size - we draw market size from the OECD international database for the countries in which we operate in a given year (see Strategy).

Market coverage - this is a percentage of the total market size and is calculated from the sum of paying and non-paying users.

Users - free version (advertising) - ad turnover is calculated with a cost per ad impression of 0.1 CZK, we have based this on the Google Adsense calculator (https://www.google.com/adsense/start). Ad turnover is based on the total annual ad impressions.

Printed products - this is a re-sale of textbooks and workbooks in the Czech and Slovak Republics that we have in stock.

Overview of the financial plan

Years	2021	2022	2023	2024	2025	2026	2027	2028
Expenditure	$ 2 365 436	$ 4 464 603	$ 8 392 171	$ 10 033 294	$ 11 350 493	$ 11 097 596	$ 11 661 054	$ 11 661 054
Revenue	$ -	$ 171 114	$ 1 066 978	$ 6 227 662	$ 13 970 774	$ 32 548 112	$ 56 383 103	$ 95 502 417
Profit after tax	$ -2 825 209	$ -4 936 328	$ -8 246 466	$ -4 874 821	$ 1 892 580	$ 17 374 918	$ 36 224 860	$ 67 911 504
Reserve fund balance	$ -	$ 669 690	$ 1 258 826	$ 1 504 994	$ 1 694 252	$ 3 431 744	$ 7 054 230	$ 13 845 380
Bank account balance	$ 31 933	$ 140 201	$ 352 219	$ 469 324	$ 267 884	$ 1 619 596	$ 27 555 303	$ 88 675 656
Liabilities (investments)	$ 2 857 143	$ 8 571 429	$ 17 619 048	$ 22 857 143	$ 20 952 381	$ 6 666 667	$ -	$ -
Balance of the year	$ -2 825 209	$ -5 606 019	$ -8 835 601	$ -5 120 990	$ 1 703 322	$ 15 637 426	$ 32 602 374	$ 61 120 354
Balance sheet total	$ -2 825 209	$ -8 431 228	$ -17 266 829	$ -22 387 819	$ -20 684 497	$ -5 047 071	$ 27 555 303	$ 88 675 656

Profit after tax - income tax is 19% if Income is higher than Expenses (not calculated using previous accounting loss).

Reserve fund balance - from 2022 to 2024 it is calculated as 15% of Expenses and from 2025 it is 10% of Profit.

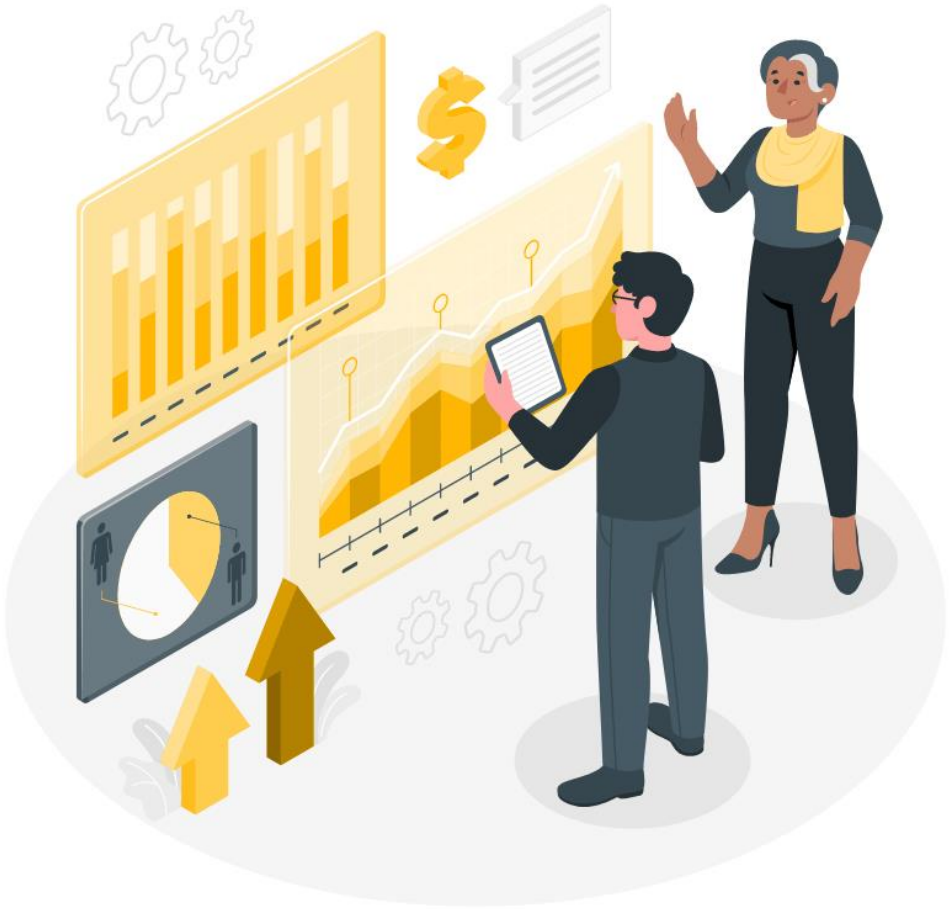
Bank account balance - the fund balance is calculated as the sum of Commitments (Investments) and Profit less the change in the Reserve Fund.

