

An IPE Tutorial

Soeren Nickel

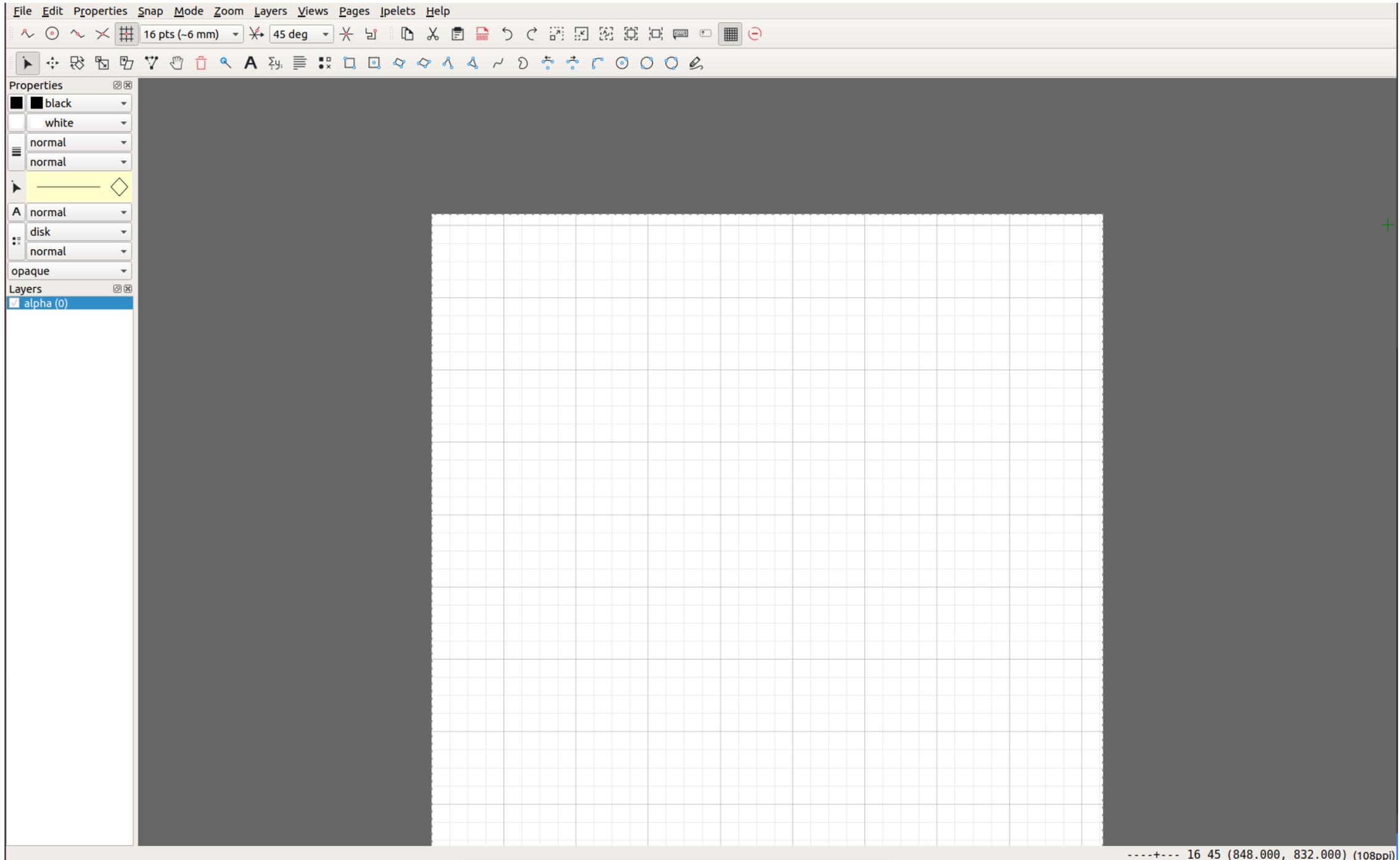
Seminar in Algorithms Graphs and Geometry · WS2021

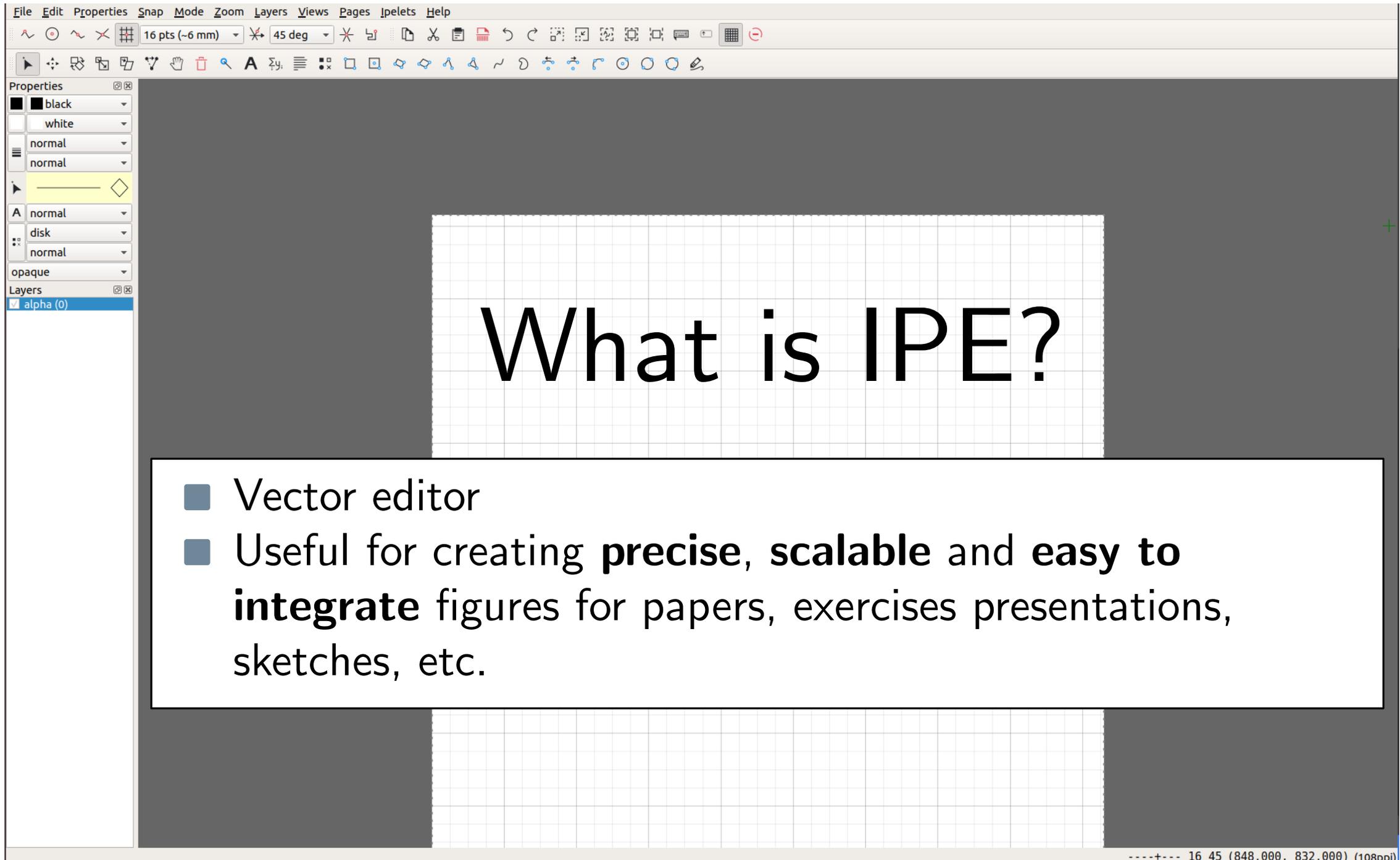
Algorithmic Geometry · WS2021

...and the rest

 Informatics

 ALGORITHMS AND
COMPLEXITY GROUP





File Edit Properties Snap Mode Zoom Layers Views Pages Ipelets Help

16 pts (~6 mm) 45 deg

Properties

- black
- white
- normal
- opaque

Layers

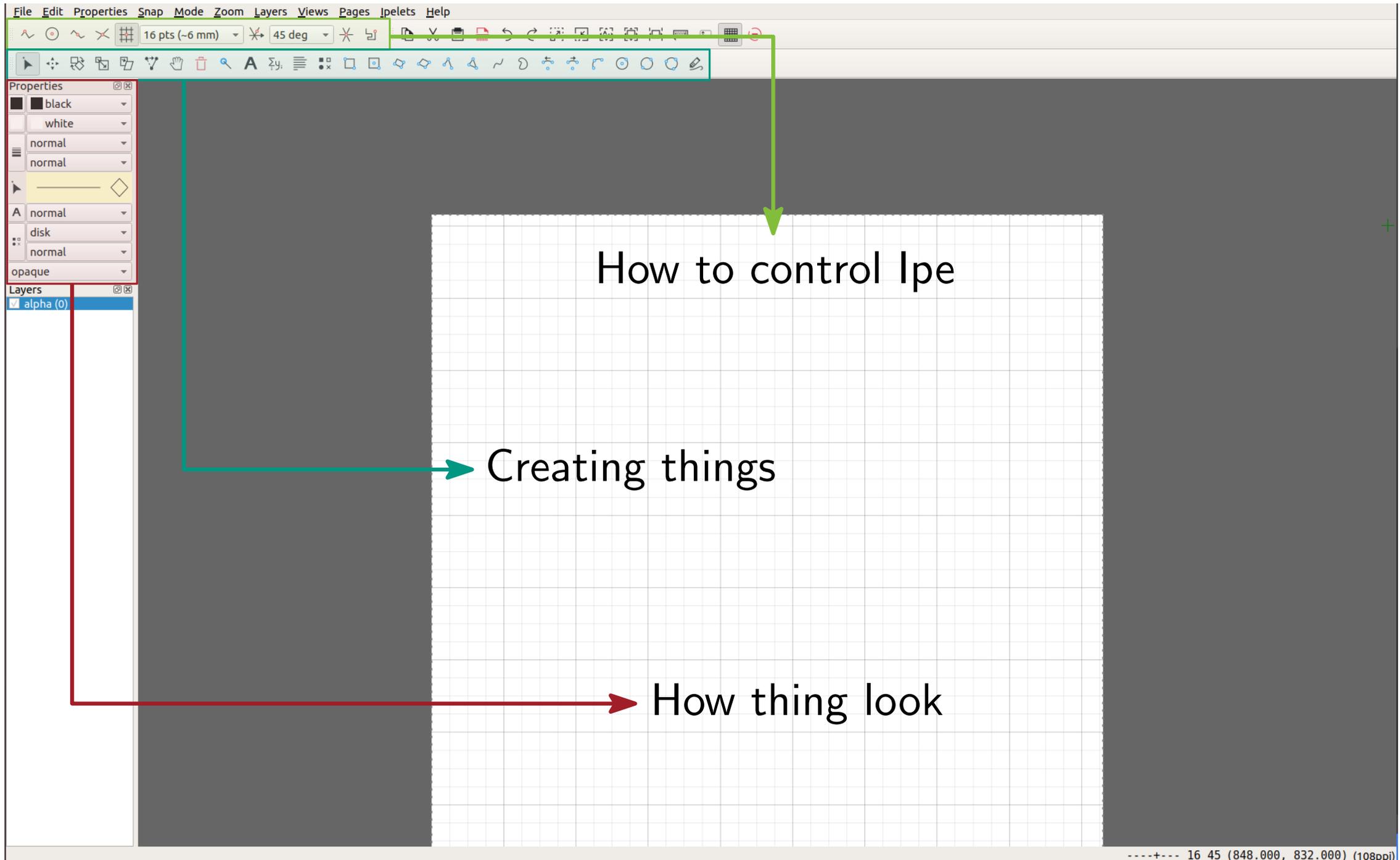
- alpha (0)

What is IPE?

- Vector editor
- Useful for creating **precise, scalable** and **easy to integrate** figures for papers, exercises presentations, sketches, etc.

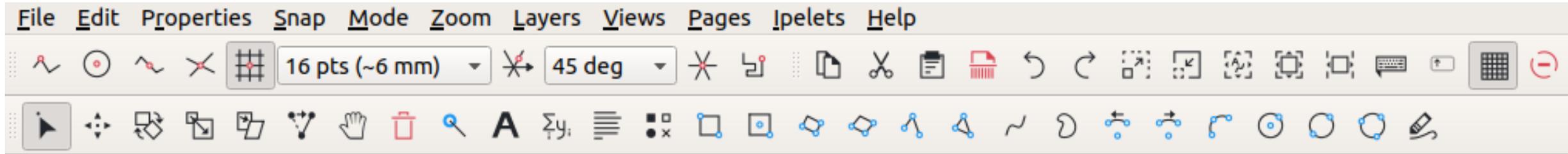
16 45 (848.000, 832.000) (108ppi) Tutorial

IPE Interface Overview



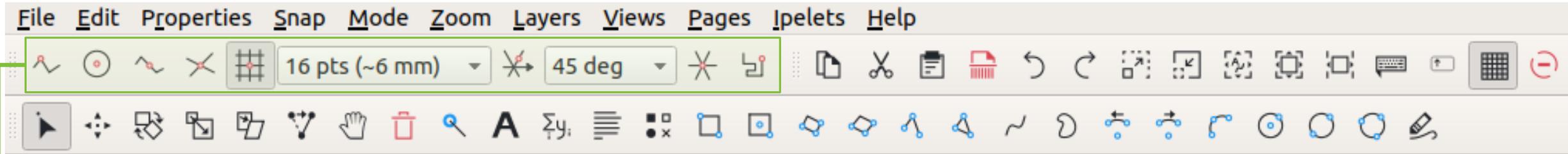
The Tools

If you are working through these slides on your own, you might want to consult the extended version of this slide at the end



The Tools

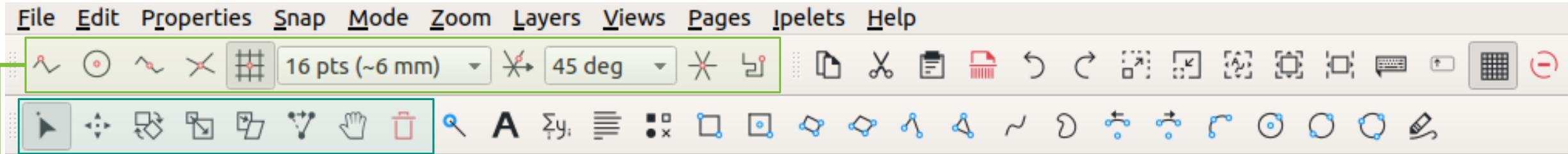
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→ Grid & Snapping

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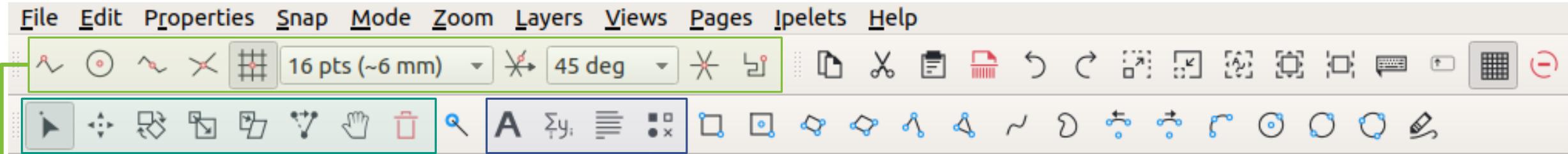


Grid & Snapping

Manipulation of objects

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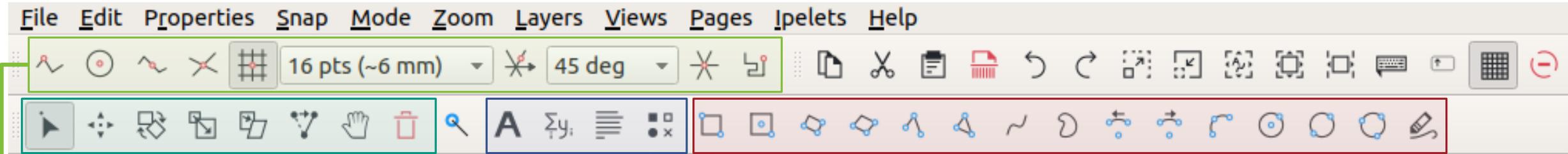
Grid & Snapping

Manipulation of objects

Text objects & Marks

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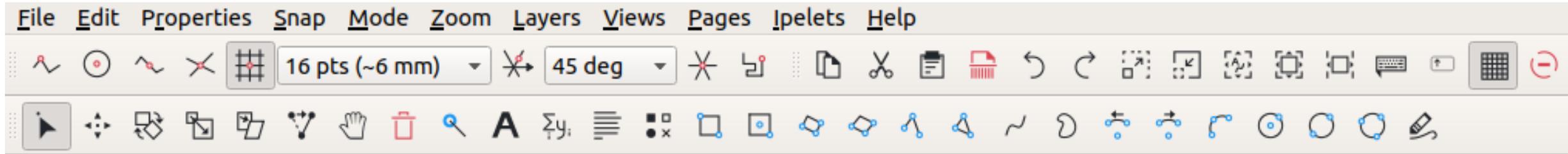
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Creation of Objects

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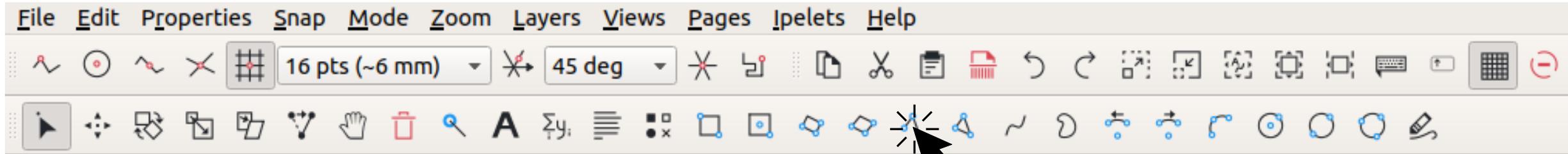
An Example:



