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///////////////////////////////
// Paraboloid module for OpenScad
//
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// http://www.thingiverse.com/Ablapo/designs
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///////////////////////////////

module paraboloid (y=10, f=5, rfa=0, fc=1, detail=44){
    // y = height of paraboloid
    // f = focus distance
    // fc : 1 = center paraboloid in focus point(x=0, y=f); 0 = center paraboloid on top (x=0, y=0)
    // rfa = radius of the focus area : 0 = point focus
    // detail = $fn of cone

    .1 hi = (y+2*f)/sqrt(2); // height and radius of the cone -> alpha = 45° -> sin(45°)=1/sqrt(2)
    .2 x = 2*f*sqrt(y/f); // x = half size of parabola
    .16 translate([0,0,-f*fc]) // center on focus
    .15 rotate_extrude(convexity = 10,$fn=detail ) // extrude paraboloid
    .14 translate([rfa,0,0]) // translate for fokus area
    .13 difference(){
        .10 union()// adding square for focal area
        .7 projection(cut = true) // reduce from 3D cone to 2D parabola
        .6 translate([0,0,f*2])
        .5 rotate([45,0,0]) // rotate cone 45° and translate for cutting
        .4 translate([0,0,-hi/2])
        .3 cylinder(h= hi, r1=hi, r2=0, center=true, $fn=detail); // center cone on tip
        .9 translate([-rfa+x ,0])
        .8 square ([rfa+x , y ]); // focal area square
    } // end union
    .12 translate([-2*rfa+x ], -1/2)
    .11 square ([rfa+x ,y +1] ); // cut of half at rotation center
} // end difference
} // end module
// Greg's code starts here

(6) difference{
    (2) translate([0,0,-1])
    (1) paraboloid (y=51,f=10.5,rfa= 0,fc=1,detail=120); // outer shell
    (3) paraboloid (y=50,f=10,rfa= 0,fc=1,detail=120); // cut out the required parabola
    (5) translate([0,0,-15])
    (4) cylinder(20,5,5); // and the aperture for access
};

1. call up paraboloid module for the outer shell
2. move it 1mm This is Entity 1 for the difference operation
3. call up the paraboloid module for the shape we need This is Entity 2
4. call up the cylinder operation to make a hole punch
5. move it so it cuts through the paraboloid section This is Entity 3
6. Subtract Entities 2 and 3 from Entity 1 This is the result to be rendered

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Steps 1 and 3 call up the paraboloid module. Within that, the actions are as follows