CADjs (www.CADjs.org); Version 2016.01

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3D Solids

- **cube**(L,H,W);
  - g = cube(200,50,10);
  - g = cube(5);
  - g = cube();
- **cylinder**(R,H)
  - g = cylinder(50,200);
- **cone**(rBase,rTop,H)
  - g = cone(100,5,300);
- **sphere**(R)
  - g = sphere(100);
- **torus**(R,r)
  - g = torus(100,40);
- **textgeom**(string,H,D)
  - g = textgeom('John')

Booleans

- **union(**geom**)**
  - g = cube(2).union(cylinder());
- **difference(**geom**)**
  - g = cube().difference(sphere(.6));
- **intersection(**geom**)**
  - g=cube().intersection(sphere(.6));

Display, Save, Info

- **display** (), **display**(color)
  - g = cube().display('blue');
- **displayTransparent**(color)
  - cube().displayTransparent ();

For colors supported see link:

Transformations,

- **clone();** make a copy
  - g2 = g.clone();
- **translateX**(d), **translateY**(d), **translateZ**(d);
  - g = cube().translateX(20);
- **translate**(dx,dy,dz);
  - cube().translate(20,40,0);
- **rotateX**(deg), **rotateY**(deg), **rotateZ**(deg),
  - g = cube().rotateX(90);
- **scale**(sx,sy,sz);
  - g = cube().scale(0.5,1,1);
- **mirrorX**(), **mirrorY**(), **mirrorZ**()
  - g = cone().mirrorY();

Info, Save

- **info**(); //area, volume, etc
  - cube().info();
- **saveSTL**(); save geometry as STL
  - cube().saveSTL();
- **saveOFF**(); save geometry in OFF format
  - cube().saveOFF();

2D Shapes

- **polygon**(arrayOfPts)

```
pts = [[0,0],[1,0],[0,1]];
s = polygon(pts);
s.display();
```

- **circle**(radius)

```
s = circle(3.0);
s.display();
```

- **polyarc**(arrayOfPtsAndArcs)

```
arc = [1.0,0.1,0.9,0.1,false];
pts = [[0,0],[0.9,0],arc,[1,1],[0,1]];
s = polyarc(pts);
s.display();
```

- **Adding holes**

```
pts = [[0,0],[1,0],[1,1],[0,1]];
s = polygon(pts);
c = circle(0.1);
s.holes.push(c);
s.display();
```

Loops

- **for** (i = 0; i < N;i++) {};

```
for (i = 0; i < 5; i= i+1){
    beep();
}
```

- **while** () {}

  See examples

Extrude, Revolve

- **extrudeShape**(s,thickness);

```
pts = [[0,0],[1,0],[0,1]];
s = polygon(pts);
g = extrudeShape(s,0.5);
```

- **revolveShape**(s,radius);

```
pts = [[0,0],[1,0],[0,1]];
s = polygon(pts);
g = revolveShape (s,3.0);
```

- **revolveShapeBetween**(s,radius,startAngle,endAngle);

```
pts = [[0,0],[1,0],[0,1]];
s = polygon(pts);
g = revolveShapeBetween (s,3,0,90);
```

- **sweepShapeAlongPath**(s,path);

