

Inserting Static and Dynamic Text into the GeoGebra's Graphics Window

GeoGebra Workshop Handout 5

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


1. Coordinates of Reflected Points

Preparations


- Open a new GeoGebra file.
- Show the algebra window, input field, coordinate axes, and the grid (*View* menu).
- In the *Options* menu set the *Point capturing* to *on (Grid)*.

Instructions

| | | |
|---|---|--|
| 1 |  | Create point $A = (3, 1)$ |
| 2 | | Create line $a: y = 0$ |
| 3 |  | Mirror point A at line a to get point A' <u>Hint</u> : You might want to match the color of line a and point A' . |
| 4 | | Create line $b: x = 0$ |
| 5 |  | Mirror point A at line b to get point A_1' <u>Hint</u> : You might want to match the color of line b and point A_1' . |

2. Inserting Text into the Graphics Window

Introduction of new tools

| | | |
|---|--------------------|-------------|
|  | Insert text | New! |
| <u>Hint</u> : Click the drawing pad to specify the location of your text. Enter the desired text into the appearing window and click <i>Apply</i> . | | |

Hints: Don't forget to read the toolbar help if you don't know how to use a tool. Try out new tools before you start the construction.

Inserting static text

Insert a heading into the graphics window of GeoGebra so your students know what this dynamic figure is about:

- Activate the  *Text* tool and click on the upper part of the drawing pad.



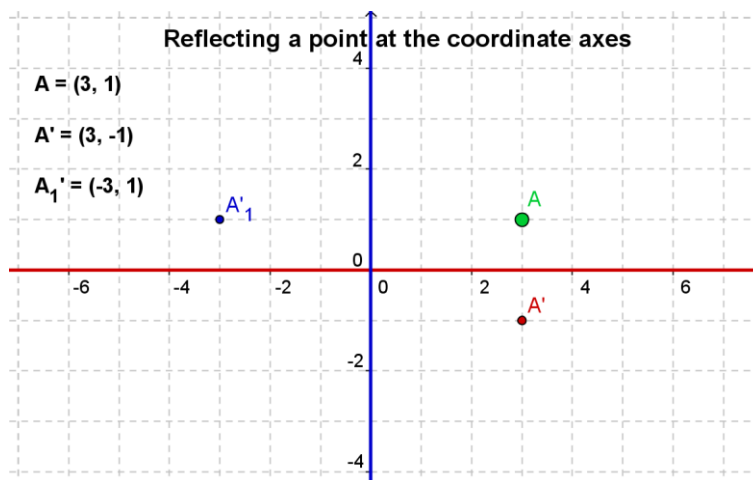
- Type the following text into the appearing window:
Reflecting a point at the coordinate axes
- You can change the properties of the text in the *Properties dialog* (e.g. wording, font style, font size, formatting).
- Click *Apply*.
- Adjust the position of the text using the *Move* tool.
- Fix the position of the text so it can't be moved accidentally (*Properties dialog* – tab *Basic* – *Fix object*).

Inserting dynamic text

Dynamic text refers to existing objects and adapts automatically to modifications, for example in $A = (3, 1)$ the coordinates change whenever point A is moved.

- Activate the ^{ABC} *Text* tool and click on the drawing pad.
- Type $A =$ into the appearing window.
Hint: This will be the static part of the text and won't change if point A is moved.
- Insert the dynamic part of this text by clicking on point A either in the algebra or the graphics window.
 - GeoGebra will insert the name of the point into the text field and add quotation marks around the already existing (static) text.
 - Additionally, GeoGebra adds a $+$ symbol to connect the static and dynamic part of the text.
 - Note: The new syntax of the text is " $A =$ " + A
- Click *Apply*.
- Fix the position of the text so it can't be moved accidentally (*Properties dialog* – tab *Basic* – *Fix object*).

Note: The text shows the coordinates of point A and adapts automatically to modifications of its position.





