

ITEMS project: JSXGraph+FORMULAS (Moodle) High School Maths activities

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E - A × M + S 2020



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Presentation outline

1. JSXGraph library
2. JSXGraph Moodle filter
3. ITEMS Project
 - JSXGraph and STACK plugin: see next talk
 - *JSXGraph and Moodle Formulas plugin*
 - JSXGraph book
 - JSXGraph Conference in 2020
4. **Example course of JSXGraph and Moodle Formulas**

JSXGraph library

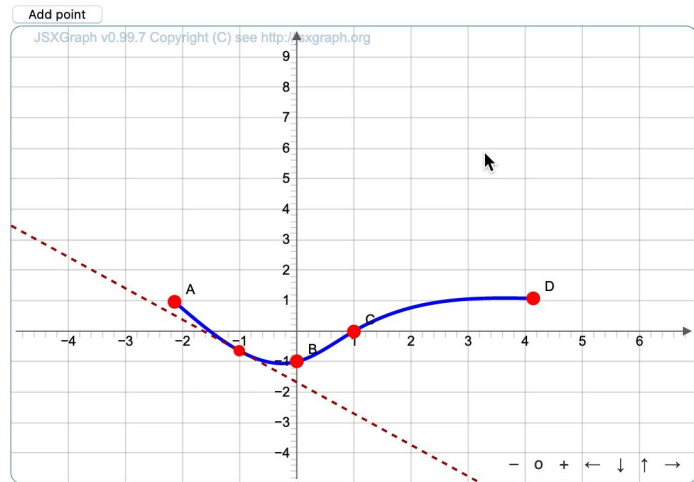
www: <https://jsxgraph.org/>

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 = 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 filter

- 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 visualization

- 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><b>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.</b></p><p><b>Construction</b></p><math>var bnd = JSXGraph.initBoard("mybox", {boundingbox: [-5.5, 5, -1]});</math><math>var p = [], i = [], j = [], c = [], k = [];</math><math>p[0] = bnd.create("point", [-2.5, -3], {name: "", strokeColor: "#7355ff", fillColor: "#7355ff"});</math><math>p[1] = bnd.create("point", [-0, 4], {name: "", strokeColor: "#7355ff", fillColor: "#7355ff"});</math><math>p[2] = bnd.create("point", [2.5, -3], {name: "", strokeColor: "#7355ff", fillColor: "#7355ff"});</math><math>p[3] = bnd.create("point", [-4, 0], {name: "", strokeColor: "#7355ff", fillColor: "#7355ff"});</math><math>p[4] = bnd.create("point", [4, 0], {name: "", strokeColor: "#7355ff", fillColor: "#7355ff"});</math><math>for (k=0;k<5;k++) {</math><math>  [i] = bnd.create("segment", [p[k], p[(k+1)%5]], {strokeColor: "black", strokeWidth: 1});</math><math>}</math><math>for (k=0;k<5;k++) {</math><math>  [j] = bnd.create("intersection", [i[k], i[(k+2)%5], 0], {name: "", strokeColor: "#EAEAD0", fillColor: "#EAEAD0"});</math></pre>
```

Result

ITEMSprototype: MATHS (High School)

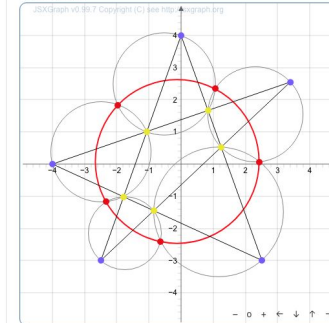
Home / My courses / ITEMSprototype: MATHS (High School) / General / JSXGraph example in resource "page"

JSXGraph example in resource "page"

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: Wednesday, 17 June 2020, 2:59 PM

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 for everybody through Google account
- LTI connection possible on the content (used for **EAMS**)
- Content (using JSXGraph):
 - Physics
 - Mathematics
 - Science



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JSXGraph & MoodleFormulas plugin

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

Question 1

Correct

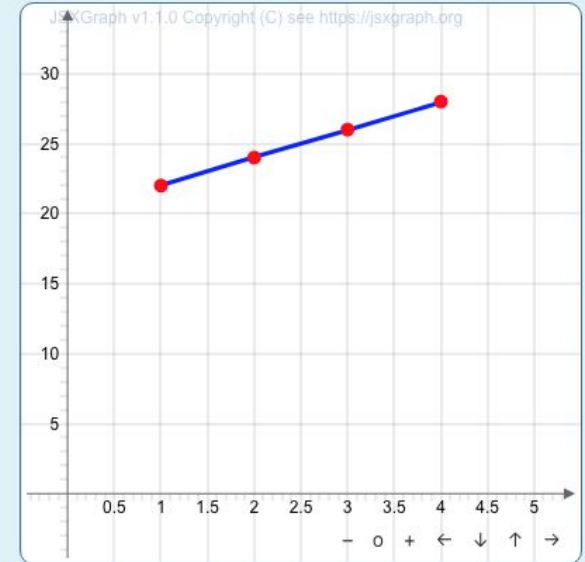
Mark 1.00 out of 1.00

Flag question

Edit question

Sketch function $f(x)=2x+20$

code



One possible correct answer is: 22, 24, 26, 28

Your answer is correct.

Try another question like this one

JSXGraph Book

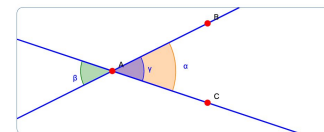
- Introduction to programming with JSXGraph
- <https://ipesek.github.io/jsxgraphbook/>
- Under active development
- Multi-language (English, German, Spanish, Czech, Slovene, Finnish, ...)

- 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

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 $p1$, $p2$, $p3$ and the angle is drawn counterclockwise from $p1$ to $p3$ around $p2$. Other combinations include two lines and a two direction (by +/-) or line and two coordinates.

```
<div id="jxgbox" class="jxgbox" style="width:500px; height:200px;"></div>
<script>
var board = JXG.JSXGraph.initBoard('jxgbox', {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,q,'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

JSXGraph conference in 2020


Date: 6.-8. October 2020

Location: Online

Topics:

- JSXGraph
 - for learning / teaching
 - moodle, ilias, STACK
 - dynamic visualizations
- Best practices
- Tools
- New developments

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



1. International JSXGraph Conference

6.-8. October 2020

The 1. International JSXGraph Conference will bring together **developers** and **teachers, instructors** and **designers** who are interested or already experienced in using [JSXGraph](#) to enhance digital learning of STEM topics.

The 1. International JSXGraph Conference will take place online between the 6th October - 8th October 2020. More details will be announced soon.

Conference format

The 1. International JSXGraph Conference is an entirely **online conference**. All participants are required to [register](#).

We invite all participants to [contribute a talk or workshop](#).

Details about the video software will be announced at a later stage.

Support

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

Questions?