

GPT no iekšpuses: ko var iesākt ar GPT? Matemātiķa skatījums. Mans skatījums.

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Ne tikai latviešu tautas mīkla: Jo izveicīgāks lietotājs, jo labāks iznākums, kas tas ir?

- Viena no pareizajām mīklas atbildēm, kas derēja jau kopš senseniem laikiem, pirms simtiem tūkstošiem gadu: -- darba rīks.
 - Jo izveicīgāks darba rīka lietotājs, jo vairāk paveiks, jo labāk paveiks
- Varbūt vēl viens pareizs mīklas risinājums, -- zināšanas.
 - Pieaugot mums zināšanām, mēs kļūstam spējīgi paveikt aizvien vairāk
 - Mēs varam teikt, -- zināšanas arī ir darba rīks.
- Un, vēl viens rīks -- prasme izgudrot, izgudrotājprasme.
- Bet, ja paskatīsimies uzmanīgi, visas trīs minētie rīki ir cēlušies no izgudrotājprasmes, no mūsu radošajām spējām: jā, gan darba rīks jāizgudro, gan zināšanas jāatklāj, gan izgudrotājprasme jāiegūst no prakses, ...(vai no TRIZ meistariem? 😊)

Kas ir darbarīks? Kāda ir tā «veiktspēja» un kāda ir lietotāja prasme, lietojot darbarīku? Kas svarīgāks?

- Viens no senākajiem darba rīkiem cirvis – jo mācēsi prasmīgāk lietot, jo labākus darbus varēsi darīt. Cits māc malku skaldīt, bet amatnieks māc būvēt māju/mēbeles.
- Metināmais aparāts,
 - Ja nemācēsi lietot, ko ar to iesāksi? Vajadzīga kvalifikācija, jo augstāk, jo produktīvāk. Vari sametināt divus dzelžus vai izgatavot kādu smalku ietaisi?
- Bet, ieiesim operāciju zālē, kur strādā ķirurgs, ... Kāda kvalifikācija vajadzīga? jo izcilāka, ... jo
 - Operāciju zāle arī ir darba rīks.
- Ieiesim zinātniskā konferencē, ... zinātniskie atklājumi arī ir darba rīki:
 - Visi zinātnieki, doktori, utt, bet atšķirsim pēc izcilības, kuŗš ir kuŗš
- Datorsistēmas, informācijas sistēmas, wikipedia, utt. Augstā veiktspēja būs atkarīga no lietotāja kvalifikācija.
 - Ko wikipedia atrod pirmklasnieks? Un ko atrod pēcdoktor- students?
- Mākslīgais intelekts: Līdzīgi runāsim par GPT vai jebkuru AI LM (Artificial Intelligence language model)?
 - Visām «gudrajām sistēmām» kopēja īpašība: jo augstāka lietotāja kvalifikācija, jo sekmīgāks rezultāts
- Vai te nav kāds paradokss? Mēs gan sakām arī, jo gudrāka sistēma, jo mēs vairāk iegūsim; bet vai daudz noteicošāk nav – jo gudrāks lietotājs, jo vairāk iegūsim. Kāpēc tā?
 - Bet atcerēsimies, mēs taču nesakām, jo gudrāks cirvis, jo vairāk izdarīsim. Lai arī no cirvja kvalitātes arī ir kas atkarīgs. Bet galvenais tomēr ir lietotājs.
 - Jā, jo gudrāki, kvalificētāki mēs ... jo vairāk iegūsim no AI LM, sekmīgi tos lietojot.
- Mākslīgā intelekta sistēmas ir darba rīki. Un galvenais te tāpat ir lietotājs.

Kā strādā AI language model (mākslīgā intelekta valodas modelis)? Ko mums iedeva tehnoloģijas?

- Daži teikumi no «gudro sistēmu» arhitektūras (citāti no OpenAI avotiem):
- Pirms 5 gadiem spēcīgākie AI LM balstījās uz t.s. rekurentajiem neironu tīkliem: ņem teksta rindu un paredz, kāds būs nākamais vārds. Tādā veidā «rekurants» modelis mācās no saviem secinājumiem: paredzējumi/predictions atgriežas neironu tīklā, lai uzlabotu turpmāko veikspēju.
- 2017. gadā Google Brain ieviesa jaunu arhitektūru ar nosaukumu «transformer», kur atsevišķu vārdu vietā apstrādājās visi vārdi vienlaicīgi.
- Transformers palielināja AI LM sarežģītību, palielinot parametru skaitu modelī. Parametri kalpo kā sakari starp vārdiem, un modelis uzlabojas, regulējot sakarus atkarībā no to pārbīdes apmācības procesā. Modeļa veikspēju noteiks visa neironu tīkla apjoms. Tehnoloģijas nodrošinās pieaugumu visā šajā kopumā radītajā neironu tīklā.
- No šī arī nosaukums GPT, kas nozīmē **Generative Pre-trained Transformer**
- Es lietoju, un par to arī runāju šeit, par GPT3 vai GPT3.5, kas tiek saukts ChatGPT, vai kas pats sevi identificē kā AI language model.

Kas ir AI LM no ārpuses? Kā GPT visu to apvienos, ko no tās gaidām?

- AI LM arhitektūru veidotāji māca sistēmas būt lietderīgām ar mērķi imitēt saprātu robotos: tulkot, rēķināt, konstruēt, organizēt datapstrādi utt., līdz tam, kad visu to jāsāk integrēt kopā vienotā vidē, kas gan rēķina gan tulko gan sarunājas gan plāno un organizēt vienā «gudrā sistēmā».
- Kad sākam šādas «gudras sistēmas» lietot, tad atklājam šīs labās īpašības, kuras raksturojām ar augstu lietderību aizvien prasmīgākam pielietotājam.
- GPT kā AI LM pilnībā to attaisno daudz lielākā mērā kā šo sistēmu projektētāji spēja paredzēt, izsapņot savos visfantastiskākajos sapņos.

“... but I do not just trust these. I check their work.”

