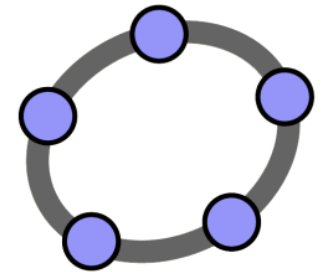


GeoGebra



Radionica za učitelje - početna

Šime Šuljić

sime.suljic@skole.hr



školska knjiga



Poveznica na ovu prezentaciju

<https://ggbm.at/wmjapq69>

GeoGebra - Dynamic Mathematics - Mozilla Firefox

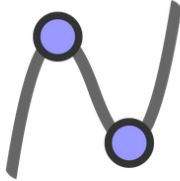
GeoGebra - Dynamic Mathematics

https://www.geogebra.org/home 90%


GeoGebra Hrvatski institut za GeoGebra

GeoGebra - alat za otkrivanje matematike

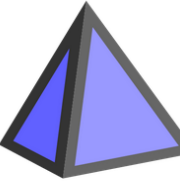
Riješite jednadžbe, nacrtajte grafove funkcija, konstruirajte, analizirajte podatke, istražite 3D matematiku!




GeoGebra grafički kalkulator



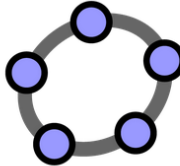
Geometrija



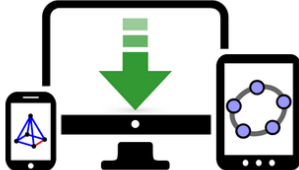
GeoGebra 3D grafički kalkulator



Materijali



Klasična GeoGebra



Preuzimanja

Download on the App Store

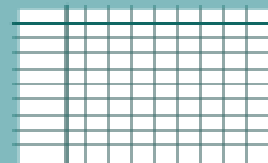
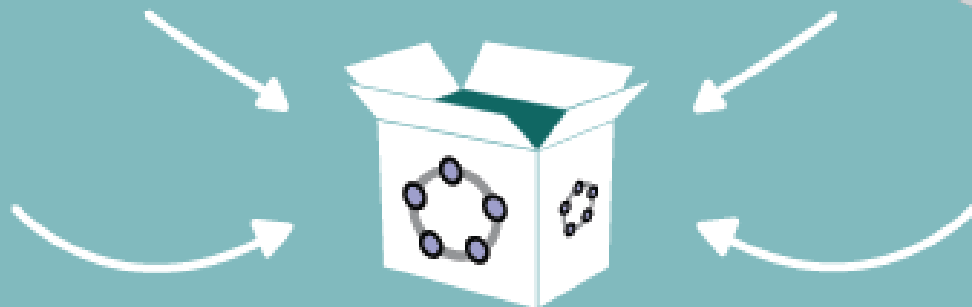
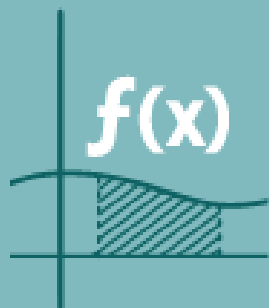
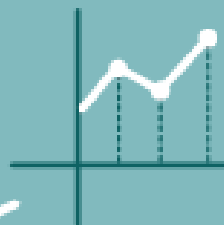
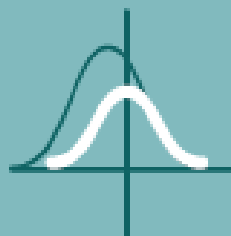
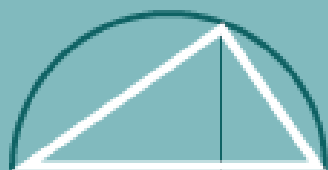
ANDROID APP ON Google play

Download from Windows Store

<https://www.geogebra.org/3d>



Što GeoGebra obrađuje?





Što s GeoGebrom?

- Interaktivna demonstracija (učionica, internet)
- Istraživački aplet za učenike
- Zadatak za učenike
- Lijep graf, crtež, konstrukcija, dijagram, animacija ...
- Konstrukcije, rješavanje zadataka, ...
- Randomski generirani zadatci i igrice (algebra, geometrija, statistika)



Sučelje

Datoteka Uređivanje Pogled Postavke Alati Prozor Pomoć Prijavljen kao Šime Šuljić

Algebra Grafički prikaz

- A = Sjecište od xOs, yOs
- c = Kružnica sa središtem A i p
- B = Točka na c
- a = Tangenta na c kroz B

The diagram shows a Cartesian coordinate system with x and y axes ranging from -4 to 6. A blue circle labeled 'c' is centered at the origin, marked with a green 'A' and '0'. A point 'B' is located on the circle in the first quadrant. A red line labeled 'a' is tangent to the circle at point B. The grid lines are spaced at intervals of 2 units.

Unos:



Datoteka Uređivanje Pogled Postavke Alati Prozor Pomoć Prijava...

