



Interactive applets in Moodle using JSXGraph

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Presentation outline

1. *JSXGraph library*
2. *JSXGraph Moodle plugin*
3. *JSXGraph book*
4. *JSXGraph in Moodle as a tool for visualizing constructions*
5. *ITEMS Project*
6. *JSXGraph and Moodle Formulas plugin*
7. *JSXGraph and Stack plugin, Abacus consortium*
8. *JSXGraph Conference in 2020*

JSXGraph library

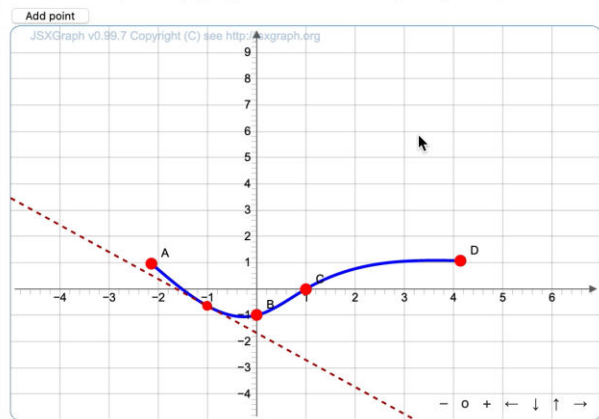
www: <https://jsxgraph.org/>

Interactive geometry, plotting, visualization

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

Cubic spline interpolation

Constructs a cubic spline through given points. Points can be added by clicking on "Add point".



```
var board = JSX.JSXGraph.initBoard('box', {boundingbox: [-5, 10, 7, -5], axis:true});
var p = [];
p[0] = board.create('point', [-1,2], {size: 4, face: 'o'});
p[1] = board.create('point', [0,-1], {size: 4, face: 'o'});
p[2] = board.create('point', [1,0], {size: 4, face: 'o'});
p[3] = board.create('point', [2,1], {size: 4, face: 'o'});

var c = board.create('spline', p, {strokeWidth:3});

var g = board.create('glider', [1.5,0,c], {name:'',style:8});
var t = board.create('tangent', [g], {dash:2,strokeColor:'#aa0000'});

function addPoint() {
  p.push(board.create('point',[(Math.random()-0.5)*10,(Math.random()-0.5)*3],{size: 4, face: 'o'}));
  board.update();
}
```

JSXGraph Moodle plugin

- https://moodle.org/plugins/filter_jsxgraph
- https://github.com/jsxgraph/moodle-filter_jsxgraph
- Build constructions in Moodle Activities or Moodle Resources

Example:

```
<jsxgraph width="600" height="500" box="mybox">
  (function() {
    var brd = JXG.JSXGraph.initBoard('mybox', {boundingbox:[-5,5,5,-5], axis:true});
    var p = brd.create('point', [1,2]);
  })();
</jsxgraph>
```

JSXGraph in Moodle as a tool for visualizing constructions

- every JSXGraph construction can be embedded in Moodle

Input

General

Name
JSXGraph example in Resource

Description

Display description on course page

Content

Page content

```
<p><b>Five Circle Theorem</b></p><p>The five circles theorem states that, given five circles centered on a common sixth circle and intersecting each other chainwise on the same circle, the lines joining their second intersection points forms a pentagram whose points lie on the circles themselves.</p><p>Construction:</p><math>var bnd = JSXGraph.initBoard('mybox', {boundingbox: [-5.5, 5], var p = [], i = 1, c = 1, j = 1, k; p[0] = bnd.create('point', [-2.5, -3], {name: '', strokeColor: '#7355ff', fillColor: '#7355ff'}); p[1] = bnd.create('point', [-0, 4], {name: '', strokeColor: '#7355ff', fillColor: '#7355ff'}); p[2] = bnd.create('point', [2.5, -3], {name: '', strokeColor: '#7355ff', fillColor: '#7355ff'}); p[3] = bnd.create('point', [-4, 0], {name: '', strokeColor: '#7355ff', fillColor: '#7355ff'}); p[4] = bnd.create('point', [4, 0], {name: '', strokeColor: '#7355ff', fillColor: '#7355ff'}); for (k=0;k<5;k++) { [k] = bnd.create('segment', [p[k], p[(k+1)%5]], {strokeColor: 'black', strokeWidth: 1}); } for (k=0;k<5;k++) { [k] = bnd.create('intersection', [[k], [(k+2)%5], 0], {name: '', strokeColor: '#EAEAD0', fillColor: '#EAEAD0'}); }
```