- Jā, AI language model bieži «melo». Ko darīt?
- Protams, nav izslēgts, ka GPT jūsu gudro jautājumu nesaprot, jo nav vēl «iemācījies». Bet šīs sistēma apmāca «visa pasaule», tā ka iemeslus, kāpēc nesaņēmām, ko meklējām, meklēsim pie sevis.
- Jāatceras: viss jau atkarīgs no mūsu kvalifikācijas.
 - Piemērs ar wikipedia: Mēs taujājam dažkārt par kā mums šķitīs vienkāršu jautājumu wikipedia, un saņemsim atbildi, kur nekā nesaprotam.
 - Kļūda komunikācijā, mums jāmeklē jautājamais citādā izteiksmē. Vai wikipedia mums ir līdzekļi kā variēt ar jautāšanu? Dažkārt mums palaimēsies. Bet, bet.
 - Toties GPT ļaus daudz lielākas iespējas variēt jautājuma izvēlē, paplašināšanā, pavēršanā vēlamā virzienā, eksperimentēšanā, t.i, taujāt iespējas nesalīdzināmi lielākas, varat taujāt AI LM bez mitas, un tas kā brašs adjutants atbildēs bez mitas, bez noguruma.

Dziļuma jēdziens, gradācija: deep learning, instrumenta sarežģītība, kvalifikācijas pakāpes

- Instrumentus varam salīdzināt pēc to sarežģītības
- Lietotāji var rindoties pēc to kvalifikācijas pakāpes:
 - E.g., Matemātiķi pēc to izglītības pakāpes, pēc publikāciju skaita un nozīmīguma, pēc ieguldījuma zinātnē, pēc pašizglītības līmeņa
- Kvalifikācijas pakāpe būs noteicošā risinot mūsu sarunas ar mākslīgā intelekta sistēmām.
 - Ko darīja «gudro» matemātikas grāmatu lasītāji, kas tajās nopietni iedziļinājās? Sarunājās matemātikas valodā, bet ar ko?
 - Ko darīja programmētāji programmējot? Sarunājās programmēšanas valodā, bet ar ko?
 - Ko darīja mākslīgā intelekta sistēmu veidotāji, organizējot «deep learning» savās topošajās AI language model sistēmās? Sarunājās pašu izveidotajās DL sistēmās, bet ar ko?
 - Ko darām mēs, kad diskutējam ar ChatGPT? Un nu mēs atbildi zinām. Ar ChatGPT, vai ne tā?
 - Vai visas iepriekšējās sarunas arī nenoritēja ar kāda līmeņa «mākslīgu intelektu»?

Kā veidot sarunu ar AI LM?

- AI LM operē tikai ar tekstu, ko jūs ievadāt. Jo izvērstāks un detalizētāks būs šis jautājuma teksts, jo vairāk detaļu, jo vairāk formulējumu, jo varat sagaidīt detalizētāku atbildi.
- Sarunas var izvērst garākas, pārjautāt, mēģināt precizēt, virzīt uz jautājumu loku, ja liekas, ka atbilde iet citā virzienā.
- Patiesībā jau sarunai jānorit kā ar dabisku cilvēku, bet šis cilvēks var runāt
 - Par jebkuru tēlu, jebkurā sarežģītības līmenī, smeļoties informāciju no atklātiem informācijas avotiem.
 - Vēlamo sarežģītības līmeni jāizvēlas pašam jautātājam, pārjautājot, precizējot savu vēlamās atbildes līmeni.
- Sagaidāmais iznākums: jo jautātājs būs dziļāks speciālists kādā izvēlētajā virzienā, jo vairāk iegūs no sarunas ar AI LM rīku.

Ko nozīmē sarunāties ar AI LM dažādos informētības līmeņos?

- Labrīt. Pieņemsim, ka $a+b=c$. Pierādi, lūdzu, bet 1) pamatskolas vecumam; 2) vidusskolas līmenim; 3) bakalauram; 4) maģistra līmenim; 5) postdoktoram.
- Pamatskolas vecumam:
 - Lai pierādītu, ka $a+b=c$, var izmantot konkrētu skaitļu piemēru. Piemēram, ja $a=3$ un $b=4$, tad $3+4=7$, kas nozīmē, ka a un b , saskaitot kopā, dod rezultātu $c=7$.
- Vidusskolas līmenim:
 - Lai pierādītu, ka $a+b=c$, var izmantot algebraisku pierādījumu. Var sākt ar vienkāršu pieņēmumu, ka a un b ir pozitīvi skaitļi. Tad var izmantot vienādību: $b=c-a$. Šo izteiksmi var ievietot jebkurā vienādībā, kas satur a un b . Piemēram, $a*b=(c-a)*b$. Pēc tam var izmantot vienādību, lai izteiktu a un ievietotu to izteiksmē $b=c-a$, lai saņemtu $b= c-a$ un pēc tam to var ievietot jebkurā vienādībā, kas satur a un b .
- Bakalauram:
 - Lai pierādītu, ka $a+b=c$, var izmantot matemātisku indukciju. Vispirms var pierādīt, ka vienādība ir patiesa gadījumā, kad a un b ir 0, jo $0+0=0$. Tad var pieņemt, ka vienādība ir patiesa, kad $a+b=k$, kur k ir jebkurš nenegatīvs vesels skaitlis. Šo pieņēmumu var izmantot, lai pierādītu, ka $a+b=k+1$ gadījumā arī ir patiesa. Var pieņemt, ka $a+b=k$, un tad a un b var izteikt kā $a=x+1$ un $b=y$, kur x un y ir nenegatīvi veseli skaitļi. Tad var ievietot šos izteiksmes a un b iepriekšējā vienādībā, kas satur a un b , un pēc tam vienādību var pārkārtot, lai iegūtu $x+y+1=k+1$. Tā kā x un y ir nenegatīvi veseli skaitļi, tad $x+y+1$ arī ir nenegatīvs vesels skaitlis, un tādējādi $a+b=k+1$ gadījumā arī ir patiesa.
- Maģistra līmenim:
 - Lai pierādītu, ka $a+b=c$, var izmantot algebraisku pierādījumu, izmantojot komplekso skaitļu teoriju. Var definēt komplekso skaitli $z=a+bi$, kur a un b ir reālie skaitļi un i ir imaginārā vienība ($i^2=-1$). Tad var definēt divus kompleksos skaitļi

Sāksim vēlreiz. Pieņemsim, ka $a+b=c$. Pierādi, lūdzu, bet 4) maģistra līmenim; 5) postdoktoram.

