



LED Origami

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<https://learn.adafruit.com/led-origami>

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Overview



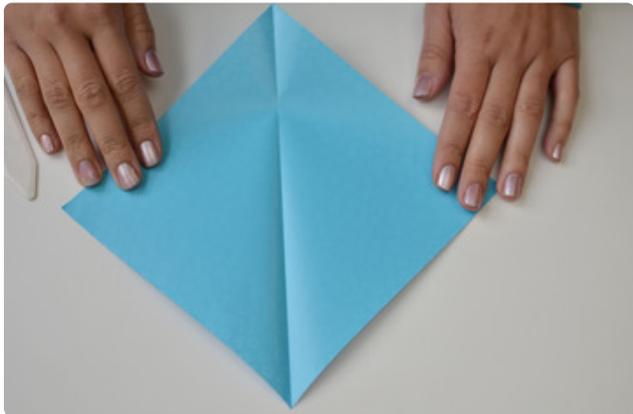
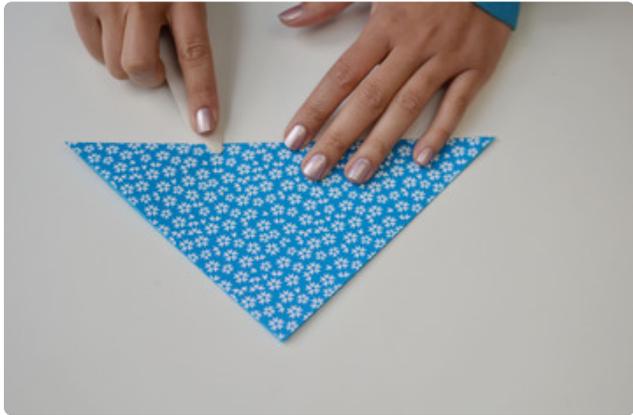
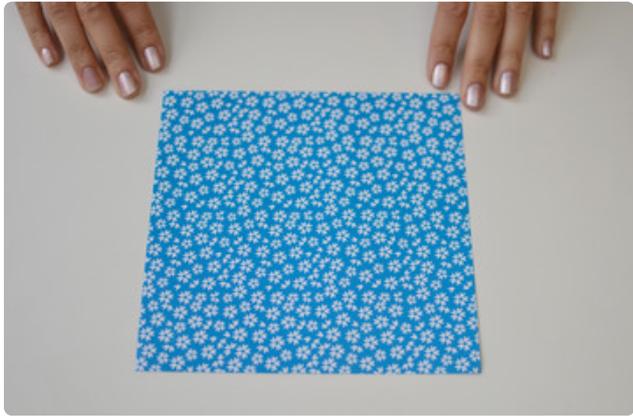
Make your origami glow! It's easy to make a simple circuit illuminating any origami form. This tutorial will show you how to make a paper lotus flower and frog, and two ways to light them up. You can either affix a coin cell battery on the underside of the form or install LEDs to use with a piece of a clear, conductive material called ITO. By powering up the whole plane with a battery pack and alligator clips, you can play out scenes with your flowers and frogs by arranging them on this clear "pond" to switch them on. This is a great project to do at a workshop or with kids!

Tutorial photos and special assistance creating this project provided by Risa Rose.

Lotus Construction

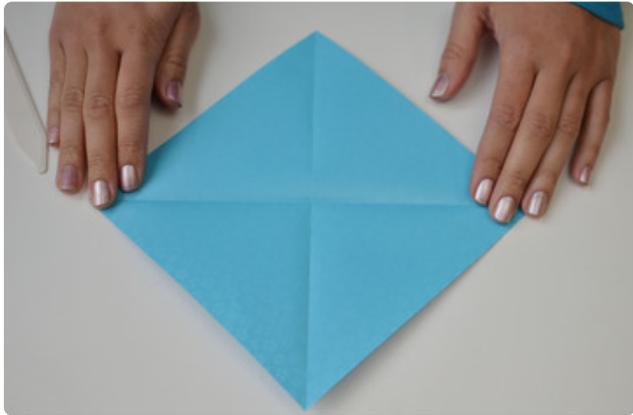
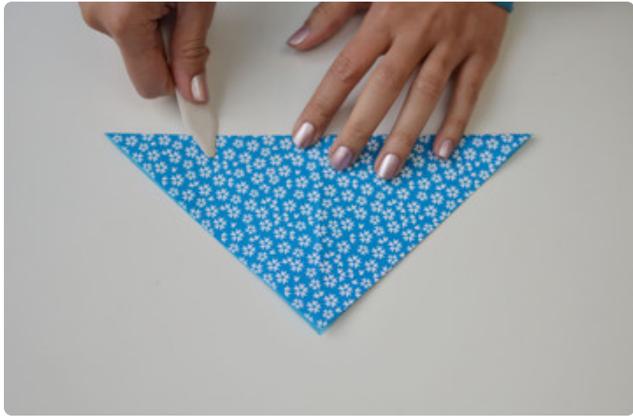