Liabilities (Investments) - our liabilities will increase over the next 4 years, primarily because we will continue to invest in products and expansion. Most of the funding goes into intangibles (or inventory - books). The plan is to have liabilities of up to USD 22.4 million, which will then gradually be reduced by our revenues. The reason, why the amount of investment is USD 38.1 million (and not only USD 22.4 million), is that our budget is set as pessimistic, i.e. it assumes the most costly form and at the same time it is ready to cover possible cash flow problems. Moreover, ForClassmates Finance always invests 60% in ForClassmates, i.e. 40% remains in ForClassmates Finance and covers the investments of the silent partners.

Balance Sheet of the year - describes the financial health of the year. It is calculated as all Income minus Expenses and minus the change in the Reserve Fund.

Total Balance Sheet - includes the balance of the year and the previous year.

Valuation



Company valuation

In the following slides we will explain to you how we determined the target valuation of the company. What formula and procedures we applied and what specific indicators we implemented.

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Valuation calculation

1 INTANGIBLE ASSETS

2 COMMUNITY + DATA

3 TEAM

4 EBITDA

5 FINANCIAL INDICATORS

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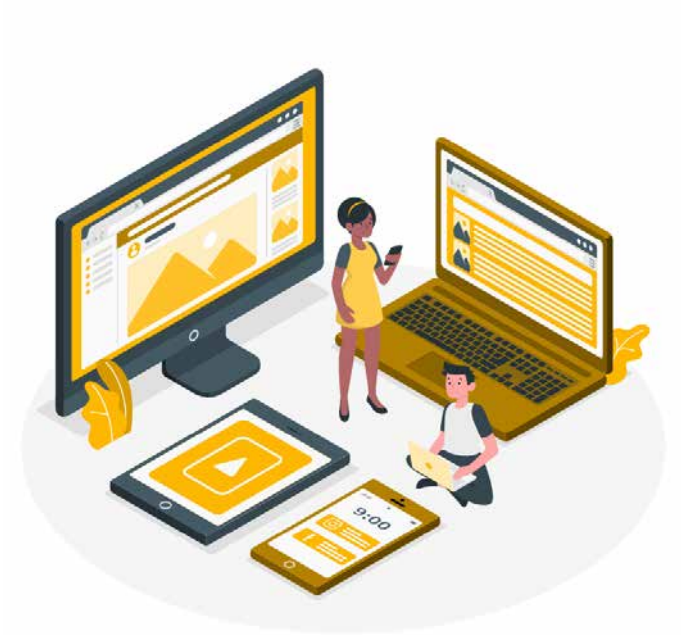
Intangible assets

Intangible assets include the created **content**, programmed **application** and **brand** of the company. We will develop all 3 areas every year and their value will continue to grow over time.