- Maģistra līmenim:
- Lai pierādītu, ka $a+b=c$, var izmantot algebrisku pierādījumu, izmantojot grupu teoriju. Var definēt grupu $G=\{a,b,c\}$, kur a un b ir elementi, kas pieder pie grupas G , un c ir grupas G rezultāts, kad a un b tiek saskaitīti. Lai pierādītu, ka $a+b=c$, jāpierāda, ka G ir grupa, kas izpilda grupu teorijas aksiomas. Piemēram, jāpierāda, ka G ir slēgta attiecībā uz operāciju saskaitīšana, ka G satur neitrālo elementu (0), ka visiem G elementiem ir inverss attiecībā uz saskaitīšanu utt.
- Postdoktoram:
- Lai pierādītu, ka $a+b=c$, var izmantot matemātisku indukciju, izmantojot Galois teoriju. Galois teorija ir atzars, kas pēta polinomu saknes un to attiecības ar citiem matemātiskiem objektiem. Var pierādīt, ka, ja polinomam ir sakne a , tad polinoma atlikums var tikt izteikts kā $(x-a) \cdot q(x)$, kur $q(x)$ ir citas polinoma saknes. Tad var izmantot matemātisku indukciju, lai pierādītu, ka, ja $a+b=c$ ir patiesa polinomam $p(x)$, kur a,b,c ir tā saknes, tad tā ir patiesa arī jebkuram citam polinomam, kas satur a,b,c kā saknes. Var izmantot Galois grupas un simetriju izpratni, lai pierādītu, ka jebkuram polinomam, kas satur a,b,c kā saknes, var veikt tās sakņu permutācijas un attiecīgās saskaitīšanas operācijas, lai pierādītu, ka $a+b=c$ ir patiesa jebkuram polinomam ar saknēm a,b,c .

Let us assume that $a+b=c$. Prove that, please. But for levels 1) ground school; 2) middle school; 3) undergraduate; 4) graduate; 5) postdoctoral.

- Sure, here's how to prove $a+b=c$ at each level:
- Ground school: Assuming $a=2$ and $b=3$, we can visually show that $2+3=5$ (using fingers or counting objects) to demonstrate that $a+b=c$.
- Middle school: We can use simple algebra to prove $a+b=c$. Assuming a and b are any two numbers, we can add them together to get c , or rearrange the equation to solve for a or b . For example, if $a=4$ and $b=7$, then $4+7=11$, and we can rearrange the equation to get $a=c-b$ or $b=c-a$.
- Undergraduate: To prove $a+b=c$, we can use mathematical induction. We start by showing that $a+b=1+1=2$, which is true for the base case. Then, we assume that $a+b=k$ is true for some integer k , and show that $a+b=k+1$ is also true. We can do this by adding 1 to both sides of the equation $a+b=k$, giving us $a+b+1=k+1$. Then, we substitute $c=k+1$, and we have shown that $a+b=c$ is true for all integers.
- Graduate: To prove $a+b=c$, we can use mathematical structures such as groups, rings, and fields. We can define a group $G=\{a,b,c\}$, where a and b are elements that belong to group G , and c is the result of adding a and b . To prove that $a+b=c$, we need to show that G satisfies the axioms of a group, such as closure, associativity, identity, and inverse. Once we show that G is a group, we can conclude that $a+b=c$ holds for all elements of G .
- Postdoctoral: To prove $a+b=c$, we can use advanced mathematical tools such as Galois theory and algebraic geometry. We can show that $a+b=c$ holds for a wide range of mathematical objects, such as polynomials, algebraic varieties, and schemes. We can use techniques such as sheaf theory, cohomology, and spectral sequences to study the geometric and topological properties of these objects. By understanding the deep connections between algebra and geometry, we can gain a deeper insight into the fundamental structure of mathematics itself.

Salīdzinājuma pēc jautājām citai AI LM sistēmai Bing AI, kura nemācēja aplūkot jautājumu diferencēti dažādiem līmeņiem

- Lai pierādītu, ka $a+b=c$, jāizmanto matemātiskais pierādījums.
- Pamatskolas vecumam: $a+b=c$ $a+b-b=c-b$ $a=c-b$
- Vidusskolas līmenim: $a+b=c$ $a+b-b=c-b$ $a=c-b$
- Bakalauram: $a+b=c$ $a+b-b=c-b$ $a=c-b$
- Maģistra līmenim: $a+b=c$ $a+b-b=c-b$ $a=c-b$
- Postdoktoram: $a+b=c$ $a+b-b=c-b$ $a=c-b$
- Citiem vārdiem sakot, ja no abiem skaitļiem atņemam vienu un pieskaitam to otram, tad iegūsim trešo skaitli. Tātad $a+b-c=0$. Tas ir matemātiskais pierādījums tam, ka $a+b=c$.

Sistēmas attīstās ļoti strauji: lūk, šorīt jau šo iegūstam

- Labdien! Lai pierādītu, ka $a+b=c$, ir jāizmanto matemātiskais pierādījums. Šeit ir daži pierādījumi atkarībā no izglītības līmeņa:
- Pamatskolas vecumam:
 - Apskatot skaitļus 1-10, var redzēt, ka $1+9=10$. Tāpat arī $2+8=10$, $3+7=10$ utt. Tātad $a+b$ vienmēr būs vienāds ar c , ja a un b ir divi skaitļi, kuru summa ir 10.
- Vidusskolas līmenim:
 - Lai pierādītu $a+b=c$, var izmantot vienādojumu pārveidošanu. Ja mēs pievienojam abiem vienādojuma pusīņiem skaitli $-b$ un pēc tam pievienojam skaitli b abiem vienādojuma pusīņiem, tad mēs iegūsim šo vienādojumu: $a+b-b=c-b+a$. Pēc tam mēs varam vienkāršot šo vienādojumu un iegūt $a=c-b$.
- Bakalauram:
 - Lai pierādītu $a+b=c$, var izmantot indukcijas metodi. Pirmkārt, pierāda pamatu (piemēram, kad $a=1$ un $b=1$). Tad pierāda induktīvo soli (piemēram, kad $a=k$ un $b=1$). Visbeidzot pierāda induktīvo soli vispārīgajam gadījumam (kad $a=k$ un $b=n-k$).
- Maģistra līmenim:
 - Lai pierādītu $a+b=c$, var izmantot matricu metodi. Šajā metodē tiek izmantotas matricas un to īpašības. Piemēram, ja mums ir matrica A ar elementiem a_{ij} un matrica B ar elementiem b_{ij} , tad matricas $C=A+B$ ar elementiem c_{ij} ir tāda pati kā matricas A un B elementu summa.
- Postdoktoram:
 - Lai pierādītu $a+b=c$, var izmantot Galois teoriju. Galois teorija ir algebraiskais atzars matemātikas zinātnē un tajā tiek izmantoti polinomi un to īpašības. Piemēram, ja mums ir polinoms $f(x)=x^2+bx+c$ ar saknēm x_1 un x_2 , tad $x_1+x_2=-b$ un $x_1x_2=c$.
- Ceru, ka tas palīdz! Vai jums ir kaut kādi jautājumi par šo tēmu?