- A line between blue points

The Tools

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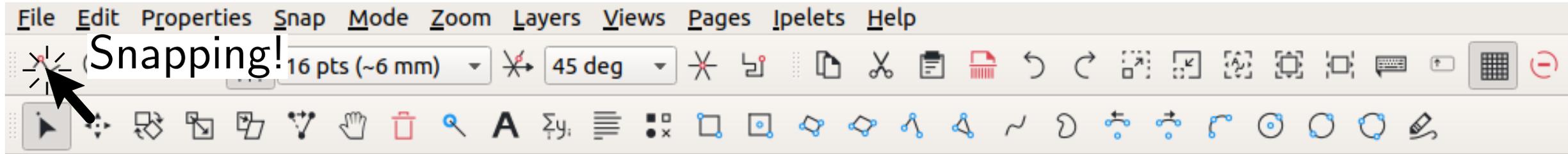
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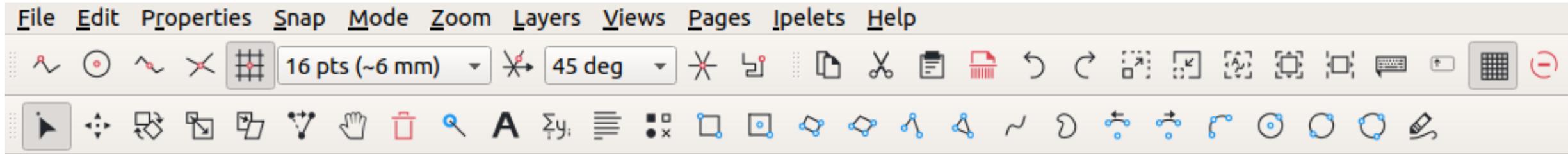
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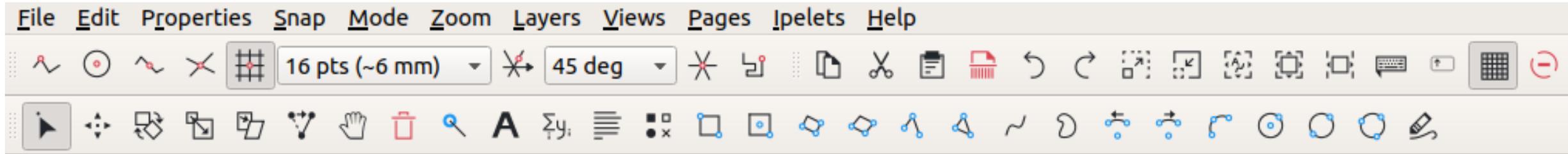
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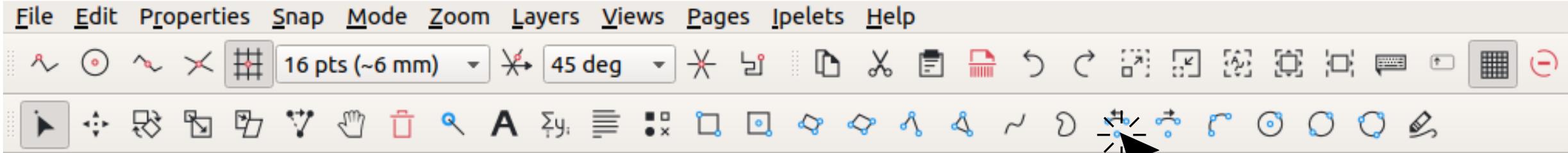
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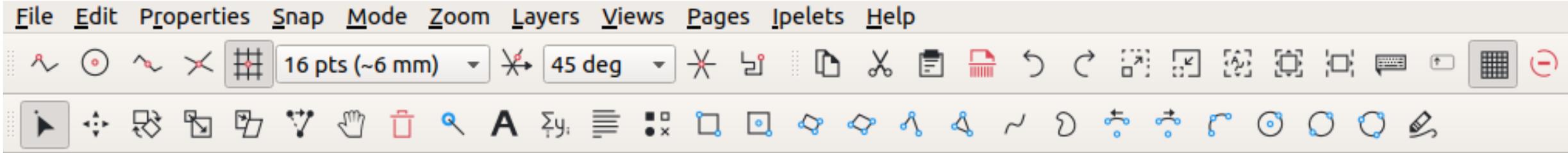
An Example:



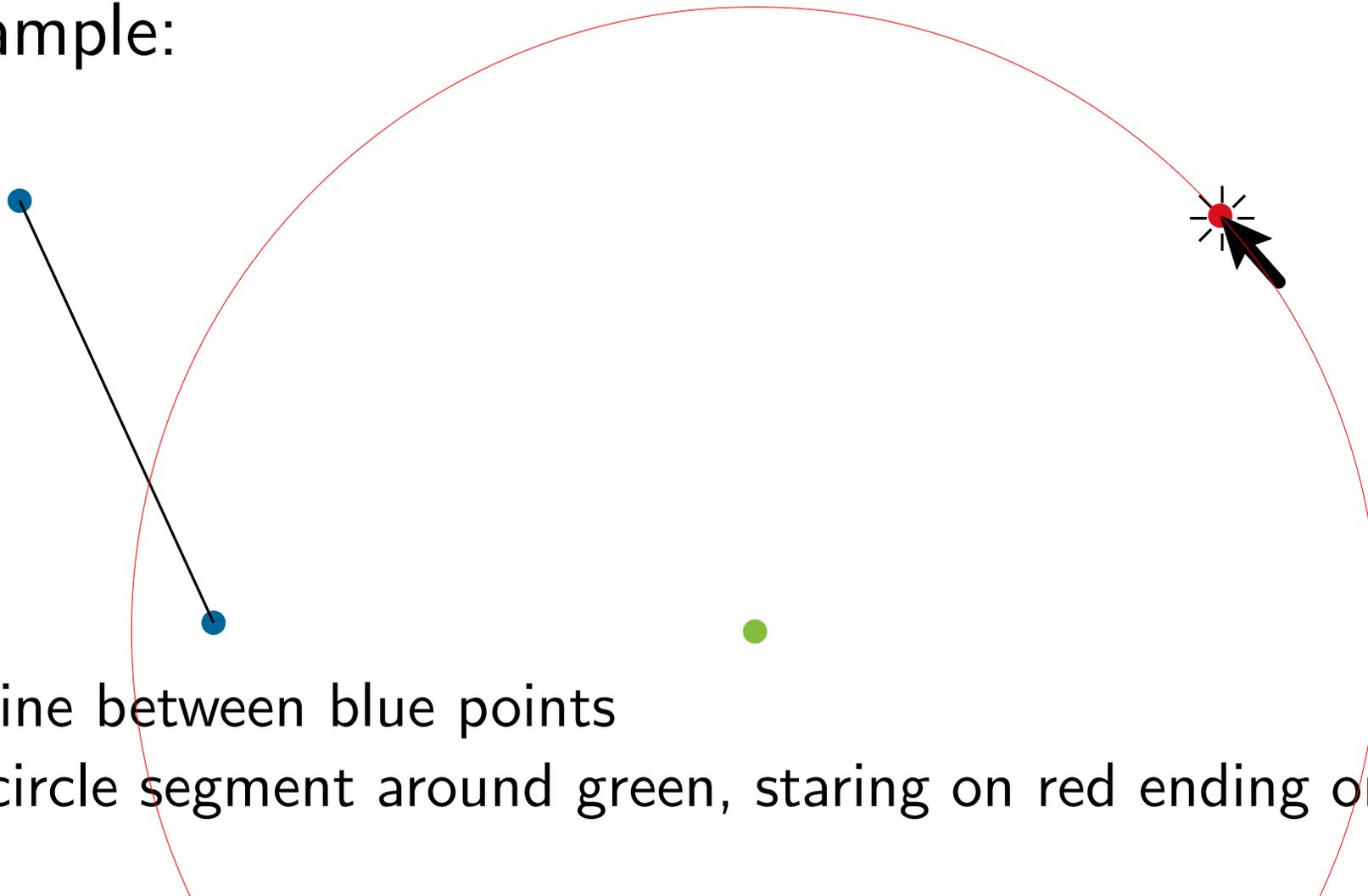
- A line between blue points
- A circle segment around green, starting on red ending on the line

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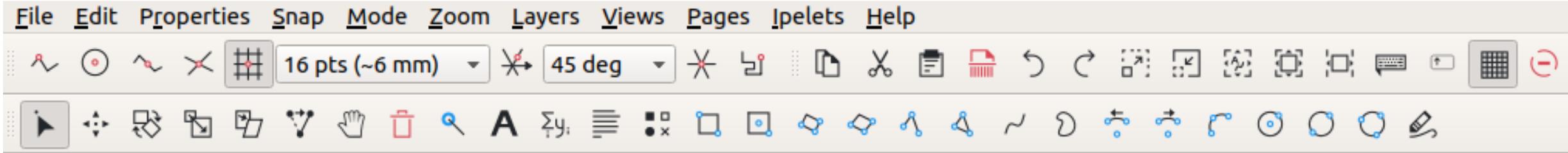
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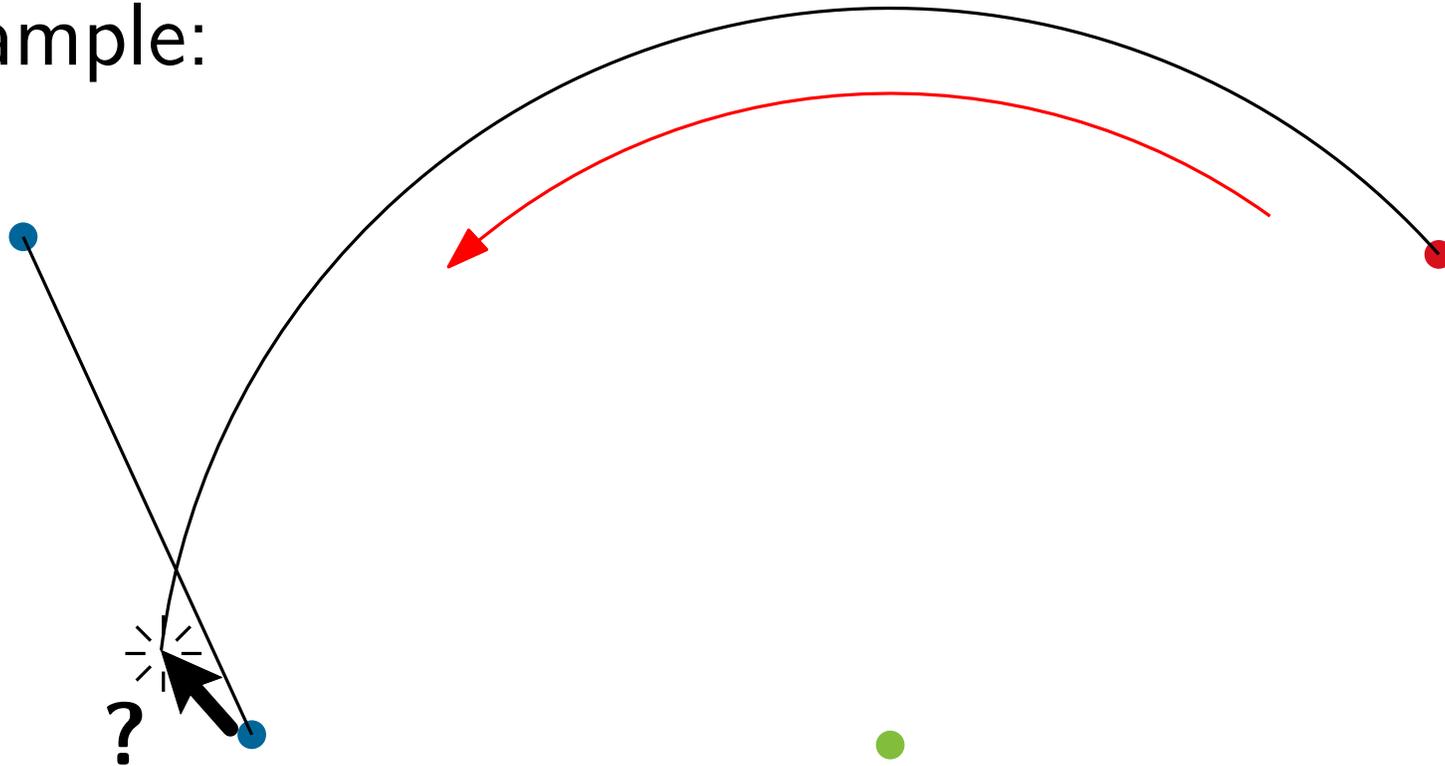
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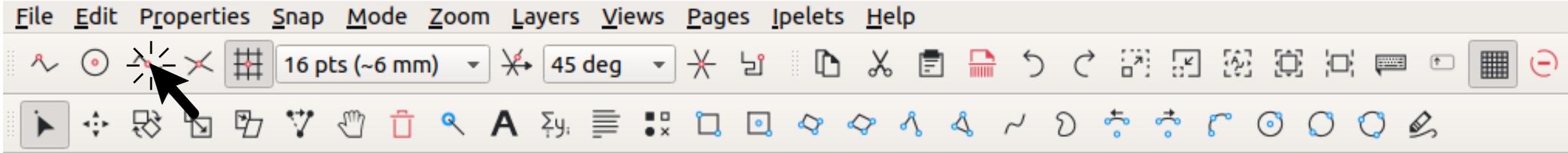
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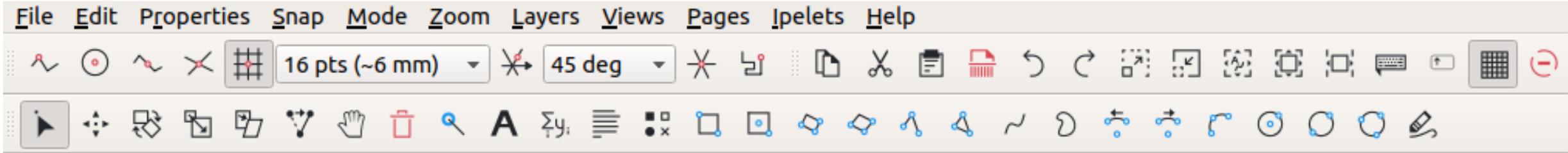
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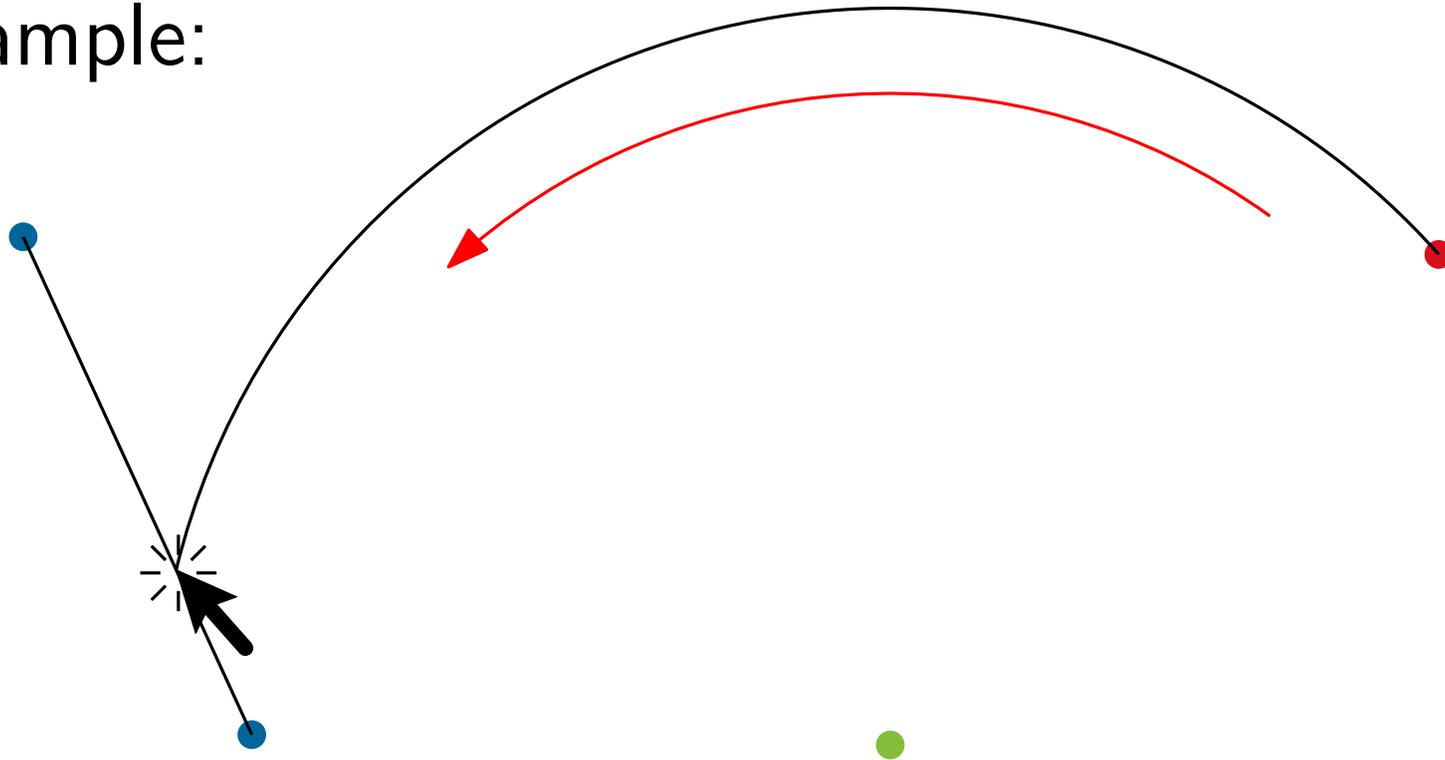
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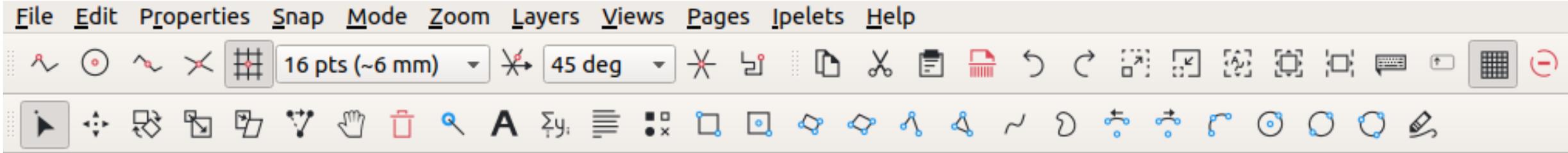
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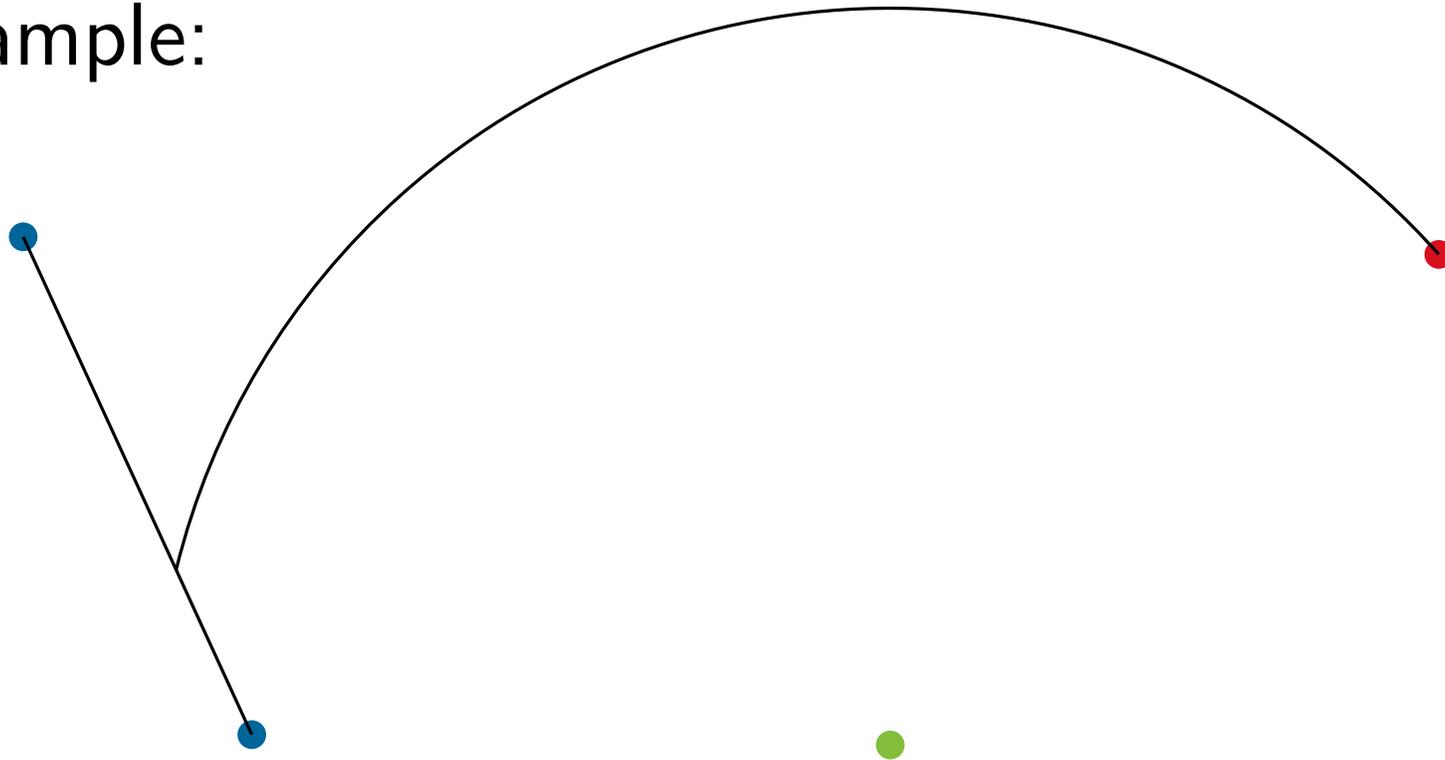
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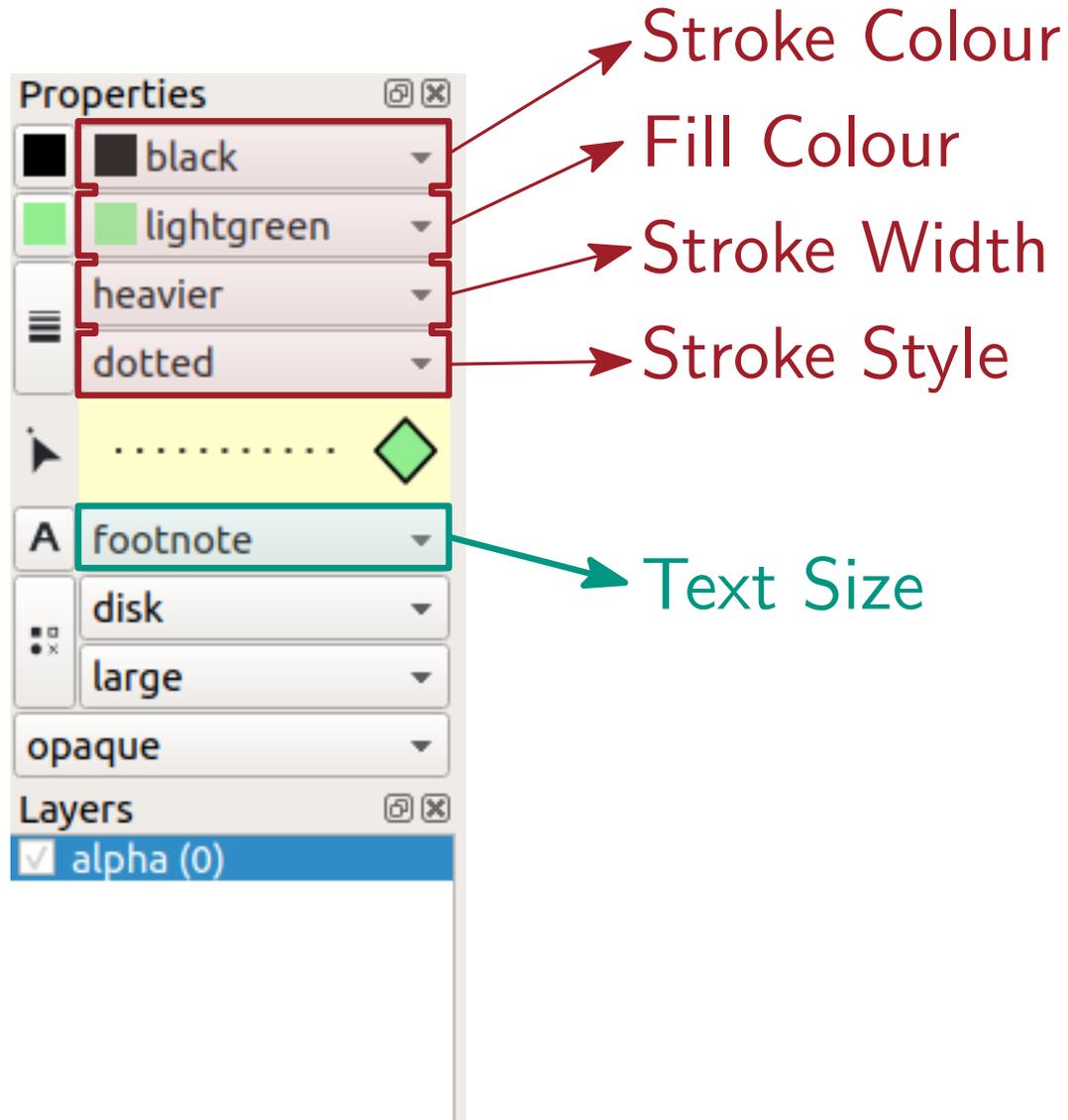
The Properties