Enhancing the dynamic figure

- Insert dynamic text that shows the coordinates of the reflected points A' and A_1' .
- Zoom out in order to show a larger part of the coordinate plane.
Hint: You might want to adjust the distance of the grid lines.
 - Open the *Properties dialog for the drawing pad* (right click / MacOS: Ctrl-click the drawing pad and select *Properties*)
 - Select tab *Grid* and check the box next to *Distance* and change the values in both text fields to 1.
 - Close the dialog window.
- Close the algebra window and fix all text so it can't be moved accidentally (*Properties dialog*).

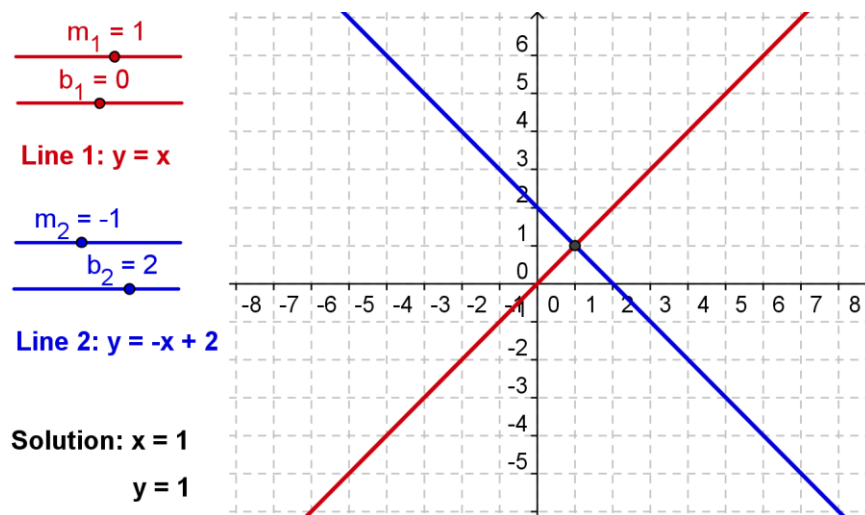
Task

Come up with instructions to guide your students towards discovering the relation between the coordinates of the original and the reflected points which could be provided along with the dynamic figure.

3. Visualizing a System of Linear Equations






Preparations

- Open a new GeoGebra file.
- Show the algebra window, input field, coordinate axes, and grid (*View* menu).





Instructions

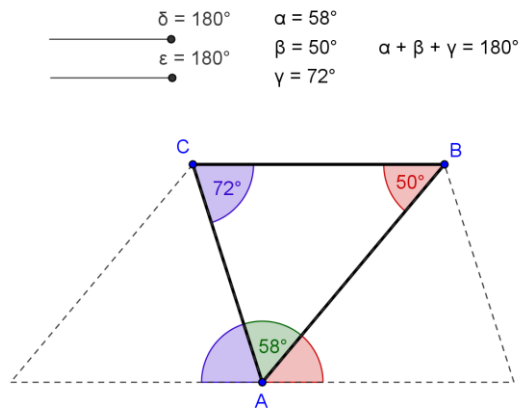
| | | |
|----|--|--|
| 1 |  | Slider m_1 with the default settings for sliders <u>Hint:</u> m_1 gives you m_1 . |
| 2 |  | Slider b_1 with the default settings for sliders |
| 3 | | Linear equation $line_1: y = m_1 x + b_1$ |
| 4 |  | Slider m_2 using the default settings for sliders |
| 5 |  | Slider b_2 using the default settings for sliders |
| 6 | | Linear equation $line_2: y = m_2 x + b_2$ |
| 7 | ABC | Dynamic $text1$: "Line 1: " + $line_1$ |
| 8 | ABC | Dynamic $text2$: "Line 2: " + $line_2$ |
| 9 |  | Intersection point A of both lines $line_1$ and $line_2$ <u>Hint:</u> You could use command <code>Intersect[line_1, line_2]</code> instead. |
| 10 | ABC | Dynamic $text3$: "Solution: $x = $ " + $x(A)$ <u>Hint:</u> $x(A)$ gives you the x -coordinate of point A . |
| 11 | ABC | Dynamic $text4$: " $y = $ " + $y(A)$ |
| 12 | | Fix the text and sliders so they can't be moved accidentally. |

Note: Such a dynamic figure can also be used to visualize an equation in one variable by entering each side of the equation as one of the two functions.