USD 28M

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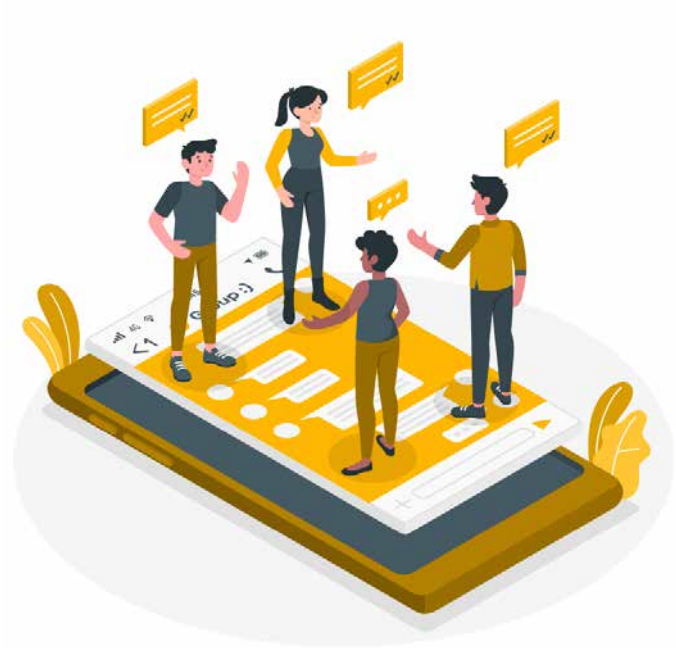
Community and data

A large part of a company's valuation is made up of **the community and data**. We divide the community into 3 pillars: users with free access, users with a premium version and teachers. At the same time, we prize data that is of immense value. It is difficult to find specific data on education on the market, what students like to learn, what methods work, how well students are doing geographically and in what subjects students succeed with a specific breakdown into individual topics.



USD 48.8M

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Team

One of the most important influences on the company's prosperity is a **high-quality and loyal team**. It will be motivated not only by participating in a change to the education system in more than 10 countries around the world but also by **contributing to the value of the company** by being our silent partner. For the team, we use a **coefficient** which, in our opinion, has **influences the entire valuation** of the company, namely at a value of 5%. In the lower right corner, we indicate the amount that corresponds to this value.

USD 31.4M

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EBITDA

EBITDA is one of the basic indicators that shows **the financial performance of the company**. It is an **indicator of gross profit** since interest, taxes and depreciation are not included.

USD 44M

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Financial indicators

The financial indicators include **the current balance on the bank account** of the company and the **reserve fund** in 2028.

USD 102M

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Valuation formula

We created a formula that includes **not only the classic EBITDA approach**, but also other parts of the whole puzzle. We have two **multipliers** in the formula. One is the EBITDA multiplier and the other is the competition multiplier. In the lower left corner, there is a legend of abbreviations.

