

## Geometry in the Yard – Guidelines and Activities

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1. Read these guidelines and activities ahead. THINK about each activity and propose a plan of action.
2. Be gentle with the grass and lawn. Avoid trees. When you drive a stack into the ground, do not disrupt the roots or otherwise damage the lawn. After you are done with the activities, make sure that you did not leave any “footprints”.
3. Briefly discuss your strategies in your group and agree on your final action plan. Carry out the construction. If appropriate, you may take pictures of each important step or object.
4. Take a picture of your final product and send them to my account (marci1t). This is not for the evaluation purposes, only to display your pictured during the discussion.
5. In your group discuss WHY your plan (construction) works.
6. Each group will be responsible for material for 1 activity. Your group will pass the material you are responsible for to other groups but will be responsible for returning the material in neat and organized manner (the same way you took it). If you need to work with the material beyond our class time, there will be a sign off sheet were you indicate taking and returning the material.

### About constructions

Geometry in the yard is a different experience than compass and ruler or dynamic geometry software. Tools are different and the way of thinking is different, too:

- To create a point, you drive a stake into the ground.
- To create a line, you need two stakes to which you attach a cord or two students that will hold the cord. The cord must be tight (straight).
- You may create (or visualize) line without a cord by using the *line of sight*. If you have two stacks in the ground, you can get close to the ground and use your eye (just one, one is closed) to visualize the line given by the two nails. If you position your eye so that both nails are in your line of sight, you can easily add more nails that belong to the same line. This procedure is exact and not considered “eyeballing”.

## ACTIVITY 1 Midpoint of a line segment

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### Material:

- String (about 3m long)
- Measuring tape (10m; use only to check your estimate)
- 6 stakes/nails (you may not need all)

### Task:

1. **Estimate** the distance of 10 meters and drive 2 stakes about 10 meters apart. Let's call the stakes  $N_1$  and  $N_2$ .
  - a. Briefly record what you did to estimate the distance.
2. Check your estimate by measuring the distance. Record the result.
3. Use the given cord and remaining nails (no measuring tape!) to find the exact midpoint of the line segment  $N_1N_2$ . You may fold the cord, however, the cord is shorter than the distance between  $N_1$  and  $N_2$ .
4. Use the tape measure to check your work. Record and briefly discuss the result.

### Construction protocol:

*(Provide step-by-step instructions. You may use a sequence of commented photographs.)*

### Justification/Proof:

*(Briefly explain WHY your procedure works.)*

### Reflection and Discussion:

(Reflect on solving strategies of individual group members. What was confusing? What issues did you have to discuss and clarify before solving the problem?)

## ACTIVITY 2: Angle bisector

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### Material:

- Clothesline (about 8m)
- String (about 4m)
- 6 stakes/nails (you may not need all)
- Large protractor (use only to check your estimate)

### Task:

1. **Estimate  $50^\circ$  angle** and use 3 stakes and the longer cord to form it.
  - Briefly record what you did to estimate the angle.
2. Check your estimation by measuring the angle. Record the result.
3. Find the angle bisector of your angle without moving the original angle (and no protractor!).
4. Use the protractor to check your work. Record and briefly discuss the results.

### Construction protocol:

*(Provide step-by-step instructions. You may use a sequence of commented photographs.)*

### Justification/Proof:

*(Briefly explain WHY your procedure works.)*

### Reflection and Discussion:

(Reflect on solving strategies of individual group members. What was confusing? What issues did you have to discuss and clarify before solving the problem?)

## ACTIVITY 3: Square flower bed

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### Material:

- Closed clothesline (about 8m)
- String (about 4m)
- 6 stakes (you may not need all)
- Tape measure (5m)
- A sheet of paper used only to check right angles

### Task:

1. Use the longer (closed) cord and 4 stakes to outline a square flower bed.
2. Make sure that your shape is an exact square all sides are equal **and** all angles are right angles. Keep in mind that having all sides congruent is not enough, you will need to figure out how to ensure right angles as well **without eyeballing**. If you need a hint, read the upside down text at the bottom of the page). Don't use the sheet of paper to form the angles; use it only to check the angles once you have decided that your shape is a square. Alternatively, you can borrow the protractor from Activity #2 to check the angles.
3. Use the tape measure and a sheet of paper (or large protractor borrowed from activity #2) to check your construction. Record and briefly discuss the results.

### Construction protocol:

*(Provide step-by-step instructions. You may use a sequence of commented photographs.)*

### Justification/Proof:

*(Briefly explain WHY your procedure works.)*

### Reflection and Discussion:

(Reflect on solving strategies of individual group members. What was confusing? What issues did you have to discuss and clarify before solving the problem?)