# Interactive visualization and e-assessment with JSXGraph

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# Let's start with examples

"JSXGraph is an open source JavaScript library for interactive geometry, function plotting, charting, and data visualization in the web browser."

- Euclidean Geometry
- Function plot
- Everything is number

# What is JSXGraph?

## Availability

- https://jsxgraph.org
- Open source project: https://github.com/jsxgraph/jsxgraph
- License: LGPL and MIT
- First published 2008 in Trondheim

# What is “dynamic”?

“Dynamic” means

Dragging / changing one object affects another object / text

# Technical details

- JavaScript library
- Runs in every **web browser** starting (from IE 10+) and in **ebooks** (epub3, ibook)
- PC, tablet, smartphone. Supports mouse, pen, multi-touch, keyboard
- Standalone, no other libraries required. Download approx. **200 kB**
- Highly configurable, seamless integration into websites
- Supports (dynamic) mathematical typesetting via *MathJax* or *KaTeX*.
- Graphics engine: SVG or Canvas

# Embedding

JSXGraph can be included in / with

- Standalone HTML web page
- Moodle *JSXGraph filter*
- ILIAS plug-in
- STACK JSXGraph plug-in
- Mediawiki plug-in
- h5p
- ...

Bold estimate: Annually, approx. 1 billion JSXGraph constructions are opened in web browsers.

# Features

- Static and interactive plots
- Calculus: functions, curves, sequences and series, Riemann sums, differential equations, various splines
- Dynamic geometry: Euclidean, analytic, projective
- Linear (projective) transformations
- Some statistics, e.g. boxplots
- Turtle graphics
- Dynamic MathJax / KaTeX
- Embedding of videos
- Path clipping
- Animations
- Some 3D

# A few examples

with source code

- sketchometry
- Taylor polynomial
- Riemann sums
- Euclidean geometry
- Projective geometry (offside line in football)
- Video embedding
- Sketch curve

# Work in progress

## New in upcoming v1.6.0:

- vector fields and slope fields
- smart labels

## Students' projects:

- json2d interface to CAS
- Some graph theory

# Is it dangerous to use JSXGraph in e-assessment?

No:

- If problems are developed by the teacher and if there are no input fields

Yes:

- If users can type into input fields (like function terms)
- If problems come from unknown sources (like open source problem collections)

Counter measures:

- Execute JSXGraph / JavaScript in sandboxed iframe
- Parse input with JSXGraph's own language JessieCode

# Where to get support?

JSXGraph:

- JSXGraph programming book
- API doc
- Wiki with many examples incl. source code
- New examples database
- Videos of online workshops and conferences
- Google groups
- Stackoverflow

JSXGraph in STACK:

- STACK documentation

# Upcoming event

- **JSXGraph conference 2023** (online)
- 10.-12. October 2023
- https://jsxgraph.org/conf2023