

# Finding the center of mass of a flat irregular-shaped object

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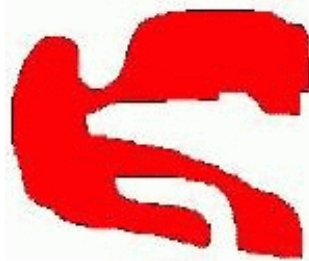


Fig. 1

It is sometimes difficult to accurately determine the center of mass of irregularly-shaped flat objects, such as the weirdly-formed plate illustrated above (Fig. 1). Here is one well-known method that always yields excellent results. The method has been in use for at least two hundred fifty years, but its discovery is probably ancient. **Note:** In order for this method to work well, the object must have a uniform thickness.

Step 1) Cut a length of string that is at least as long as the longest dimension of the object that you are measuring. Attach a weight (such as a lead fishing sinker) to one end. Tie a small loop at the opposite end of the string.

Step 2) Place a small dot at 3 randomly-placed locations on the object, each dot located near an edge (Fig. 2).

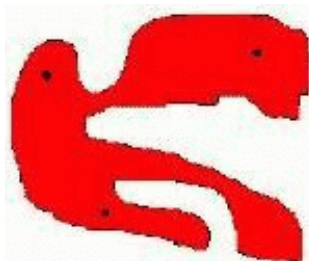


Fig. 2

Step 3) Using a pin or a nail, punch a hole through each dot. Insert a pin or tack through one of the holes (Fig. 3). If the object is hard, then you will have to drill a hole in the object. **Important:** The hole should be *slightly larger* than the diameter of the pin or nail (in other words, the hole should be big enough so that the object rotates *freely* on the mounting pin). Then, using the same pin/nail as a hanging attachment, attach the object onto a vertically-oriented cork board or to a similar vertical wall. Make sure that the object can swing freely, with *no* resistance and no binding.

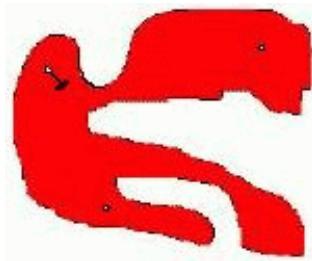


Fig. 3

Step 4) Next, attach the string with its attached weight onto the pin/nail (Fig. 4). The weight should hang straight down, with the string perfectly aligned with the "g" (gravity) vector. The string with its attached weight is your **plumb line**.

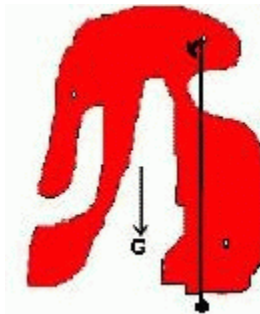


Fig. 4

Step 5) Trace the line of the string onto the object with a pencil or other marker. This step is where you must be very precise. One easy way to do this is to use as one end point the hole from which the string is hanging. Then place a mark on the object, directly under the string, close to its opposite end (to facilitate this, you can shine a flashlight's beam at *exactly*... really...I mean *exactly* 90 degrees to the surface of the object, and then place your mark along the shadow that is being cast by the string. Do not touch the string, itself). Lastly, use a straight edge (ruler) to help you draw a straight line between these two points.

Step 6) Remove the pin from the object and place the pin in the second hole. Re-hang the object and repeat the same procedure. Repeat the procedure with the third hole. When you have finished, you will have drawn three lines on the object (Fig. 5).

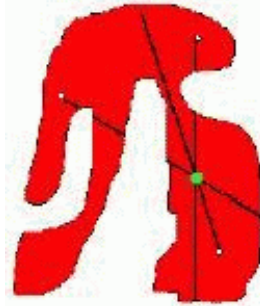


Fig. 5

Step 7) The center of mass should be at the intersection of the three lines (Fig. 5, above).\*

**Note:** It should be obvious, even to the casual observer, that only *two* lines are needed to find the object's center of mass. The 3rd line is only used to check the accuracy of your methodology (were you sloppy in step 5?). If all three lines don't meet at a single point, then repeat the process from the beginning (using the same three holes). Make sure that the object can rotate freely on its pin with no resistance.

\* To be precise, the center of mass is under the green-colored point, *inside* the plate, exactly half-way through its thickness.