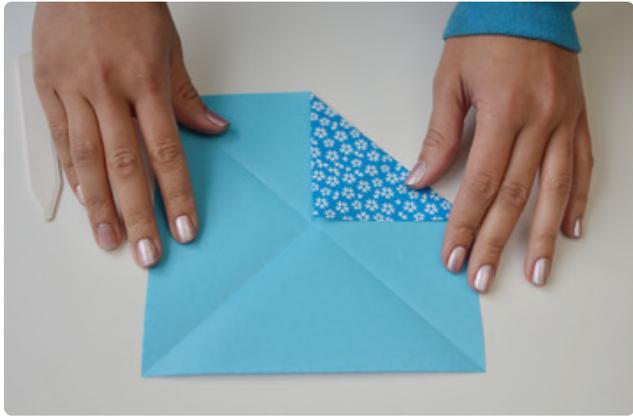
To make an LED paper lotus, grab your favorite origami paper, an LED, battery, and some tape. Use a hard object to help you crease your paper-- it could be a genuine bone folder, the handle of your scissors, or even the edge of your iPhone.



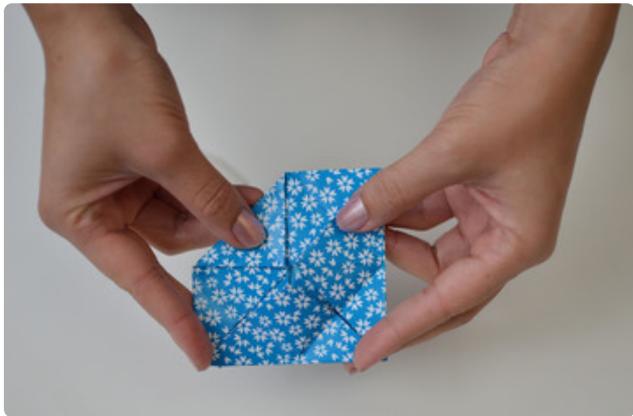
Start with one sheet of square origami paper-- any size will work.

Fold in half diagonally to make a triangle, unfold and repeat in the opposite direction. Unfold.





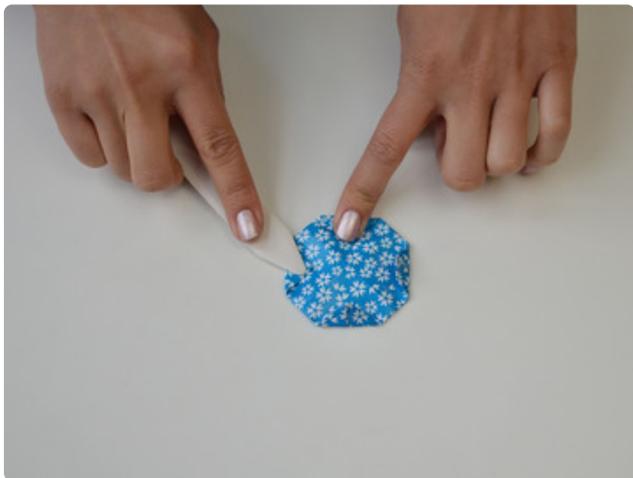
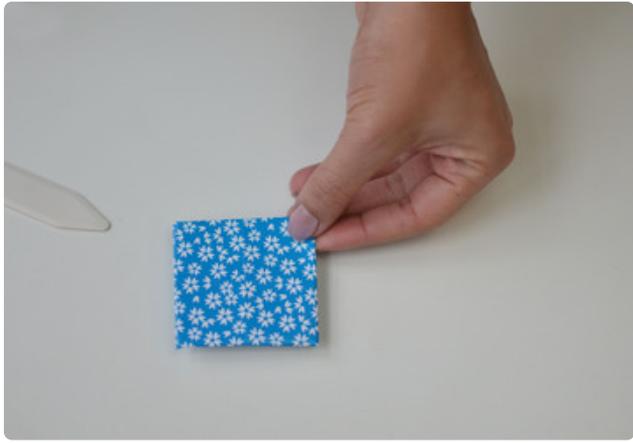
Fold all four corners to the center X.