4. Visualizing the Angle Sum in a Triangle

Preparations

- Open a new GeoGebra file.
- Hide the algebra window and coordinate axes (*View* menu).
- Show the input field (*View* menu).
- Set the number of decimal places to 0 (menu *Options – Decimal places*).



Introduction of new tool



Hints: Don't forget to read the toolbar help if you don't know how to use a tool. Try out new tools before you start the construction.

Instructions

| | | |
|----|--|--|
| 1 | | Triangle ABC with counter clockwise orientation |
| 2 | | Angles α , β , and γ of triangle ABC . |
| 3 | | Slider for angle δ with interval 0° to 180° and increment 10° |
| 4 | | Slider for angle ϵ with interval 0° to 180° and increment 10° |
| 5 | | Midpoint D of segment AC and midpoint E of segment AB |
| 6 | | Rotate the triangle around point D by angle δ (setting <i>clockwise</i>). |
| 7 | | Rotate the triangle around point E by angle ϵ (setting <i>counterclockwise</i>). |
| 8 | | Move both sliders δ and ϵ to show 180° . |
| 9 | | Create angle ζ using the points $A'C'B'$ |
| 10 | | Create angle η using the points $C'B'A'$ |
| 11 | | Enhance your construction using the <i>Properties dialog</i> . <u>Hint</u> : Congruent angles should have the same color. |

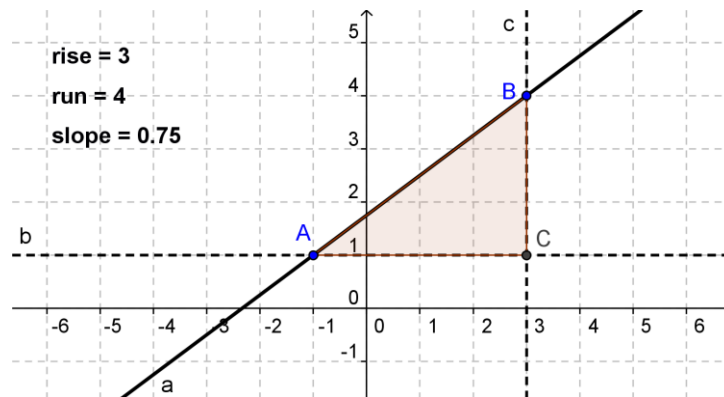


| | | |
|----|-----|---|
| 12 | ABC | Create dynamic text displaying the interior angles and their values (e.g. " $\alpha = $ " + α). |
| 13 | | Calculate the angle sum using $\text{sum} = \alpha + \beta + \gamma$ |
| 14 | ABC | Insert the angle sum as a dynamic text: " $\alpha + \beta + \gamma = $ " + sum |
| 15 | | Match colors of corresponding angles and text. Fix text that is not supposed to be moved. |

5. Constructing a Slope Triangle

Preparations

- Open a new GeoGebra file.
- Show the algebra window and input field (*View* menu).
- Show the coordinate axes and the grid (*View* menu).
- Set the point capturing to *On grid* (menu *Options* – *Point capturing*).
- Set the labeling to *All new objects* (menu *Options* – *Labeling*).