$$(IA + CD + FI + (EBITDA * Em)) * Cm * T$$

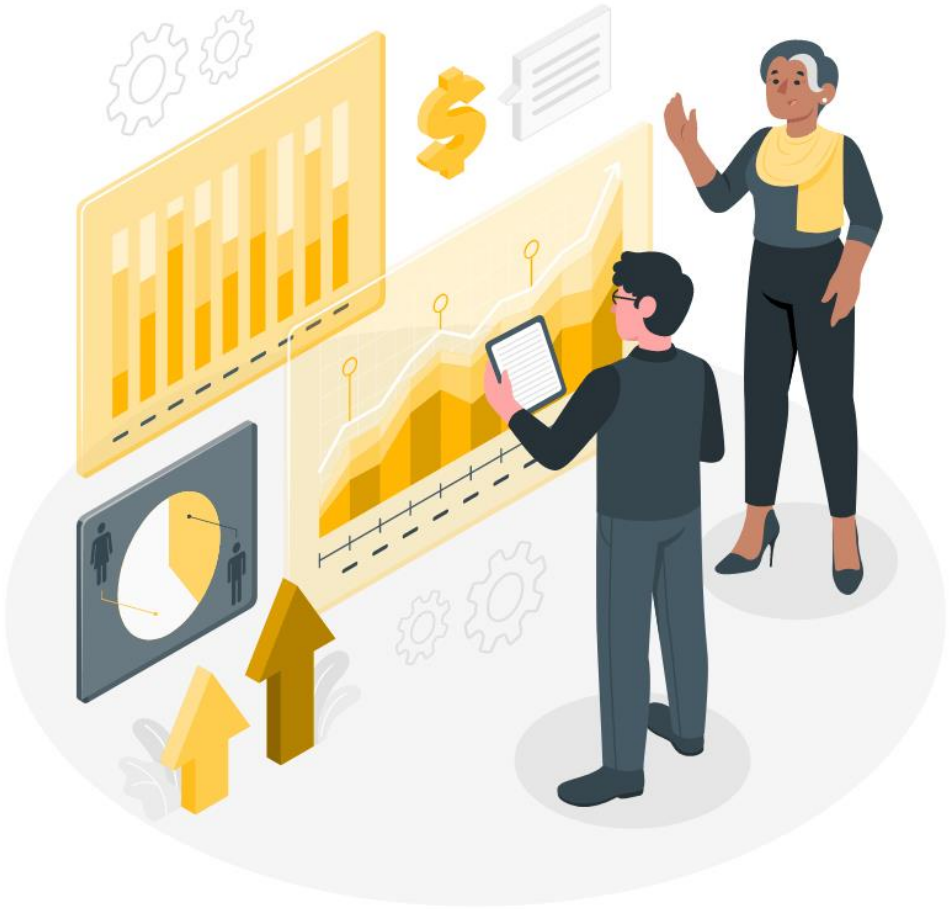
$$(28 + 48.8 + 102 + (44 * 5)) * 1.5 * 1.05$$

Valuation ≐ **USD 628M**

The EBITDA multiplier is set to 4–12 by default.

We set the range of 1–2 to the competition multiplier.

IA – Intangible assets
CD – community and data
FI – financial indicators
Em – EBITDA multiplier
Cm – competition multiplier
T – team



USD 628M

Company valuation

Our goal is to achieve a valuation of the company of **USD 628M**, which should be an additional **10-fold appreciation of the investment** for a silent partner.

Comparison with similar projects

When calculating the valuation of the company, it was important for us to compare with similar projects that operate in online education. Do you know, for example, the valuation of the language educational application Duolingo, the teaching tools of the Quizlet application or the Udemy course market?