Algebarski opisi
Zaokruživanje

ABC a=2

Algebra Grafik

Konika
c: $x^2 + y^2 = 2$

Točka
A = (0, 0)
B = (1, 1)

Označavanje
Veličina slova
Jezik
Dodatno ...
Spremi postavke
Vrati zadane postavke

automatsko
svih novih objekata
isključeno
samo novih točaka

Unos:

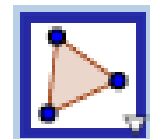
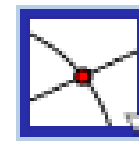
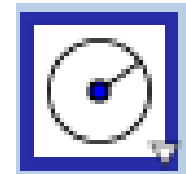
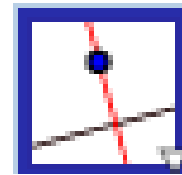


Za brz i ugodan rad

- **LT** = lijeva tipka miša, **DT** = desna tpka miša
- Pomicanje crtaće plohe: **LT**, **Shift + LT**
- Pomak objekta: (**Esc**) tipka miša na objekt i povlačenje
- Poništi: **Ctrl + z**
- Lijevi Alt: **Alt + p** = π , **Alt + o** = $^\circ$, **Alt + a** = α
- Traka stilova ili **DT** -> Koordinatna mreža, Osi
- Pogled > Algebarski prikaz, Tablica, ...
- Kotačić miša: zoom in/out (**Ctrl +/-** na laptopu)
- Reskaliranje osi: **Shift + LT** na osi
- Skočni izbornik – **DT** na objekt
- **DT** na prazno > Standardni pogled



Konstruirati pravokutnik sa stranicama $a = 5$, $b = 3$





Pravokutník (2)

- $\check{s} = 3$
- $d = \text{Du\check{z}ina}[A, B]$
- $C = B + \check{s} \text{ Jedin}i\check{c}niOkomitVektor[d]$
- $D = A + \check{s} \text{ Jedin}i\check{c}niOkomitVektor[d]$



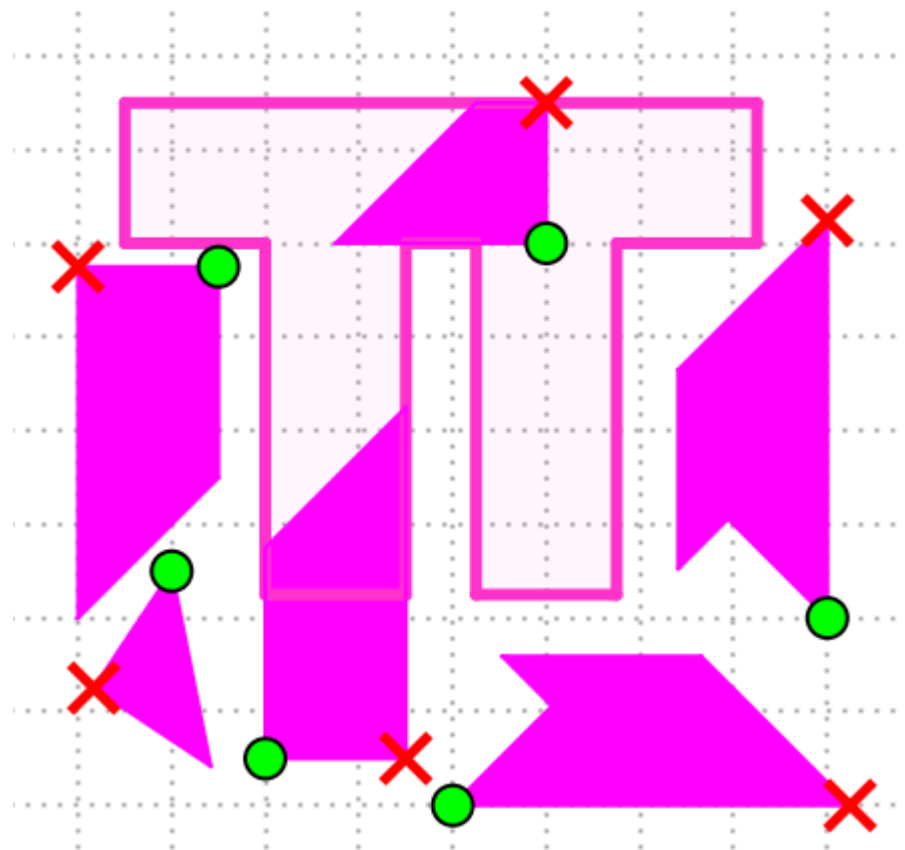
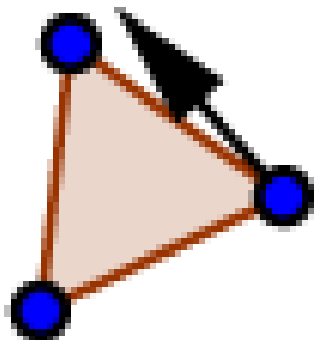
Pravokutnik (3)

- $\check{s} = 3$
- $d = \text{Dužina}[A, B]$
- $\alpha = \text{Kut}[\text{VektorSmjera}[d]]$
- $C = (x(B) - \check{s} \sin(\alpha), y(B) + \check{s} \cos(\alpha))$
- $D = (x(A) - \check{s} \sin(\alpha), y(A) + \check{s} \cos(\alpha))$