Once again fold each newly-formed corner into the center. Strongly crease these folds using a bone folder or similar hard-edged tool.

Then repeat this process one more time--fold all four corners to the center and crease.





Flip over and fold in the corners 1/3 of the way toward the center X.

Try to fold an even amount on each corner.

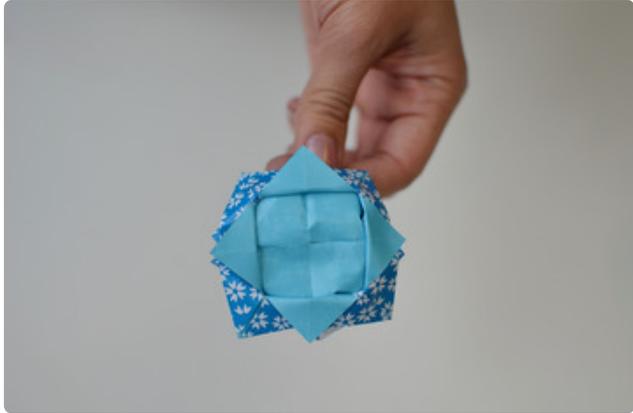


Flip over and slowly pull back each quarter-section from the center toward the outside edge of the figure, turning the flap inside-out onto itself, sort of like peeling off your socks!

Make sure to hold the flower from both sides so it doesn't rip while pulling. Repeat for the other three petals, then peel back the next layer of exposed petals in the same manner.



Continue to slowly pull each petal over to face the top of the flower figure. Try placing your finger in the center of the petal on the opposite side especially on the second layer as it gets tougher to pull over the first layer.



Fold back the last remaining layer like the others, then turn the flower over and curl the petals for a more natural look as well as easy access to the center of the flower. Your lotus is finished, now it's time to add the LED!



Apply a small piece of tape the center of the flower on the back and front so when you pierce the LED through the paper will not rip.



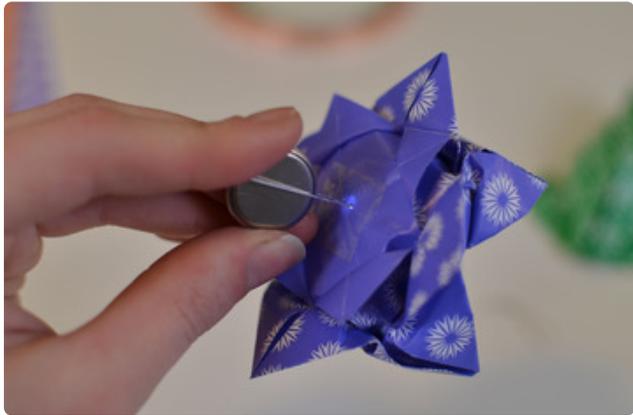
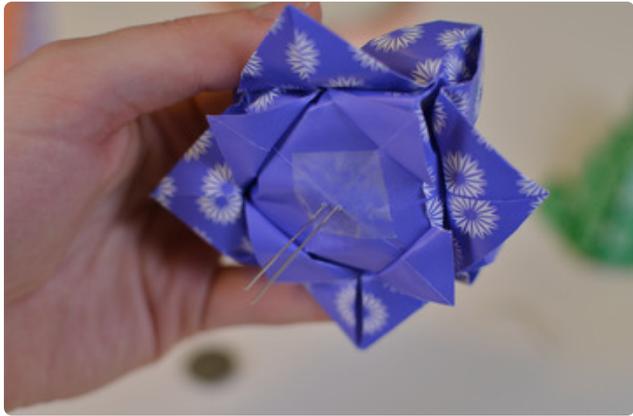
Pierce the LED legs through the center of the flower.

