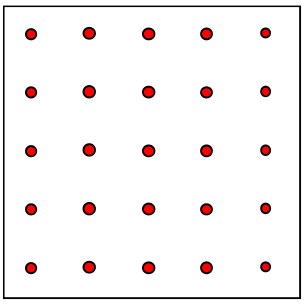
GEOBOARDS



A geoboard is a square about 15 cm on a side with 25 pegs in a 5x5 array. It can be cheaply and simply constructed from plywood and nails. On a geoboard, rubber bands are used to construct geometrical figures.

There is nothing that you can teach using a geoboard that can't be taught using other methods. However the geoboard does have certain advantages that makes it a valuable teaching tool in the classroom.

1. It is hands-on. Kids in general prefer making things rather than drawing them.
2. It is fast. For example, a triangle can be constructed rapidly by snapping a rubber band around 3 nails.
3. It allows for easy experimentation. An incorrectly constructed figure can be "erased" simply by removing the rubber band.
4. It is a great motivator. Used in moderation, kids enjoy working with geoboards.
5. It is easy to check for understanding – just ask the class to hold up their geoboards to display their answers.

A First Lesson with Geoboards

You need one geoboard per class member and a supply of rubber bands.

1. THIS STEP IS VITAL. Let the kids play for 5 minutes with the geoboards. If you don't let them play now, they will just choose to play later. Watch out for flying rubber bands – it is an occupational hazard with this activity!

ASK THE STUDENTS TO CONSTRUCT:

2. The first initial of their name. You can show various answers by holding up a geoboard for the rest of the class to see.

3. Parallel lines. The first attempts shown will probably be horizontal or vertical. Then some clever kid will figure out how to put them on a slant.
   If not, suggest it.
4. Perpendicular lines. See above.

5. Intersecting lines.

6. Lines that will intersect off the board if they are extended. Again, the teacher should hold up boards with different correct solutions for the class to see.

7. Lines that intersect off the board as far as possible. Some interesting arguments can develop from this one!

8. The largest possible number. Depending upon the sophistication of the class, power notation and factorials may be included in the solution.

9. The smallest possible number. Don't forget negative numbers!

10. A square with the largest possible area.

11. A square with the smallest possible area.

12. A square with an area of 9 square units.

13. Challenge! A square with an area of 2 square units.

14. Mega-Challenge! A square with an area of 10 square units. (Students need to know about the Pythagorean Theorem for this question.)

15. A square with a perimeter of 12 units.

16. A square with the smallest possible perimeter.

17. A polygon with the smallest possible perimeter.

18. A polygon with the largest possible perimeter.

19. A polygon with the greatest number of sides.

20. An equilateral triangle, an isosceles triangles, a scalene triangle, a trapezoid, etc.

More Geoboard Ideas

1. Show the students a shape and have them reproduce it on the geoboard.

2. Ask the students to find the area of the shape. (For tricky shapes, one technique is to find the area of the enclosing rectangle, and then subtracting the extra bits – usually triangles.)

3. Make a 1 x 1 square and ask the students to find its area and perimeter.

   Ask the students to make a shape 2 times as big, and find its area and perimeter.

   Ask the students to make a shape 3 times as big, and find its area and perimeter.

   Challenge the students to find the rules when a shape is enlarged.

4. What numbers can be the area of a square on a geoboard? How do you know that you have found them all?

   (Warning! This question is trickier than it first appears.)

Giga-Challenge!

5. Challenge the students to discover Pick's Theorem for the area of a polygon drawn on a lattice, given the number of edge points and interior points.

Geoboard Fractions

1. Put a rubber band around the pegs. This represents 1 unit. Now ask the students to show you:

   a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. $\frac{1}{8}$ d. $\frac{1}{16}$

2. Put a rubber band around the pegs. This represents 1 unit. Ask the students to show you $\frac{1}{2}$ in as many ways as they can. They need to be able to justify each solution. They should record their solutions on the Geoboard recording sheet.

3. Put a rubber band around the pegs. This represents 1 unit. Ask the students to show you $\frac{1}{4}$ in as many ways as they can. They need to be able to justify each solution. They should record their solutions on the Geoboard recording sheet.

4. Challenge the students to make as many other fractions as they can. They must justify their solutions.

5. Ask the students to use the geoboard to show that:

   a. $\frac{1}{4}+\frac{1}{4}=\frac{1}{2}$ b. $\frac{1}{4}+\frac{1}{2}=\frac{3}{4}$

6. a. Ask the students to use the geoboard to find 3 different fractions that add to 1.

   b. Ask the students to use the geoboard to find 4 different fractions that add to 1.

   c. Ask the students to use the geoboard to find 5 different fractions that add to 1.

The Geoboard