Dan broja π – puzzle **SEPzhPr9**

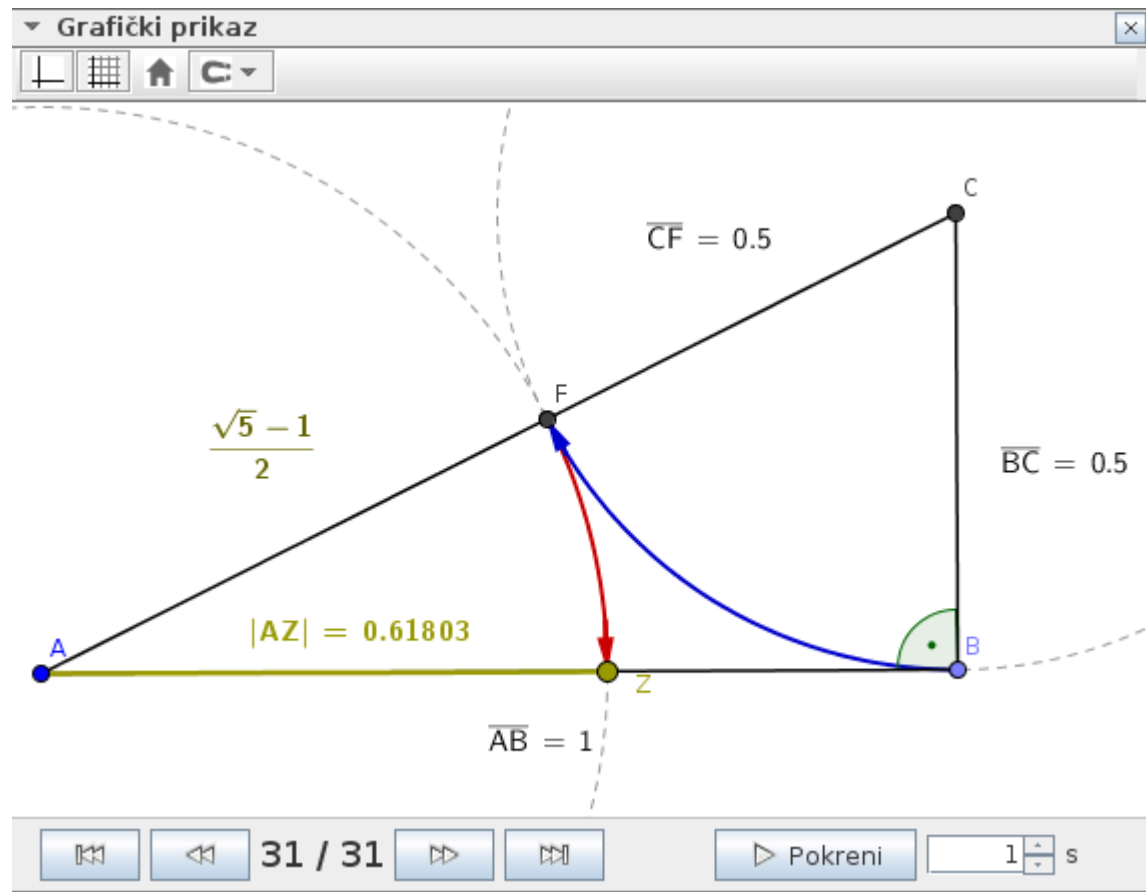
- Rabite koordinatnu mrežu
- Nacrtajte mnogokut alatom **Kruti mnogokut**
- Kliknite ponovo istim alatom na nacrtani mnogokut














Traka za korake

332789





Izvoz opisa konstrukcije

| Br. | Naziv | Ikona alatne trake | Naredba |
|-----|----------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------|
| 1 | Točka A |  | |
| 2 | Točka B |  | Točka[Kružnica[A, 1]] |
| 3 | Broj udaljenostAB |  | Udaljenost[A, B] |
| 4 | Tekst TekstAB |  | "\overline{" + (Naziv[A]) + (Naziv[B]) + "}" \, = \, " + udalj |
| 5 | Dužina a |  | Dužina[A, B] |
| 6 | Točka C ₁ |  | Polovište[a] |
| 7 | Kružnica c |  | Kružnica[B, C ₁] |
| 8 | Pravac b |  | Okomica[B, a] |
| 9 | Točka D |  | Sjecište[c, b] |



Umetanje i mjerenje slike



- Pozicioniranje slike
- Vezivanje uglova
- Pozadinska slika
- Alati za mjerenje
- `AfiniOmjer[A, B, C]`

ggbm.at/VBTMy56Y




Izrada novog alata - VMp24KWA

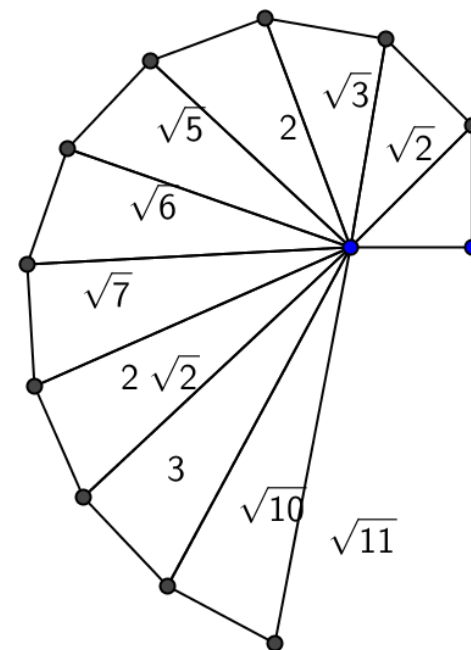
Izlazni objekti Ulazni objekti Naziv i ikona