  See examples

If, Else

- **if () {} else {};** see examples

Functions

- **function f**(h){}; see examples

Splines, Bezier

- **start2DGeom**(x,y)

```
s = start2DGeom(0,0);
```

- **addLine**(x,y);

```
s.addLine(1,1);
```

- **addArc(x,y,xc,yc,clockwise)**

```
s.addArc(1,1,0,1,false);
```

- **addSpline(<array of 4 pts>)**
- **addBezier(<array of 4 pts>)**

Math

- **makeArray(start,end,step);**

```
t= makeArray(0,1,0.1);
```

- **math.poly(coeffArray,tArray);**

```
x= math.poly ([0,1,-1],t);
```

- **math.sin(tArray);**

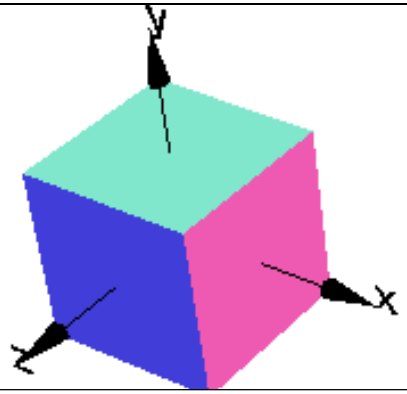
```
x= math.sin ([0,1,-1],t);
```

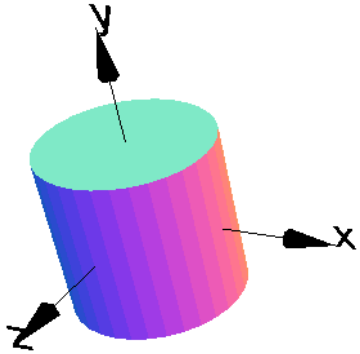
- **b = scalarMultiply(array,a)**

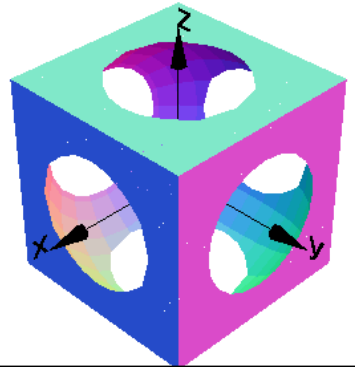
```
x = scalarMultiply(x,2.0);
```

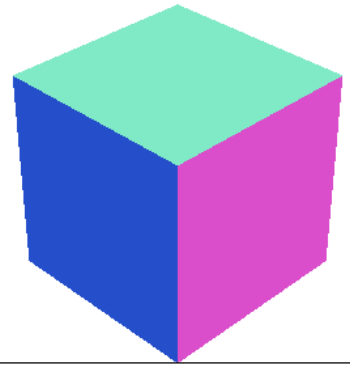
- **plot2d(xArray,yArray,clr);**
- **plot3d(xArray,yArray,zArray,clr);**

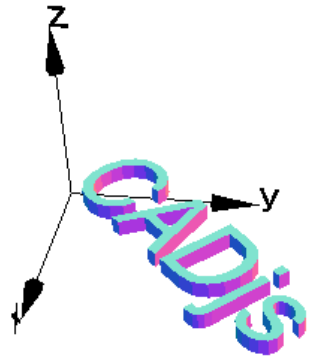
CADjs Examples

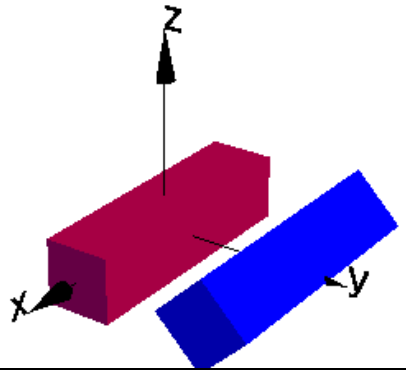
Category	Figure	Example	Variations
Basics		g = cube(100); g.display();	g = cube(200,60,20); g.display('blue');

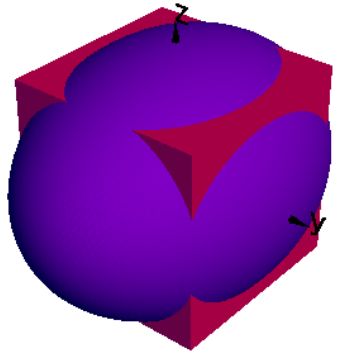
Solids		radius = 100;
		height = 200;
		g = cylinder(radius,height);
		g.display();
			g = torus(100,25);
			g = cone(100,50)
			g= sphere(100);