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The screenshot shows the 'Properties' panel in IPE. The panel is divided into several sections. The top section contains four dropdown menus: 'black', 'lightgreen', 'heavier', and 'dotted'. Red arrows point from these menus to the labels 'Stroke Colour', 'Fill Colour', 'Stroke Width', and 'Stroke Style' respectively. Below these is a yellow bar with a dotted line and a green diamond icon. The next section has a dropdown menu with 'footnote' selected, with a green arrow pointing to the label 'Text Size'. Below that are two more dropdown menus: 'disk' and 'large'. The bottom section is labeled 'Layers' and contains a checked checkbox next to 'alpha (0)'. The entire panel is titled 'Properties' at the top left.

The Properties

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Stroke Colour

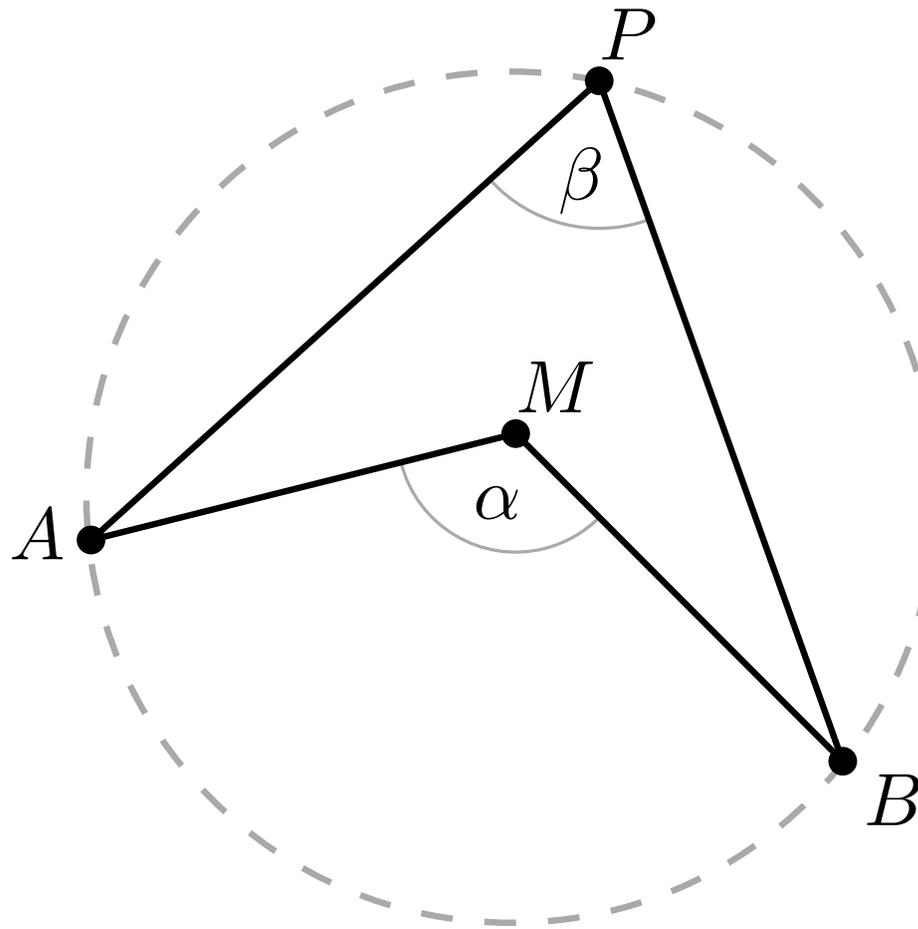
Fill Colour

Stroke Width

Stroke Style

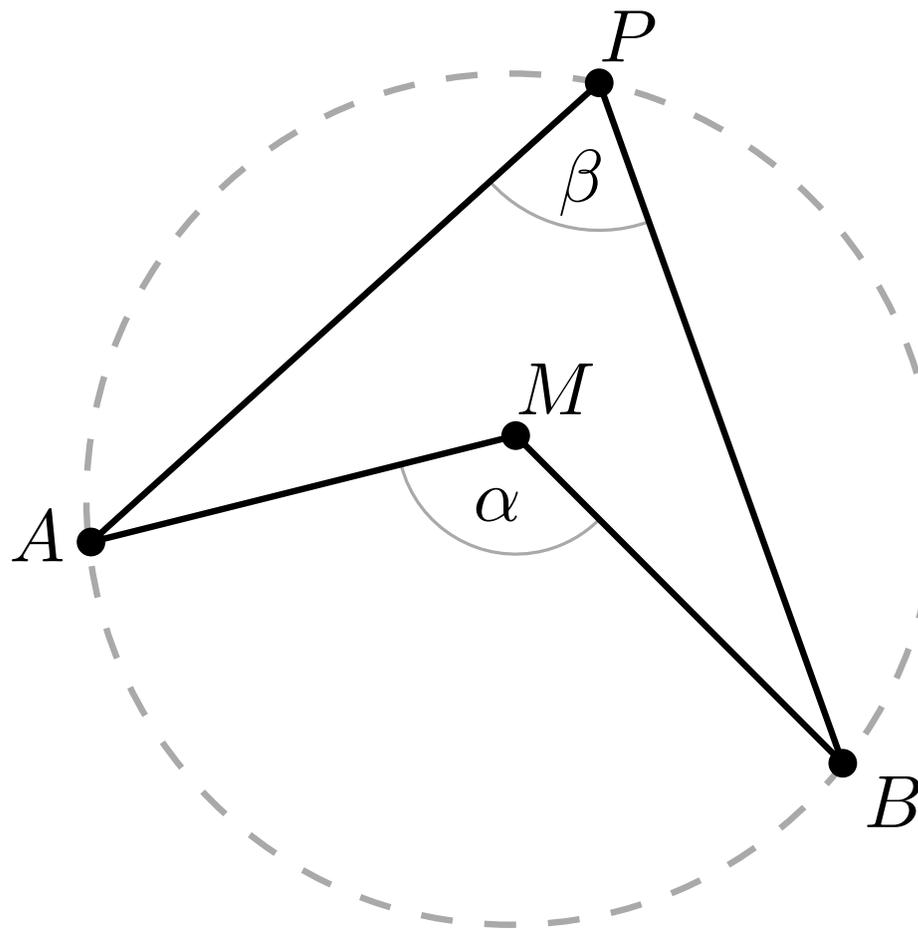
Text Size

How does Ipe think?
Changing color (or something) changes the **selected** object!
Therefore: Create and then style!



The angle at the midpoint M is double the size of the angle at P ($\alpha = 2\beta$)

~ 5 minutes



The angle at the midpoint M is double the size of the angle at P ($\alpha = 2\beta$)

Some useful shortcuts:

- [S] Select
- [E] Scale
- [R] Rotate
- [T] Translate
- [M] Marks
- [G] Minipage Text

~ 5 minutes

- An .ipe file is XML format

```
</page>
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<text layer="alpha" transformations="translations" pos="16 496" stroke=
"black" type="minipage" width="880" height="19.3928" depth="5.404"
valign="top" style="item">An .ipe file is XML format</text>
</page>
<page title="Demo I">
```

Text, \LaTeX and the .ipe File

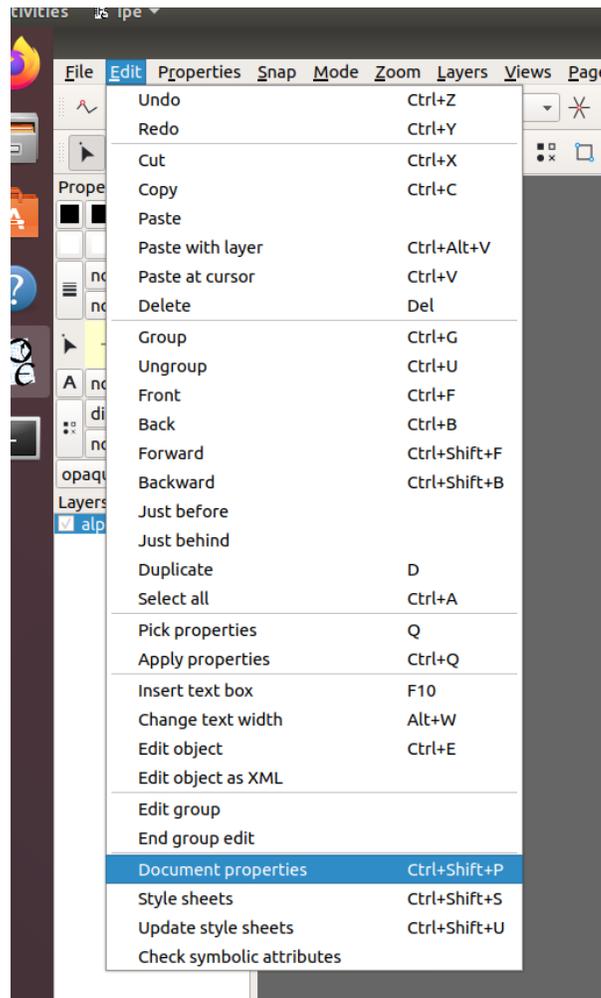
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</page>
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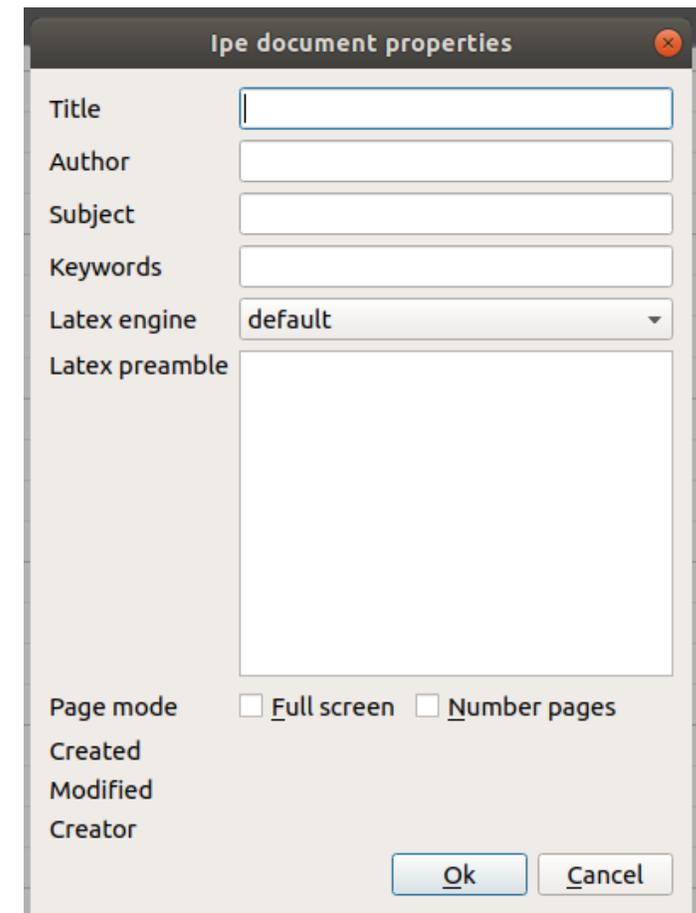
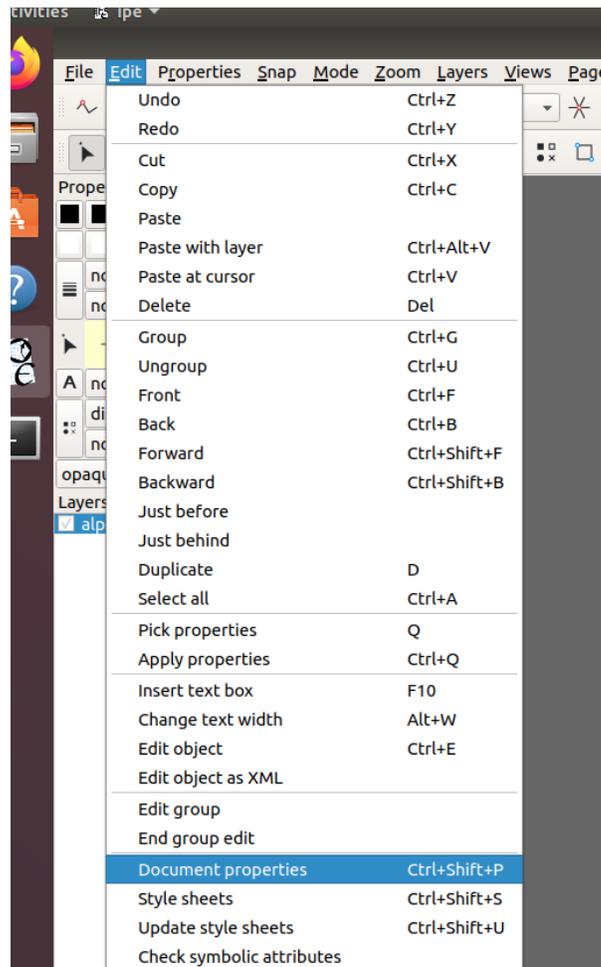
Text, L^AT_EX and the .ipe File