Naziv alata

Naziv naredbe

Pomoć za alat

 Pokaži u alatnoj traci



Za polovište hipotenuze prikačiti
tekst **PrirodniZapis[c]**



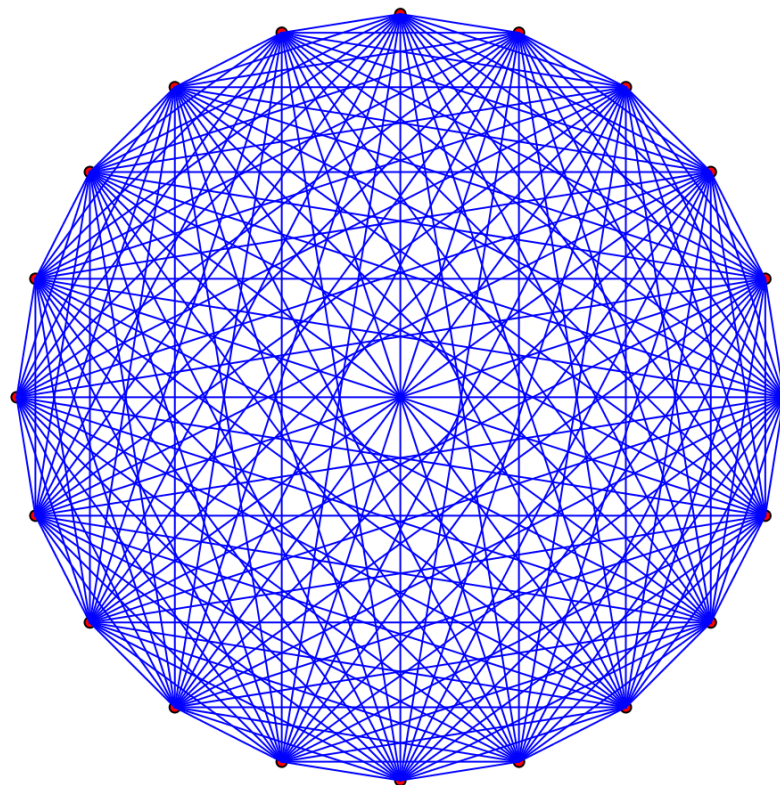
Dijagonale mnogokuta **327391**

- Klizač n cijeli broj
- Kut: $\alpha = 360^\circ/n$
- Točka A izvan ishodišta
- **vrhovi** = Niz[Rotacija[A, $i \alpha$], i , 0, n]
- Dijagonale iz jednog vrha: Niz[Dužina[Element[**vrhovi**, 1], Element[**vrhovi**, i]], i , 2, n]
- Niz[Niz[Dužina[Element[**vrhovi**, i], Element[**vrhovi**, j]], j , 1, i], i , 1, n]