Skip to the last step to add a battery on-board, or read on:

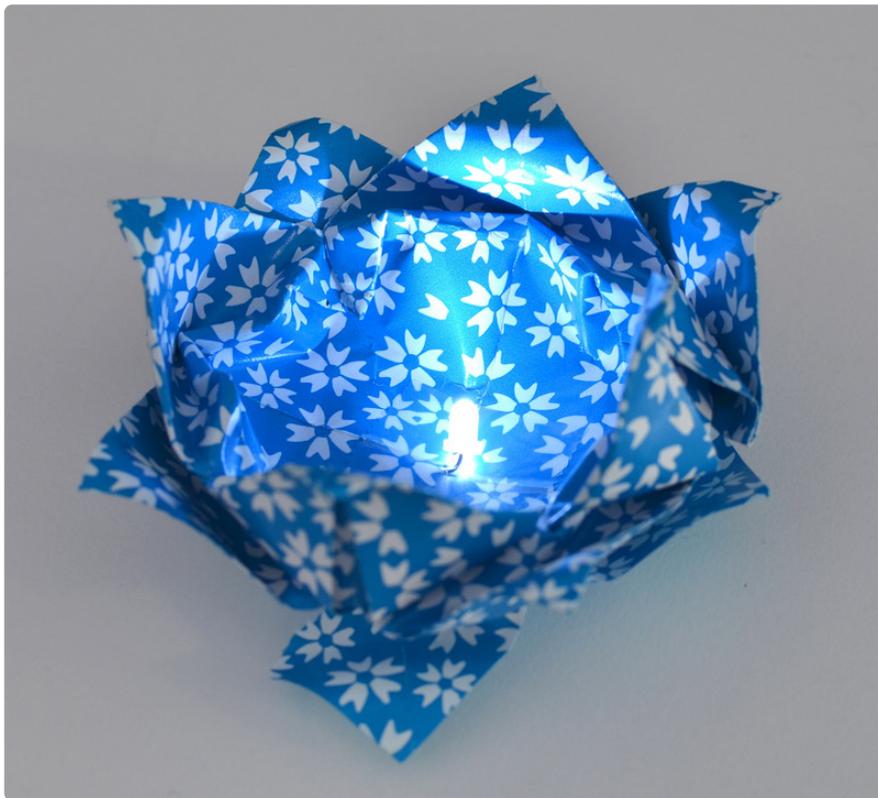
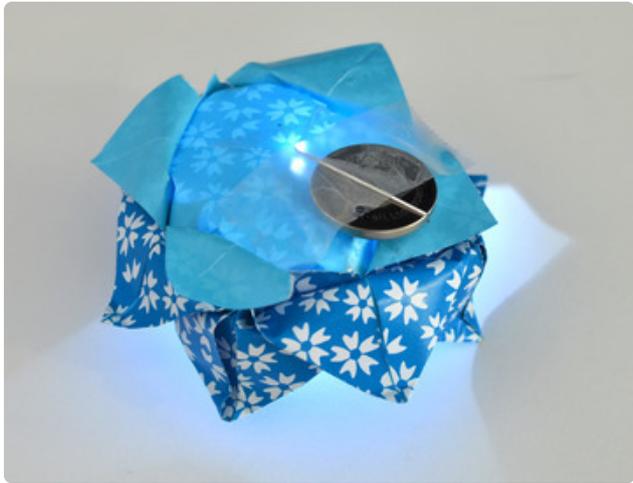


To make the lotus light up on a clear "pond" as described in [an upcoming page \(https://adafru.it/c6n\)](https://adafru.it/c6n), pull the LED legs apart. Use pliers to give the LED legs a gentle curve for better contact with the ITO.