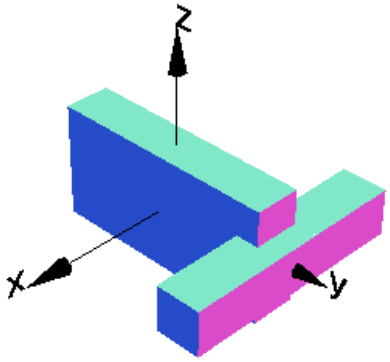
Booleans		g1 = cube(1);
		g2 = sphere(0.6);
		g1 = g1.difference(g2);
		g1.display();
			g1 = g1.union(g2);
			g1=g1.intersection(g2);

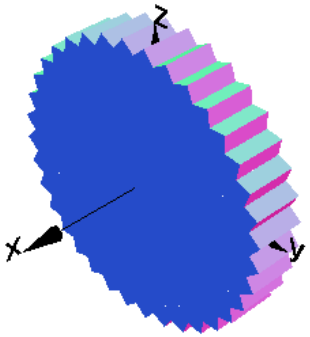
Axes		g = cube(1);
		g.display();
		axesoff();
			g = cube(1);
			g.display();
			axeson();

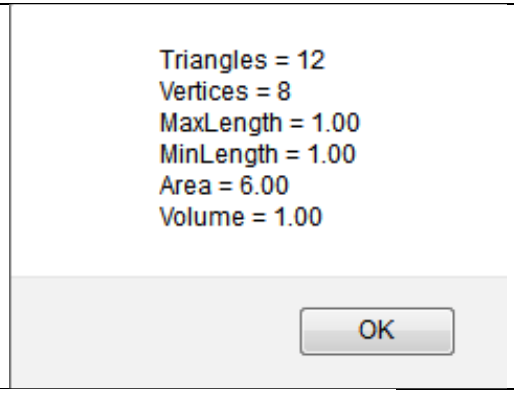
Text Geometry		g = textGeom("CADjs");
		g.scale(2).rotateZ(45);
		g.display();	

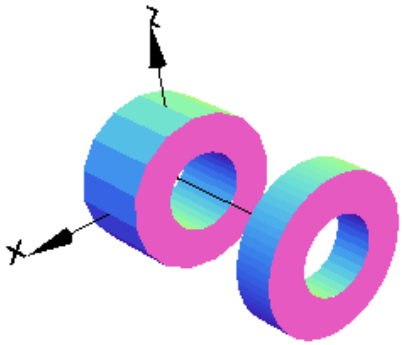
Move & Rotate		g = cube(1,0.25,0.25);
		g1 = g.clone();// create copy
		g1.rotateX(45);
		g1.translateY(0.5);
		g.display('red');
		g1.display('blue');
			g1.translateY(0.5);
			g1.rotateX(45);
			g1.translate(1,-1,0.2);
			g1.displayWireFrame();

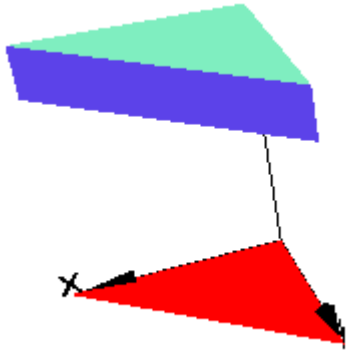
Scaling		g1 = sphere(1,64);
		g1.scale(1,0.75,0.75);
		g1.display('purple');
		g2 = cube(1.15);
		g2.display('red');	

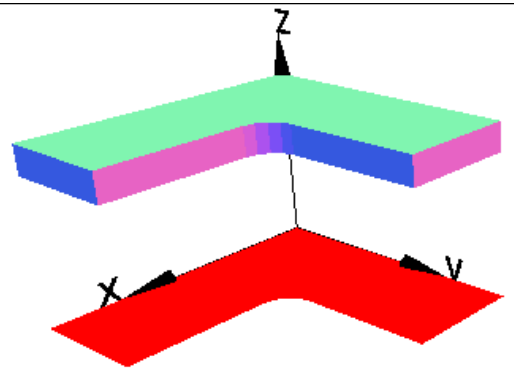
Concatenation of functions		g1 = cube(1,0.2,0.2).rotateX(90).translateY(0.5);
		g = cube(0.2,1,0.5).union(g1);
		g.display();	