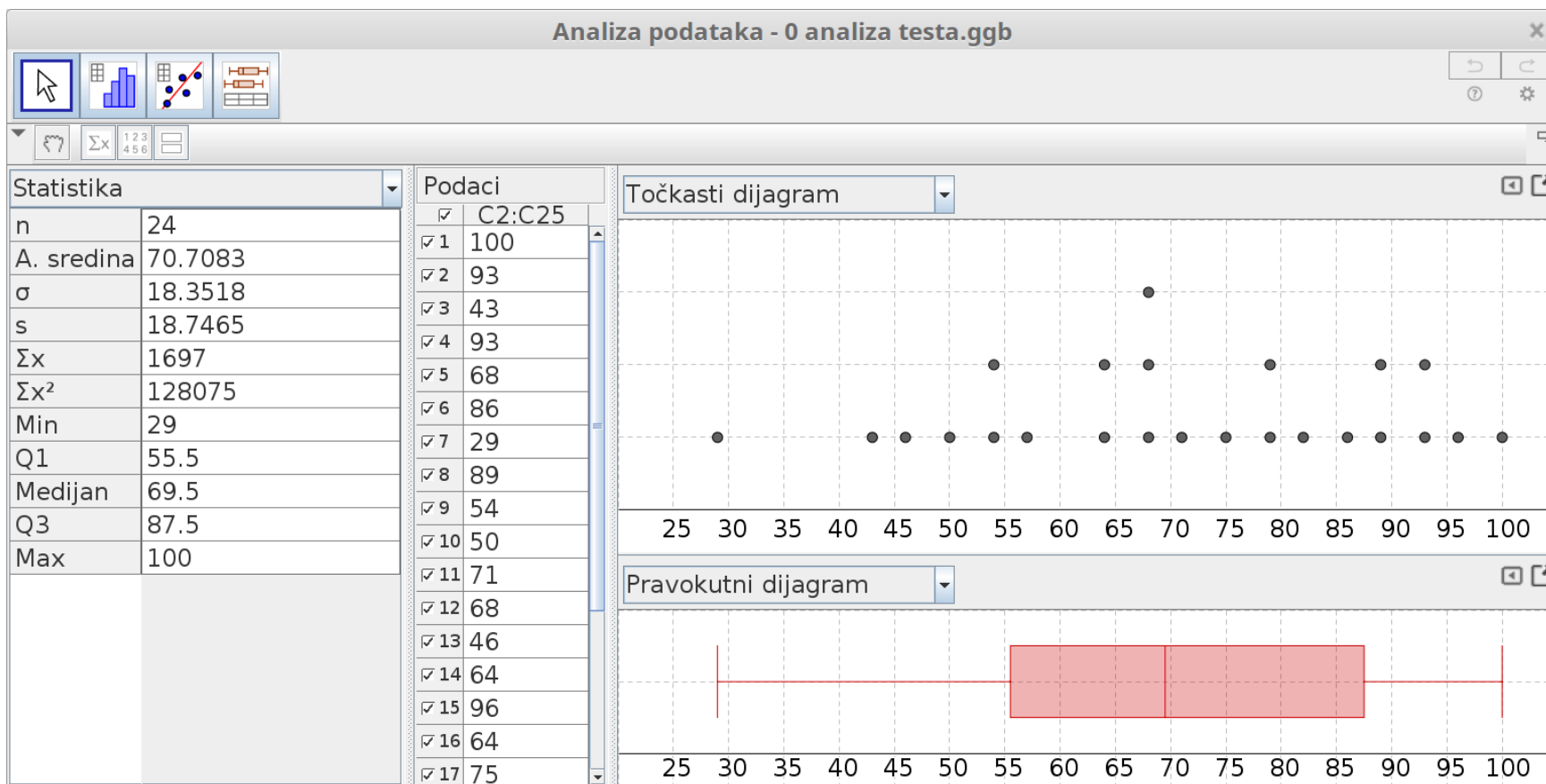
Izvoz slike

- Kopiraj –
zalijepi
- PNG,
SVG, ...
- PDF
- LaTeX





Analiza testa - **byBLwAkl**





Moćna tablica - **EJVHe5JR**

2 prosti i složeni.ggb

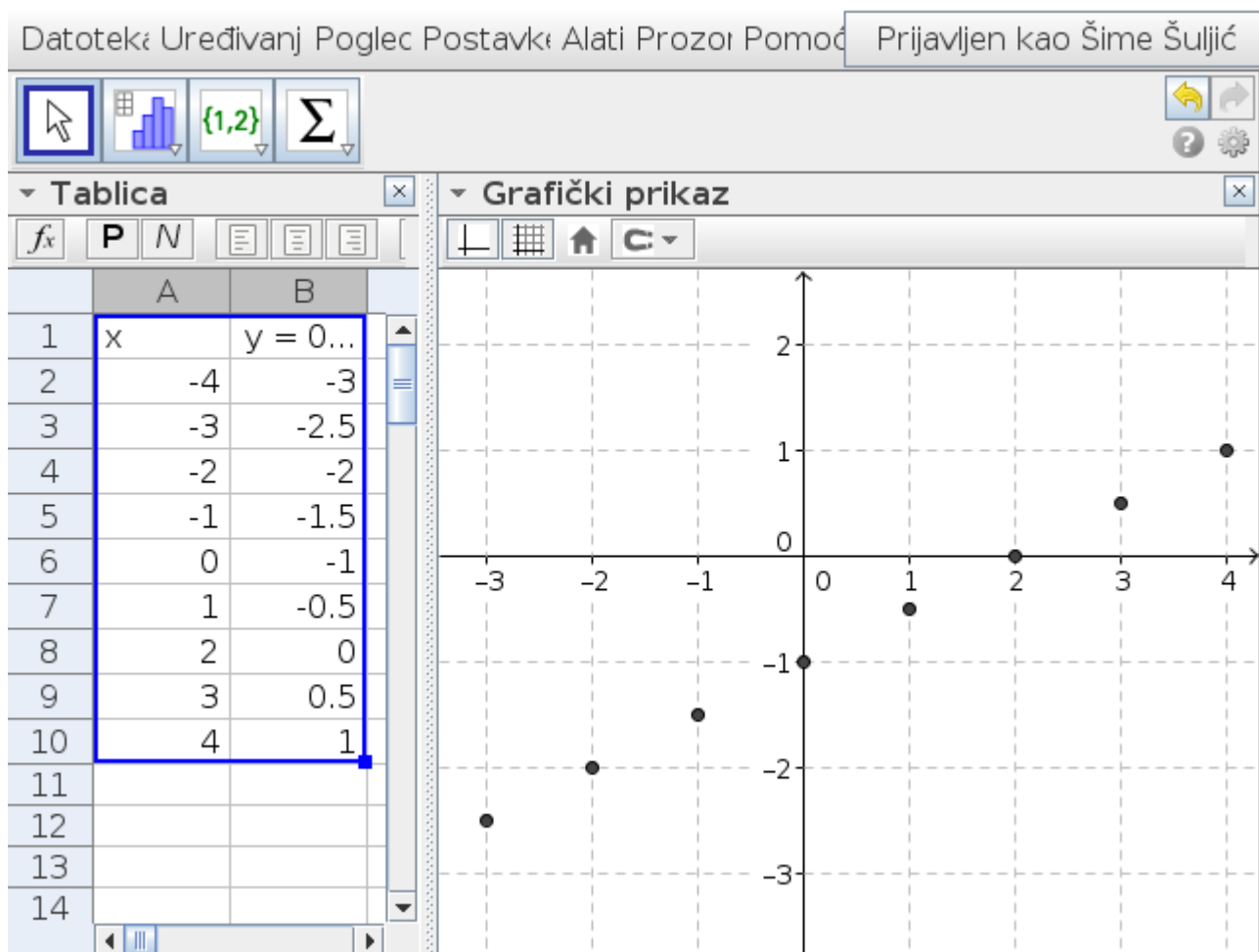
Datoteka Uređivanje Pogled Postavke Alati Prozor Pomoć Prijava...