Result

JSXGraph MoodleMoot Barcelona

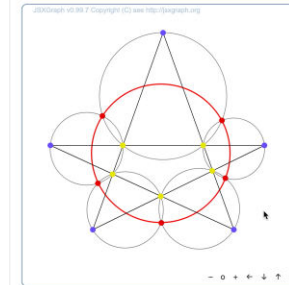
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JSXGraph example in Resource

Five Circle Theorem

The five circles theorem states that, given five circles centered on a common sixth circle and intersecting each other chainwise on the same circle, the lines joining their second intersection points forms a pentagram whose points lie on the circles themselves.

Construction:



Last modified: Sunday, 10 November 2019, 11:47 AM

FORMULAS

Jump to...

JSXGraph Book

- Introduction to programming with JSXGraph
- <https://ipesek.github.io/jsxgraphbook/>
- Under active development
- Multilanguage (English, German, Spanish, Czech, Slovene, Finnish, etc)

- 1. Introduction
- 2. How to setup
- 3. Basics
 - 3.1. Drawing area
 - 3.2. Creating points
 - 3.3. Creating lines
 - 3.4. Adding attributes to the objects
 - 3.5. Example
 - 3.6. Circles
 - 3.7. Polygons
 - 3.8. Intersections
 - 3.9. Angles
 - 3.10. Curves
 - 3.11. Drawing functions
- 4. Animating
 - 4.1. Moving objects
 - 4.2. Example
 - 4.3. Sliders
 - 4.4. Animating with sliders
 - 4.5. Example
 - 4.6. Transformations
- 5. Advanced topics
 - 5.1. Adding images
 - 5.2. Capture the construction as image
 - 5.3. JSXGraph options
 - 5.4. Events
 - 5.5. Saving user actions
 - 5.6. Jessie Code
- 6. JSXGraph and Moodle
 - 6.1. JSXGraph as a Moodle Filter

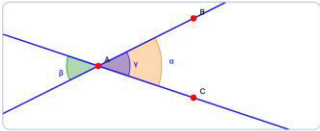
EN

JSXGraph Book

Angles

When we need to emphasise some angle in our construction, we can do this with object *Angle*. As an input we need to provide three points p_1, p_2, p_3 and the angle is drawn counterclockwise from p_1 to p_3 around p_2 . Other combinations include two lines and a two direction (by ± 1) or line and two coordinates.

```
<div id="jsgbox" class="jsgbox" style="width:500px; height:200px;"></div>
<script>
var board = JXG.JSXGraph.initBoard('jsgbox', {boundingbox: [-5, 2, 5, -2],keepAspectRatio: true});
var p = board.create('point',[-2,0],{name:'A'});
var q = board.create('point',[1,1.5],{name:'B'});
var r = board.create('point',[1,-1],{name:'C'});
var l1 = board.create('line',[p,q]);
var l2 = board.create('line',[p,r]);
var angle1 = board.create('angle',[l1,l2,'A', 'B'], {radius:2});
var angle2 = board.create('angle',[l2,l1,-1,-1], {radius:1,color:'green'});
var angle3 = board.create('angle',[l2,l1,1,1], {radius:1,color:'blue'});
</script>
```



In this example we first created three points and then through them created two lines with common/intersection point A.