duolingo

duolingo.com

USD 2.4B

Quizlet

quizlet.com

USD 1B

Udemy

udemy.com

USD 3.2B

Source: www.cbinsights.com/research-unicorn-companies

Silent partner

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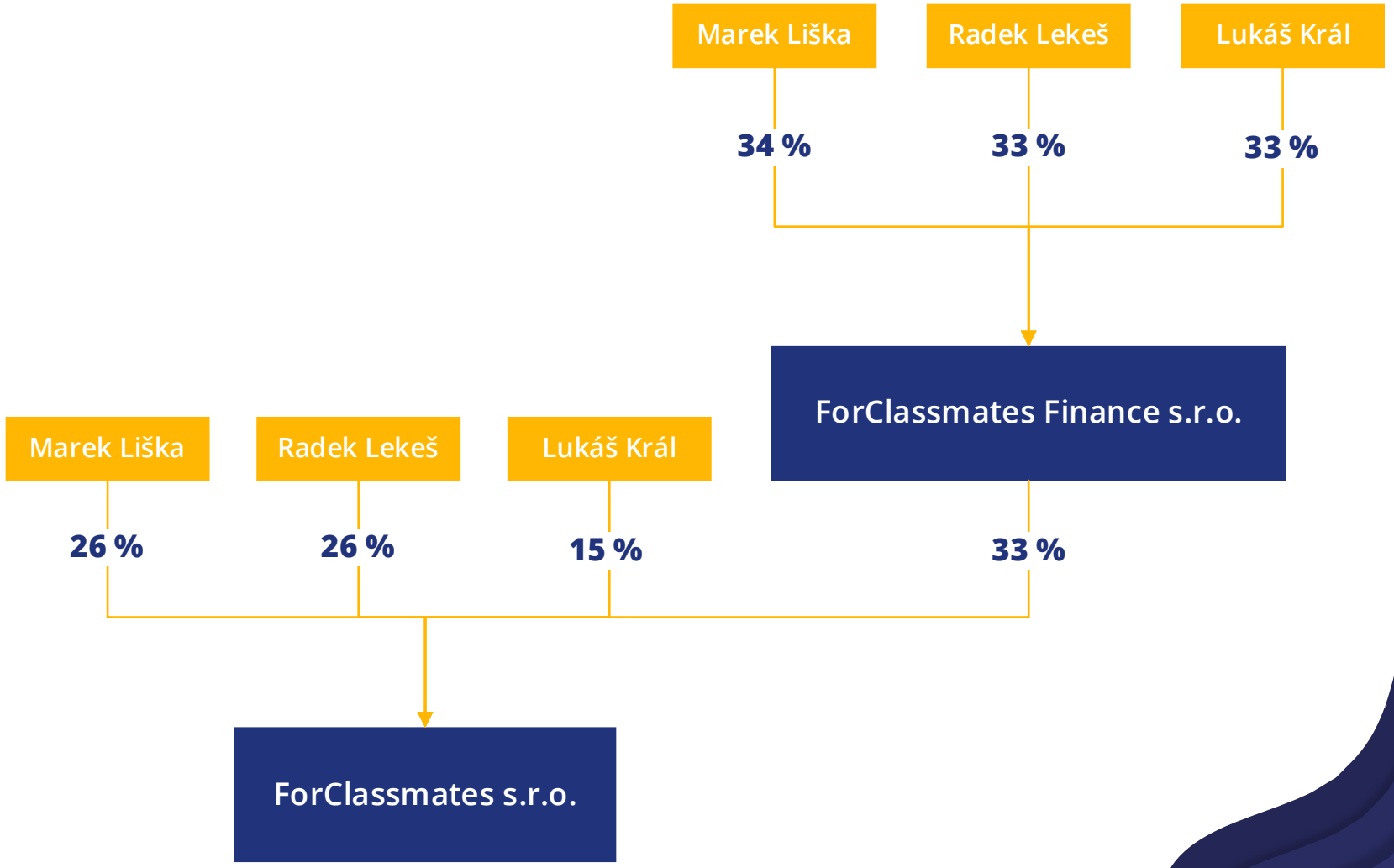
Property structure