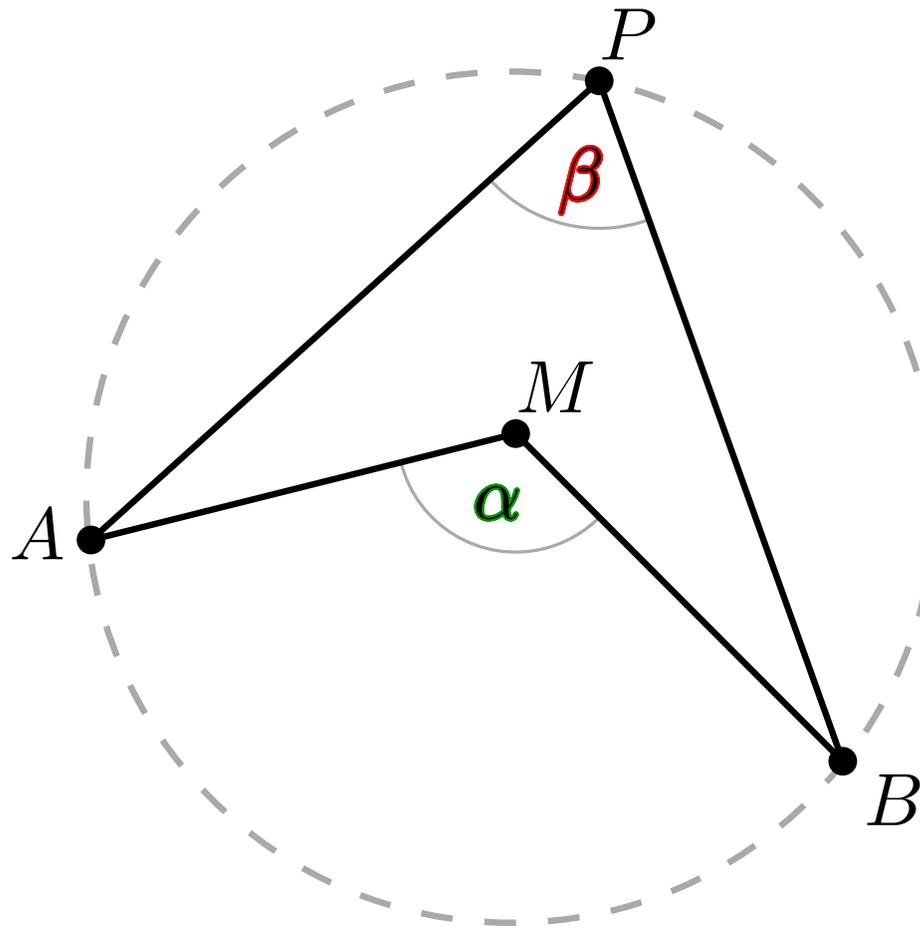
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- An ipe File has a preamble for packages, definitions, newcommands etc.



Text, L^AT_EX and the .ipe File

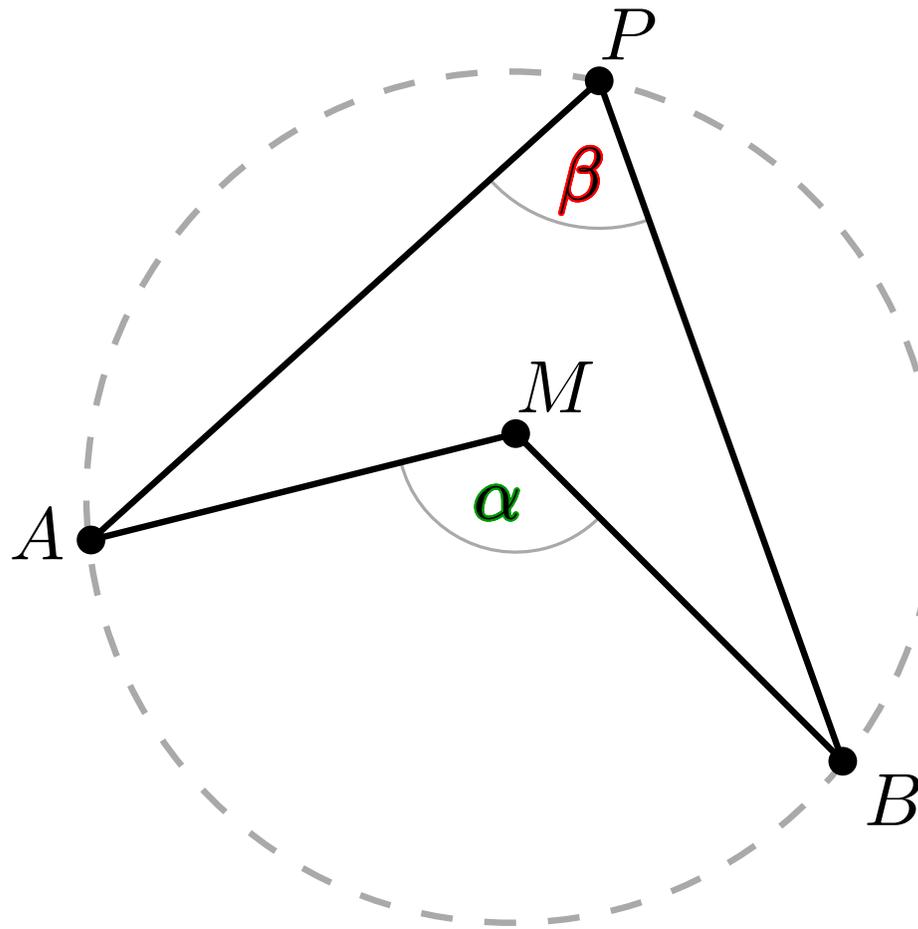
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Theorem 1 *The angle at the midpoint M is double the size of the angle at P ($\alpha = 2\beta$)*

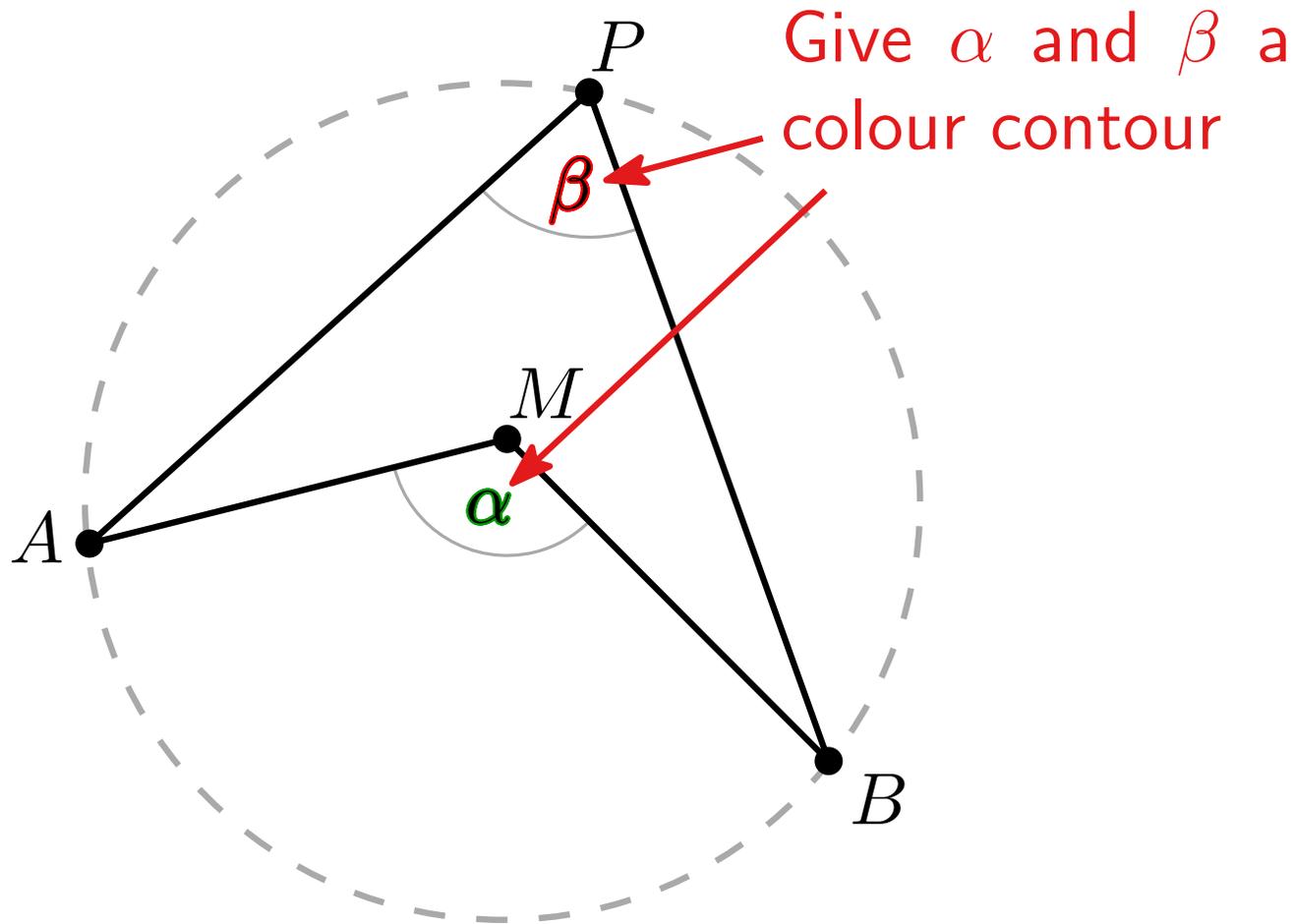
~ 2 minutes



Theorem 1 *The angle at the midpoint M is double the size of the angle at P ($\alpha = 2\beta$)*

Make this a theorem
(environment)

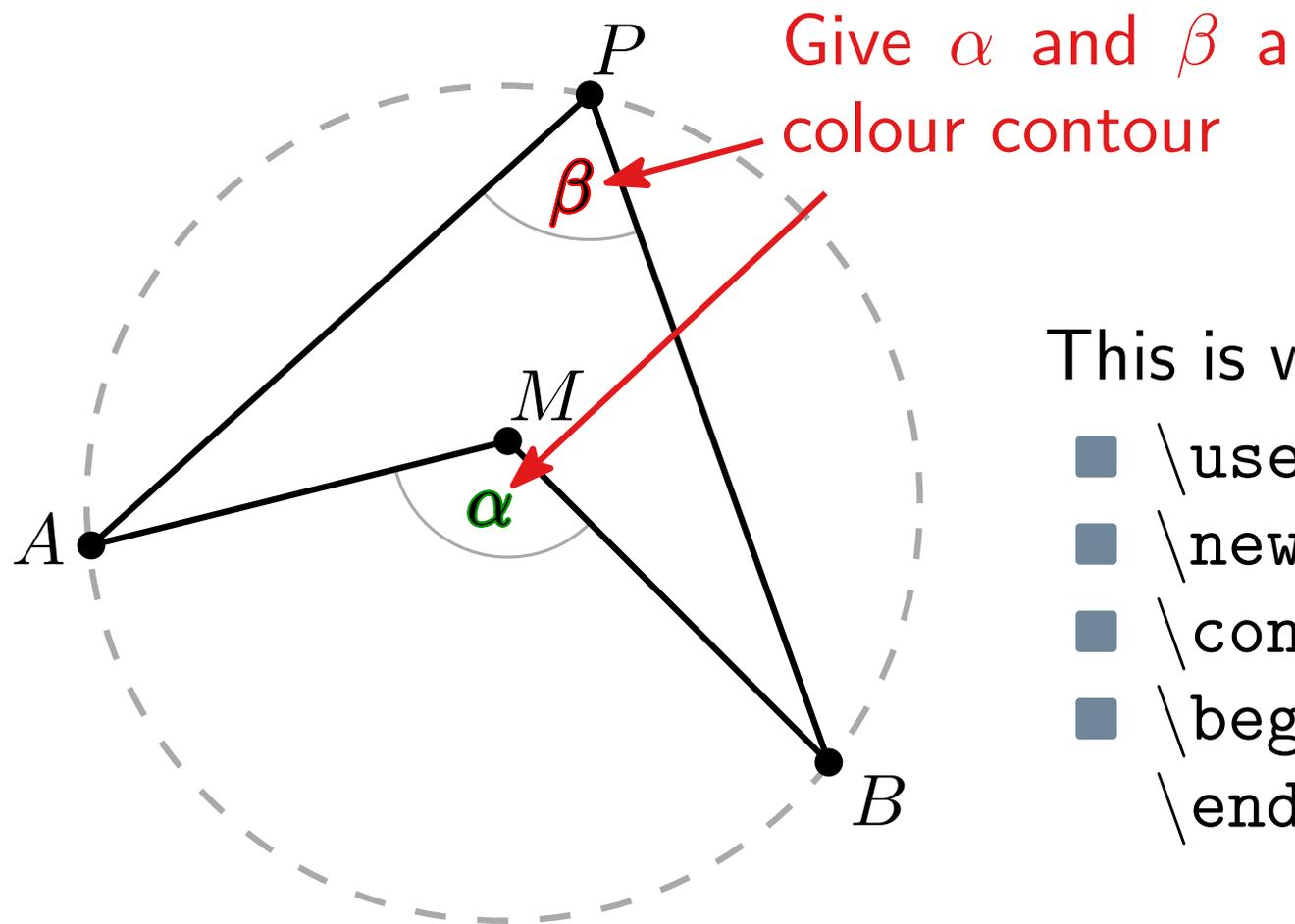
~ 2 minutes



Theorem 1 *The angle at the midpoint M is double the size of the angle at P ($\alpha = 2\beta$)*

Make this a theorem (environment)

~ 2 minutes



This is what you need

- `\usepackage{contour}`
- `\newtheorem{thm}{Theorem}`
- `\contour{COLOURNAME}{TEXT}`
- `\begin{thm} [...]`
- `\end{thm}`

Theorem 1 *The angle at the midpoint M is double the size of the angle at P ($\alpha = 2\beta$)*

Make this a theorem (environment)

~ 2 minutes

Edit Mode





In edit mode you can:

- **Move** vertices of polygons/control points of bezier curves independently
- **Cut** polygons at vertices → polyline
- **Cut** polylines at vertices → 2 sub-paths, STILL 1 object (!)
- **Duplicate** and **delete** vertices/control points



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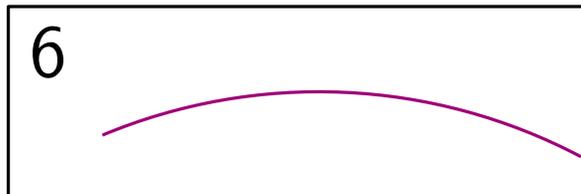
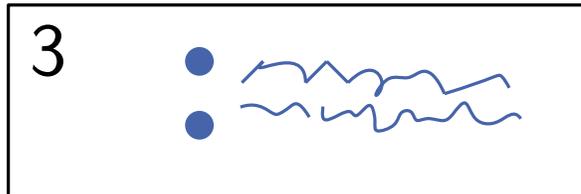
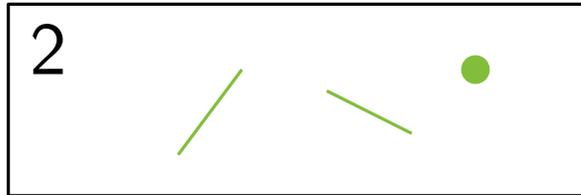
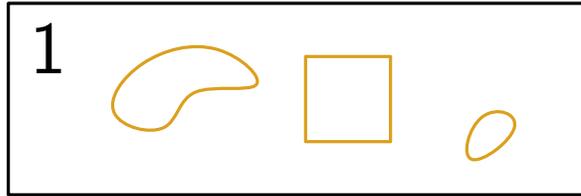
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How does Ipe think?

- Transformation tools change the appearance of an object (theres a transformation matrix for these).
- Edit mode changes its structure (number of vertices and the like).

