



Blending **academic** and **entrepreneurial** knowledge
in technology enhanced learning

eLearning
7th Conference on e-Learning 2016



BAEKTEL

ADVANTAGES AND CHALLENGES IN PRESENTING MATHEMATICAL CONTENT USING EDX PLATFORM

September 29-30,

Belgrade Metropolitan University

e-Learning Conference

*Marija Radojičić, Ivan Obradović,
Ranka Stanković, Olivera
Kitanović, Roberto Linzalone,*

Presentation outline

- Open educational resources
- Tempus project BAEKTEL
- edX platform
- Course “Preparation for entry exam”
- Didactical criteria for developing OER content
- Termi application –connecting with course “Preparation for entry exam”
- Conclusion

Open Educational Resources - OER

Open Educational Resources (OER), definition :

OER materials are educational materials that can be freely accessed, changed, reused and shared. They include courses, textbooks, videos, tests, software ...

Massive Open Online Courses (MOOCs) providers

edX – MIT, Harvard (As of March 24, 2016, edX has more than 7 million students taking more than 700 courses online)

Coursera - Stanford (As of January 11, 2016, Coursera offers 1 563 courses from 140 partners across 28 countries)

Udacity - (As of April 28, 2014, Udacity has 1.6 million users)

Tempus project - Blending Academic and Entrepreneurial Knowledge in Technology Enhanced Learning (BAEKTEL)

EdX platform

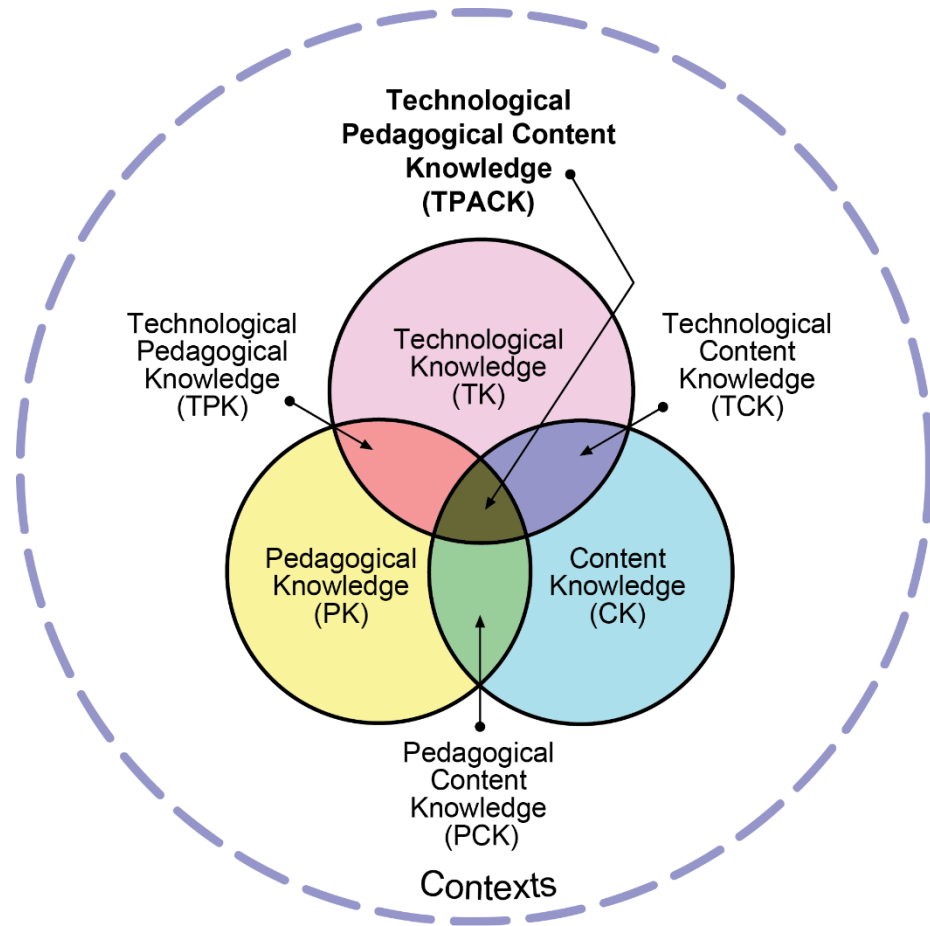
Main purposes of the project :