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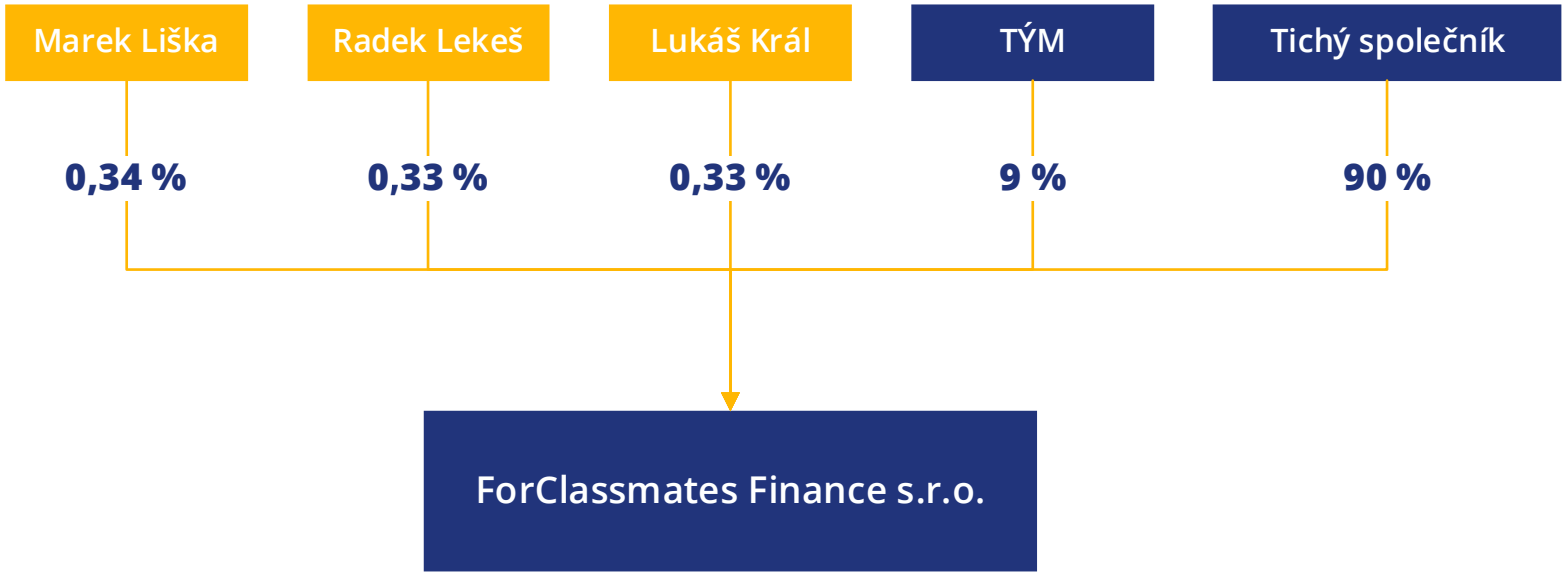
Profit share structure of ForClassmates Finance s.r.o.



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Details of a silent partner

1) What does a silent partner mean in the law? Is it legal?

– "A silent partner may be a natural or legal person, business entity or non-business entity that, with its deposit, participates in the business of another person. In many developed countries of the world, silent partnership is a common form of participation in the business of others. Within the laws of the Czech Republic, a silent partnership was first regulated by the Commercial Code (after 1989); however, since 1 January 2014, its legal regulation has been included in the Civil Code. Through a Silent Partnership Contract, in accordance with the provisions of Section 2747 of Act No. 89/2012 Coll., The Civil Code, as amended, a silent partner undertakes to make a deposit by means of which it will participate in the results of the Company's business for the entire duration of the Contract, and the company undertakes to pay the silent partner a dividend."

Arrows Law Office

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2) What are the rights and obligations of a silent partner?

- Through our private platform, the Silent Partner has the right to inspect all published business documents and accounting records of ForClassmates Finance s.r.o. and ForClassmates s.r.o.

  It also has the right to receive, through the private platform, copies of each financial statement, each income tax return, including appendices thereto, as well as each auditor's report on the audit of financial statements of ForClassmates Finance s.r.o., which will be prepared at the time or during the silent partnership.

  The Silent Partner is entitled to dividends from the distributed profit in the amount it has purchased for its investment as at the date of preparation of the Financial Statements, as well as of any other profit to be paid out based on the decision of the General Meeting of ForClassmates Finance s.r.o.

  The silent partner's obligation, in addition to proper payment of the deposit and confidentiality, is also a tax liability on any income from dividends, which is not paid by ForClassmates Finance s.r.o., nor is it charged to the silent partner or paid for the silent partner.

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3) What are the advantages of a silent partner over other types of investing in companies?