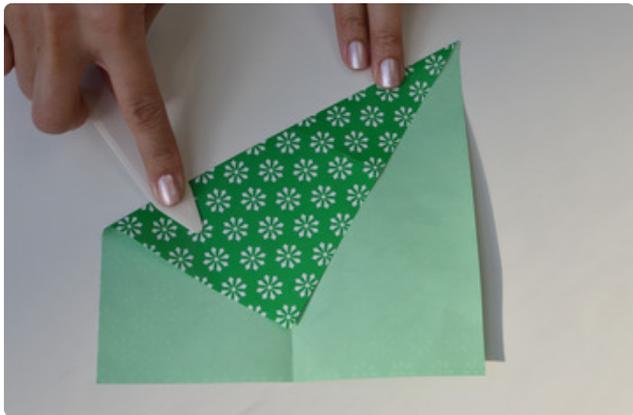
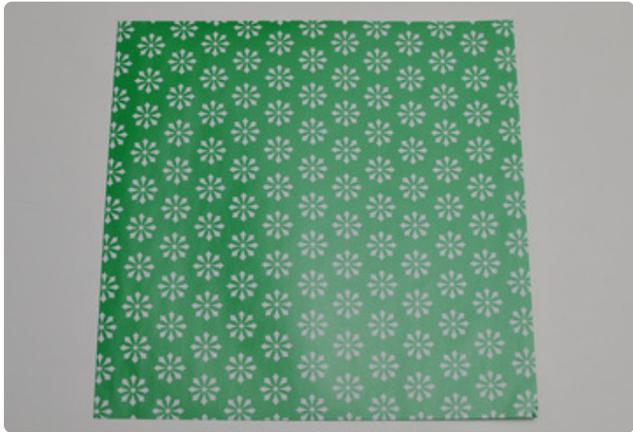


For a battery on-board, don't splay the LED legs, but instead place the battery in between them. If the LED doesn't light up, reverse the battery. Bend the whole sandwich to the side and tape to the bottom of the lotus.



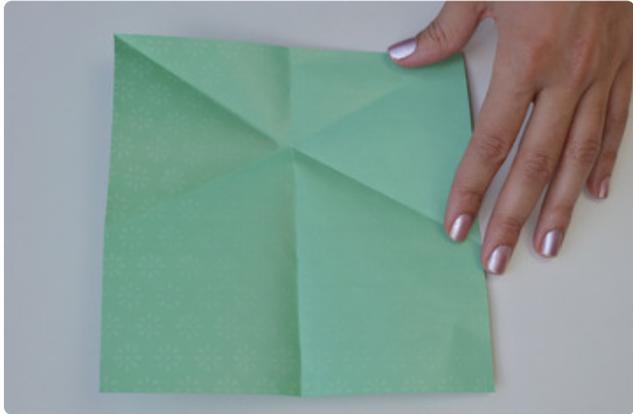
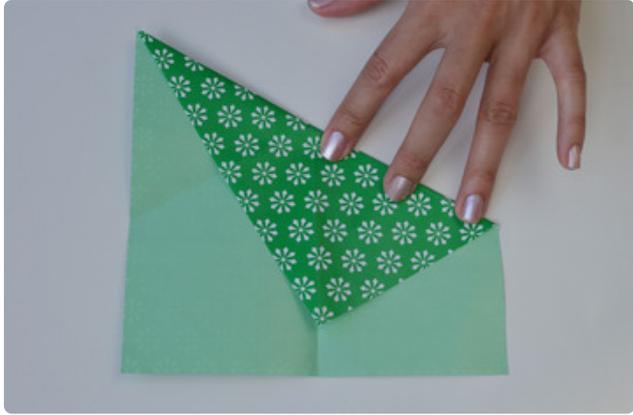
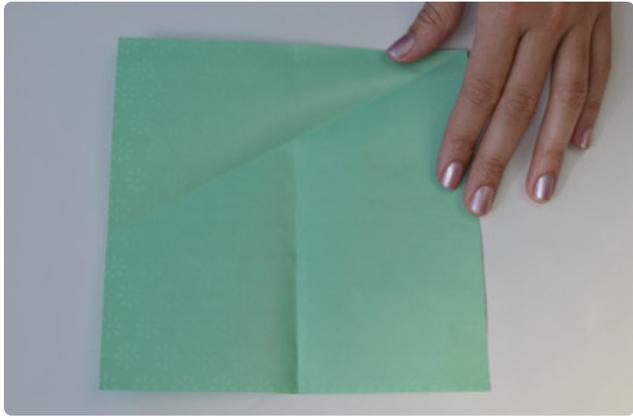
Frog Construction





Start with a 7 inch square of origami paper-- smaller becomes more difficult.