Then we created first angle with `var angle = board.create('angle',[r, p, q], {radius:2});` using three points. Remember, when defining angle with three points we have to provide them in



ITEMS project

www: <https://itemspro.eu/>

Objectives

- To create ICT STEM-based modules integrating e-assessment tools and assignments
- To research on the use of JSXGraph software
- To monitor the pedagogical effectiveness of materials by means of Learning Analytics tools
- To promote professional development training activities and the mentoring of educators involved.
- To distribute materials created as Open Education Resources (OER) and through MOOCs.

ITEMS moodle

- <https://moodle.itemspro.eu/>
- accessible also through Google account
- LTI connection possible on the content
- Content (using JSXGraph)
 - Physics
 - Mathematics
 - Science



JSXGraph and Moodle Formulas question type plugin

- JSXGraph interacts with Moodle Formulas question type question type (<https://moodleformulas.org/>)
- introducing randomization in the questions
- saves user interaction

JSXGraph MoodleMoot Barcelona

Home / My courses / JSXGraph MoodleMoot Barcelona / General / FORMULAS / Preview

The screenshot displays a Moodle question interface. On the left, a sidebar shows 'Question 1', 'Tries remaining: 1', 'Marked out of 23.00', and options to 'Flag question' and 'Edit question'. The main content area contains the following elements:

- Table:** A table with two rows: 'Mass (kg)' and 'Volume (L)'. The first row is highlighted in blue.
- Graph:** A coordinate system with a grid. The x-axis is labeled 'V (L)' and the y-axis is labeled 'm (kg)'. Both axes have tick marks from 0 to 5. A legend in the top-left corner shows a blue square for 'm(kg)' and a red square for 'V(L)'. A legend in the bottom-right corner shows a blue square for 'm(kg)' and a red square for 'V(L)'. The graph shows a blue line along the x-axis and a red line along the y-axis.
- 3D Visualization:** Below the graph, there are five cubes of increasing size, labeled 'V=1L', 'V=2L', 'V=3L', 'V=4L', and 'V=5L'. Each cube is accompanied by a small image of a container.
- Text:** 'Are made the cubes of the same substance?' followed by a text input field.
- Buttons:** A 'Check' button at the bottom.

JSXGraph and STACK question type, Abacus

- The STACK question type adds a sophisticated assessment in mathematics and related disciplines, with emphasis on formative assessment underpinned by computer algebra.
- www: https://moodle.org/plugins/qtype_stack

- Abacus is a material bank for STEM education based at Aalto University, Finland. We seek to produce, share and host high-quality educational material between collaborators.
- www: <https://abacus.aalto.fi>
- More than 9000 problems, 7000 of them as STACK questions.
 - Aalto University => more than 200k STACK questions answered,
 - Open University (UK) => 500k STACK questions answered

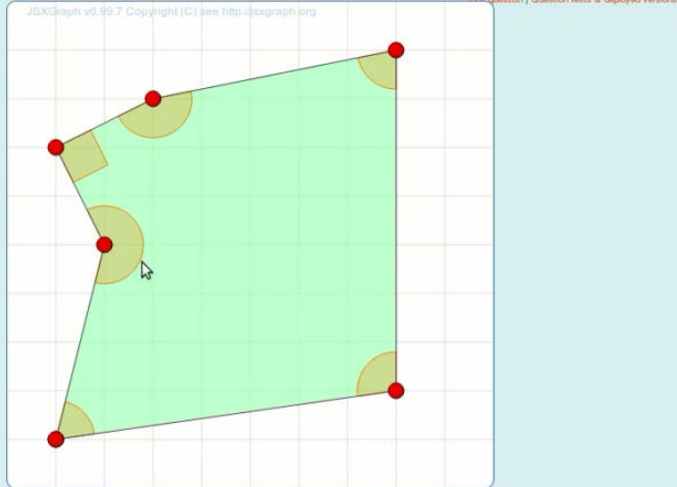
QUESTION 1

Not complete

Marked out of 1.00

Flag question

Edit question



Place the vertices of the hexagon so that

- Three of the angles are either **acute** or **obtuse** angles i.e. between 0° and 180° .
- The other three angles are **reflex** angles i.e. between 180° and 360° .

