

Paper Weaving with Math Magic!

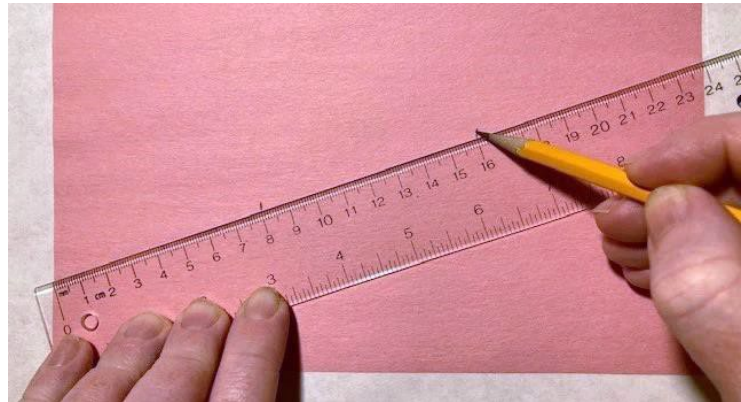


Presenters: Reed Moore and Dahlia Benedikt

Grade Range	Content Area	Materials
3 and up	<ul style="list-style-type: none">● Patterning● Geometry and Measurement	<ul style="list-style-type: none">● 2 sheets of colored paper● 30cm ruler● pencil● scissors

Activity

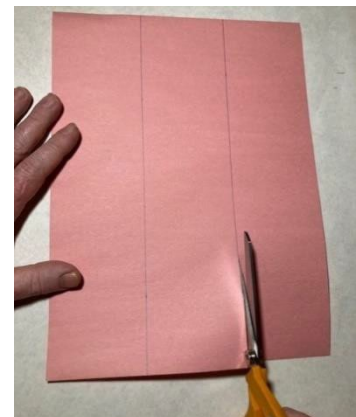
1. Cut two different colors of paper into strips. Construction paper (or a similar size) is recommended. Strips must be at least 3x longer than they are wide. To make optimal use of your paper, cut it into equal thirds lengthwise using the measuring “trick” described below.



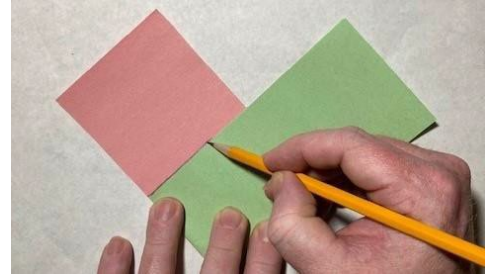
Measure the width of your paper. It is most likely a number not easily divisible by 3, for example mine was 22.9cm. To avoid using a calculator and bothersome decimal numbers, find the multiple of 3 just past your width, in my case 24cm. Angle your ruler up the page slightly until 24 lines up with the edge. Since $24 \div 3 = 8$, make a mark at 8 and another mark at 16. Ta-da! Perfect thirds!

2. Repeat this trick further up or down the page to create a second set of marks. Connect the pairs of marks and cut along the lines to create 3 equal pieces!

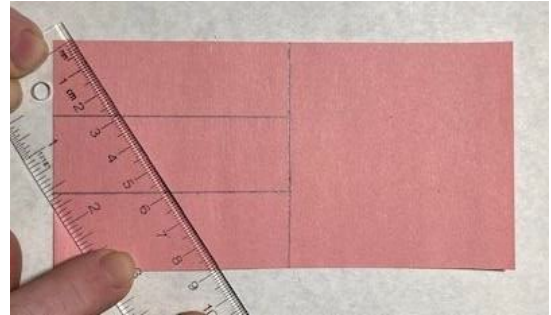
Note: This trick works in many other situations too – if dividing something into 5 equal parts, angle the ruler to the nearest multiple of 5 (say 25cm) and then make marks at 5, 10, 15, and 20. It’s even more effective when using imperial measurements to avoid fraction math: Need to find the center of something $11 \frac{7}{16}$ ” wide? Tilt the ruler to 12” and make a mark at 6”!



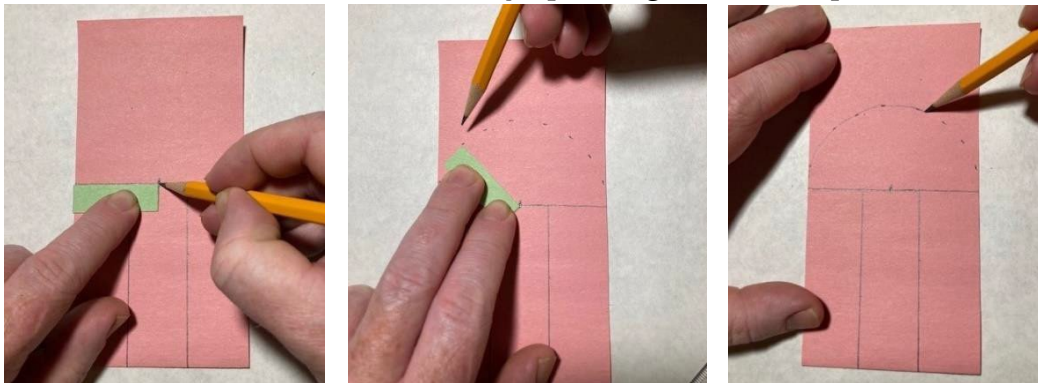
3. Fold your two colored strips in half and line them up as shown below. The folds should be towards your body. Mark with a pencil where the top one overlaps the bottom one.