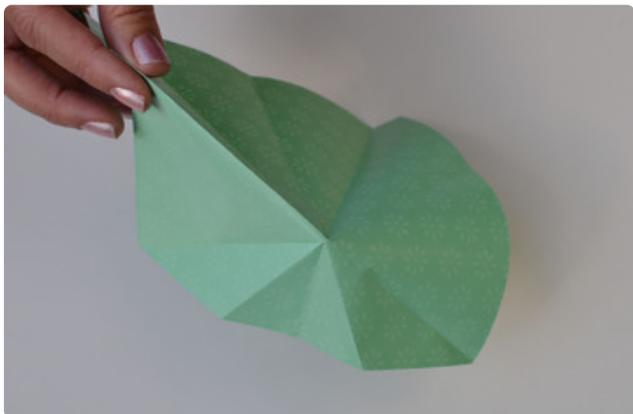
Fold in half to make a rectangle with your desired side facing out (for us it's the patterned side as shown). Then pull the corner to the mid crease, bisecting the corner shown in the upper right. Unfold and repeat with the upper left corner, then unfold.

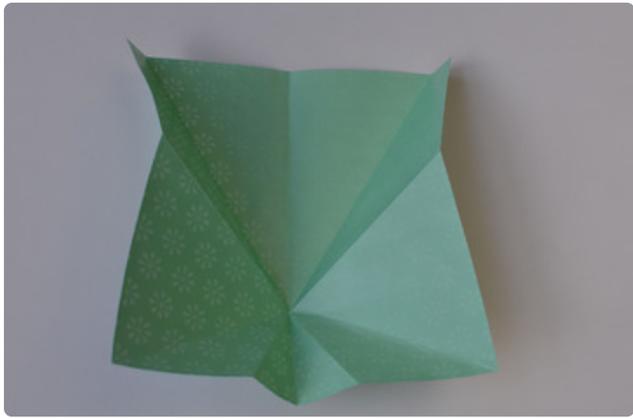




Refold the upper left corner along the crease you just made. Bisect the creased edge by bringing the upper right corner point over to the left edge of the paper, right where the fold is. Crease the new fold created at the right side of the paper.

Completely unfold the paper and repeat the above on the other side, starting with the upper right corner. Unfold and check that your creases match the photo, then spin your paper 180 degrees so the top edge is now at the bottom edge.

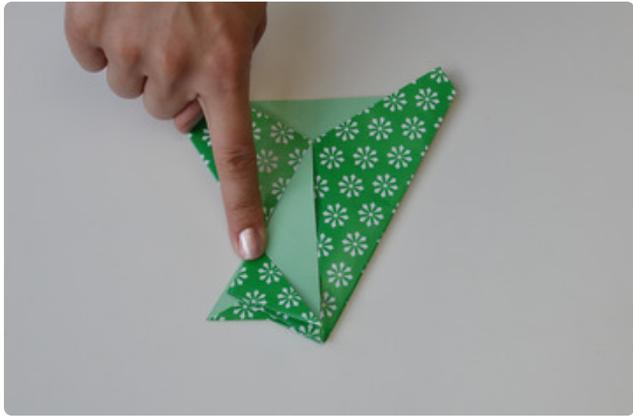


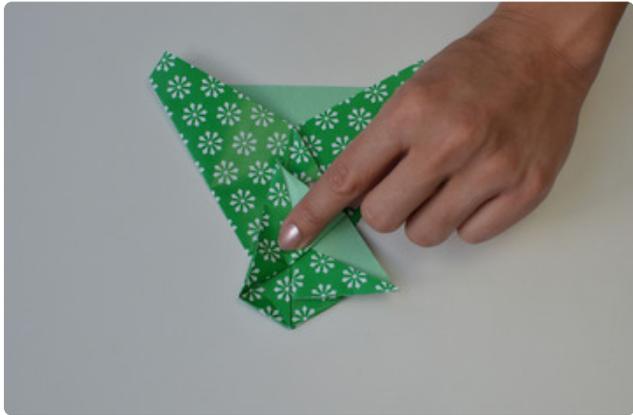
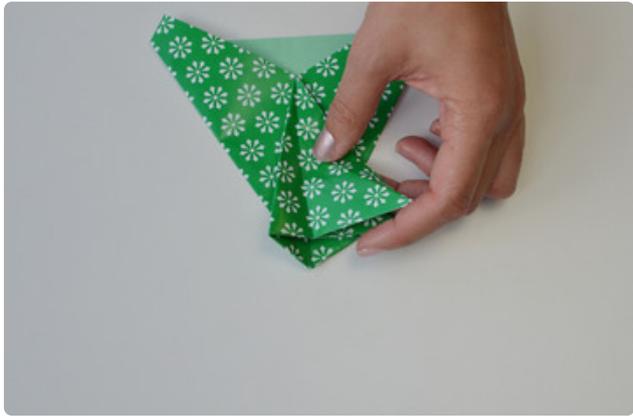