- Dividends from ForClassmates Finance s.r.o. and dividends from the eventual sale of the subsidiary of ForClassmates s.r.o., which can achieve a higher appreciation, for example, than in the case of bonds, is a fixed percentage annual return.
- No entry or ongoing fees, you invest directly in the project without an intermediary.
- Possibility to view issued documents concerning the company's management through the private platform of ForClassmates Finance s.r.o.
- It is possible to enter the project right from the beginning of the idea, and thus get a much higher appreciation.

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4) How can I become a silent partner?

- By registering through our private investor platform app.forclassmates.io. A silent partner can be an independent person or a business entity that successfully passes the verification process, invests the required funds in ForClassmates Finance s.r.o. and will be approved at the General Meeting of ForClassmates Finance.

5) How does the verification process work (KYC, AML, etc.)?

- Although we are not an obligor within the meaning of the provisions of Section 2 of Act No. 253/2008 Coll., on Certain Measures against the Legalisation of Proceeds from Crime and Terrorist Financing, as amended (hereinafter the "AML Act"), i.e. we are not subject to client identification and control obligations under the AML Act; however, to protect our company in which you wish to invest, we identify each silent partner using at least one proof of identity and basic verification (PEP, international sanctions, negative mentions in the media, etc.). This operation is provided for us by the getid.ee application based in the European Union, so you do not have to worry about your personal data, as GetID Ltd is subject to strict European legislation, including GDPR.

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6) Are there any fees associated with the silent partnership contribution?

- Everything is free of charge. You invest directly in the project without intermediaries. The fee can only arise within the transaction itself, which can be charged by your bank or payment gateway.

7) When and under what conditions is a silent partner entitled to dividends from the distributed profit?

- The right to the payment of profit arises when it is approved by the General Meeting of ForClassmates Finance s.r.o. and the subsequent amount of the dividends corresponds to the purchased share of the distributed profit.

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8) For how long is the Silent Partnership Contract?

- The Silent Partnership Contract is for the period of 7 years, when the development phase is expected to be completed and the growth of ForClassmates s.r.o. will be at the global level.

SWOT analysis

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Strengths

Modern stylisation

Digital content with nice design and illustrations without unnecessary text.

Entertaining form

We constantly involve a student in learning with the help of gamification (play).

Available everywhere

The application will be available on all devices (desktop and mobile).

We explain in an approachable language

We write all the content in an approachable language for the current generation. Authors must be close to the target group.

Interactivity

Students can try connections using interactive graphs or videos that will not bore them.

Proven content

Our style of creation has been proven by the creation of printed textbooks that have received positive feedback directly from students.

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Weaknesses

Expertise

The need to have quality employees who will guarantee expertise.

New team

Time-consuming in training and gaining experience in development in our style.

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Opportunities

Little direct competition

There is no competition for similar system size, complexity and range of features.

Student motivation

Many students want to get into their dream school and have a quality education.

Continuity of study

As soon as we get a student in primary school, he/she can grow up with us until the end of secondary school (a total of 10 years).

Coronavirus

Coronavirus has spread awareness of online learning, and many people are beginning to see the benefits in it.

Bad test results

The need to pass final exams.

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Threats

System malfunction

Slow, complex and unreliable system on all devices.

SW illiteracy

Customers cannot use and control online applications.

No printed version

Until now, a user has been used to using printed products.

Translation and localisation

Difficulty of translation and localisation due to customisation of the system.