- Establish an OER framework for fostering technology enhanced learning
- Establishing cooperation between academic institutions and enterprises in the purpose of sharing knowledge



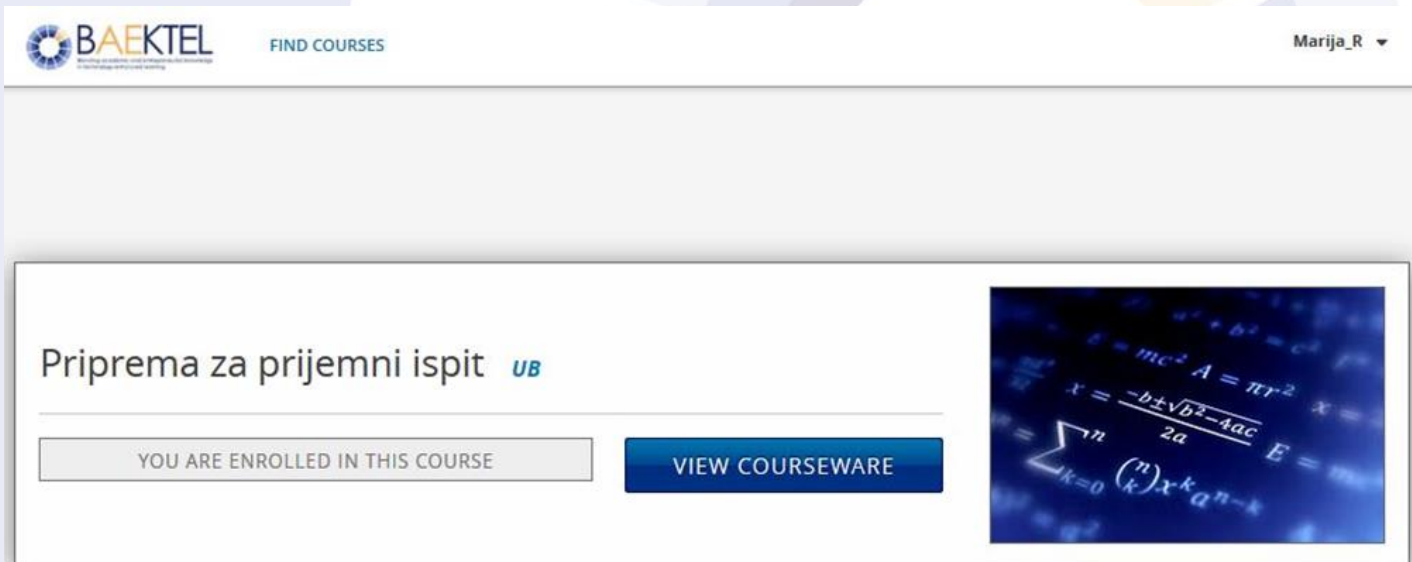
TPACK-Technological Pedagogical Content Knowledge

TPACK has been presented as a system which interconnects and intersects technology, pedagogy, and content knowledge



Course “Preparation for entry exam”

- 13 sections
- Theoretical part -The theoretical part contains basic axioms, theorems and formulae related to a specific mathematical topic
- Exercise part - contains tasks that represent relevant and purposeful examples
- Instructions for the exam process



The screenshot shows the BAEKTEL interface. At the top left is the BAEKTEL logo and the text 'FIND COURSES'. At the top right is the user name 'Marija_R' with a dropdown arrow. The main content area displays the course title 'Priprema za prijemni ispit UB'. Below the title are two buttons: 'YOU ARE ENROLLED IN THIS COURSE' and 'VIEW COURSEWARE'. To the right of the buttons is a decorative image featuring mathematical formulas such as $E = mc^2$, $A = \pi r^2$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, and $\sum_{k=0}^n \binom{n}{k} x^k a^{n-k}$.