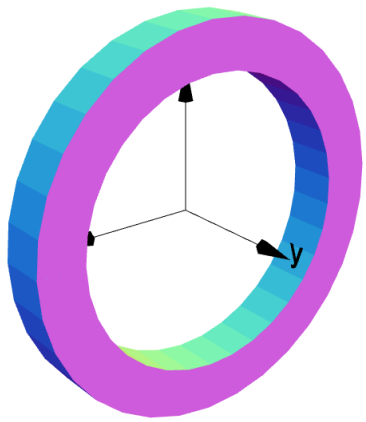
loops		g1 = cube(0.25,1,1);
		g = g1.clone();
		for (var i = 0;i < 9;i++) {
		  g1.rotateX(10);// 10 degrees each time
		  g = g.union(g1);
		}
		g.display();
			i = 0;
			while (i < 10) {
			...
			i++;
			}

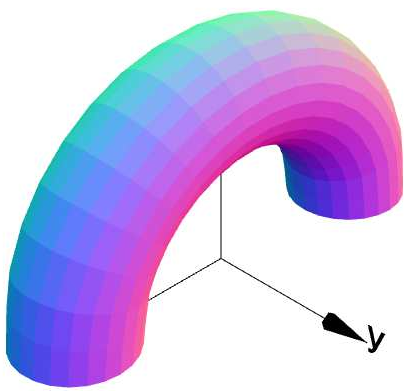
Geometry Info		g = cube(1); g.info();	

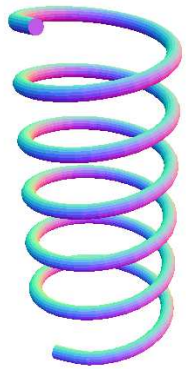
functions		function insert(h) {
		var g1, g2, g;
		g1 = cylinder(0.2,h);
		g2 = cylinder(0.1,h);
		g = g1.difference(g2);
		return g;
		}
		g1 = insert(0.2);
		g1.display();
		g2 = insert(0.1).translateY(0.5).display();	

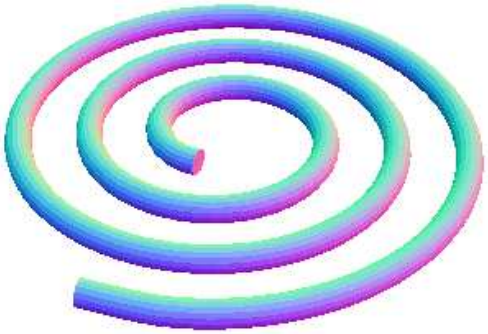
extrude		s = polygon([[0,0],[0,1],[1,0]]);
		s.display();
		g = extrudeShape(s,0.25);//thickness
		g.translateZ(1).display();	

extrude		arc =[0.4,0.5,0.5,0.5,true];
		s = polyarc([[0,0], [1,0],[1,0.4],[0.5,0.4],arc,[0.4,1],[0,1]]);
		s.display();//display 2D shape
		thickness = 0.1;
		g = extrudeShape(s,thickness).translateZ(0.5);
		g.display();

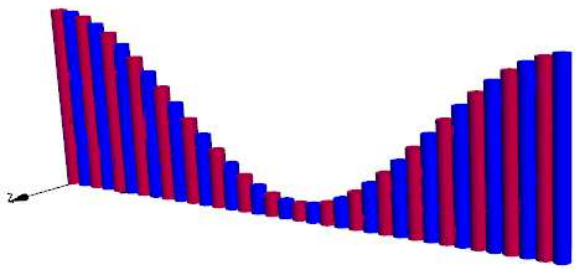
revolve		pts = [[0,0],[1,0],[1,1],[0,1]];
		s = polygon(pts);
		radius = 3;
		g = revolveShape (s,radius);
		g.display();