$\{1,2\}$ Σ

| | A | B | C | D | E |
|----|-----|---------------|---------------------|-----------------------|--------------------------|
| 1 | ... | Broj | Prost/složen | Prosti faktori | |
| 2 | 1 | 31 | true | {31} | |
| 3 | 2 | 331 | true | {331} | |
| 4 | 3 | 3331 | true | | Broj B10 : 3 (10) |
| 5 | 4 | 33331 | true | {33331} | |
| 6 | 5 | 333331 | true | {333331} | |
| 7 | 6 | 3333331 | true | {3333331} | |
| 8 | 7 | 33333331 | true | {33333331} | |
| 9 | 8 | 333333331 | false | {17, 19607843} | |
| 10 | 9 | 3333333331 | false | {673, 4952947} | |
| 11 | 10 | 33333333331 | false | {307, 108577633} | |
| 12 | 11 | 333333333331 | false | {19, 83, 211371803} | |
| 13 | 12 | 3333333333331 | false | {523, 2049, 20002521} | |



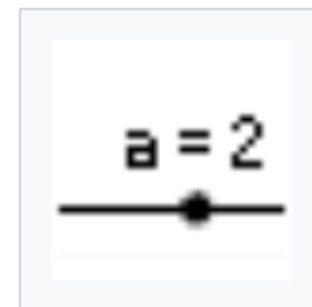
Od točka do pravca





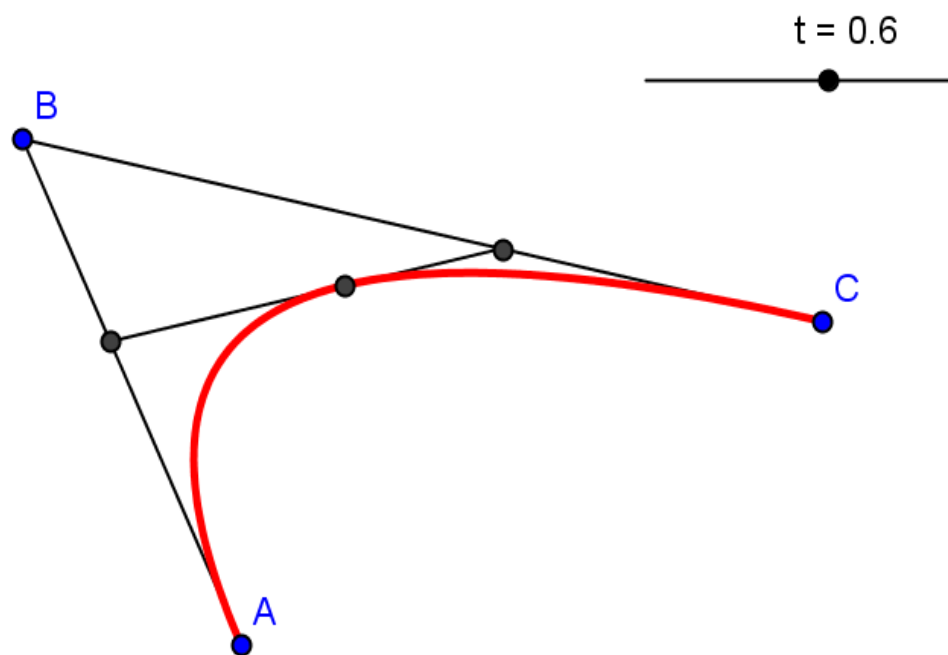
Klizači

- Traka stilova -> Koordinatne osi
- Traka stilova -> Koordinatna mreža
- Izradi klizače a i b
- $y = a x + b$
- Desni klik na klizač **Animiraj**
- Mijenjate korak povećanja klizača
- **Nagib[c]**





Bezierove krivulje



Opis konstrukcije

| ... | Naziv | Definicija |
|-----|--------------|-----------------|
| 3 | Točka C | |
| 4 | Broj t | |
| 5 | Točka D | $A + t (B - A)$ |
| 6 | Točka E | $B + t (C - B)$ |
| 7 | Točka F | $D + t (E - D)$ |
| 8 | Lokus lokus1 | Lokus[F, t] |

11 / 11



Metoda Monte Carlo –

k7qJkcxj

monteCarlo.ggb

Datoteka Uređivanje Pogled Prikazi Postavke Alati Prozor Pomoć

Algebra Grafčki prikaz Tablica

Nezavisni c

- n = 500
- teorijsk

Zavisni obj

- c : (x
- lista1
- lista2
- mnogo**
- pokus

1

n = 500

Novo

| | A | |
|----|----|--------|
| 1 | | pok... |
| 2 | 1 | 0.72 |
| 3 | 2 | 0.79 |
| 4 | 3 | 0.82 |
| 5 | 4 | 0.76 |
| 6 | 5 | 0.78 |
| 7 | 6 | 0.8 |
| 8 | 7 | 0.76 |
| 9 | 8 | 0.82 |
| 10 | 9 | 0.78 |
| 11 | 10 | 0.78 |

Unos:



Metoda Monte Carlo

- `Mnogokut[(0, 0), (2, 0), 4]`
- `Kružnica[(1, 1), 1]`
- `lista1 = Niz[(SlučajniUniformniBroj[0, 2],
SlučajniUniformniBroj[0, 2]), i, 1, n]`
- `lista2 = Niz[JeLiUPodručju[Element[lista1,
i], c], i, 1, n]`
- `UvjetnoPrebrajanje[x $\stackrel{?}{=} true$, lista2] / n`



Kockanje i GO :)

335473



Zbroj: 11

Baci ih!