Instructions

| | | |
|---|--|--|
| 1 | | Line a through two points A and B . |
| 2 | | Perpendicular line b to the y -axis through point A |
| 3 | | Perpendicular line c to the x -axis through point B |
| 4 | | Intersect perpendicular lines b and c to get intersection point C . <u>Hint</u> : You might want to hide the perpendicular lines. |
| 5 | | Triangle ACB |



| | | |
|----|------------|---|
| 6 | AA | Hide the labels of the triangle sides. |
| 7 | | Calculate the rise: $\text{rise} = y(B) - y(A)$ <u>Hint:</u> $y(A)$ gives you the y-coordinate of point A. |
| 8 | | Calculate the run: $\text{run} = x(B) - x(A)$ <u>Hint:</u> $x(B)$ gives you the x-coordinate of point B. |
| 9 | ABC | Insert dynamic <i>text1</i> : $\text{"rise"} = \text{"} + \text{rise}$ |
| 10 | ABC | Insert dynamic <i>text2</i> : $\text{"run"} = \text{"} + \text{run}$ |
| 11 | | Calculate the slope of line a: $\text{slope} = \text{rise} / \text{run}$ |
| 12 | ABC | Insert dynamic <i>text3</i> : $\text{"slope"} = \text{"} + \text{slope.}$ |
| 13 | | Change properties of objects in order to enhance your construction and fix text that is not supposed to be moved. |

6. Dynamic Fractions and Attaching Text to Objects

Inserting dynamic fractions

Using *LaTeX* formulas, text can be enhanced to display fractions, square roots, or other mathematical symbols. Enhance your construction of the slope triangle by entering a fraction showing how to calculate the slope of a line.

1. Activate tool **ABC Insert text** and click on the drawing pad.
2. Type $\text{slope} =$ into the *Insert text* window's input field.
3. Check *LaTeX formula* and select *a/b* from the drop-down list.
4. Place the cursor within the first set of curly braces. Select number *rise* in the algebra window.
Hint: GeoGebra will add quotation marks and + symbols to your text.
5. Place the cursor within the second set of curly braces. Select number *run* in the algebra window.
6. Click *Apply*.



Attaching text to objects

Whenever an object changes its position, attached text adapts to the movement and follows along. Enhance your construction of a slope triangle by attaching text to the sides of the slope triangle.

1. Create midpoint D of the vertical segment using tool *Midpoint or center*.
2. Create midpoint E of the horizontal segment.
3. Open the *Properties dialog* and select *text1* (*rise = ...*). Click on tab *Position* and select point D from the drop-down list next to *Starting point*.
4. Select *text2* (*run = ...*) in the *Properties dialog* and set point E as starting point.
5. Hide the midpoints D and E .

7. The mod 3 Clock

The mod 3 clock allows you to determine the remainder if you divide a given number by 3. In this dynamic figure you can create a random number between 0 and 100. Moving the blue slider causes the hand of the clock to rotate. When the value of the slider matches the given number, the hand of the clock points at the corresponding remainder for division by 3.

Open the file *08_mod3_clock.html* in order to try out this unusual clock.

Preparations

- Open a new GeoGebra file
- Show the algebra window, coordinate axes, and input field (*View menu*).

Introduction of new tool



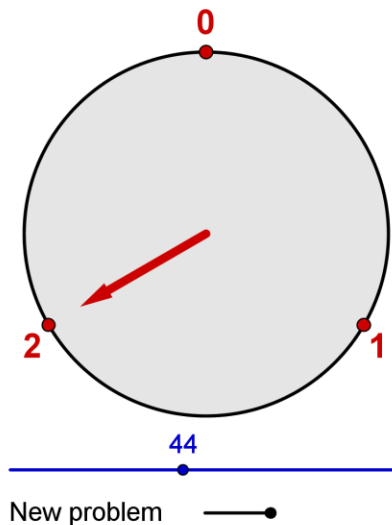
Ray through two points

New!

Hint: The first click determines the starting point and the second click determines a point on the ray.

The mod 3 Clock










number = 44






Hints: Don't forget to read the toolbar help if you don't know how to use a tool. Try out new tools before you start the construction.