Note that the hexagon has to be non-self-intersecting!

Check

Next page

Save in category

JSXGraph+STACK (6)

Question name

Complex Multiplication

Question variables

 $z_1 : 1+i;$
 $ta_1 : i;$

Random group

Question text

Rich text editor toolbar with icons for bold, italic, underline, link, unlink, list, table, image, video, audio, etc.

```

<div style="max-width:70em">
<br>
<span class="multilang" lang="fi"><p>Määritä sellainen kompleksiluku  $\omega$ , että kertolasku  $\omega \cdot z_1$  kiertää pistettä  $z_1$  origon ympäri  $(90^\circ)$  vastapäivään.</p></span>
<span class="multilang" lang="en"><p>Find a complex number  $\omega$  such that the multiplication  $\omega \cdot z_1$  rotates the point  $z_1$   $(90^\circ)$  degrees around the origin.</p></span>
<br>
<p>[[input:ans1]]</p>
<p>[[validation:ans1]]</p>
<script type="text/javascript">
var startAnimation;
</script>
[[jsxgraph width="500px" height="500px"]]
MathJax.Hub.processSectionDelay = 0;
var board = JSXGraph.initBoard(divid, {
  boundingbox : [-5,5,-5],
  axis : false
  }
  
```

JSXGraph conference in 2020

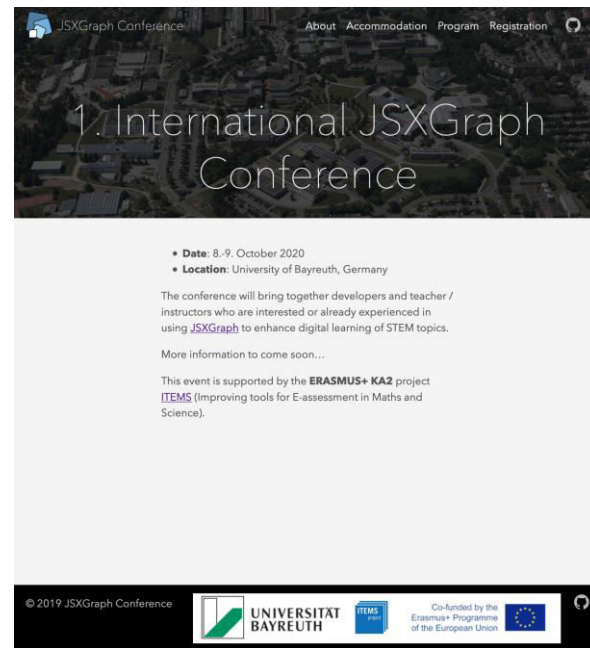
Date: 8.-9. October 2020

Location: University of Bayreuth, Germany

Topics:

- JSXGraph
- JSXGraph and Moodle

www: <https://jsxgraph.org/conf/>



The screenshot shows the homepage of the 1. International JSXGraph Conference. The header includes navigation links for 'About', 'Accommodation', 'Program', and 'Registration'. The main content area features the conference title, date, and location. Below this, there is a paragraph describing the conference's focus on digital learning in STEM topics, followed by a note about funding from the ERASMUS+ KA2 project and the ITEMS initiative. The footer contains logos for the University of Bayreuth, the Erasmus+ Programme, and the European Union.

JSXGraph Conference

About Accommodation Program Registration

1. International JSXGraph Conference

- **Date:** 8.-9. October 2020
- **Location:** University of Bayreuth, Germany

The conference will bring together developers and teacher / instructors who are interested or already experienced in using [JSXGraph](#) to enhance digital learning of STEM topics.

More information to come soon...

This event is supported by the **ERASMUS+ KA2** project [ITEMS](#) (Improving tools for E-assessment in Maths and Science).

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ITEMS

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Questions?