View of courseware

The screenshot shows a courseware interface. At the top left is the BAEKTEL logo. The course title is 'UB: UB8 Priprema za prijemni ispit' and the user is 'Marija_R'. Below the title is a dropdown menu set to 'Staff'. A navigation bar contains 'Courseware', 'Course Info', 'Discussion', 'Wiki', 'Progress', and 'Instructor'. The left sidebar lists course topics: 'Opšte napomene', 'Izrazi', 'Kvadratne jednačine i nejednačine' (with 'Kvadratne jednačine' selected), 'Iracionalne jednačine i nejednačine', and 'Eksponecijalne jednačine i nejednačine'. The main content area shows a document icon, a 'VIEW UNIT IN STUDIO' button, and text explaining quadratic equations. It includes the equation $ax^2 + bx + c = 0$ and the quadratic formula $x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. It also lists three cases for the discriminant $\Delta = b^2 - 4ac$.

View this course as:

Courseware Course Info Discussion Wiki Progress Instructor

- Opšte napomene
- Izrazi
- Kvadratne jednačine i nejednačine**
 - Kvadratne jednačine**
- Iracionalne jednačine i nejednačine
- Eksponecijalne jednačine i nejednačine

VIEW UNIT IN STUDIO

Jednačina $ax^2 + bx + c = 0$ ($a, b, c \in R, a \neq 0$) se zove kvadratna jednačina (sa realnim koeficijentima, u daljem tekstu se ovo podrazumeva). Rešenja kvadratne jednačine su:

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Izraz $\Delta = b^2 - 4ac$ se naziva diskriminanta i važi:

- $\Delta > 0$ jednačina ima 2 različita realna rešenja
- $\Delta = 0$ jednačina ima 2 ista realna rešenja
- $\Delta < 0$ jednačina ima 2 različita konjugovano kompleksna rešenja

Vijetove formule:

View of a task

ZADATAK 3 (1 point possible)

Rešenje jednačine

$$\log_3(\log_2(\log_5(x))) = 0$$

pripada intervalu:

(0, 8)

(8, 16)

(16, 24)

(24, 32)

?

CHECK

SHOW ANSWER

Rešenje

$$\log_3(\log_2(\log_5(x))) = 0$$

$$\log_2(\log_5(x)) = 1$$

$$\log_5(x) = 2$$

$$x = 25$$

Dakle, rešenje pripada intervalu (24,32).

CHECK

HIDE ANSWER

Under the hood

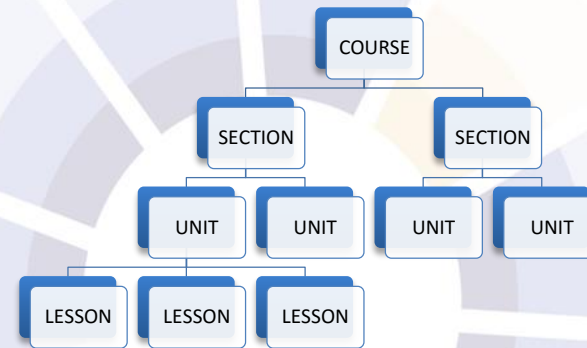
- Python programming language
- LaTeX notation for mathematical formulae
- Tags

```
Editing: ZADATAK 4
1 <problem>
2 <p> </p>
3 <p>Za sve vrednosti  $\alpha$  za koje je definisan, izraz  $\frac{1+\cos 2\alpha+\sin 2\alpha}{1+\cos 2\alpha+\sin 2\alpha}$  identički je jednak izrazu: </p>
4 <multiplechoiceresponse>
5 <choicegroup type="MultipleChoice">
6 <choice correct="true"> $\alpha$ </choice>
7 <choice correct="false"> $2\alpha$ </choice>
8 <choice correct="false"> $\sin 4\alpha$ </choice>
9 <choice correct="false"> $\cot 2\alpha$ </choice>
10 </choicegroup>
11 </multiplechoiceresponse>
12 <p> </p>
13 <solution>
14 <p>Rešenje:</p>
15 <p> $\frac{2\sin^2\alpha+2\sin\alpha\cos\alpha}{2\cos^2\alpha+2\sin\alpha(\sin\alpha+\cos\alpha)} = \frac{2\sin\alpha(\sin\alpha+\cos\alpha)}{2\cos\alpha(\sin\alpha+\cos\alpha)} = \frac{2\sin\alpha}{2\cos\alpha} = \tan\alpha$ </p>
16 <p></p>
17 </solution>
```