Instructions

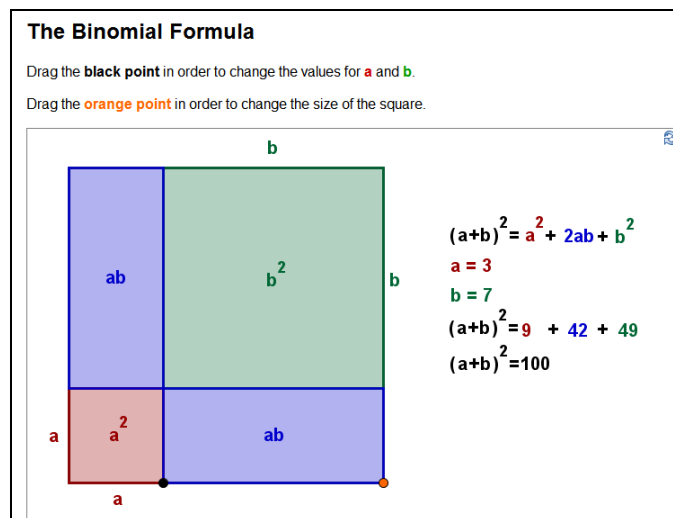
| | | |
|----|---|---|
| 1 | | Points $A = (0, 0)$ and $B = (0, 1)$ |
| 2 |  | Circle c with center A through point B |
| 3 |  | Zoom into the drawing pad. |
| 4 |  | Rotate point B clockwise around point A by 120° to get point B' |
| 5 |  | Rotate point B clockwise around point A by 240° to get point B'_1 |
| 6 | ABC | Create <i>text1</i> "0", <i>text2</i> "1", and <i>text3</i> "2" <u>Hint</u> : You might want to edit the text (bold, large font size). |
| 7 | | Attach <i>text1</i> to point B , <i>text2</i> to point B' , and <i>text3</i> to point B'_1 (<i>Properties dialog</i>) |
| 8 | ABC | Create <i>text4</i> "New problem" |
| 9 |  | Slider a with an interval from 0 to 1 and increment 1 |
| 10 | | Create a random number between 0 and 100: <code>number = floor(100 * random()) + a - a</code> <u>Note</u> : Function <code>random()</code> gives you a random number between 0 and 1. If you multiply this random number by 100 you get a decimal between 0 and 100. Function <code>floor()</code> gives you the greatest integer less or equal to the decimal, thus, an integer between 0 and 100. The extension <code>+ a - a</code> allows you to create a new problem whenever the slider is moved. |
| 11 | ABC | Create <i>text5</i> : "number = " + number |
| 12 | ABC | Create <i>text6</i> : "The mod 3 Clock" |
| 13 |  | Slider n (interval from 0 to 100, increment 1, width 300) |
| 14 |  | Clockwise angle BAB'_1 with given size $n \cdot 120^\circ$ |
| 15 |  | Ray with starting point A through point B'_1 |
| 16 | | Point $D = (0, 0.8)$ |
| 17 |  | Circle d with center A through point D |



| | | |
|----|---|---|
| 18 |  | Intersect the ray with circle d to get intersection point D |
| 19 |  | Hide the ray and circle d |
| 20 |  | Vector from A to D |
| 21 | | Change the font size of the GeoGebra window to 20 pt <u>Hint:</u> Menu <i>Options</i> – <i>Font size</i> |
| 22 | | Use the <i>Properties dialog</i> to enhance your construction and fix text and sliders so they can't be moved accidentally. |

8. Challenge of the Day: Visualize a Binomial Formula

Check out the dynamic worksheet [10_binomial_formula.html](#). It visualizes the binomial formula $(a+b)^2 = a^2 + 2ab + b^2$ and contains dynamic text that automatically adapts if the values of a and b are changed. Recreate the construction shown in the dynamic worksheet.



Hints:

- In the *Options* menu change *Point capturing* to *on (Grid)*.
- Use static text to label congruent sides of your construction and attach it to the midpoints of the corresponding sides.
- Use static text to label the areas of the different parts of the square and attach it to the center of the smaller squares / rectangles. Check the box LaTeX formula in order to create the 2 when creating the text.
- Add dynamic text that adapts to changes of the sides a and b . If you want to color code the text you need to create a text for each term.
- Fix text that is not supposed to be moved by students (*Properties dialog*).