Imagine you are given the task of automating the quoting for parts to be made with a 2 axis laser cutting machine. When a user submits their 3D part, it automatically gets converted to a 2D object which represents the profile of the extrusion.

Profile Representation

A profile contains a set of **edges**, each of which derive from a type of curve. Edges adjoin to one another at **vertices** so that each edge has one or two vertex endpoints. Each edge and vertex element is keyed by a unique integer, *id*.

We will consider two types of curve in this exercise, straight line segments and circular arcs. While a line segment is completely defined via its vertices, circular arcs contain the additional *Center* and *ClockwiseFrom* fields. The *ClockwiseFrom field* references the vertex from which the circular arc may be drawn clockwise until it reaches the other vertex for that edge.

All units are in inches.

JSON Schema

```
{
    "Edges": [
        id: {
            "Type": "LineSegment",
            "Vertices": [id]
        },
        id: {
            "Type": "CircularArc",
            "Center": {
                "X": double,
                "Y": double
            },
            "ClockwiseFrom": id
            "Vertices": [id]
        }
    ]

    "Vertices":[
        id: {
```

```
        "Position": {
            "X": double,
            "Y": double
        }
      }
   ]
}
```

Quoting

Main considerations that should be taken into account when quoting a part are material costs and machine cost.

Material costs are proportional to the area of stock used. Stock is pre cut into rectangular shape where, to consider kerf thickness from the laser, additional padding is added to the design bounds in each direction to define stock size.

Machine costs are proportional to the time laser spends cutting. It may be considered that the speed of the laser traveling in a straight line is the maximal laser cutting speed, v_max, while for a circular arc of nonzero radius, R, it is given by $v\_max * exp(-1/R)$.

Task

(1) Write code to deserialize extrusion profiles so that it can be represented in memory

(2) Write a program that takes a profile and produces a quote. Assume:
   ○ Padding: 0.1in.
   ○ Material Cost: $0.75/in^2
   ○ Maximal laser cutter speed: 0.5 in/s
   ○ Machine Time Cost: $0.07/s

Examples

Three example json files are provided for you to test your code:

● **Rectangle.json** - a simple 3in x 5in rectangle. Your program should output: **14.10 dollars**

- **ExtrudeCircularArc.json** - a 2in x 1in rectangle with semicircle added onto one of the 1in sides. Your program should output: **4.47 dollars**

- **CutCircularArc.json** - A 2in x 1in rectangle with semicircle cut into one of the 1in sides. Your program should output: **4.06 dollars**