Save Cancel

Some didactic criteria for developing OER content

- Principle of systematization and gradualism in the teaching process



- Principle of active role of end users in learning process
- Didactic principle of science
- Connecting theory and practice

Advantages of edX platform which are in line with didactical criteria

- Allows adding and easy editing videos, tasks, texts...
- Combining different components in the same unit
- Wide specter of tasks in various forms
- Monitoring a user progress
- Detailed description of learning materials
- Easy to use

Task Types

TEXT INPUT (1 point possible)

A text input problem accepts a line of text from the student, and evaluates the input for correctness based on an expected answer. The answer is correct if it matches every character of the expected answer. This can be a problem with international spelling, dates, or anything where the format of the answer is not clear.

Which US state has Lansing as its capital?

Check

NUMERICAL INPUT (3 points possible)

A numerical input problem accepts a line of text input from the student, and evaluates the input for correctness based on its numerical value.

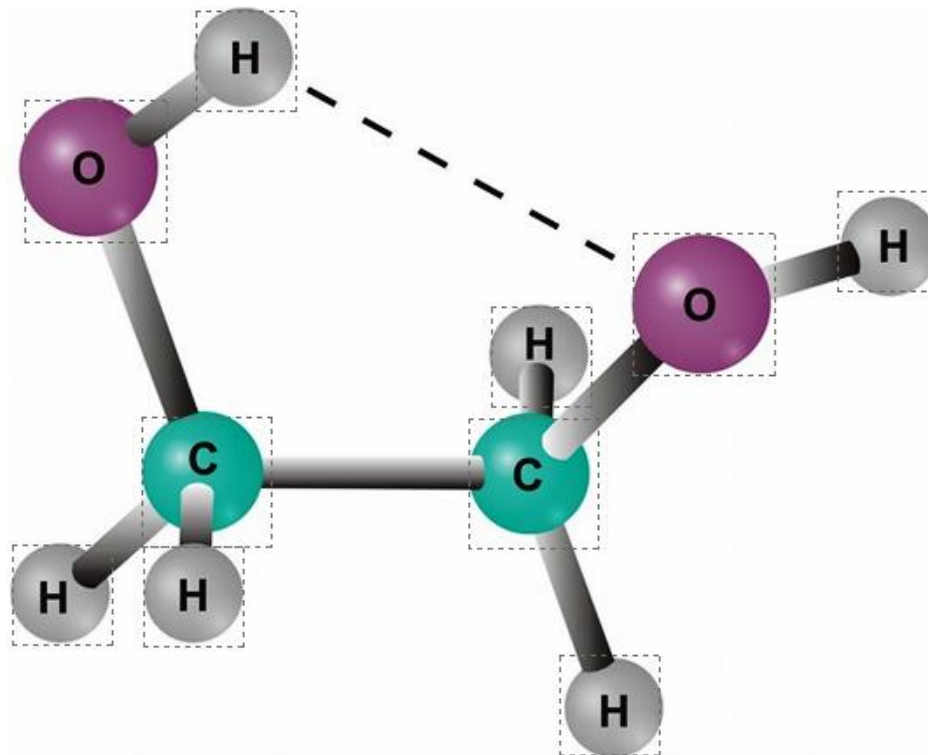
The answer is correct if it is within a specified numerical tolerance of the expected answer.

Enter the numerical value of Pi:

Task Types

DRAG AND DROP WITH OUTLINE

Please label hydrogen atoms connected with left carbon atom.



← Hydrogen Hydrogen →

Task Types

Dropdown

EDIT



DROPDOWN (1 point possible)

Dropdown problems give a limited set of options for students to respond with, and present those options in a format that encourages them to search for a specific answer rather than being immediately presented with options from which to recognize the correct answer.

The answer options and the identification of the correct answer is defined in the **optioninput** tag.

Translation between Dropdown and _____ is extremely straightforward:

- Multiple Choice
- Text Input
- Numerical Input
- External Response
- Image Response

Task Types

MULTIPLE CHOICE (1 point possible)

A multiple choice problem presents radio buttons for student input. Students can only select a single option presented. Multiple Choice questions have been the subject of many areas of research due to the early invention and adoption of bubble sheets.