Layers, Views & Pages

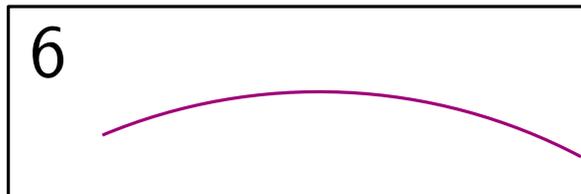
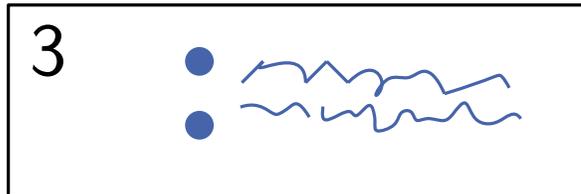
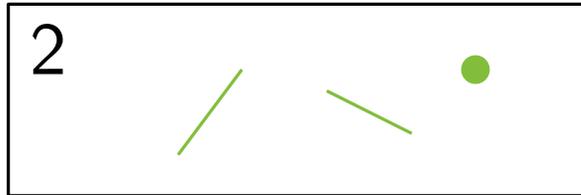
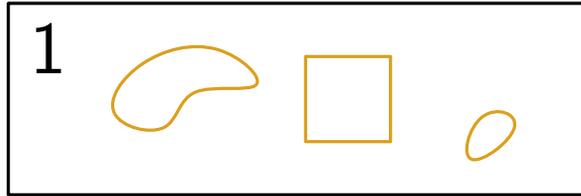
Layer



- Every object lies on exactly **one** layer

Layers, Views & Pages

Layer

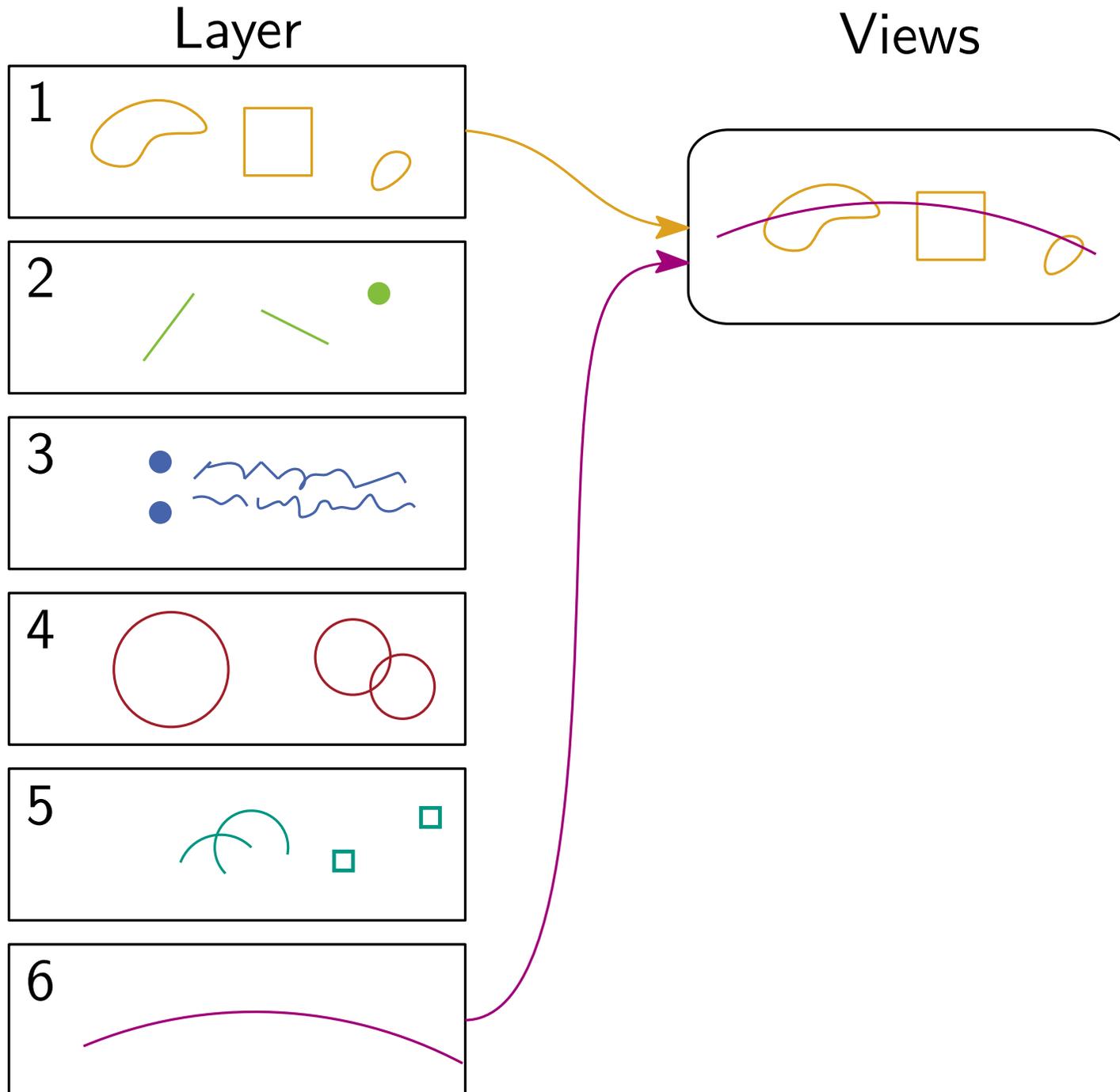


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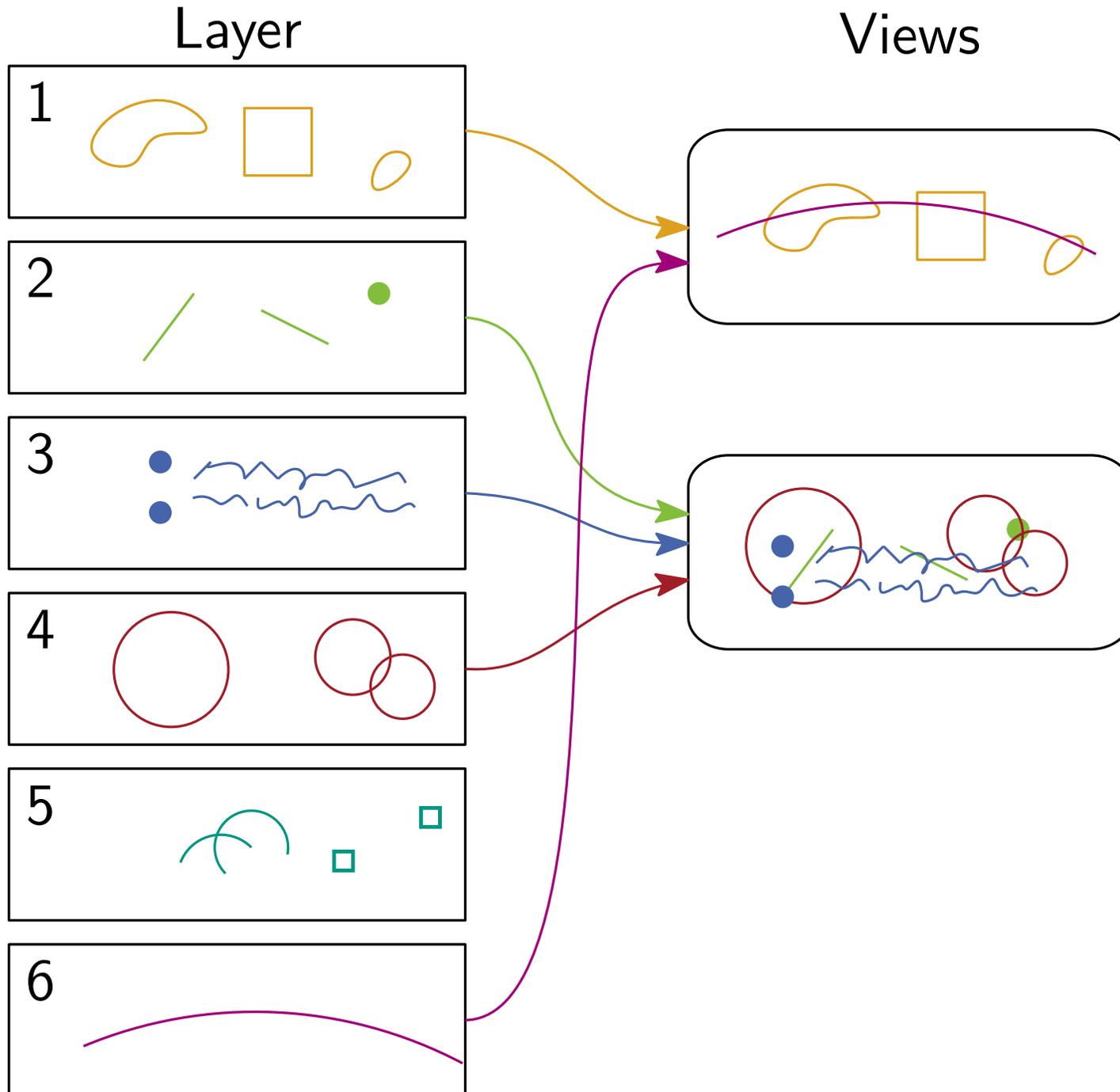
Layers and Z-Order are not related!
Different from Photoshop etc.

Layers, Views & Pages



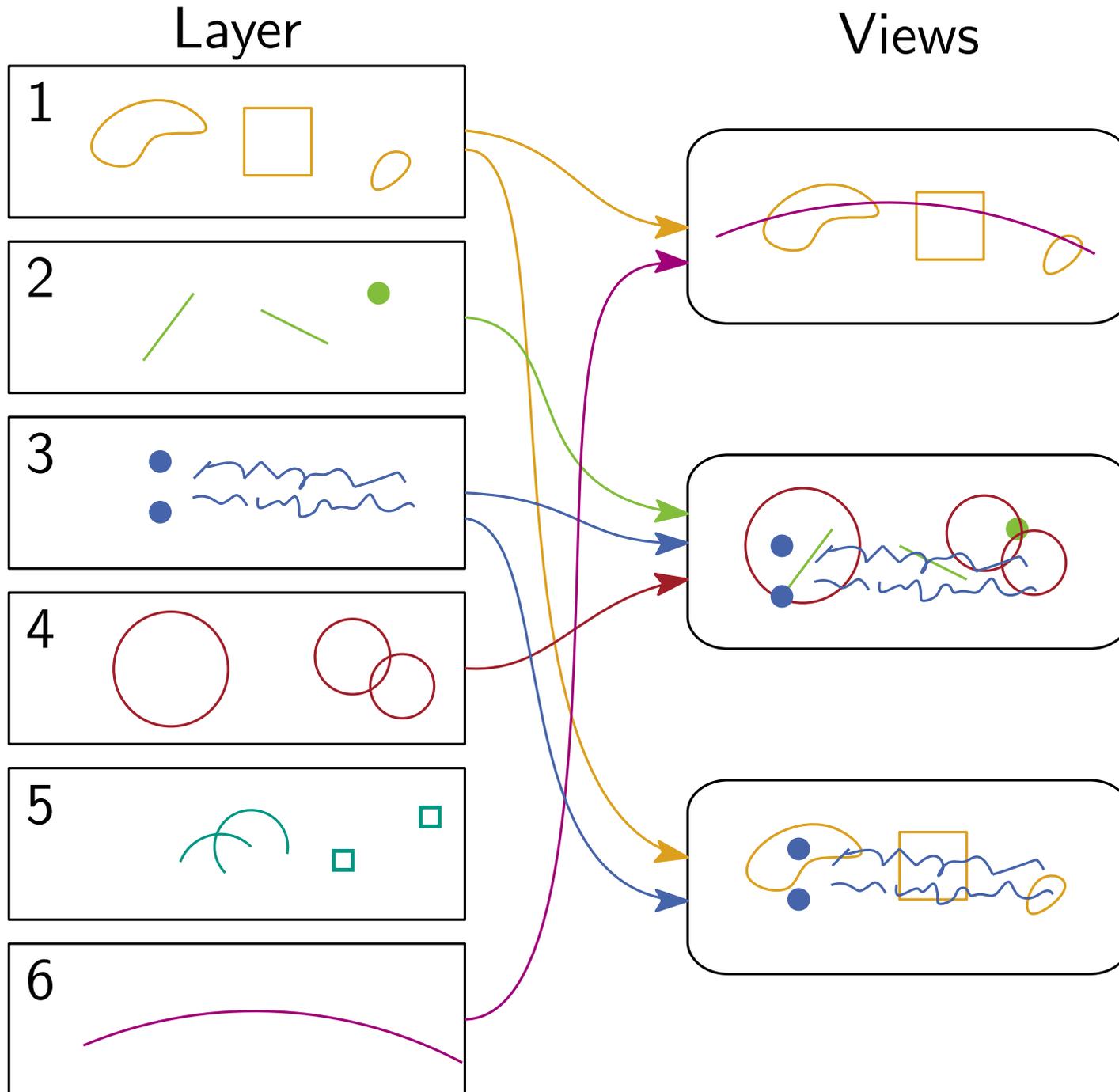
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Layers, Views & Pages



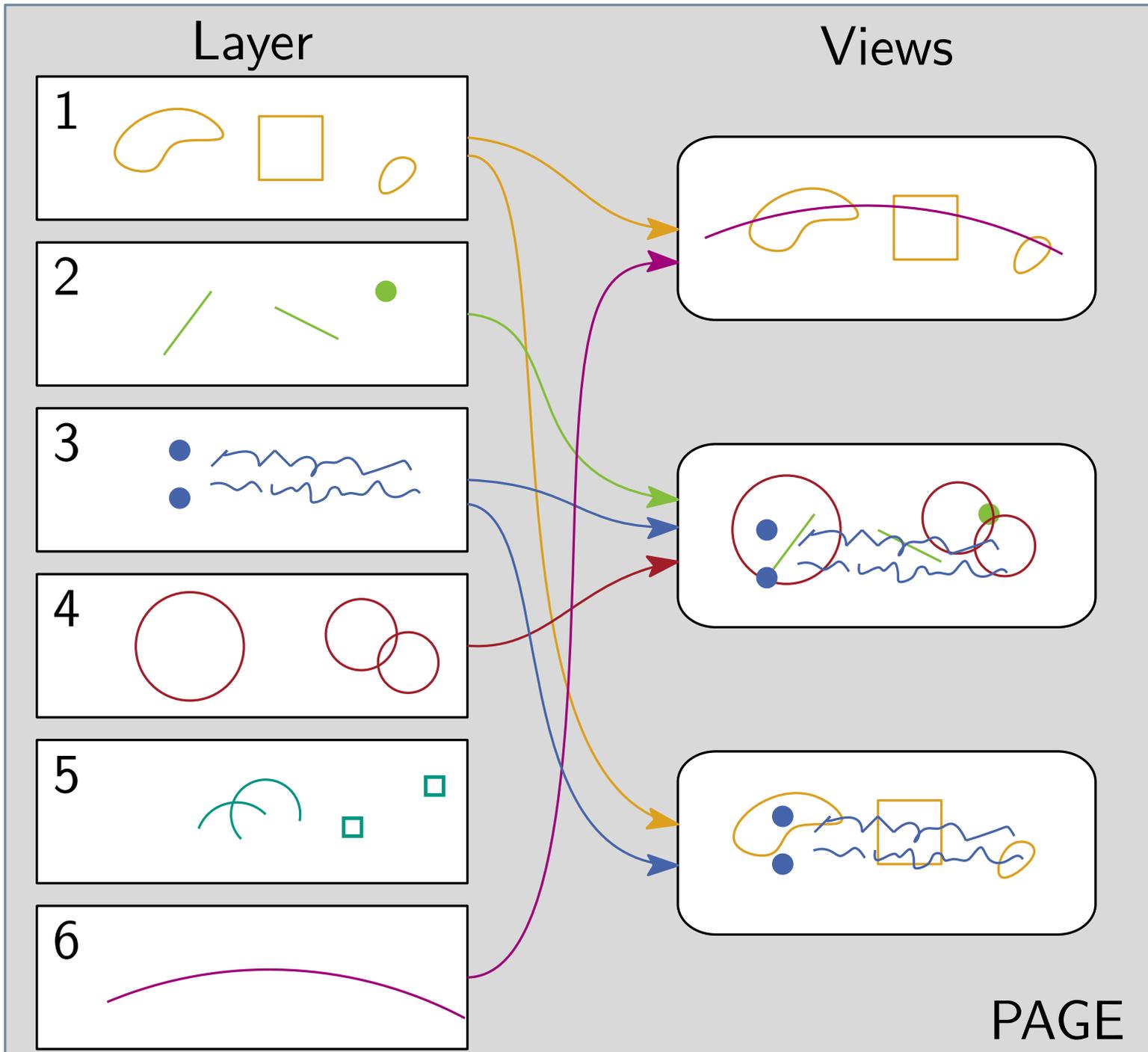
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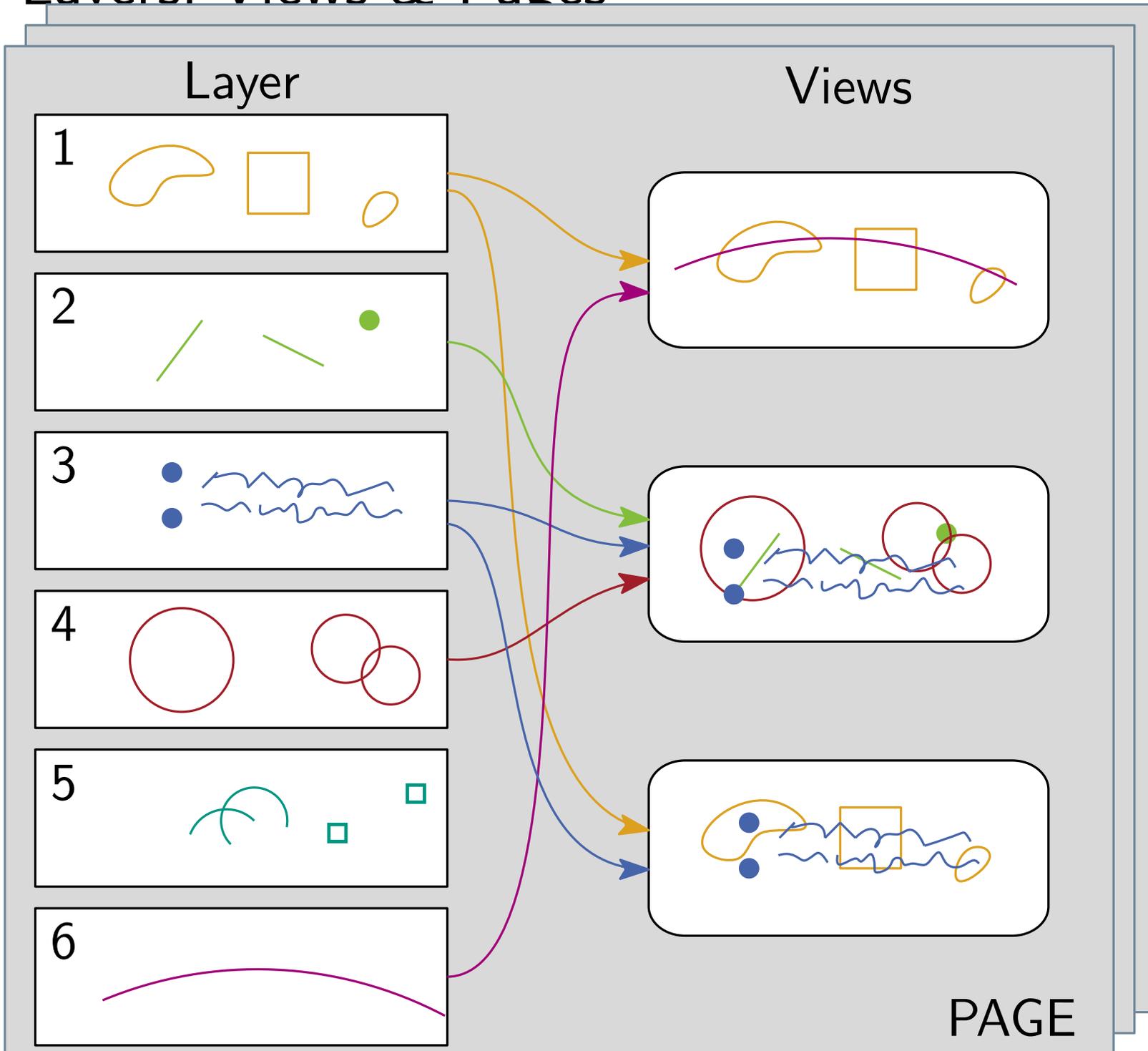
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Layers, Views & Pages



