

What is a Rekenrek?

The rekenrek, or arithmetic rack, was designed by Adrian Treffers, a mathematics curriculum researcher at the Freudenthal Institute in Holland, to support the natural development of number sense in children.

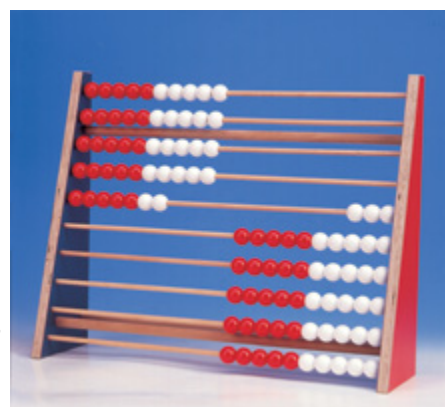


The rekenrek consists of two rows of 10 beads. Larger versions with ten rows of ten beads are also available. Each row is made of five red beads and five white beads. This allows students to make mental images of numbers. Using 5 and 10 as anchors for counting, adding and subtracting is obviously more efficient than one-by-one counting. This tool provides learners with the visual models they need to discover number relationships and develop a variety of addition and subtraction strategies, including doubles plus or minus one, making tens, and compensation, thereby leading to automaticity of basic facts.

Rekenreks provide opportunities for many different math activities. Listed below are a few examples.

Possible Activities

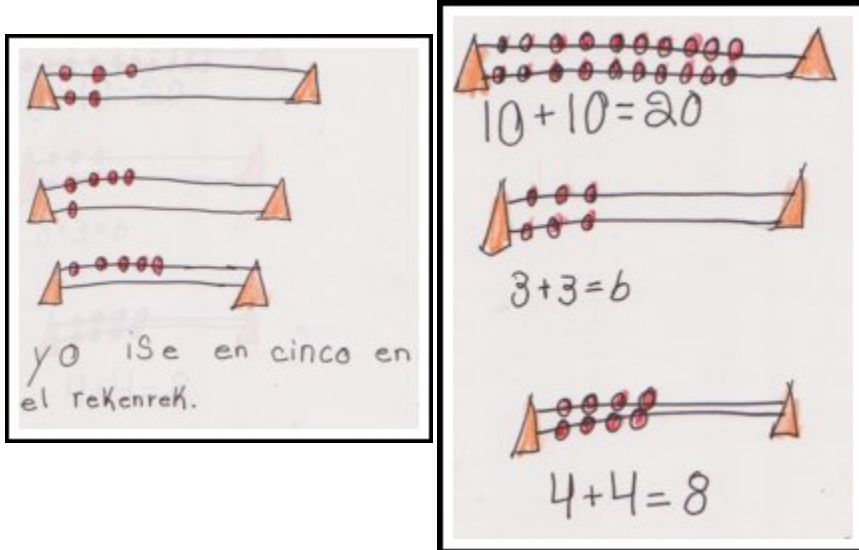
- **Meet the Rekenrek:** Begin by asking children what they notice about the rekenrek. Then introduce the 'start position' (all beads over to the far right) and have them practice sliding beads in groups rather than one by one "Put your beads in start position. Now, without touching your rekenrek, count the first three beads in your mind. On the count of three, slide all three beads at once across the string. One... two...three!" Repeat with other numbers.
- **Show me 0-10:** Say a number, or hold up a numeral card (0-10). Ask students to show the given number on their rekenrek by moving the beads with one push.
- **Show me 11-20:** As above but ask students to show the given number of beads using only two pushes.
- **Quick Images:** Push some beads across and display them briefly before covering them with a piece of cloth or card. Ask, "How many beads did you see? How do you know?" Asking children to draw or write what they saw on a dry erase board ensures that everyone is actively involved and serves as a quick assessment. If using a 100 bead rekenrek gradually add rows until you are displaying quick images to 100. This can be extended by asking students to show the number that is one more/one less/ten more/ten less than/double the number flashed.
- **Finding Different Ways to Make a Given Number:** Initially use only the top row of beads. Cover the bottom row with a folded sheet of card or piece of fabric. Begin by sliding the red beads to the left and the white beads to the right on the top row of the rekenrek. Choose a number to build. "Let's see how many ways we can build 6 by sliding beads from each side to the middle. What if I slide 4 red beads from the left and 2 white beads from the right. Does that make 6 beads? Can you think of another way to make 6? Record the different ways 6 can be built. This activity should be repeated many times using different numbers from 1-10. Once children are confident using the top row, combinations can be found using both the top and bottom rows. Children can record the different ways they find to build the given number.
- **Building Missing Addends:** Ask a student to be your partner. Tell the class that you and your partner are going to build the number 6 as a team. You will move beads on the top row of the rekenrek and your partner will move beads on the bottom row. "I am going to slide 4 beads to the left on the top row. Now in one move, you slide beads on the bottom row to build the number 6." Pair students up and have them choose a number from the number cards. They then work with their partner to build that number. Begin



with cards 1-10, later increase to 1-20. When using number cards 11-20 help students see that certain combinations require a minimal number of beads on the top row to build numbers larger than 10. The ten row rekenrek can be used with students who are ready to represent numbers larger than 20. Have students work in pairs, taking turns drawing a 1-100 number card and building the numbers together.