Sarunas ar GPT

- Tālākajā prezentācijas daļā ir sarunas ar GPT:
 - Augšdaļā ir komentārs latviešu valodā, par jautājumu;
 - Pirmajā rindiņā ir jautājums, ko uzdodu GPT;
 - Nākamajos paragrāfos ir GPT atbilde
- Apskatītie jautājumi:
 - jautājumi par prasmēm uzdot jautājumus
 - BibleWorks salīdzinājumā ar Wolfram Mathematica, vai var salīdzināt?
 - kā tulkot "ΓΝΩΘΙ ΜΑΘΗΜΑ» no grieķu valodas, kas ir parafrāze no "Gnothi Seauton";
 - par matemātikas vēsturi, tās nozīmīgumu;
 - vai GPT māc lasīt grāmatas?
 - GPT, atbildot uz juridisku jautājumu, māc lietot latīniskos terminus pareizi;
 - Tālāk jautājumi par Wolfram Mathematica,:
 - Vai Wolfram Mathematica var tikt efektīgi sajūgta ar GPT;
 - GPT māc lasīt Wolfram Mathematica programmu:
 - vai GPT var pateikt vai programma ir korekta?
 - Līdzīgu programmu GPT negrib izpildīt;
 - Tāāk GPT izlabo vienu savu kļūdu
 - Te vēl beidzot jautājums par Wolfram Mathematica izvedošanas principu, uz ko GPT atbild ļoti labi un, šķiet, pareizi.

GPT: jautājums par prasmēm uzdot jautājumus

- I am teaching my students that the main wisdom we can teach is to raise students' ability to pose correct questions. But it turns out most important when we get as our consultants AI systems like GPT. What would be important and what effect we could gain in trying to pose to GPT most interesting professional questions?
- Teaching students how to pose correct questions is a valuable skill, especially in the age of AI systems like GPT. AI systems can provide us with access to vast amounts of information, but they require us to ask the right questions in order to get the best answers.
- By teaching students how to pose correct questions to AI systems like GPT, we can help them develop critical thinking and problem-solving skills. They can learn how to identify and articulate their information needs, as well as how to evaluate the relevance and quality of the information they receive.
- In addition, posing interesting professional questions to GPT can help us gain new insights and perspectives on a wide range of topics. GPT can provide us with access to a wealth of information from various sources, including academic papers, news articles, and online forums.
- However, it's important to keep in mind that GPT is an AI language model and not a human expert. While it can provide us with valuable insights and information, it may not always be accurate or reliable. Therefore, it's important to evaluate the information provided by GPT critically and to cross-check it with other sources when possible.
- Overall, teaching students how to pose correct questions to AI systems like GPT can help them develop valuable skills and gain new insights into the world around them. However, it's important to use these tools responsibly and to always be mindful of their limitations.

Šis pats jautājums uzdots kādu laiku vēlāk: GPT sniedz savas rekomendācijas

- Hello! Asking questions of GPT can be a very interesting and useful experience to gain deeper insights into how these AI systems work and how they can help solve professional questions. Here are some tips on what could be important and what effects you could gain by asking interesting professional questions to GPT:
- Try formulating questions in different ways. GPT can interpret different question types, so trying questions that are formulated differently could help understand how AI systems interpret questions and provide answers.
- Create questions related to your professional field. Creating questions related to your professional field could help you gain a better understanding of how AI systems can help improve your work.
- Try questions related to your industry. To make questions interesting and engaging, try to relate them to current topics and events in your industry.
- Ask GPT questions that are not clearly defined. GPT can interpret ambiguous and ambiguous questions, so trying to ask questions that are not clearly defined could help understand how AI systems use context to understand questions and provide answers.
- Test GPT by asking questions about complex and specific issues. Questions about complex and specific topics could help test GPT's abilities and give you insight into how accurately and effectively the AI system can solve complex questions.
- Try GPT's abilities by asking questions in another language. GPT is available in several languages, so trying to ask questions in another language could help you understand how well the AI system can handle questions in different languages.

Es vēršu GPT uzmanību tieši uz spēju jautāt.

- But I wanted to ask about the ability itself to pose a qualified in the necessary field question. How this ability might be characterized?

The ability to pose a qualified question in a specific field can be characterized by a few key factors:

Domain expertise: To ask a qualified question in a specific field, one needs to have a strong understanding of the domain, including its key concepts, principles, and practices.

Clarity of thought: The ability to think clearly and logically is critical when it comes to posing qualified questions. One needs to be able to identify the relevant information, break down complex concepts, and connect various ideas in a coherent manner.

Curiosity and creativity: Asking qualified questions requires a curious and creative mind. One needs to be able to explore different angles and perspectives, challenge assumptions, and generate new ideas.

Communication skills: Finally, the ability to communicate effectively is essential when it comes to posing qualified questions. One needs to be able to articulate their thoughts clearly and concisely, use appropriate terminology, and adapt their language to the intended audience.

Overall, the ability to pose qualified questions in a specific field is a combination of knowledge, critical thinking, curiosity, creativity, and effective communication. Developing this ability takes practice and continuous learning, and it can be an essential skill in many professions.

GPT jautāju par BibleWorks pielietošanas iespējām atkarībā no lietotāja profesionalitātes

- If we have some 'clever' system we use then the effectiveness of usefulness of our work with this system is directly proportional with our skill in the field we apply it. Exempli gratia, I use BibleWorks. In case I know Ancient languages then the use of system is much more productive. Can you comment this situation?
- Your statement that the effectiveness and usefulness of a 'clever' system is directly proportional to our skill in the field we apply it is generally true. In the case of BibleWorks, if you have knowledge of ancient languages, then you would be able to use the system much more effectively than someone who does not have that knowledge.
- Having knowledge of the ancient languages used in the Bible would allow you to better understand the nuances and subtleties of the text, which would in turn enable you to use BibleWorks to its full potential. You would be able to more easily search for specific words or phrases in the original language, which would allow you to gain a deeper understanding of the text.
- In general, having a strong background in the field in which you are using a particular tool or system is important for maximizing its effectiveness. This is because you are better equipped to understand the intricacies of the data or information you are working with and to identify patterns or trends that might not be immediately apparent to someone without that knowledge.
- Of course, this is not to say that a 'clever' system cannot be useful to someone without extensive knowledge in the field. In many cases, these systems are designed to be user-friendly and intuitive, which means that they can be used effectively by people with a range of different skill levels. However, having a deep understanding of the field can certainly give you an edge and enable you to get the most out of the system.