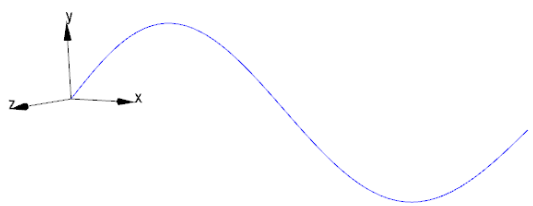
revolveShapeBetween		s = circle(1);
		radius = 3;
		g = revolveShapeBetween (s,radius,0,180);
		g.display();

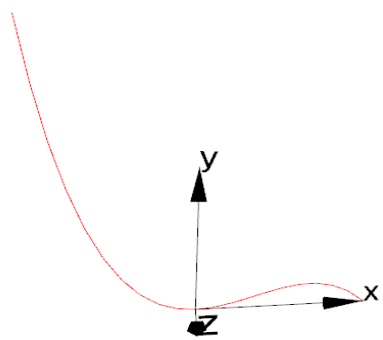
sweepShapeAlongPath		function helicalSpring(radius, rCrossSection,nTurns, pitch) {
		var x,y,z,nSamples,theta,vec;
		var path = [];
		shape = circle(rCrossSection);// make a circular shape
		nSamples = 10;//samples per turn
		for (var i = 0; i <= nSamples*nTurns; i++) {
		theta = 2*3.1415*i/(nSamples);
		x = radius*Math.cos(theta);
		y = radius*Math.sin(theta);
		z = pitch*i/(nSamples);
		vec = new THREE.Vector3(x, y, z);
		path.push(vec);
		}
		var g = sweepShapeAlongPath(shape,path);
		return g;
		}
		radius = 5; // radius of spring
		rCrossSection = 0.5;
		pitch = 4;// distance between consecutive turns
		nTurns = 6;// Number of turns
		spring = helicalSpring(radius, rCrossSection, nTurns, pitch);
		spring.display();

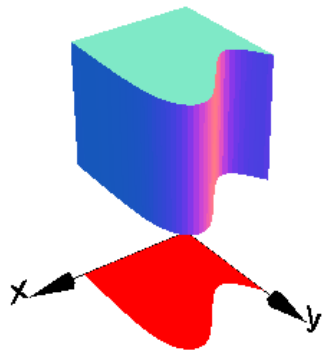
sweepShapeAlongPath		function torsionalSpring(rStart, rEnd,rCrossSection, nTurns) {
		var x,y,z,nSamples,theta,vec;
		var path = [];
		shape = circle(rCrossSection);// make a circular shape
		nSamples = 20;//samples per turn
		for (var i = 0; i <= nSamples*nTurns; i++) {
		theta = 2*3.1415*i/(nSamples);
		radius = rStart + (rEnd-rStart)*i/(nSamples*nTurns);
		x = radius*Math.cos(theta);
		y = radius*Math.sin(theta);
		vec = new THREE.Vector3(x, y, 0);
		path.push(vec);
		}
		var g = sweepShapeAlongPath(shape,path);

		return g;
		}
		rStart = 5; //
		rEnd = 1;//
		rCrossSection = 0.25;
		nTurns = 3;// Number of turns
		spring = torsionalSpring(rStart, rEnd,rCrossSection, nTurns);
		spring.display();

math		for (i = 0; i < 36;i++) {
		height = Math.cos(i*10*3.14/180)*50+60;
		g = cylinder(5,height);
		g.translateX(10*i).translateY(height /2);
		if (i % 2 == 0) // even
		g.display('red');
		else
		g.display('blue');
		}

plot2d & math		x = makeArray(0,2*3.1415,0.1);
		y = Math.sin(x);
		plot2d(x,y);

plot2d & math		t = makeArray(-1,1,0.1);
		x = Math.poly([0,1],t);
		y = Math.poly([0,0,1,-1],t);
		plot2D(x,y,'red');

spline		s = start2DGeom(0,0);
		s.addLine(1,0);
		s.addSpline([[1,1],[0.75,1.25],[0.25,0.75],[0,1.0]]);//4 points to create cubic spline
		s.addLine(0,0);
		s.display();
		g = extrudeShape(s,1).translateZ (1);
		g.display();