- Every object lies on exactly **one** layer
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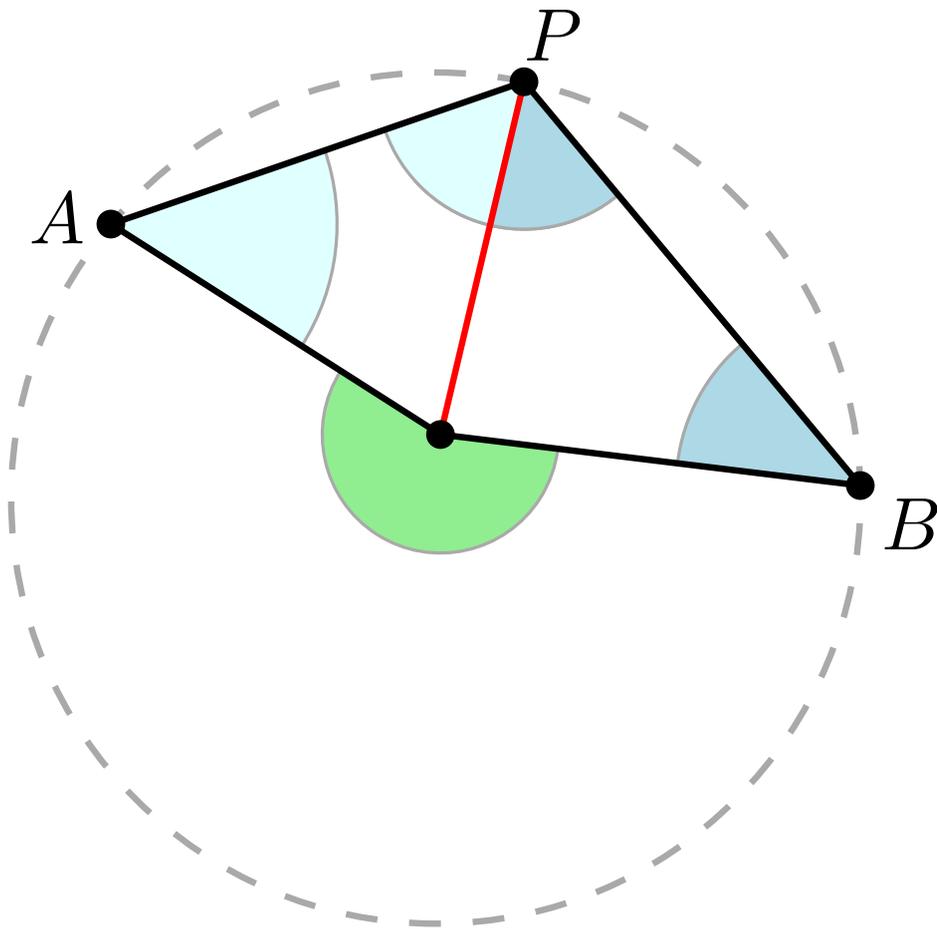
Layers, Views & Pages



- Every object lies on exactly **one** layer
- Every view can show any number and combination of layers
- All layers and views belong to one page
- One document can have many pages
- Use for variations on figures or animations in presentations

Demo II

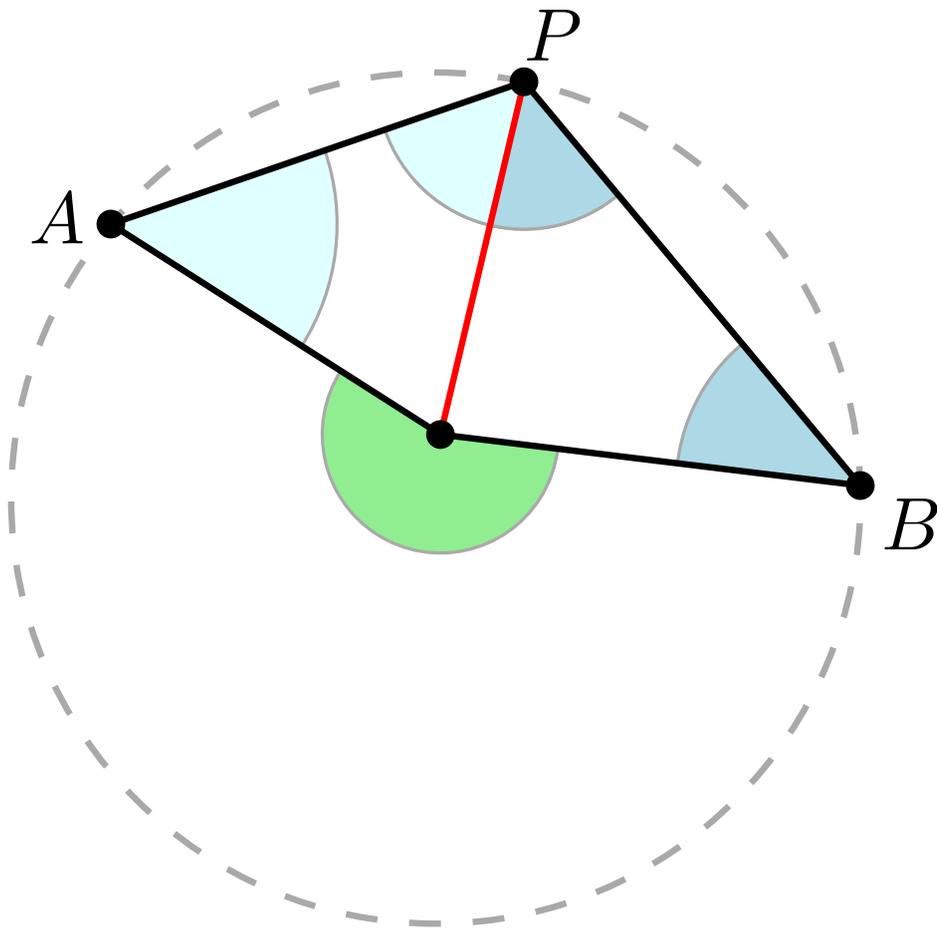
1. Create 2 new views with a new layer each ([CTRL + SHIFT + I])



~ 5+ minutes

Demo II

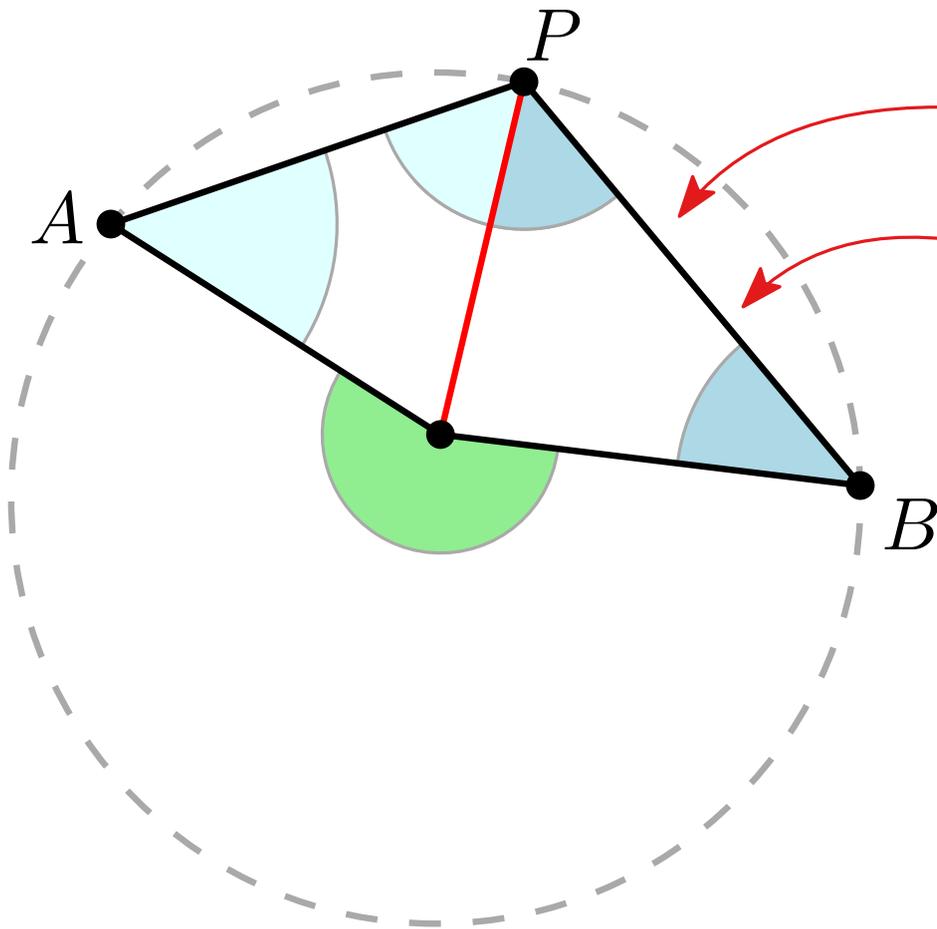
1. Create 2 new views with a new layer each ([CTRL + SHIFT + I])
2. Leave things, which are in both images on the first layer. Move the rest to the second layer.



~ 5+ minutes

Demo II

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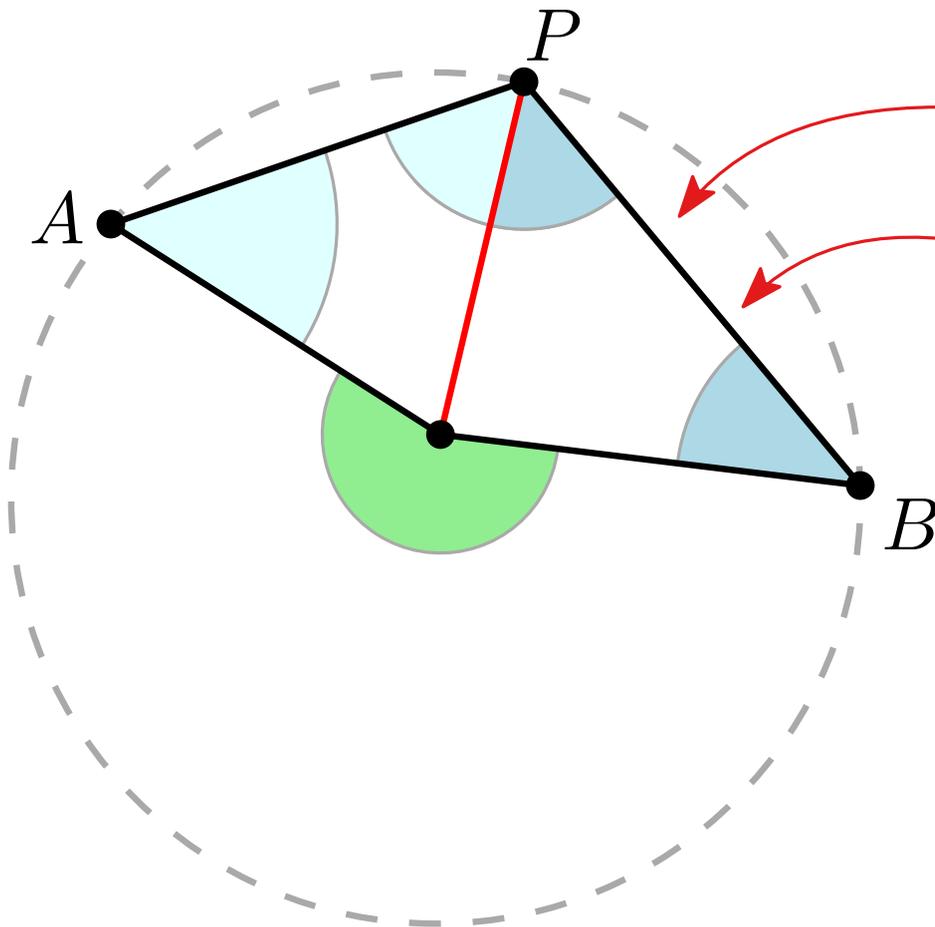
3. Copy quadrilateral to third layer and use edit mode to change the shape of the quadrilateral (where do you need to snap?)

[CTRL + E] → Edit mode

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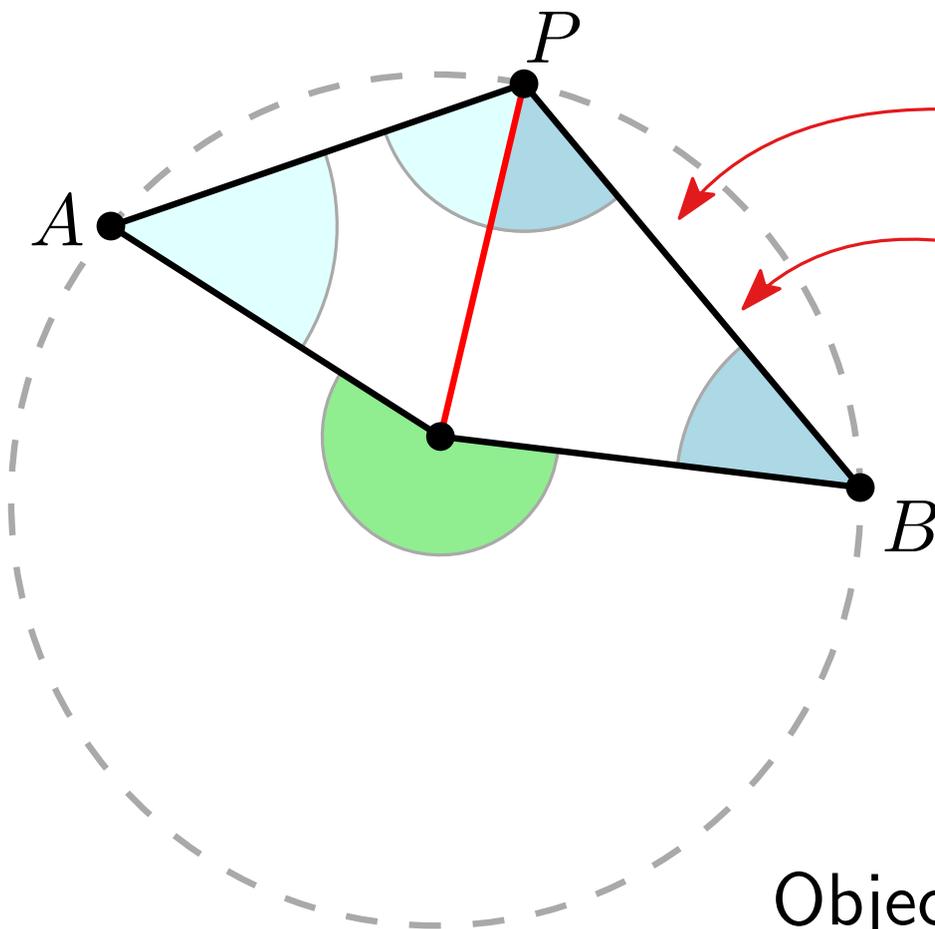
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Bonus:

- Use join to create “angle pizza slices” (what are the basic components?)
- Add styling

~ 5+ minutes

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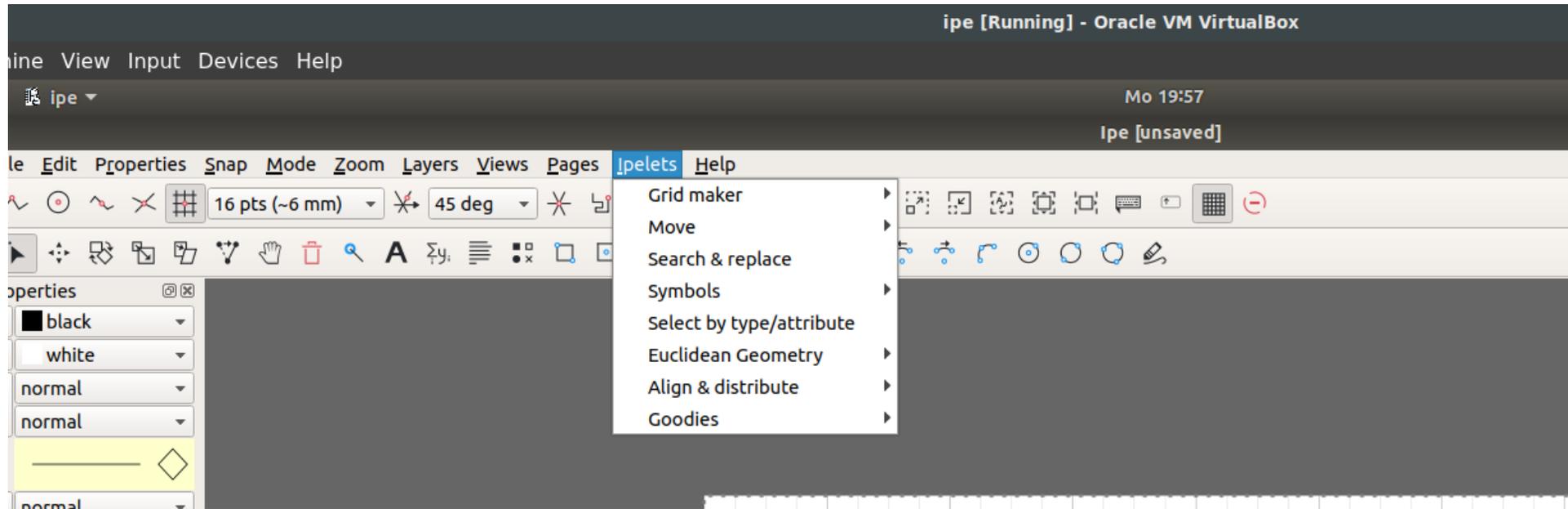
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- Add styling

Objects are added to highlighted layer
(click on layer name to change)

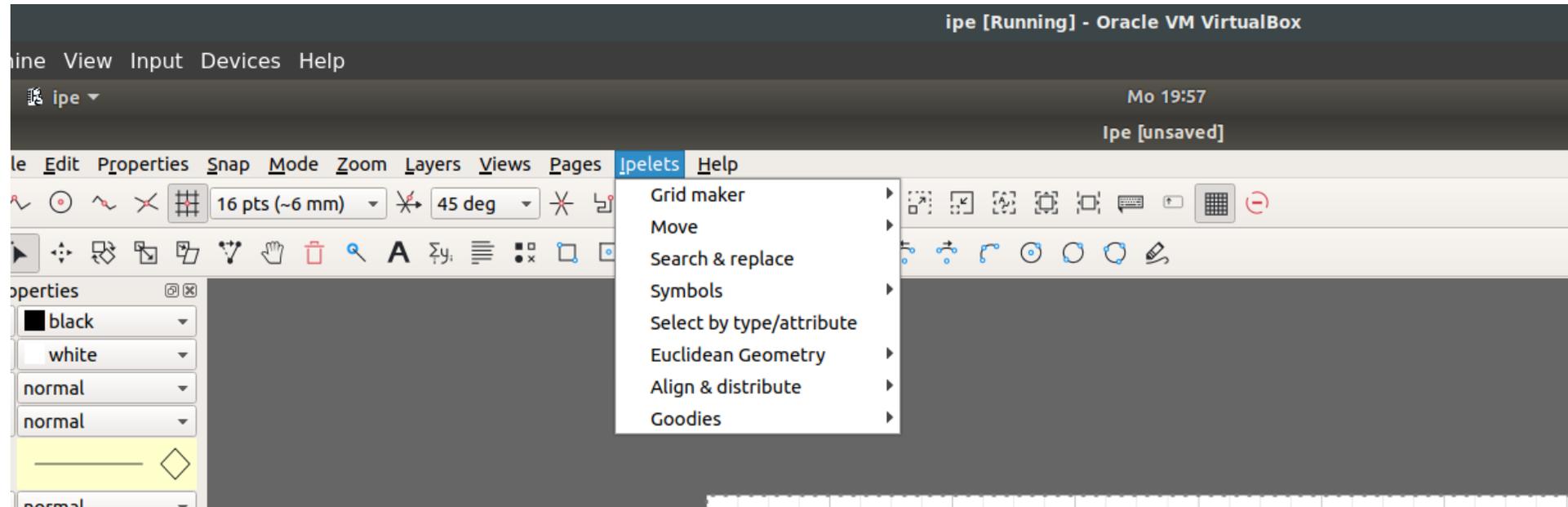
~ 5+ minutes

Ipelets

- Plugins written in Lua (like IPE itself)