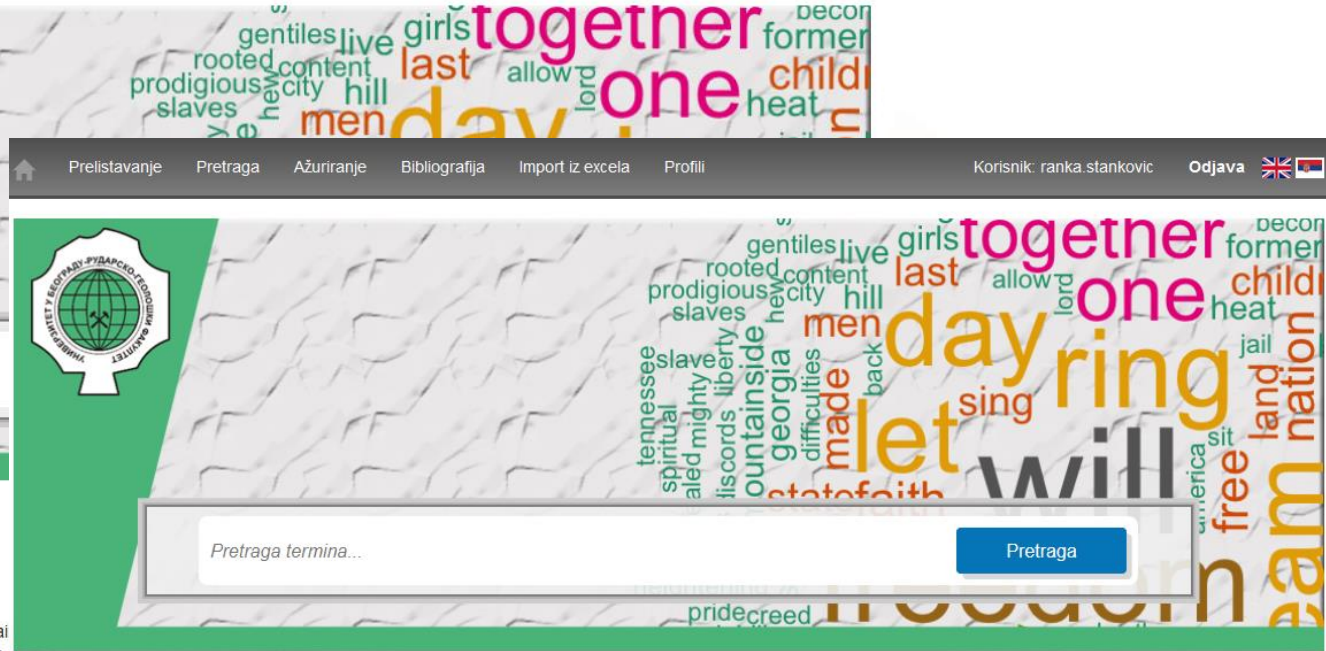
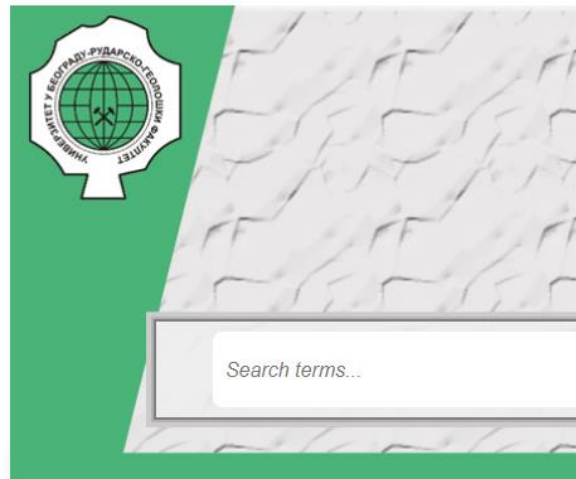
One of the main elements that goes into a good multiple choice question is the existence of good distractors. That is, each of the alternate responses presented to the student should be the result of a plausible mistake that a student might make.

What Apple device competed with the portable CD player?