polygon example

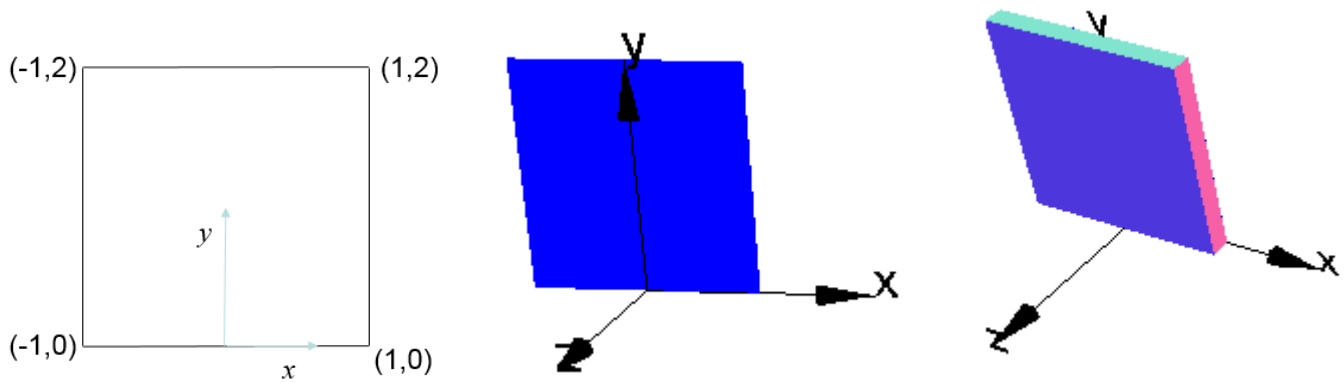
The shape below consists of 4 straight lines. To draw the sketch, we simply list the points in the anti-clockwise direction, starting from any point.

```
s = polygon([  [1,0], [1,2],[-1,2] ,[-1,0] ]);
s.display();
```

This will result in the shape shown in the middle. You can now extrude the sketch via:

```
g = extrudeShape(s,0.2).display();
```

This will result in the geometry shown at the right.



polyarc example-1

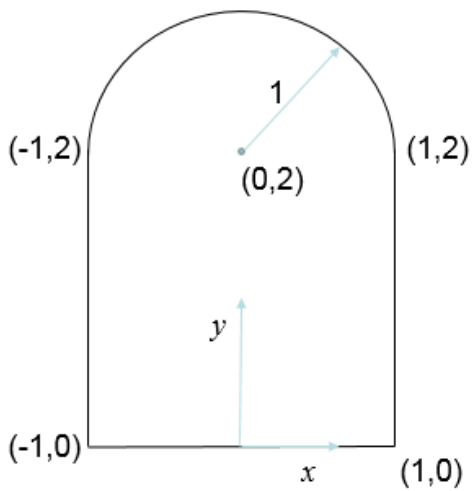
The shape shown on the left consists of 3 straight lines, and 1 arc. Observe that the arc goes from start point (1,2) to end point (-1,2) (anti-clockwise direction), with the center located at (0,2) with a radius of 1. To draw the arc, we don't need to worry about the start point or the radius. Instead we specify the end point, center point and direction, and create the sketch as follows.

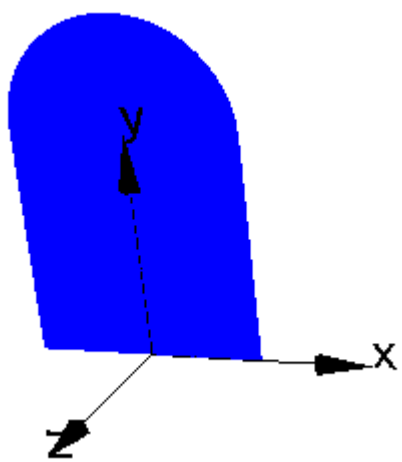
```
arc = [-1,2,0,2,false]; // first the end point, then the center point and finally the direction.
s = polyarc([  [1,0], [1,2],arc,[-1,0] ]);
s.display();
```