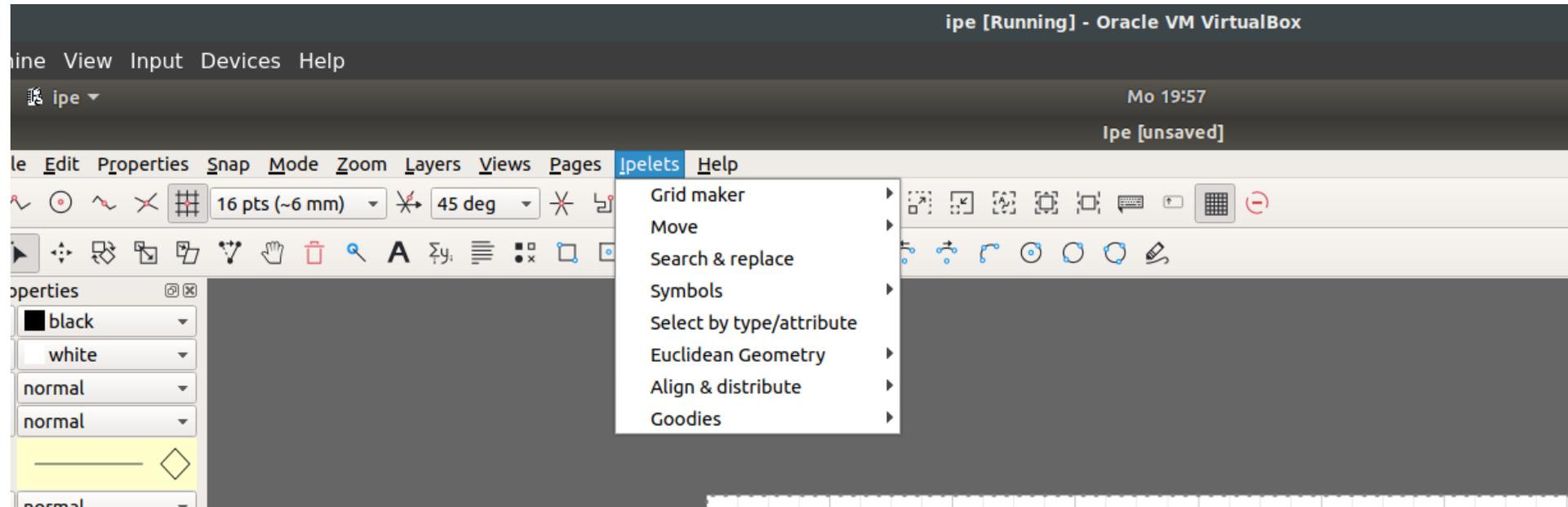


- Plugins written in Lua (like IPE itself)



- handy and often used functions (align, center, distribute, move objects)
- very specific functionality (Voronoi Diagrams/Delaunay Triangulations)
- Utility functions (triangular/custom grids)
- geometric features (mirroring, generating regular k-gons, incircles, etc.)

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- very specific functionality (Voronoi Diagrams/Delaunay Triangulations)
- Utility functions (triangular/custom grids)
- geometric features (mirroring, generating regular k-gons, incircles, etc.)
- There is a CGAL ipelet (this is advanced in setup and usage)

Tipps, Trick & Space for Notes

- **[F10]** gives you a box spanning the whole page, useful for presentations
- templates for presentations exist
- Pagenumbers are built into ipe (but sometimes tricky)
- Decorations ipelet allows for automatically boxed text (I haven't checked compatibility for some versions)

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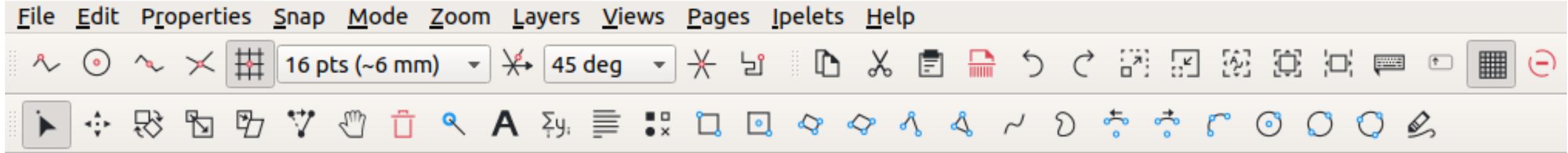
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- Decorations ipelet allows for automatically boxed text (I haven't checked compatibility for some versions)
- Grouped objects can be clipped by a path (e.g. crop images)
- There is a tool to move graph edges together with nodes (use marks and single polylines to create the graph)



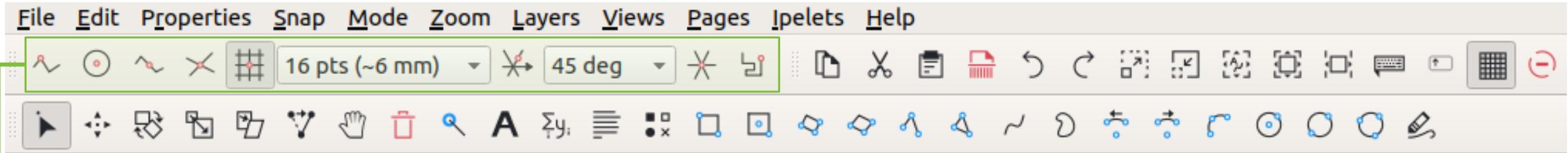
Tipps, Trick & Space for Notes

- **[F10]** gives you a box spanning the whole page, useful for presentations
- templates for presentations exist
- Pagenumbers are built into ipe (but sometimes tricky)
- Decorations ipelet allows for automatically boxed text (I haven't checked compatibility for some versions)
- Grouped objects can be clipped by a path (e.g. crop images)
- There is a tool to move graph edges together with nodes (use marks and single polylines to create the graph) 
- Almost everything you see can be changed through style-files

The Tools [EXTENDED VERSION]

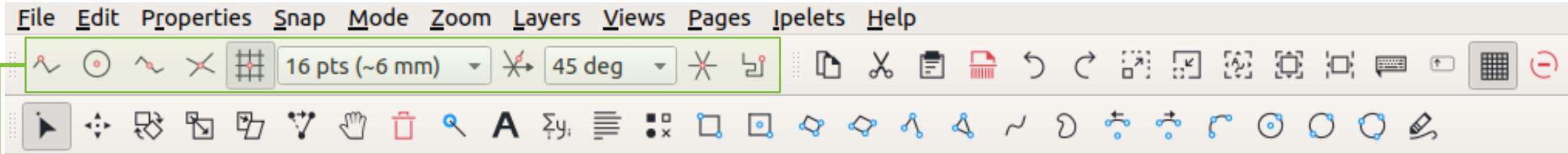


The Tools [EXTENDED VERSION]



Grid & Snapping

The Tools [EXTENDED VERSION]

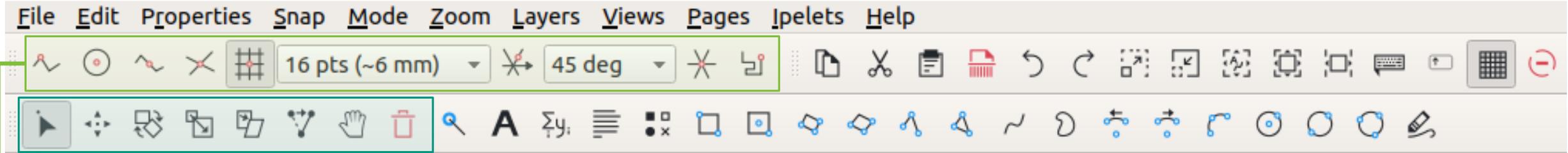


→ Grid & Snapping



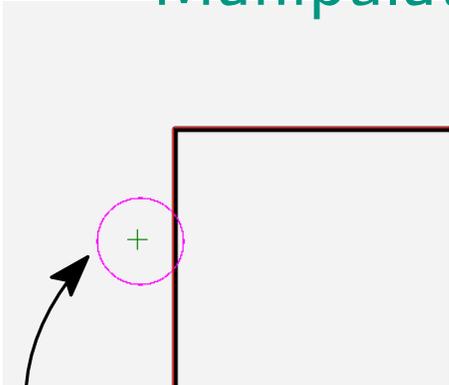
- Grid
- Intersection
- Lines
- Centers (Objects), Corners of Text
- Endpoints & Marks

The Tools [EXTENDED VERSION]



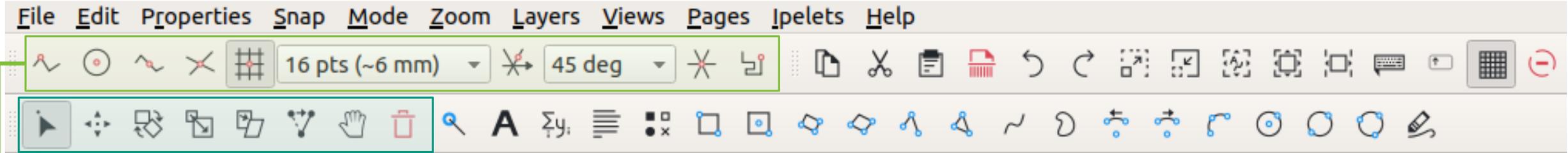
Grid & Snapping

Manipulation of objects



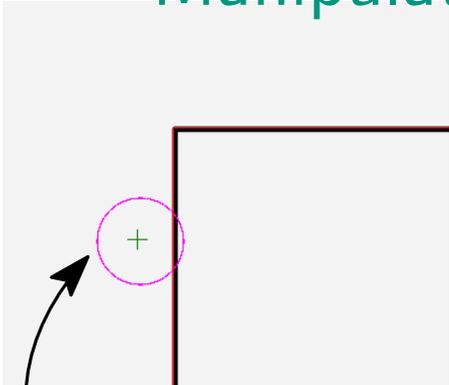
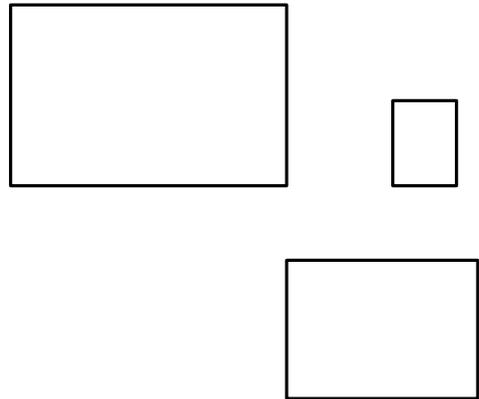
Theres a radius of selection

The Tools [EXTENDED VERSION]



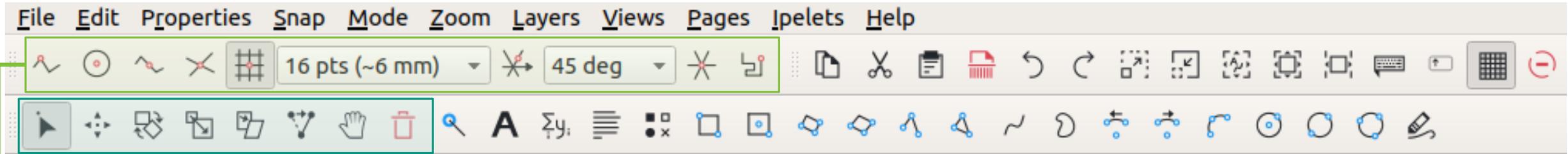
Grid & Snapping

Manipulation of objects



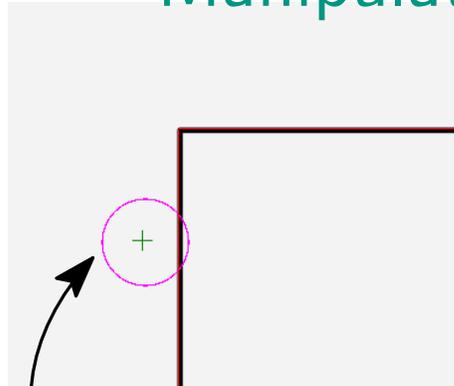
Theres a radius of selection

The Tools [EXTENDED VERSION]

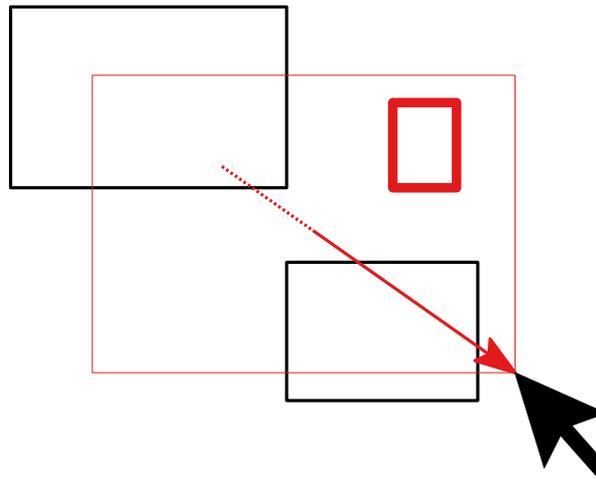


Grid & Snapping

Manipulation of objects

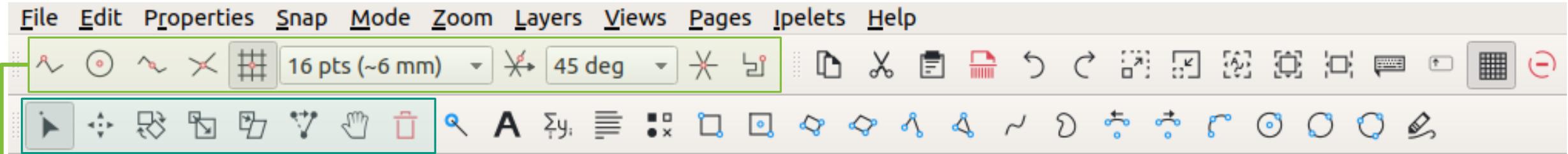


Theres a radius of selection



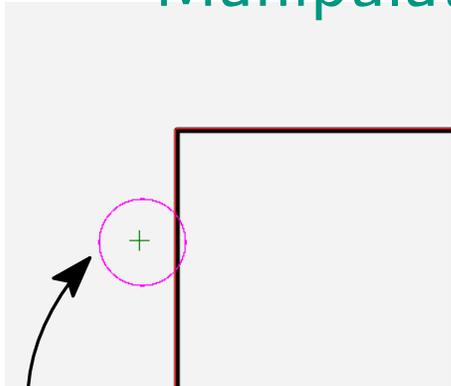
left \rightarrow right \implies select included

The Tools [EXTENDED VERSION]

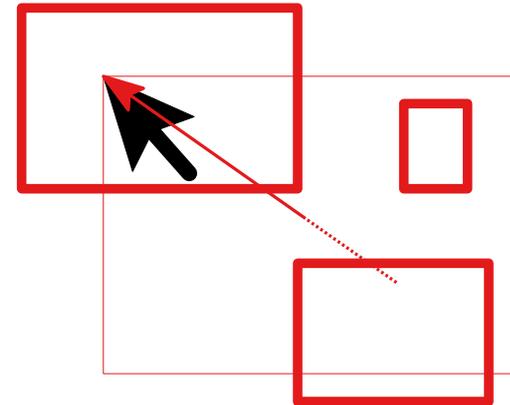


Grid & Snapping

Manipulation of objects

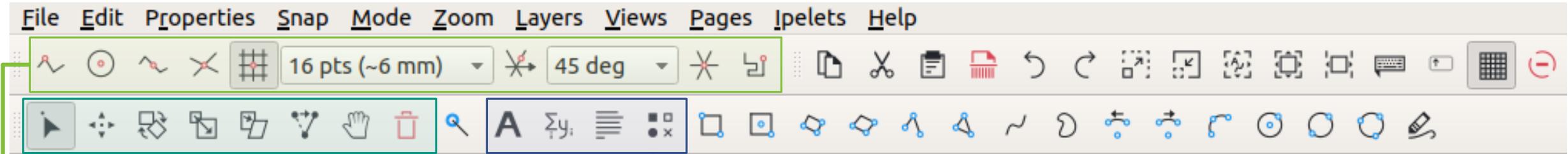


Theres a radius of selection



left \rightarrow right \implies select included
right \rightarrow left \implies select intersected

The Tools [EXTENDED VERSION]

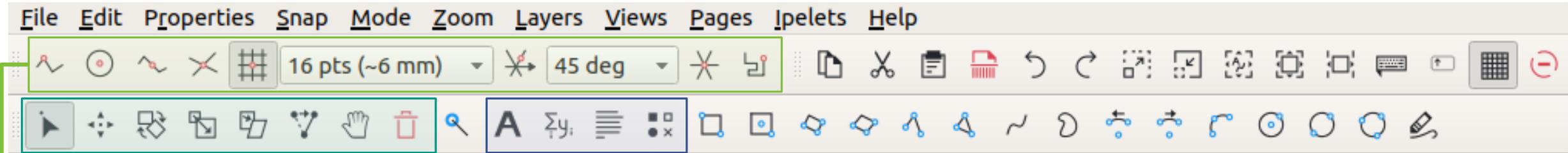


Grid & Snapping

Manipulation of objects

Text objects & Marks

The Tools [EXTENDED VERSION]



Grid & Snapping

Manipulation of objects

Text objects & Marks

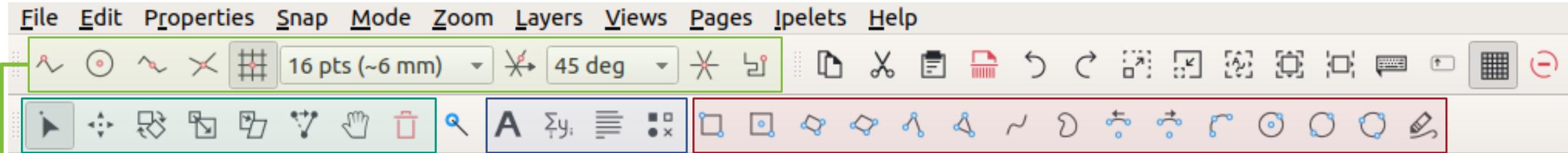


↳ Minipage (multiline, fixed width)

↳ Just adds \$ [TEXT] \$ to label

↳ Meant for labels in figures (no Linebreaks, some commands don't work, adaptive width)

The Tools [EXTENDED VERSION]



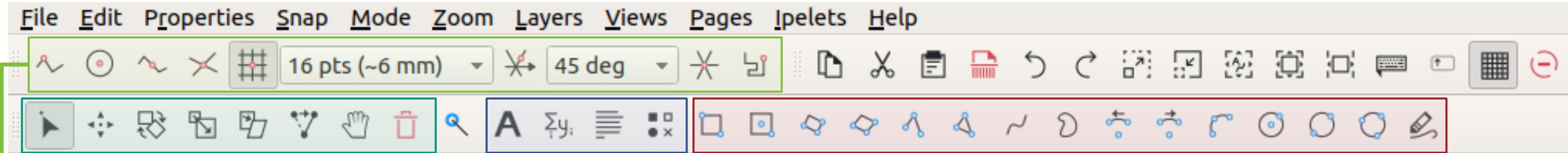
Grid & Snapping

Manipulation of objects

Text objects & Marks

Creation of Objects

The Tools [EXTENDED VERSION]



Grid & Snapping

Manipulation of objects

Text objects & Marks

Creation of Objects

1.  Rectangle by opposing corners
2.  Polylines/-gons, Curves

3.  Circle by center and size
4.  Circle segments by center, start, end

The Properties [EXTENDED VERSION]



The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE. A red box highlights the first four settings, with red arrows pointing to their labels:

- Stroke Colour:** Points to the 'black' dropdown menu.
- Fill Colour:** Points to the 'lightgreen' dropdown menu.
- Stroke Width:** Points to the 'heavier' dropdown menu.
- Stroke Style:** Points to the 'dotted' dropdown menu.