GPT: BibleWorks salīdzinājumā ar Wolfram Mathematica, vai var salīdzināt?

- The previous question I posed about BibleWorks. But, changing to Wolfram Mathematics your answer would be mostly different? Look, here religions, and there science.
- The basic principle that the effectiveness and usefulness of a 'clever' system is directly proportional to our skill in the field we apply it to remains true for Wolfram Mathematica as well.
- In the case of Wolfram Mathematica, if you have a strong background in mathematics, statistics, or programming, then you would be able to use the system more effectively than someone without that knowledge. This is because Wolfram Mathematica is a powerful computational tool that is designed to perform a wide range of mathematical and scientific computations, and having a deep understanding of the underlying concepts and techniques would enable you to use the system more effectively.
- However, it's important to note that Wolfram Mathematica is designed to be user-friendly and accessible to a wide range of users, including those who may not have extensive experience in mathematics or programming. The system includes many built-in functions and tools that can be used without a deep understanding of the underlying mathematics or programming concepts.
- That being said, if you do have a strong background in mathematics, statistics, or programming, then you would be able to use Wolfram Mathematica to its full potential. You would be able to more easily create custom functions and algorithms, optimize computations for specific tasks, and integrate Wolfram Mathematica with other tools and systems in your workflow.
- So, while there are some differences between using BibleWorks and Wolfram Mathematica, the basic principle remains the same: the effectiveness and usefulness of a 'clever' system is directly proportional to our skill in the field we apply it to. Having a strong background in the field can give you an edge and enable you to get the most out of the system, but it is not necessarily a requirement for using it effectively.

Vai GPT māk lasīt grāmatas?

- What would be necessary for you as AI language model to gain ability to read books like e. g. the book of E. Vinberg A Course in Algebra? May be possible that we could expect in future to see you reading books much like as humans do?
- As an AI language model, I am capable of processing and analyzing text data, but I don't have the ability to read books like humans do, at least not in the way we traditionally think of reading. However, there are some interesting developments in natural language processing and machine learning research that are bringing us closer to the possibility of creating AI systems that can read and understand books in a more human-like way.
- To be able to read books like "A Course in Algebra" by E. Vinberg, an AI language model would need to have a deeper understanding of mathematical concepts and not just recognize the symbols and equations on the page. This would require training the model on a large dataset of mathematical texts and giving it the ability to reason abstractly and symbolically.
- One of the challenges of creating an AI system that can read books like humans do is the need for the system to be able to make inferences and draw conclusions based on the information presented in the text. This requires a more nuanced understanding of language and context than current AI systems are capable of.
- Overall, while it's not currently possible for an AI language model like myself to read books in the same way humans do, advancements in AI research are making progress towards this goal. It's possible that in the future we may see AI systems that can read and understand texts with a level of comprehension that is similar to that of humans.

GPT: par to k̄a tulkot "ΓΝΩΘΙ ΜΑΘΗΜΑ"

- I understand Greek words ΓΝΩΘΙ ΜΑΘΗΜΑ as Try to understand mathematics, scientific way of thinking in general. What should be here added or corrected?
- The phrase "ΓΝΩΘΙ ΜΑΘΗΤΗΝ" (transliterated as "Gnothi Seauton") actually means "Know Thyself" in ancient Greek and is inscribed at the entrance of the Temple of Apollo at Delphi. However, it has been interpreted in different ways, including as an exhortation to seek knowledge and understanding.
- The phrase "ΓΝΩΘΙ ΜΑΘΗΜΑ" (transliterated as "Gnothi Mathema") is a later modification of the original phrase, which adds the word "mathema" (meaning "learning" or "knowledge") at the end. This modification is often attributed to the philosopher Plato and has been interpreted as "know mathematics" or "learn mathematics."
- In modern times, the phrase "ΓΝΩΘΙ ΜΑΘΗΜΑ" has come to be associated with the idea of scientific inquiry and the scientific method, which emphasizes the importance of observation, experimentation, and the systematic analysis of data in the pursuit of knowledge.
- Therefore, it could be said that "ΓΝΩΘΙ ΜΑΘΗΜΑ" can be interpreted as an exhortation to seek knowledge and understanding, particularly through the study of mathematics and the scientific method.

GPT: par matemātikas vēsturi, tās nozīmīgumu

- What do you think about the history of mathematics? Should it be developed on equal foot as contemporary mathematics or it is of less importance than contemporary?
- As an AI language model, I don't have personal opinions or beliefs. However, I can provide you with information and insights about the importance of the history of mathematics in relation to contemporary mathematics.
- The history of mathematics is an essential part of the field because it allows us to understand how mathematical concepts and ideas developed over time. It provides us with a context for contemporary mathematical concepts and helps us appreciate the contributions made by mathematicians from different eras and cultures.
- Studying the history of mathematics can also help us develop a deeper understanding of current mathematical theories and concepts by providing insights into the reasoning behind them. It can also help us identify common themes and patterns in mathematical development that can be applied to current research and future discoveries.
- In addition, the history of mathematics can help us appreciate the beauty and elegance of mathematical ideas, as well as the human stories behind them. Understanding the historical context of mathematical ideas can also help us better understand the social and cultural contexts in which they were developed.
- Therefore, it is important to continue to develop the history of mathematics on an equal footing with contemporary mathematics. By doing so, we can gain a better understanding of the field and its evolution over time, which can ultimately lead to new insights and discoveries in the future.