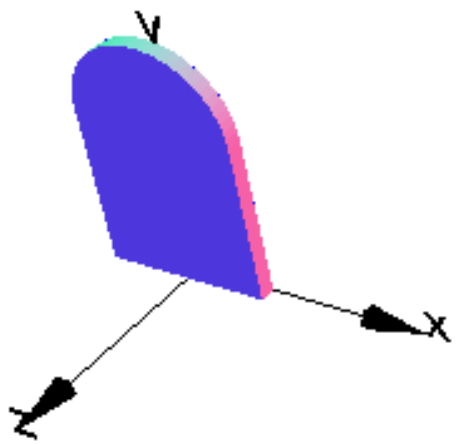
You can now extrude the sketch via:

```
g = extrudeShape(s,0.2).display();
```

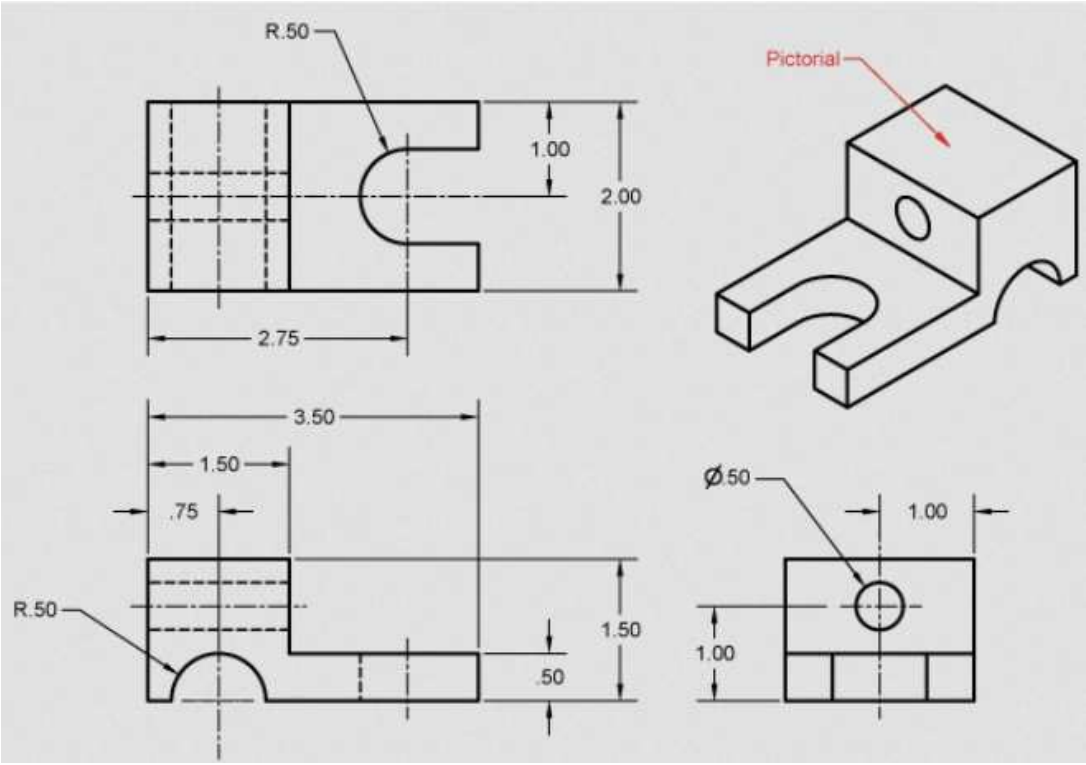
This will result in the geometry shown at the right.