- The iPad**
- Napster**
- The iPod**
- The vegetable peeler**

Check

Termi application as a support for the development of terminological dictionaries in various fields



About Termi

The importance of terminological resources for specific domains is increasing as the availability of various texts on the web expands. Terminological consistency needs to be achieved or content needs to be adapted for different audiences, levels of expertise, etc. In addition to monolingual and bilingual information retrieval, multilingual information retrieval emphasizes the need for development of terminological resources as well. The Termi application supports the development of terminological resources in various fields (mathematics, computer science, mining, library science, computer science, etc.). On the Browse and Search page all terms verified by editors can be viewed whether they are logged in or not. Export to excel, TBX, csv is supported.

Termi Aplikaciji

Važnost terminoloških resursa za specifične domene u elektronskom obliku rapidno se širi dostupnošću tekstova na Internetu. Terminološki resursi su važni za mnoge aplikacije kod kojih sadržaj treba da bude opisan na više jezika, treba da bude prilagođen različitim korisnicima ili različitim nivoima stručnosti korisnika. U odnosu na jednojezične resurse, sistemi za mašinsko prevđenje, kao i sistemi za višjezičnu pretragu informacija imaju potrebu za višjezičnim i dvojezičnim resursima. Termi aplikacija podržava razvoj terminoloških rečnika u raznim naučnim sferama (matematika, računarske nauke, rudarstvo, bibliotekarska nauka, računarska lingvistika...). Termi trenutno podržava obradu i prikaz termina na engleskom i srpskom jeziku, a u planu je razvoj za druge jezike. Na stranicama Prelistavanje i Pretraga dostupni su svi termini verifikovani od strane autora. Ove stranice u vidljivoj svin korisnicima bili prijavljeni ili ne. Podržan je izvoz u excel tabelu, TBX i csv fajlove, a u planu je i razvoj izvoza u rdf, owl i slične formate.



Korisni linkovi

[Jerteh.rs](#)

[Biblisha](#)

[CaSa NaRA](#)

[Baektel Meta portal](#)

[GeolISS Term](#)

Termi application - search page

The screenshot shows the search interface of the Termi application. At the top, there is a navigation bar with links for 'Prelistavanje', 'Pretraga', 'Ažuriranje', 'Bibliografija', and 'Import iz excela'. On the right, it displays the user 'Korisnik: marijaradojic' and an 'Odjava' button with flags for the UK and SRB. The main heading is 'Pretraga'. A search input field contains 'geometrija' and a dropdown menu is set to 'Sadrži'. Below the search bar, there are two columns: 'Srpski' and 'Engleski'. The 'Srpski' column shows a list with 'geometrija' selected. Below this list, there is a definition in Serbian: 'geometrija (Geometrija je grana matematike koja se bavi proučavanjem i odnosom geometrijskih objekata. Naziv geometrija potiče od 2 grčke reči gea (zemlja) i metri (meriti).)' followed by 'Nadređeni: geometrija> matematika> terminološki rečnik' and 'Podređeni: tangenta'. The 'Engleski' column shows the English definition: 'geometry (The branch of mathematics concerned with the properties, relationships, and measurement of points, lines, curves, and surfaces.)' followed by 'Hyperonyms: geometry> mathematics> terminological dictionary' and 'Hyponyms: tangent line'.

Termi application - math terms

The screenshot shows the Termi application interface. At the top, there are navigation tabs: Preistavanje, Pretraga, Ažuriranje, Bibliografija, and Import iz excela. The user is logged in as 'Korisnik: marjaradojic' with an 'Odjava' button. The main content area is divided into two parts. On the left is a tree view under 'Ažuriranje' for the 'SRPSKI' language. The tree structure is as follows:

- matematika
 - algebra
 - analiza
 - aritmetika
 - geometrija
 - aksioma Lobačevskog
 - analitička geometrija
 - euklidska geometrija
 - euklidski prostor
 - hiperbolička geometrija
 - hipotenuza
 - invarijantnost
 - izometrija
 - koincidencija
 - otvoreni poluprstor
 - Plejferova aksioma paralelnosti**
 - tangenta
 - vektori
 - zatvoreni poluprstor
- obrazovanje
- poljoprivreda-CaSa
- računarstvo i informatika
- rudarsko inženjerstvo
- statistika
- termin

On the right, the detailed view for 'Plejferova aksioma paralelnosti' is shown. It includes the following fields:

- Status: Zaključan
- Naziv: Plejferova aksioma paralelnosti
- Sinonimi: aksioma euklidske geometrije
- Skracenicica: (empty)
- Opis: Postoje tačka SBS i prava SaS koja je ne sadrži takve da u njima određenoj ravni ne postoji više od jedne prave koja sadrži tačku S BS , a sa pravom SaS nema zajedničkih tačaka.