GPT: uzdodu juridisku jautājumu un GPT māk arī juriskajā plānā konsultēt, pie kam nepieciešamie termini latīņu valodā arī tiek aktīvi lietoti, piemēram, *jurisprudencia*

- What is the difference between *juris prudens* and *legis prudens*?
- "*Juris prudentia*" and "*legis prudentia*" are both Latin terms that relate to legal expertise or knowledge. However, there is a subtle difference in their meanings.
- "*Juris prudentia*" refers specifically to the expertise or knowledge of the law itself. It is the ability to understand and interpret the law and its applications, and to provide legal guidance based on that understanding. In other words, it is the expertise of a legal practitioner or expert.
- On the other hand, "*legis prudentia*" refers to the wisdom or prudence in making and interpreting laws. It is the ability to create or interpret laws that are fair, just, and beneficial to society as a whole. In other words, it is the expertise of a lawmaker or legislator.
- So, to summarize, "*juris prudentia*" relates to legal expertise, while "*legis prudentia*" relates to legal wisdom or prudence in making and interpreting laws.

Vai Wolfram Mathematica var tikt efektīgi sajūgta ar GPT?

- What are the perspectives of Wolfram Mathematica to be joined with GPT?
- Wolfram Mathematica and GPT are two different types of tools with different functionalities, but there could be interesting perspectives in combining them.
- Wolfram Mathematica is a powerful computational software system that is widely used in many fields, including science, engineering, finance, and more. It is designed to perform a wide range of mathematical, scientific, and technical computations, as well as data analysis and visualization.
- GPT, on the other hand, is an AI language model that is trained to generate natural language text based on the patterns and structures it has learned from a vast corpus of text data. It is designed to understand and generate human-like language, which makes it a valuable tool for tasks such as language translation, question-answering, and text generation.
- Combining Wolfram Mathematica and GPT could have several interesting perspectives, such as:
- Enhanced Natural Language Processing: Wolfram Mathematica already has some natural language processing capabilities, but by integrating GPT's language generation abilities, it could become even more powerful. This could enable users to ask more complex and nuanced questions in natural language and get more accurate and informative responses.
- Improved Text Generation: GPT's ability to generate natural language text could be used to enhance Wolfram Mathematica's text generation capabilities. This could enable users to generate reports, summaries, and other types of text output that are more readable and understandable.
- Data Analysis and Visualization: Wolfram Mathematica's data analysis and visualization capabilities could be enhanced by integrating GPT's ability to understand natural language. This could enable users to ask questions about their data in natural language and get more intuitive and informative visualizations in response.
- New Applications and Use Cases: Combining Wolfram Mathematica and GPT could lead to the development of new applications and use cases that leverage the strengths of both tools. For example, it could enable the creation of intelligent tutoring systems that can answer student questions in natural language and provide personalized feedback based on their performance.
- Overall, combining Wolfram Mathematica and GPT could open up new possibilities for natural language processing, text generation, data analysis, and more. It could lead to the development of more powerful and intuitive tools for scientific research, data analysis, and technical computing.

GPT māk lasīt Wolfram Mathematica programmu.
Piemērs ņemts no E. Vinberg, A Course in Algebra.
Tiek rēķināta matrica pakāpē m .

- Can you read a simple code in Wolfram Mathematica? Say, `PotentiateMatrix[A_][m_]:=Module[{pt, am, a, b, c, su}, pt = a t^2 + b t + c; su = Solve[{{(pt /. t -> 1) == 1, (pt /. t -> 2) == 2^m, (D[pt, t] /. t -> 2) == m 2^(m - 1)}}, {a, b, c}][[1]]; am = su[[1, 2]] a.a + su[[2, 2]] a + su[[3, 2]] e; am /. {a -> A, e -> IdentityMatrix[Length[A]]}`
Actually, you may judge from the name of routine.
- Yes, I can read the code in Wolfram Mathematica.
- The code defines a function called "PotentiateMatrix", which takes two arguments: a matrix A and an integer m . The function returns a new matrix, which is the result of raising the matrix A to the power of 2^m .
- The function works by first defining a polynomial expression pt in the variable t , and then solving for the coefficients of this polynomial so that it satisfies certain conditions. Specifically, the polynomial must pass through the points $(1,1)$ and $(2,2^m)$, and its derivative at $t=2$ must be equal to $m \cdot 2^{(m-1)}$.
- Once the coefficients of the polynomial have been determined, the function constructs a new matrix am , which is a linear combination of A , the identity matrix, and A^2 . The coefficients of the linear combination are determined by the coefficients of the polynomial.
- Finally, the function returns the matrix am , which is the result of raising the matrix A to the power of 2^m .
- In short, the function "PotentiateMatrix" takes a matrix A and an integer m , and returns the matrix A raised to the power of 2^m , using a polynomial-based algorithm.

Šeit es prasu, vai GPT var pateikt vai programma ir korekta.

- Does my routine work correctly?
- Without knowing the specific intended functionality and expected behavior of your routine, it's difficult to say for certain whether it works correctly or not.
- However, based on the code you provided, I can see that your routine defines a function called "PotentiateMatrix" which takes a matrix A and an integer m as input, and returns a new matrix that represents A raised to the power of 2^m .
- The function seems to work by first defining a quadratic polynomial pt with undetermined coefficients a , b , and c , and then solving for these coefficients so that pt satisfies certain conditions. Specifically, pt must pass through the points $(1,1)$ and $(2,2^m)$, and its derivative at $t=2$ must be equal to $m \cdot 2^{(m-1)}$.
- After solving for the coefficients of pt , the function constructs a new matrix am , which is a linear combination of A , the identity matrix, and A^2 , with coefficients determined by the coefficients of the quadratic polynomial pt .
- Finally, the function returns the matrix am , which is the result of raising A to the power of 2^m .
- So, based on the code you provided, it appears that your routine is intended to compute $A^{(2^m)}$ using a polynomial-based algorithm. Whether the algorithm is correct and produces the expected output for all possible inputs of A and m would require further testing and analysis.

Šeit es jau prasu citu programmiņu izpildīt GPT, bet atbild, ka te ir vajadzīgi papildu dati

- Here WM code, much like the previous. Can't GPT simply make run the code and tell it gives numerical result or fails to do this?
`A = {{1, 0, -3}, {1, -1, -6}, {-1, 2, 5}} x0 = {{1}, {1}, {0}} pt = a t^2 + b t + c eq1 = (pt /. t -> 1) == Exp[t]
eq2 = (pt /. t -> 2) == Exp[2 t] eq3 = (D[pt, t] /. t -> 2) == t Exp[2 t] su = Solve[{eq1, eq2, eq3}, {a, b, c}][[1]]
am = su[[1, 2]] a.a + su[[2, 2]] a + su[[3, 2]] e am /. {a -> A, e -> IdentityMatrix[3]} // MatrixForm sol = %.x0 // Simplify`
- Yes, GPT could be used to run the code you provided and check if it produces a numerical result or not.
- However, note that the code you provided is not a complete Wolfram Mathematica program - it consists of several statements that define variables and equations, but it does not actually define a function or specify a desired output.
- In order to use GPT to run this code, you would need to provide more context about what you want the code to do and what specific output you are looking for. For example, you could specify that you want to solve a certain system of equations or compute a specific matrix operation, and provide the necessary input values.
- Once you have a clear goal and input values, GPT could be used to execute the code and return the resulting output or error message.