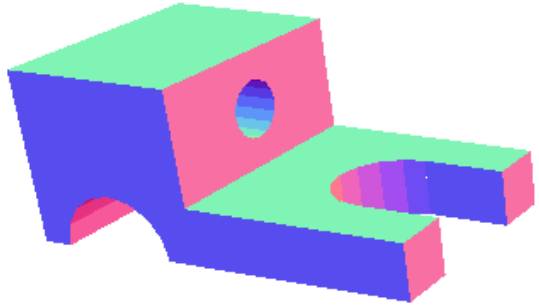






Fixture

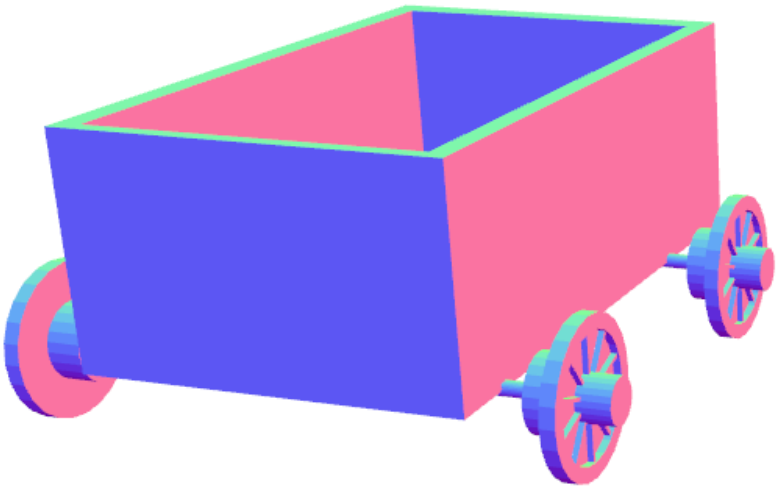




Method 1 using Booleans of cubes and cylinders	Method 2 using Sketch

base = cube(3.5,1.5,2);
g1 = cube(2,1,2);
hump = cylinder(0.5,2.5).rotateX(90).translateX(-1).translateY(-0.75);
cut1 = cylinder(0.5,2).translateX(1);
cut2 = cube(1,0.5,1).translateX(1.5).translateY(-0.5);
hole = cylinder(.25,2).rotateZ(90).translate(-1,0.25);
g1.translate(0.75,0.25,0);
base = base.difference(g1).difference(hump).difference(cut1);
base = base.difference(cut2).difference(hole);
base.display();
	arc = [1.25,0,0.75,0,true];
	s=polyarc([[0,0],[0.25,0],arc,[3.5,0],[3.5,0.5],[1.5,0.5],[1.5,1.5],[0,1.5]]);
	g = extrudeShape(s,2.0);
	cut1 = cylinder(0.25,2).rotateZ(90).translate(0.75,1,1);
	g = g.difference(cut1);
	g.display();

Wagon



```
function wheelFunction()
{
   //always declare variables, else they will be
   //treated as global variables, messing up code
   var g1, g2, g3,g4,g,gs,gsr;//always declare

   g1 = cylinder(10,2);//main
   g2 = cylinder(3,5).translateY(2);// outside hub
   g3 = cylinder(5,5).translateY(-3); //inside hub
   g4 = cylinder(8,2).translateY(1);//cutout
   g = g1.difference(g4).union(g2).union(g3);
   gs =cube(9,1.5,0.5).translate(4.5);// spoke
   for (i = 0; i < 10;i++) {
       gsr = gs.rotateY(36);
         g = g.union(gsr);
   }
   g = g.rotateZ(-90);
   return g;
}
var wheels = [];// create an empty array

wheels[0] = wheelFunction().translateX(35);
```

```
// use clone instead of calling function again
wheels[1]  = wheels[0].clone().translateZ(50);
// mirroring same as rotate about Z
wheels[2] = wheels[0].clone().rotateZ(180);
wheels[3] = wheels[1].clone().rotateZ(180);
for (i = 0; i < 4; i++)
   wheels[i].display();

axle1 = cylinder(1,70).rotateZ(90);
axle2 = axle1.clone().translateZ(50);
axle1.display();
axle2.display();

box1 = cube(50,30,80).translate(0,15,20);
box2 = cube(44,24,74).translate(0.25,19,21);
box = box1.difference(box2);
box.display();
```