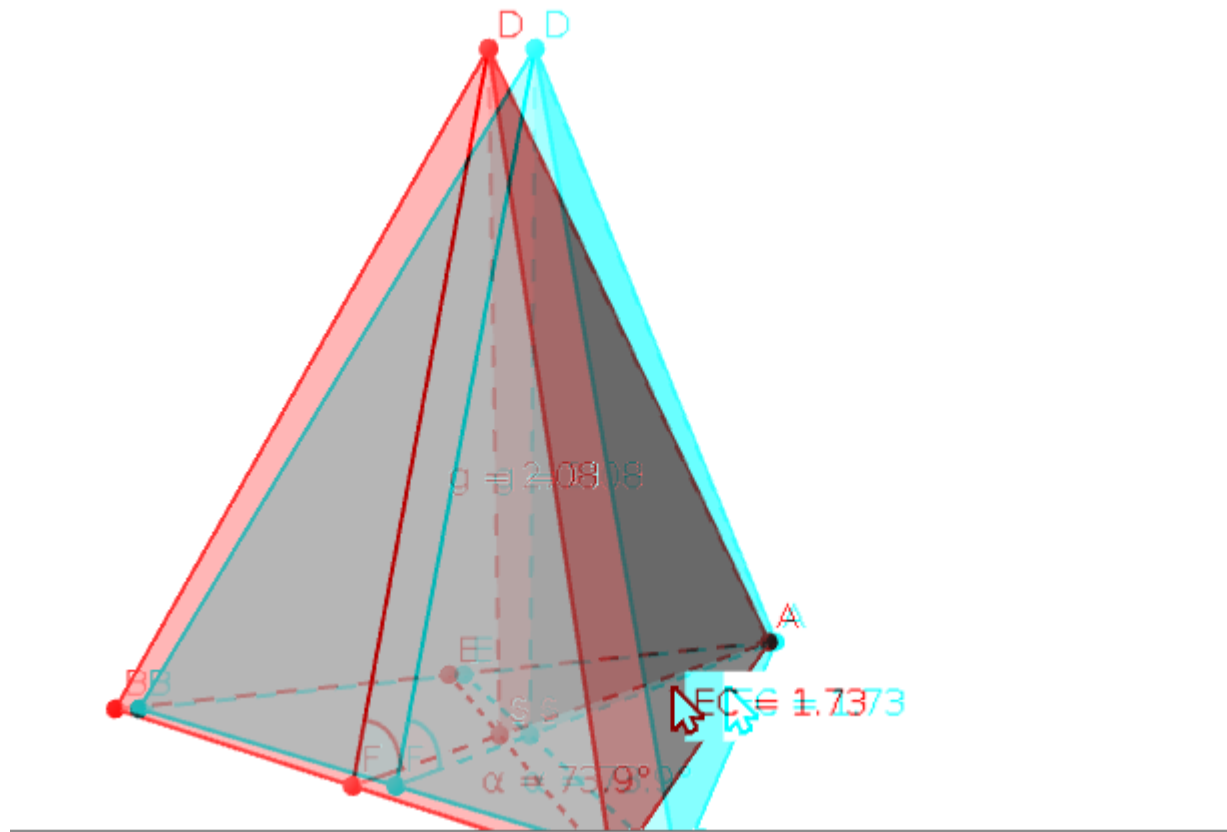


3D grafički prikaz

- Podešavanje prikaza
- Naredba `Kocka[(0, 0), (4, 0)]`
- Dodavanje vrhova
- Crtanje prostorne dijagonale
- Presjek ravninom i prikaz u 2D
- 3D naočale
- Mreža vezana uz klizač