Šeit GPT pēkšņi saka, ka var izpildīt kodu, rāda it kā izpildi, bet ir tikai procedūras izsaukums

- When I try to execute this code I get numerical results, what the matter?
- I apologize for the confusion in my previous response. It appears that the code you provided does indeed define a function, and the function is correctly implemented to perform a numerical calculation.
- The function, `PotentiateMatrix[A_][m_]`, takes as input a matrix A and a positive integer m, and returns the mth power of the matrix A. The function first solves for coefficients a, b, and c that satisfy certain conditions involving a quadratic polynomial $pt = a t^2 + b t + c$, and then uses those coefficients to compute the matrix a^m .
- To use GPT to evaluate this function, you would need to provide the necessary input values for A and m. For example, you could call the function as follows:
 - `PotentiateMatrix[{{1, 2}, {3, 4}}][3]`
 - This would compute the 3rd power of the matrix `{{1, 2}, {3, 4}}` using the `PotentiateMatrix` function, and return the resulting matrix as a numerical output.
- I hope this clarifies the matter.

Un nu viens gudrs jautājums GPT, bet GPT tiešām gudri arī atbild, un man liekas ka ļoti pareizi un precīzi.

- The Wolfram Mathematica, as I understand, is based on a very simple principle, i.e., it uses a simple replacement rule, say, $ex1 \rightarrow ex2$ where the expression $ex1$ is replaced by $ex2$. In this sense, the code of WM is a precise mathematical expression of a sequence of many many such replacements. Now, in case I am correct, my question: can't this specific nature of WM code be used to operate with this code specifically as purely mathematical item. Truly, a sequence of expressions is still nothing else as expression.
- Yes, you are correct that one of the key features of the Wolfram Mathematica language is the use of pattern matching and replacement rules to manipulate expressions. The basic idea is that you can define patterns that match specific subexpressions, and then use replacement rules to transform those subexpressions into something else.
- In terms of your question about whether the code of Mathematica can be treated as a mathematical object, the answer is yes. In fact, many Mathematica users do exactly that, treating Mathematica code as a form of symbolic mathematics.
- The Wolfram Language is designed to be a symbolic manipulation system, meaning that it allows you to work with mathematical expressions in a way that is similar to how you would work with them by hand. For example, you can perform algebraic manipulations, solve equations, differentiate and integrate functions, and so on.
- Furthermore, because Mathematica code is itself an expression in the language, you can perform symbolic manipulations on the code itself. For example, you can manipulate a piece of code to create a new function, or you can use pattern matching to automatically generate code based on a set of rules.
- Overall, the Wolfram Language is designed to be a very powerful and flexible system for working with mathematical expressions, and many users find that its symbolic manipulation capabilities make it an extremely useful tool for both research and education.

Dažas GPT pierādītās teorēmas

- Interesants ir fakts, ka GPT pats mēģina pierādīt teorēmas.
 - Uzreiz seko, vai šie pierādījumi ir uzticami/bez kļūdām?
 - Nē, tie nav pasargāti no kļūdām. Kļūdas ir bieži.
 - Neskatoties uz to, šie «pierādījumi» ar kļūdām arī ir noderīgi. Vispirms šīs kļūdas ir jāatrod; ir iespēja arī GPT norādīt, kad tās atklājam, izlabot un mēģināt uz priekšu virzīties.
 - Šādus gadījumus arī sastopam; kļūda izlabota, uzrodas jauna kļūda, labojam to, un virzāmies uz priekšu. Pirmais, protams, nogurs lietotājs, jo GPT ir nenogurdināms, viņš ir robots.

Differential of homomorphism of Lie groups is homomorphism of their tangent algebras. How to prove this?

- Let G and H be Lie groups, and let $f: G \rightarrow H$ be a smooth homomorphism between them. Let \mathfrak{g} and \mathfrak{h} be elements of the Lie algebras of G and H , denoted by $\mathfrak{g} \in \mathfrak{g}$ and $\mathfrak{h} \in \mathfrak{h}$. We want to show that if f is a homomorphism, then its differential $df: T_eG \rightarrow T_eH$ is a homomorphism between the Lie algebras \mathfrak{g} and \mathfrak{h} .
- Recall that the Lie algebra \mathfrak{g} of G is the tangent space T_eG at the identity element e of G , equipped with the Lie bracket operation $[\cdot, \cdot]$. Similarly, the Lie algebra \mathfrak{h} of H is the tangent space T_eH at the identity element e of H , equipped with the Lie bracket operation $[\cdot, \cdot]$.
- We can define the differential of f at the identity element e of G as:
 - $df: T_eG \rightarrow T_eH$ $df(X) = \left. \frac{d}{dt} f(\exp(tX)) \right|_{t=0}$
 - where $X \in \mathfrak{g}$. Note that the image of df is contained in T_eH since $f(e) = e$.
 - Now, let's show that df is a homomorphism. For any $X, Y \in \mathfrak{g}$, we have:
 - $df([X, Y]) = \left. \frac{d}{dt} f(\exp(t[X, Y])) \right|_{t=0}$
 - $= \left. \frac{d}{dt} f(\exp(tX)\exp(tY)\exp(-tX)\exp(-tY)) \right|_{t=0}$
 - $= \left. \frac{d}{dt} f(\exp(tX)\exp(tY)\exp(-tX))f(\exp(-tY)) \right|_{t=0}$
 - $= \left. \frac{d}{dt} f(\exp(tX)\exp(tY)\exp(-tX)) \right|_{t=0} + \left. \frac{d}{dt} f(\exp(-tY)) \right|_{t=0}$
 - $= df(X)h + df(Y)h$
 - where $h = \left. \frac{d}{dt} f(\exp(tX)\exp(tY)\exp(-tX)) \right|_{t=0}$. Note that $h \in T_eH$ since f is a homomorphism.
 - Using the homomorphism property of f , we have:
 - $f(\exp(tX)\exp(tY)\exp(-tX)) = f(\exp(tY))$
 - Taking the derivative of both sides with respect to t and evaluating at $t=0$, we obtain:
 - $h = df(Y) - \text{Ad}_f(\exp(X))(df(X))$
 - where Ad_f denotes the adjoint representation of f . Note that $\text{Ad}_f(\exp(X))$ is a linear transformation on the tangent space T_eH , defined by $\text{Ad}_f(\exp(X))(h) = df(\exp(X)) h (df(\exp(X)))^{-1}$.
- Therefore, we have:
 - $df([X, Y]) = df(X)h + df(Y)h = [df(X), df(Y)]$
 - where the last equality follows from the definition of the Lie bracket in the tangent space.
- This shows that df is a homomorphism between the Lie algebras \mathfrak{g} and \mathfrak{h} .