Below the description, there is an 'Embed' button with a red star icon. At the bottom, there is a 'Bibliografija' section with a table:

Redni broj	Naslov	Autor	Izdavač
1	Euklidska i hiperbolička geometrija	Zoran Lučić	Total design i Matematički fakultet

Termi application - math example

off

Naziv:

Sinonimi:

Skracenica:

Opis:

Spⁱⁿ \mathbb{N} , onda važi formula:

$$f(x) = f(c) + f'(c)(x-c) + \frac{f''(c)}{2!}(x-c)^2 + \dots + \frac{f^{(n)}(c)}{n!}(x-c)^n + R_n(x)$$

$$R_n(x) = \frac{(x-c)(x-\xi)^n}{p \cdot n!} f^{(n+1)}(\xi)$$

za neko ξ koje je između c i x . Navedena formula se naziva Tejlorovom formulom u Šlemilih-Rošovom ostatku.

Neka je funkcija $f(x)$ neprekidna sa svim svojim izvodima do n -tog reda, zaključno sa $(n+1)$ -vim izvodom u nekoj okolini U tačke c . Ako $x \in U$ i $p \in \mathbb{N}$, onda važi formula:

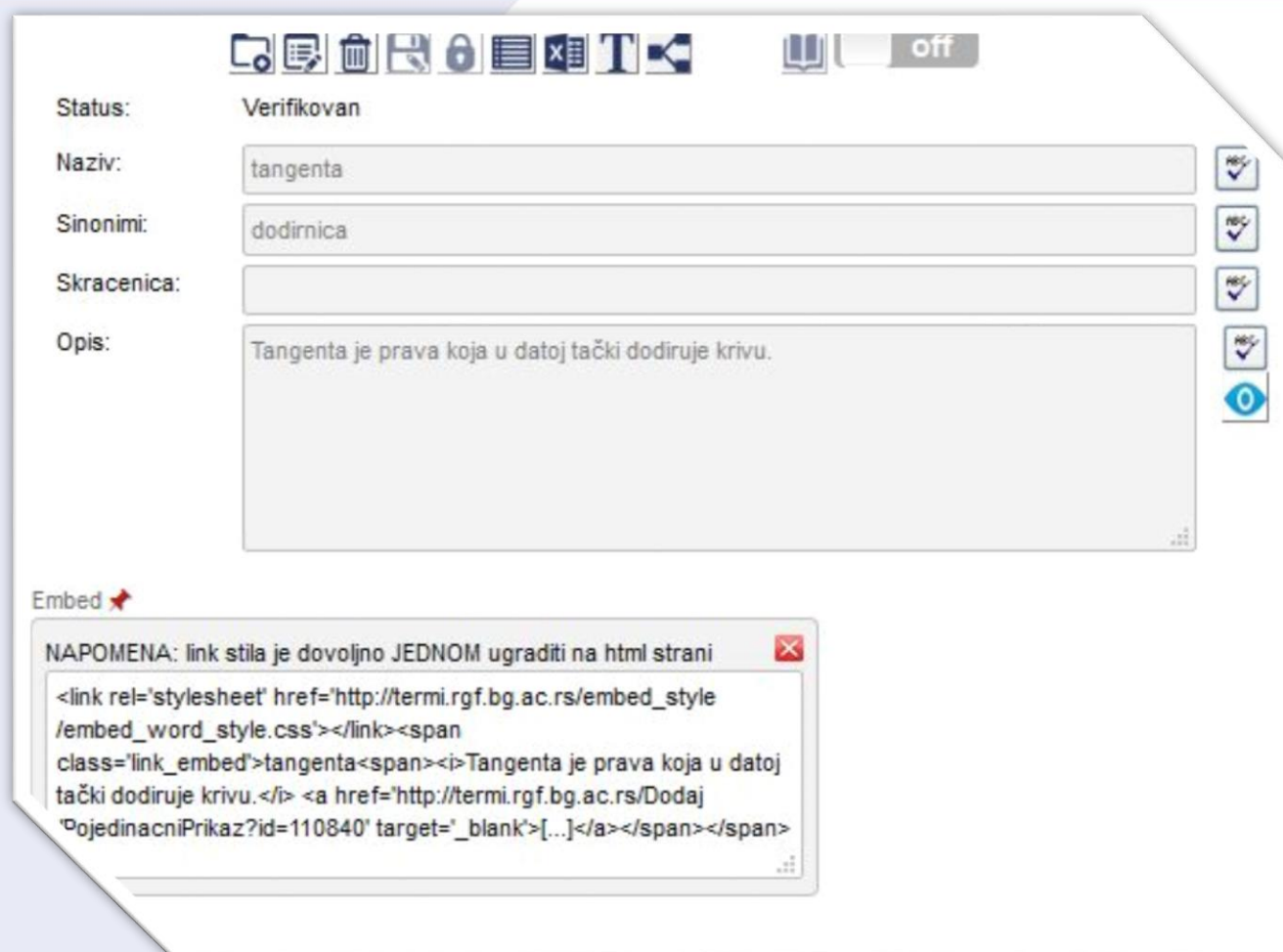
$$f(x) = f(c) + f'(c)(x-c) + \frac{f''(c)}{2!}(x-c)^2 + \dots + \frac{f^{(n)}(c)}{n!}(x-c)^n + R_n(x)$$