Deadlines

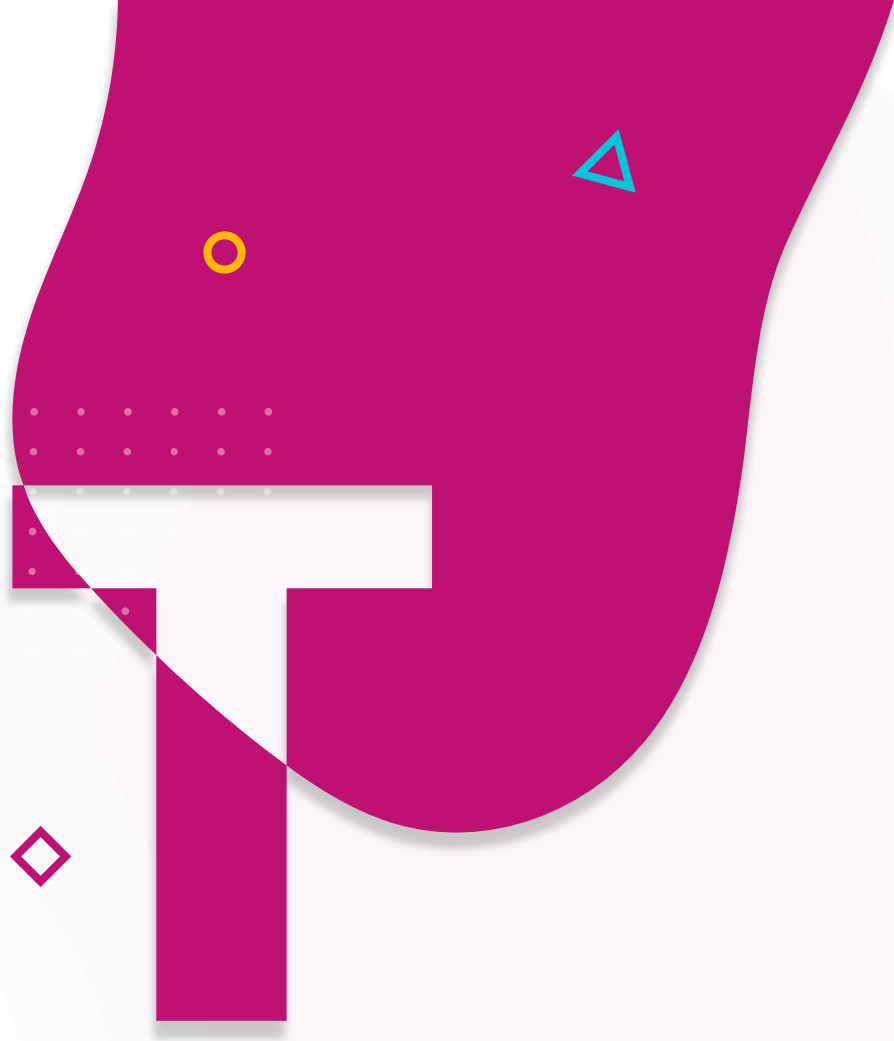
Failure to create content and application development by deadline.

Premature rejection

Users have no experience with online learning.

Reluctance to pay

A customer does not know or understand the added value of the system.



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Summary of SWOT analysis

	Strengths	Weaknesses
Internal nature	1. Modern stylisation 2. We explain in an approachable language 3. Entertaining form 4. Interactivity 5. Available everywhere 6. Proven content	1. Expertise 2. New team
	Opportunities	**Threats**
External factors	1. Little direct competition 2. Coronavirus 3. Student motivation 4. Bad test results 5. Continuity of study	1. System malfunction 2. Deadlines 3. SW illiteracy 4. Premature rejection 5. No printed version of the textbook 6. Reluctance to pay 7. Translation and localisation

Cryptocurrencies

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We will want to issue our own crypto tokens

The world is changing every day. The only thing left behind in most places is education. Education is the basis of everything, but at the same time its quality is far behind.

Crypto tokens BEP-20 are one of the other technologies we want to use, specifically in gamification. We will also use **SmartContract** for transparency and immutability of data.

We will inform you about further details.

Contacts

ForClassmates™
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ForClassmates Finance s.r.o.
Evropská 516/10
160 00 Prague 6
Czech Republic
Company Reg. No.: 10852531

+420 777 725 099
+420 723 276 129

info@forclassmates.io

DO NOT HESITATE TO CONTACT US

Contacts

Do you have any questions? Have you already decided and want to become a silent partner? Or were you so interested in our visions and plans that you want to be there and work for us?

I want to invest

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Thank you!

We are looking forward to a common path of modernising education.

Illustrations by Freepik Storyset