Possible Math Journal Activities:

- **Show 5:** How many different ways can you show 5 on your Rekenrek? (repeat with different numbers)
- **Doubles:** How many different doubles facts can you show on your Rekenrek? Record.



The above two work samples were completed by a Kindergarten student. This student represented her work on the Rekenrek very clearly on the blank pages in her Math Journal using pictures, numbers and words. To begin with some Kindergarten students may find it difficult to represent their work on the Rekenrek on paper. Having Rekenrek paper available for children who choose to use it is one way to scaffold early attempts at recording. You may like to leave a supply of this paper in your Math Center to prompt children's recording during Math Center sessions.

Near Doubles: How many different 'near doubles' can you show on your Rekenrek? Record.

Turn Around Facts: Show an addition fact on your Rekenrek. What would the turn around fact look like? Repeat.

Number Stories: Have children use individual arithmetic racks as a tool to solve various types of addition and subtraction number stories. This may be used as a journal or oral activity, with the focus on children explaining their strategy for solving the problem. Be sure to include open-ended problems that have more than one solution which can be modeled on the rekenrek, such as the following:

There were 8 children on a bunk bed. Some were on the top bunk and some were on the bottom bunk. How many children were on the top bunk? How many children were on the bottom bunk? Show as many different solutions as you can.

There were 12 passengers on a double-decker bus. Some passengers were on the top deck and some were on the bottom deck. How many passengers were on the top deck? How many passengers were on the bottom deck? Show as many different solutions as you can.

How to Make a Rekenrek

Would you like to use rekenreks in your classroom but don't have the budget to buy a class set? Use the simple directions below to make a class set for just a fraction of the cost of store bought models.

Materials

200 red beads

200 white beads

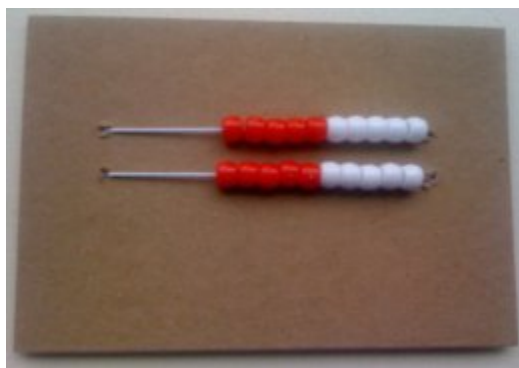
6 yds. beading elastic

20 medium weight chipboard sheets

Scissors

Things to consider:

- The above materials will make 20 small two row rekenreks (4in. x 6in.) This size is perfect for little hands but if you would prefer to make a larger size purchase 8 1/2 in. x 11 in. chipboard sheets and cut in half to make two 8 1/2in. x 5 1/2in. boards.
- The beads usually come in packets of 750-1000 so you can save money by working with another teacher on your grade level and splitting the cost of materials. You could also cut the boards from cardboard boxes, although if you are making a class set this may be too time consuming to make it worth the effort.



Directions: These directions are for 4in. x 6in. boards. If you are making a larger size adjust the measurements accordingly.

- Use the tip of your scissors (or a large needle) to poke two small holes at each end of the chipboard sheet, about 1in. in from the side.
- Cut two 5in. lengths of elastic. Place one end of each piece of elastic into the holes at one end of the board and tie in a knot at the back.
- Place five white beads and five red beads on each length of elastic. When looking at the finished board, the beads should be pushed over to the 'Start Position' (the right hand side), with the white beads on the right and the red beads towards the left. Note that the start position has the beads on the right so that when a child pushes the beads over s/he can 'read' the rekenrek from left to right.
- Once all the beads are on the elastic, thread the elastic through the holes on the other end and tie securely so that the elastic is pulled tight.

If you are having a curriculum information session early in the year where you will discuss your math curriculum have your students' parents help you with this project. Explain how you will be using this tool throughout the year and show parents a few of the rekenrek activities that you will be introducing throughout the year to develop number sense. Get them to help you out by making two for their child: one for school and one to take home. If you have all the materials ready ahead of time this should only take a few minutes and will save you having to make them all yourself.