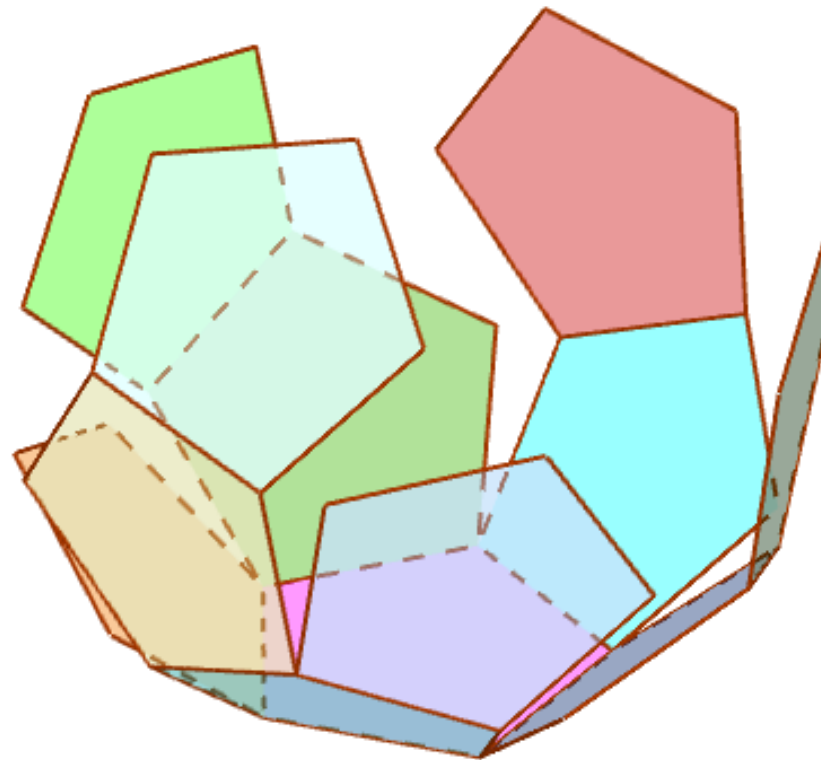


Piramida za 3D naočale - KtttDz7Y





Nikad lakše, a dinamično!



ggbm.at/zvE28qF7



Tako lako

| | Naziv | Ikona | Opis |
|---|---------------|-------|-------------|
| 1 | Broj r | $a=2$ | |
| 2 | Točka A | | $(r; r)$ |
| 3 | Lokus spirala | | Lokus(A, r) |

Unos...



Manje poznato

- Imena osi xOs , yOs
- Algebarski opisi
- Prozorske trake
- Promjena svojstava više objekata
- Klizači s varijabilnim granicama
- Formule u natpise
- Povlačenje jednažbe u grafički prozor
- Tablica i tekst u grafički prozor



Mrežni servisi na [geogebra.org](https://www.geogebra.org)

Materijali [geogebra.org/materials](https://www.geogebra.org/materials)

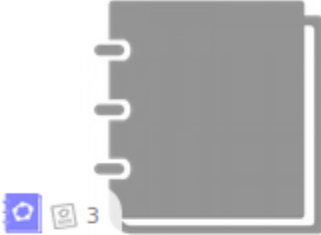
Virtualni razred [geogebra.org/groups](https://www.geogebra.org/groups)

Web app [geogebra.org/app](https://www.geogebra.org/app)





www.geogebra.org/gghr



Uređivanje GeoGebrinog e-u
[Docu HR](#)
prije 6 minuta



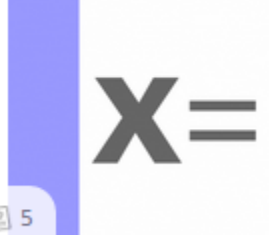
GeoGebra ubrzani vodič za
[Docu HR](#)
prije 9 minuta



GeoGebra - Ubrzani vodič za
[Docu HR](#)
prije 11 minuta



GeoGebra - Ubrzani vodič za
[Docu HR](#)
prije 13 minuta



GeoGebra - Ubrzani vodič za
[Docu HR](#)
prije 16 minuta



GeoGebra 3D geometrija - u
[Docu HR](#)
15. siječnja 2017.



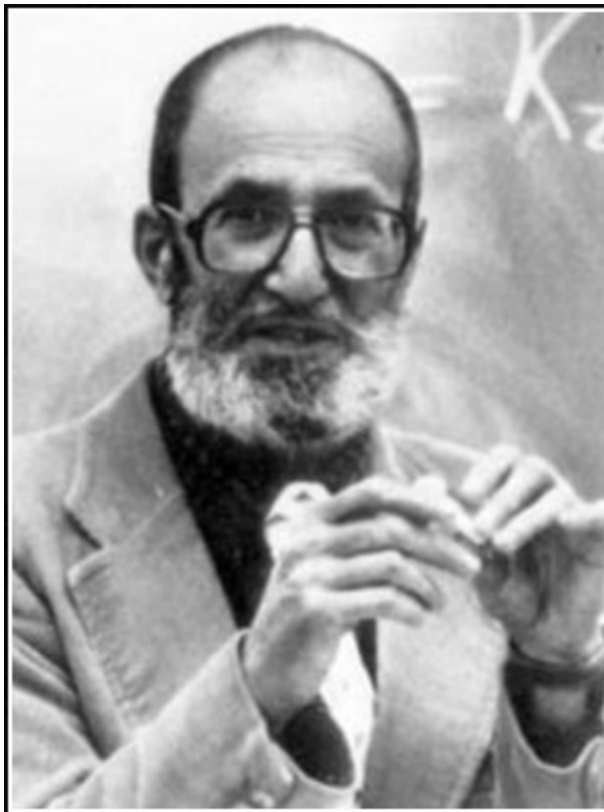
Poveznice

- Ne zaboravite www.geogebra.org/forum
- Facebook grupa:
www.facebook.com/groups/geogebrauskoli/





Poruka za kraj



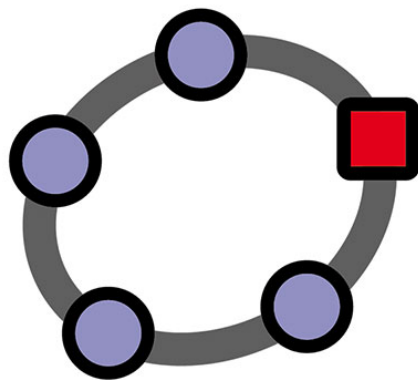
The only way to learn mathematics
is to do mathematics.

— *Paul Halmos* —



Hvala na pažnji

sime.suljic@skole.hr



Hrvatski institut za GeoGebra
Croatian GeoGebra Institute

