

Math visualization with JSXGraph – an overview

Alfred Wassermann

Department of Mathematics, University of Bayreuth, Germany

Workshop “Using JSX graphs in STACK”

Edinburgh

8. 12. 2022

Let's start with examples

“JSXGraph is a cross-browser JavaScript library for interactive geometry, function plotting, charting, and data visualization in the web browser.”

Examples

- ▶ <https://jsxgraph.org>
- ▶ Function plot
- ▶ Everything is number
- ▶ JSXGraph in STACK

Who am I

- ▶ JSXGraph lead developer
- ▶ JSXGraph is developed at the University of Bayreuth
- ▶ *Chair of math education*, Prof. Volker Ulm
- ▶ Center of *mobile learning with digital technology*, Prof. Peter Baptist
- ▶ Working on *visualization of mathematics in the web browser* since 1996
- ▶ Former projects: Geonet (1996), Geonext (2000)

What is JSXGraph?

Javascript is a library for

- ▶ interactive geometry
- ▶ function plotting
- ▶ diagrams
- ▶ visualization (mostly 2D, recently started 3D)

in the web browser.

Availability

- ▶ <https://jsxgraph.org>
- ▶ Open source project: <https://github.com/jsxgraph/jsxgraph>
- ▶ License: LGPL and MIT
- ▶ First published 2008

Technical details

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

Technical background

JSXGraph constructions can be displayed by the web browser as

- ▶ SVG graphics (default)
- ▶ canvas graphics

Requisites for potential content authors

- ▶ Basic knowledge of HTML
- ▶ Some knowledge of JavaScript (of course, the more the better)
- ▶ Some courage

Healthy approach for content authors:

"I'm not a programmer, I'm an adaptor"

Embedding

JSXGraph can be included in / with

- ▶ Standalone web page
- ▶ Moodle: *JSXGraph moodle filter*
- ▶ Moodle STACK: *JSXGraph STACK plug-in*
- ▶ Wikis: *JSXGraph mediawiki plug-in*
- ▶ ...

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
- ▶ Embedding of videos
- ▶ Path clipping
- ▶ Animations
- ▶ Some 3D

What is “dynamic”?

“Dynamic” means

Dragging / changing one object affects another object / text

Feature show

Where to get support?

- ▶ JSXGraph programming book
- ▶ API doc
- ▶ Wiki with many examples plus code
- ▶ Videos of online workshops and conferences
- ▶ Google groups
- ▶ Stackoverflow

Workshop – Programming with JSXGraph

Prerequisites

In this morning workshop we will

- ▶ focus on JSXGraph
- ▶ learn to write a web page including JSXGraph
- ▶ *not yet* use Moodle or STACK

We need the following tools:

- ▶ a (free) editor: visual studio code, notepad++, ...
- ▶ a web browser