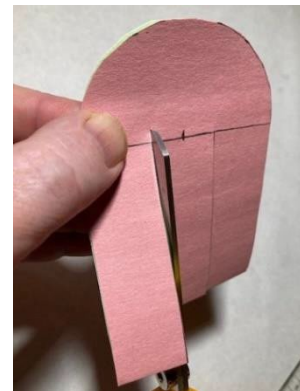
4. The overlapping parts will eventually become the woven part, so next you'll need to mark out the "fingers" that will be woven together on one of the two pieces. You can use the measuring trick above to divide the width evenly – I recommend dividing into thirds, although halves, quarters, fifths, etc. will all work. (In this example I angled the ruler to 9cm and marked at 3cm and 6cm.)



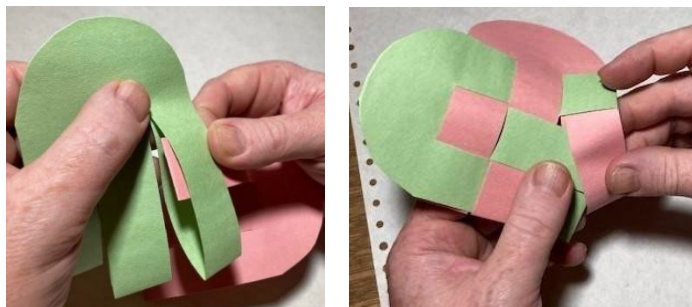
5. Create a semi-circle above the woven area. This will form the two upper "lobes" of the heart. This can be done freehand, or use a small cutoff from the top of one of your strips to help sketch out the radius. Fold the cutoff in half and use it to first find the center of the semi-circle and then use the folded piece to make a series of dots around that center – these can then be connected to make an eye-pleasing circular shape.



6. Lay your two pieces of paper together and cut them both at the same time (I find it works best if one is nested inside the other). Tip: cut the fingers a little bit past the boundary line to give yourself a bit of wiggle room when weaving.



7. Weave the fingers together. So it can open as a basket, weave together by passing a finger THROUGH the other finger (not over or under). Complete slipping the fingers through each other in an alternating pattern until the weave is complete!



Extensions, Modifications & Additional Resources



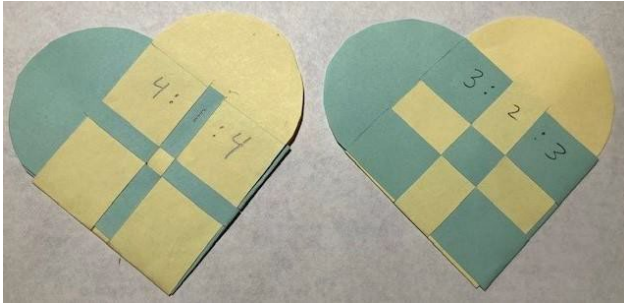
Simplifications:

- Create a 2x2 woven pattern before attempting the 3x3 pattern described above.
- The measuring techniques and lay out of lines can be done by a teacher or adult beforehand so children can focus on cutting and weaving.
- Simple over-under weaving instead of passing fingers through each other (requires less manual dexterity but will not make a basket).

Intermediate/Advanced Techniques:

- Create fingers of different widths using a variation on the measurement trick. In step 4, when the ruler is tilted to 9cm to divide into thirds, instead think of numbers that ADD to 9, for example $4+1+4=9$. Make marks at 4cm and 5cm (instead of 3 and 6) to create a thin center finger. Or tilt the ruler to 8cm and use $3+2+3=8$. See picture examples on next page.
- This is a good opportunity to discuss questions such as:
 - ✓ What other 3-finger width combos can you make using 9? Or 8? Or 10?
 - ✓ How many unique 3-finger patterns can you make using 9 or 8 or 10?
 - ✓ Are there more patterns with a wide or a narrow middle finger?
 - ✓ Does this change if the number is even or odd?
 - ✓ Why must the starting strips be at minimum 3x longer than they are wide?

- Try some of the advanced patterns below, and even attempt to create your own patterns, like my Super Bowl-themed attempt below.



Advanced Patterns (screenshots from: <https://youtu.be/Oni3nX9sYkw>)