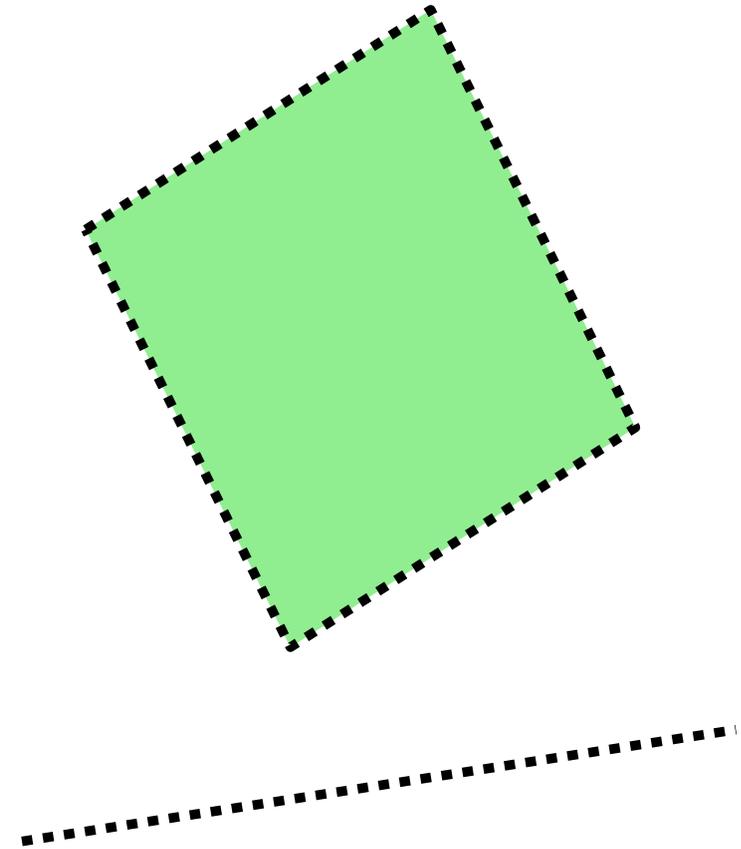
Other visible settings in the panel include:

- A yellow highlight on the '.....' stroke style with a green diamond icon.
- 'A footnote' dropdown menu.
- 'disk' dropdown menu.
- 'large' dropdown menu.
- 'opaque' dropdown menu.
- 'Layers' section with a checked 'alpha (0)' layer.

The Properties [EXTENDED VERSION]

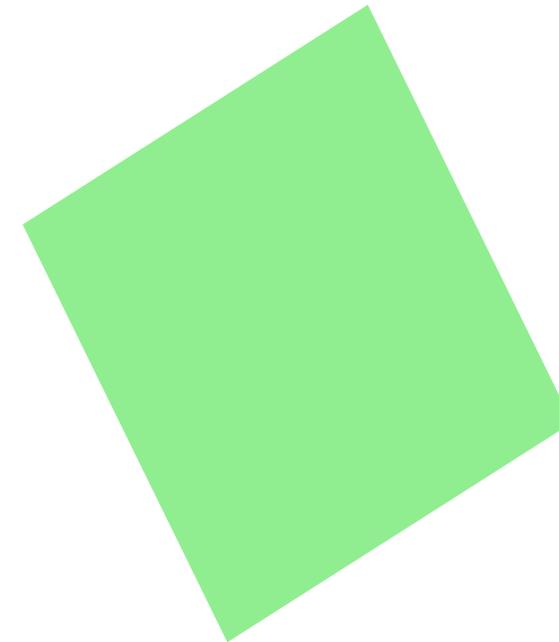
The screenshot shows the 'Properties' panel in IPE. A red box highlights the stroke settings, with red arrows pointing to labels: 'Stroke Colour' (black), 'Fill Colour' (lightgreen), 'Stroke Width' (heavier), and 'Stroke Style' (dotted). Other settings include 'footnote', 'disk', 'large', 'opaque', and 'Layers' (alpha (0)).

Property	Value
Stroke Colour	black
Fill Colour	lightgreen
Stroke Width	heavier
Stroke Style	dotted
Footnote	footnote
Disk	disk
Large	large
Opaque	opaque
Layers	alpha (0)



The Properties [EXTENDED VERSION]

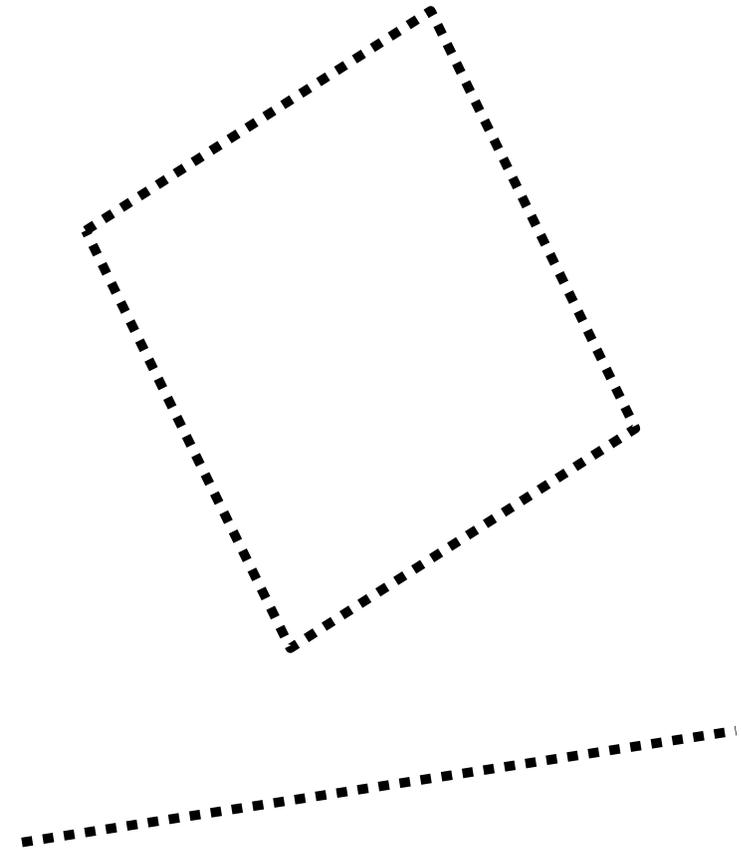
The screenshot shows the 'Properties' panel in IPE. A red box highlights the top four settings: 'black', 'lightgreen', 'heavier', and 'dotted'. Red arrows point from these settings to labels: 'Stroke Colour' (pointing to 'black'), 'Fill Colour' (pointing to 'lightgreen'), 'Stroke Width' (pointing to 'heavier'), and 'Stroke Style' (pointing to 'dotted'). Below these, a yellow dashed line is shown with a green square and a black arrow pointing to it, labeled 'x1'.



(Line is still there, but without contour)

The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE. A red box highlights the top four settings: 'black', 'lightgreen', 'heavier', and 'dotted'. Red arrows point from these settings to labels: 'Stroke Colour' (pointing to 'black'), 'Fill Colour' (pointing to 'lightgreen'), 'Stroke Width' (pointing to 'heavier'), and 'Stroke Style' (pointing to 'dotted'). Below these, a yellow highlight is on the 'dotted' style icon, which is also being pointed to by a black mouse cursor. A '×2' label is next to the cursor. The rest of the panel shows 'footnote', 'disk', 'large', 'opaque', and a 'Layers' section with 'alpha (0)' checked.

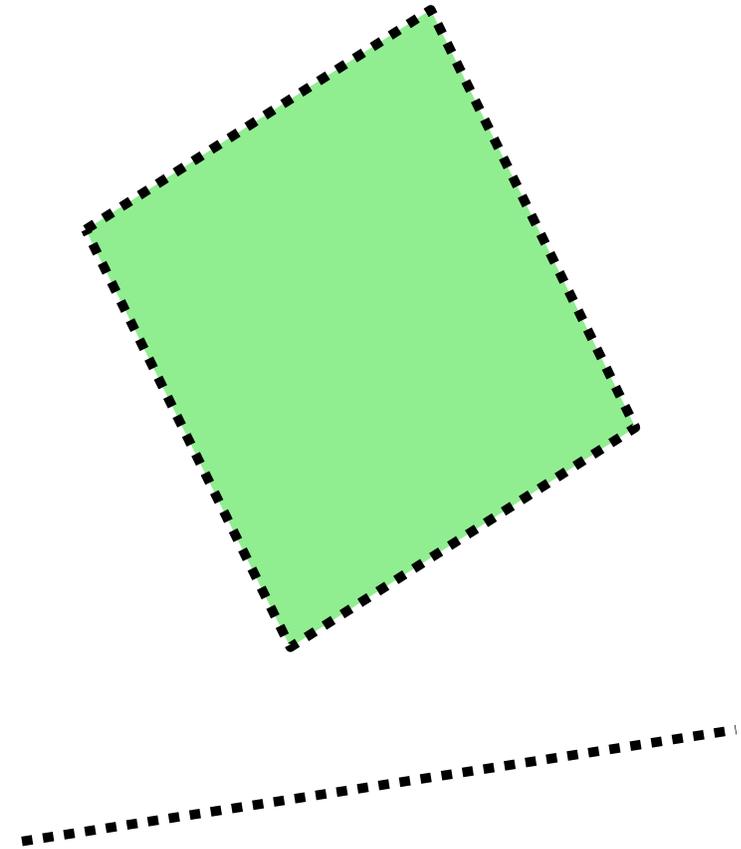


The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE. The following properties are highlighted with red boxes and arrows pointing to labels:

- Stroke Colour:** Points to the 'black' dropdown.
- Fill Colour:** Points to the 'lightgreen' dropdown.
- Stroke Width:** Points to the 'heavier' dropdown.
- Stroke Style:** Points to the 'dotted' dropdown.

A black arrow points to a green square icon with radiating lines, labeled 'x3', indicating a zoom or focus action.

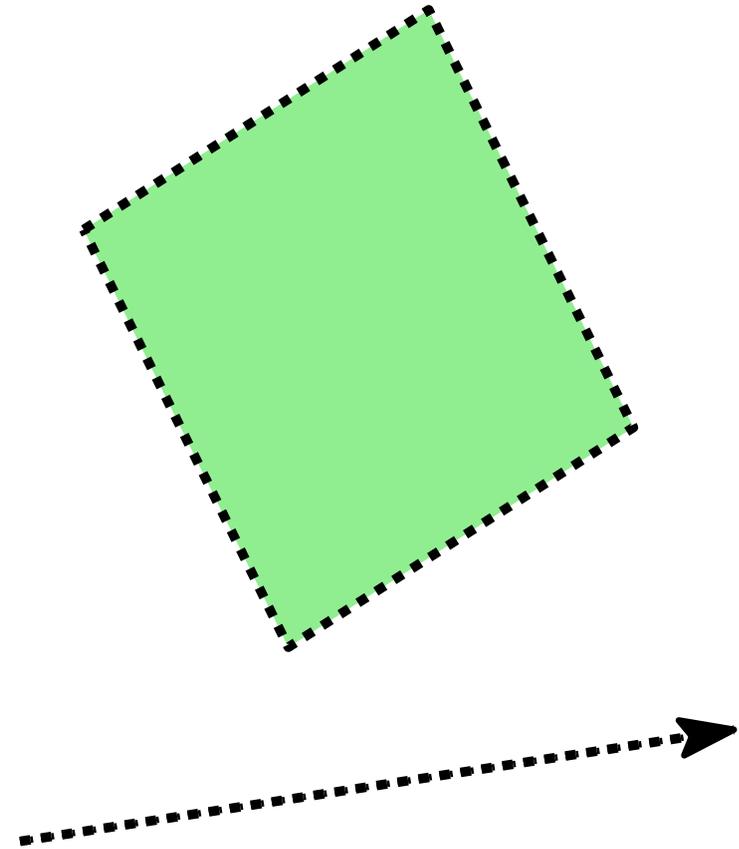


The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE. The following settings are highlighted with red boxes and red arrows pointing to labels:

- Stroke Colour:** black
- Fill Colour:** lightgreen
- Stroke Width:** heavier
- Stroke Style:** dotted

A mouse cursor is shown clicking on the 'dotted' stroke style icon, which is highlighted in yellow. Below the stroke style icons, other settings are visible: 'footnote', 'disk', 'large', 'opaque', and 'Layers' (with 'alpha (0)' checked).



The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE. A red box highlights the first four dropdown menus: 'black', 'lightgreen', 'heavier', and 'dotted'. Red arrows point from these to the labels 'Stroke Colour', 'Fill Colour', 'Stroke Width', and 'Stroke Style' respectively. A teal box highlights the 'footnote' dropdown menu, with a teal arrow pointing to the label 'Text Size'. Below these are 'disk', 'large', and 'opaque' dropdowns. At the bottom is the 'Layers' panel with a checked 'alpha (0)' layer.

Stroke Colour

Fill Colour

Stroke Width

Stroke Style

Text Size

The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE with several dropdown menus. Red arrows point from the following dropdowns to their respective labels: 'black' to 'Stroke Colour', 'lightgreen' to 'Fill Colour', 'heavier' to 'Stroke Width', and 'dotted' to 'Stroke Style'. A green arrow points from the 'footnote' dropdown to 'Text Size'. Blue arrows point from the 'disk' and 'large' dropdowns to 'Mark Style (Box, Disk, Cross, etc.)' and 'Mark Size' respectively. The 'Layers' panel at the bottom shows 'alpha (0)' selected.

Stroke Colour

Fill Colour

Stroke Width

Stroke Style

Text Size

Mark Style (Box, Disk, Cross, etc.)

Mark Size

The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE with several dropdown menus. Red arrows point from the first four dropdowns to labels: 'Stroke Colour' (black), 'Fill Colour' (lightgreen), 'Stroke Width' (heavier), and 'Stroke Style' (dotted). A yellow diamond-shaped mark is visible in the background. Below this, a teal arrow points from the 'footnote' dropdown to 'Text Size'. Two blue arrows point from the 'disk' and 'large' dropdowns to 'Mark Style (Box, Disk, Cross, etc.)' and 'Mark Size' respectively. A green arrow points from the 'opaque' dropdown to 'Opacity (Stroke Opacity != Opacity)'. The 'Layers' panel at the bottom shows 'alpha (0)' checked.

Stroke Colour

Fill Colour

Stroke Width

Stroke Style

Text Size

Mark Style (Box, Disk, Cross, etc.)

Mark Size

Opacity
(Stroke Opacity != Opacity)

The Properties [EXTENDED VERSION]

The screenshot shows the 'Properties' panel in IPE with several dropdown menus. Red arrows point from the first four dropdowns to labels: 'Stroke Colour' (black), 'Fill Colour' (lightgreen), 'Stroke Width' (heavier), and 'Stroke Style' (dotted). A yellow diamond icon is shown next to a dotted line. A teal arrow points from the 'footnote' dropdown to 'Text Size'. Blue arrows point from the 'disk' and 'large' dropdowns to 'Mark Style (Box, Disk, Cross, etc.)' and 'Mark Size' respectively. A green arrow points from the 'opaque' dropdown to 'Opacity (Stroke Opacity != Opacity)'. A purple arrow points from the 'Layers' panel to 'Layers and Views (later)'. The 'Layers' panel shows a checked checkbox for 'alpha (0)'.

Stroke Colour

Fill Colour

Stroke Width

Stroke Style

Text Size

Mark Style (Box, Disk, Cross, etc.)

Mark Size

Opacity
(Stroke Opacity != Opacity)

Layers and Views (later)

The Properties [EXTENDED VERSION]

Stroke Colour

Fill Colour

Stroke Width

Stroke Style

Text Size

Mark Style (Box, Disk, Cross, etc.)

Mark Size

Opacity
(Stroke Opacity \neq Opacity)

Layers and Views (later)

Exact input is possible
(colour picker, enter size in points)

Shortcuts

Manipulation

[S]	Select
[E]	Scale
[Shift+E]	Scale (keep aspect ratio)
[R]	Rotate
[CTRL+R]	Exact rotate
[T]	Translate
[CTRL+E]	Edit mode/Change text
[CTRL + B]	Push object back
[CTRL + F]	Pull object on top

Objects

[M]	Marks
[P]	Polyline
[Shift+P]	Polygon
[G]	Minipage text
[F10]	Width-spanning

Extras

[SHIFT+V]	Center vertically (on horizontal line)
[SHIFT+H]	Center horizontally (on vertical line)
[SHIFT+ALT+V]	Distribute vertically (No horizontal version)
[ALT+NP 2/4/6/8]	Translate by small steps
[CTRL+NP 2/4/6/8]	Translate by medium steps
[ALT+CTRL+NP 2/4/6/8]	Translate by big steps
[CTRL+G]	Group objects