Your new creases can help guide you-- let the right and left sides come together while the bottom edge folds up, as shown.

Swing the right "wing" to the left, hinging at the center line. Bring the point of this wing down to meet the bottom center point and crease your fold. Repeat with the other wing.

Then create a valley fold in each of the "inner triangles," bringing the creased edges you just made to the center line and flatten the form as shown.





Open up one of the flaps and fold the flap's bottom edge up to meet the flap's outer edge.

Use this new crease to invert the center bottom corner of the flap and re-flatten, as shown.

Repeat on the other side.

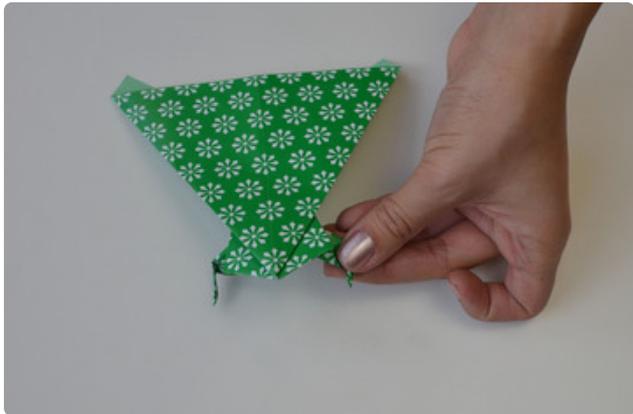




In this step the frog begins to become 3D. See the remaining back side of the paper showing? Fold this triangle over itself beginning with the point of the front foot and easing into the center of the frog, allowing the top end of the paper to begin to curve.

Fold each front leg in half lengthwise to give them shape.





Turn the frog over and bend 1/4 of the arm forward and invert the "hand" so it is able to stand.

Turn your attention to the broad back end of the frog. See those bits of paper showing out from under the cape? Fold them to the interior of the frog to hide them.





Turn your frog over and fold the body 1/3 of the way up.

Fold each leg over to make the hip. The exact angle isn't important, just keep the legs consistent.



Fold each leg back onto itself and create another crease parallel to the hip.

You can stop here for a perfectly respectable frog! If you want to create extra bounce and a more 3D form, unfold the bottom half of the frog and then fold the whole frog in half at its center back. Bend the "belly" to one side to create an inversion that helps tuck the frog's rear under itself while doming the back.









Return the frog to its unfolded state and invert the creases you just made while helping the back become a dome. Then re-fold the back legs for an extra hippity-hoppity frog.



If you're making a pond scene with ITO as described on the next page (<https://adafruit.it/c6n>), prepare the led by taping it inside the frog with copper tape that extends from each lead to the rear feet.

To carry a battery on board, simply sandwich the LED leads around the battery (flip it around until it lights up) and tape the assembly inside the frog. Adjust the angle of the LED to suit your taste.



Here is the frog photographed from underneath the clear ITO!

Pond Scene with ITO



To create a pond for your flowers and frogs, score a piece of [indium tin oxide-coated plastic \(ITO\)](http://adafru.it/1309) down the middle with the blade of a pair of scissors, a craft knife turned sideways, or another sharp-but-not-too-sharp tool to create two conductive planes. Use alligator clips to attach one plane to power and one plane to ground of a battery pack.

Place your lotus across the score in the ITO so one LED leg is touching each plane. If it doesn't light up, just turn it around the other way to reverse polarity.

Experiment with different LED colors and even use multiple LEDs in one lotus! Watch what happens when you add a red LED to the mix-- it "hogs" the power since it's easier for electricity to conduct through it than a blue LED.