,

$$R_n(x) = \left(\frac{x-c}{x-\xi}\right)^n \frac{(x-\xi)^{n+1}}{p \cdot n!} f^{(n+1)}(\xi),$$

za neko ξ koje je između c i x . Navedena formula se naziva Tejlorovom formulom u Šlemilih-Rošovom ostatku.

Linking terms from courses to Termi




Status: Verifikovan


Naziv: tangenta

Sinonimi: dodirnica

Skracenica:

Opis: Tangenta je prava koja u datoj tački dodiruje krivu.

Embed 

NAPOMENA: link stila je dovoljno JEDNOM ugraditi na html strani 

```
<link rel='stylesheet' href='http://termi.rgf.bg.ac.rs/embed_style/
embed_word_style.css'></link><span
class='link_embed'>tangenta<span><i>Tangenta je prava koja u datoj
tački dodiruje krivu.</i> <a href='http://termi.rgf.bg.ac.rs/Dodaj
'PojedinačniPrikaz?id=110840' target='_blank'>[...]</a></span></span>
```

Linking terms from courses to Termi

ZADATAK 1 (1 point possible)

Jednačina tangente kružnice

$$k : x^2 + y$$

Tangenta je prava koja u datoj tački dodiruje krivu.[...]

koje su paralelne pravoj

$$p : 2x - y + 1 = 0$$

Tangenta Tangent line

Termin:	 tangenta  tangent line
Definica:	 Tangenta je prava koja u datoj tački dodiruje krivu.  Tangent line to a plane curve at a given point is the straight line that touches the curve at that point
Nadređeni koncept: :	geometrija matematika terminološki rečnik
Bibliografija :	The Crooked Made Straight: Roberval and Newton on Tangents, Wolfson, Paul R, 2001

2016 - Univerzitet u Beogradu, Rudarsko-geološki fakultet

Concluding remarks

- “Preparation for entry exam” was offered to more than 300 students, but only 155 students have enrolled
- Possible reasons:
 - unsuccessful promotion of the course and its content
 - lack of students’ habit to use OER courses
 - lack of interest of students for additional learning materials
 - students’ fear that their work will be evaluated by their future teachers
 - lack of internet access or basic IT skills required
- Introduction of this course did not mean just adding a new tool, but also offering a new learning paradigm
- There are still open questions what can be done to improve and promote OER in Serbia and to explore crucial reasons for scarce use of OER



BAEKTEL

Blending academic and entrepreneurial knowledge
in technology enhanced learning



Tempus



Thank you for your attention

Grazie per la vostra attenzione

Vă mulțumesc pentru atenție

Hvala za vašo pozornost

Hvala na pažnji

Хвала на пажњи