How to prove that matrix of form $\begin{Bmatrix} a & -\text{Conjugate}[b] \\ b & \text{Conjugate}[b] \end{Bmatrix}$ have in correspondence a quaternion?

- To show that a 2x2 matrix of the form
- $M = \begin{Bmatrix} a & -\text{Conjugate}[b] \\ b & \text{Conjugate}[a] \end{Bmatrix}$
- has a correspondence with a quaternion, we need to first define what we mean by a quaternion. In this context, a quaternion is a number of the form $q = w + xi + yj + zk$, where $w, x, y,$ and z are real numbers and $i, j,$ and k are imaginary units that satisfy the relations $i^2 = j^2 = k^2 = -1$ and $ij = k, jk = i,$ and $ki = j$.
- Given a quaternion $q = w + xi + yj + zk$, we can represent it as a 2x2 complex matrix:
- $Q = \begin{Bmatrix} w + ix & y + iz \\ -y + iz & w - ix \end{Bmatrix}$
- Conversely, given a 2x2 complex matrix of the form $M = \begin{Bmatrix} a & -\text{Conjugate}[b] \\ b & \text{Conjugate}[a] \end{Bmatrix}$, we can construct a quaternion as follows:
- $q = a + bi + cj + dk$,
- where $i, j,$ and k are the imaginary units that correspond to the 2x2 matrices:
- $I = \begin{Bmatrix} i & 0 \\ 0 & i \end{Bmatrix}, J = \begin{Bmatrix} 0 & 1 \\ -1 & 0 \end{Bmatrix}, K = \begin{Bmatrix} 0 & i \\ i & 0 \end{Bmatrix}$.
- Note that these matrices satisfy the relations $I^2 = J^2 = K^2 = -IJK = 1$. Therefore, we can write the quaternion q in terms of these matrices:
- $q = aI + bJ + cK$
- where $c = 0$ since we are working with real numbers.
- Substituting the matrices for $I, J,$ and K , we get:
- $q = (a + bi) \begin{Bmatrix} 1 & 0 \\ 0 & 1 \end{Bmatrix} + (-b + ai) \begin{Bmatrix} 0 & 1 \\ -1 & 0 \end{Bmatrix} + 0 \begin{Bmatrix} 0 & i \\ i & 0 \end{Bmatrix}$
- $= \begin{Bmatrix} a + bi & 0 \\ 0 & a - bi \end{Bmatrix} + \begin{Bmatrix} 0 & -b \\ b & 0 \end{Bmatrix}$
- $= \begin{Bmatrix} a & -b \\ b & a \end{Bmatrix}$
- which is precisely the matrix M that we started with.
- Therefore, we have shown that there is a correspondence between the 2x2 complex matrices of the form $M = \begin{Bmatrix} a & -\text{Conjugate}[b] \\ b & \text{Conjugate}[a] \end{Bmatrix}$ and the quaternions of the form $q = a + bi + cj + dk$.

How to prove $\text{Exp}[t \begin{Bmatrix} 0 & -1 \\ 1 & 0 \end{Bmatrix}] = \begin{Bmatrix} \text{Cos}[t] & -\text{Sin}[t] \\ \text{Sin}[t] & \text{Cos}[t] \end{Bmatrix}$?

- One way to prove this identity is to use the power series expansions of the matrix exponential and the cosine and sine functions.
- First, we can express the matrix exponential as:
- $\text{Exp}[t \begin{Bmatrix} 0 & -1 \\ 1 & 0 \end{Bmatrix}] = \text{Sum}[(t \begin{Bmatrix} 0 & -1 \\ 1 & 0 \end{Bmatrix})^n / n!, \{n, 0, \text{Infinity}\}]$
- Next, we can expand the cosine and sine functions using their power series:
- $\text{Cos}[t] = \text{Sum}[(-1)^n t^{(2n)} / (2n)!, \{n, 0, \text{Infinity}\}]$ $\text{Sin}[t] = \text{Sum}[(-1)^n t^{(2n+1)} / (2n+1)!, \{n, 0, \text{Infinity}\}]$
- Now, we can substitute these power series into the matrix exponential and simplify using the fact that $i^2 = -1$:
- $\text{Exp}[t \begin{Bmatrix} 0 & -1 \\ 1 & 0 \end{Bmatrix}] = \begin{Bmatrix} \text{Sum}[(-1)^n t^{(2n)} / (2n)!, \{n, 0, \text{Infinity}\}], -\text{Sum}[(-1)^n t^{(2n+1)} / (2n+1)!, \{n, 0, \text{Infinity}\}] \\ \text{Sum}[(-1)^n t^{(2n+1)} / (2n+1)!, \{n, 0, \text{Infinity}\}], \text{Sum}[(-1)^n t^{(2n)} / (2n)!, \{n, 0, \text{Infinity}\}] \end{Bmatrix}$
- Simplifying this expression by combining the terms with like powers of t , we obtain:
- $\text{Exp}[t \begin{Bmatrix} 0 & -1 \\ 1 & 0 \end{Bmatrix}] = \begin{Bmatrix} \text{Cos}[t] & -\text{Sin}[t] \\ \text{Sin}[t] & \text{Cos}[t] \end{Bmatrix}$
- Therefore, we have proven the identity $\text{Exp}[t \begin{Bmatrix} 0 & -1 \\ 1 & 0 \end{Bmatrix}] = \begin{Bmatrix} \text{Cos}[t] & -\text{Sin}[t] \\ \text{Sin}[t] & \text{Cos}[t] \end{Bmatrix}$.

Paldies par uzmanību!