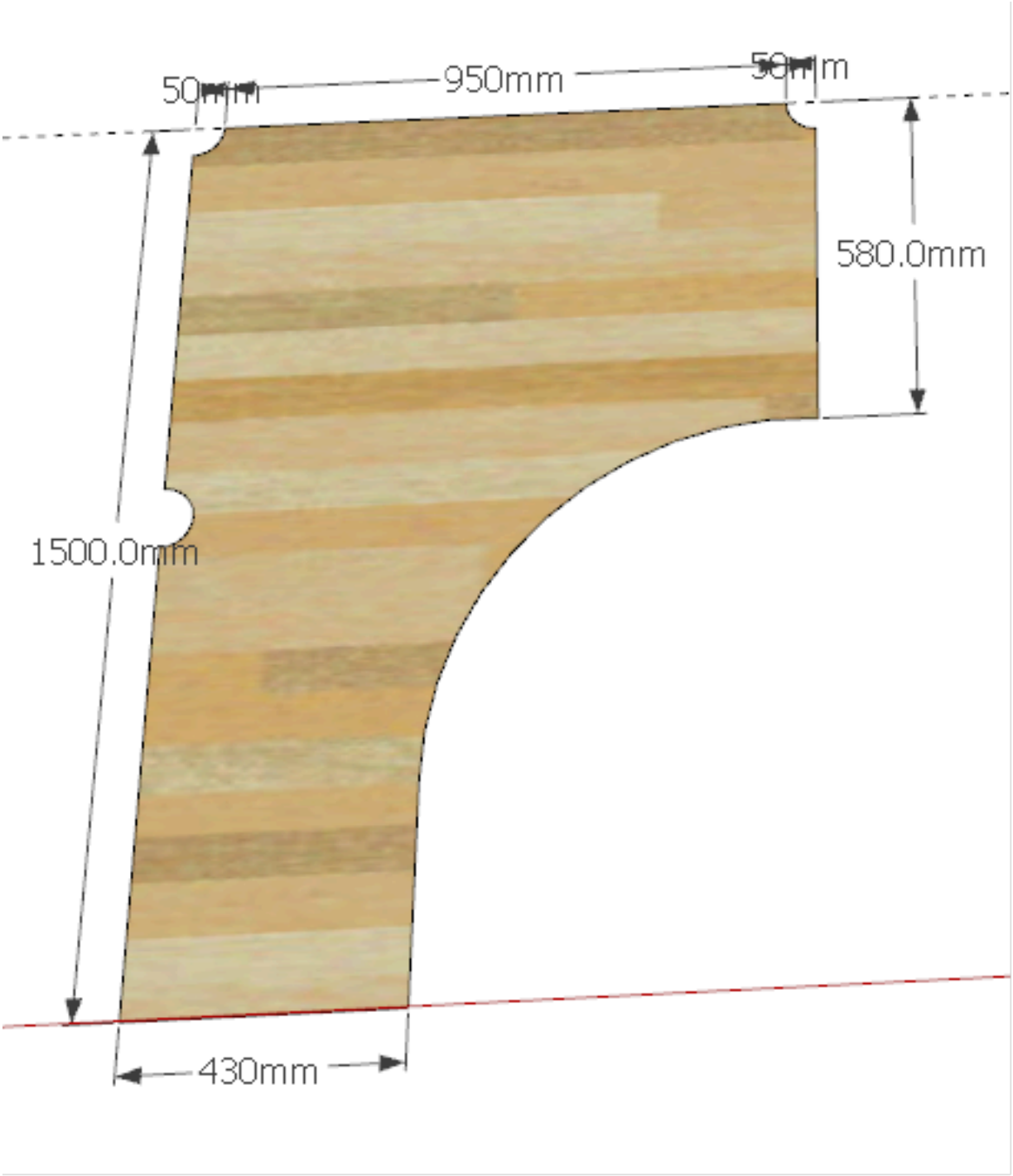
Board Calculator

This script has been written in order to determine the number of boards that will be required to cover a particular shape. In my case, I have designed a desk that looks like this:



This script needs to work out what amount of material would be needed to build this.

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Prepare

```
close all;
```

```
clear all;
clc;
```

Define the area to be covered

A MATLAB array will be used to create a binary map that represents the desk area which is required to be covered.

A resolution of one element = 10 mm has been chosen.

```
yDimension = 1500; % mm
xDimension = 1050; % mm
deskAreaMap = false(yDimension / 10 ,xDimension / 10);
```

Now we set the perimeter values of the desk to true.

```
deskAreaMap(:,1) = true;         % left hand edge
deskAreaMap(1,:) = true;         % top edge
deskAreaMap(end, 1:43) = true;   % bottom edge
deskAreaMap(1:58, end) = true;   % right hand straight edge
```

And the curved section will be represented as a straight line for simplicity

```
% Calculate the gradient of line
x1 = 43;
x2 = 105;

y1 = 150;
y2 = 58;

% Because MATLAB uses y = 0 at the top, rather than the bottom, y1 & y2 are
% reversed
m = (y2 - y1) / (x2 - x1)
```

```
m = -1.4839
```

```
%m = (x1 - x2) / (y1 - y2)

% Calculate the y-axis intercept using x1 & y1
% normally y = mx + c
% rearrange to make c the subjet
% c = y - mx
% substiute in:
%   y = y1
%   m = m
%   x = x1

c = y1 - m * x1
```

```
c = 213.8065
```

Now that we have values of the m and c co-effecients in the y=mx + c equation. We can calculate the co-ordinates of what pixels should be used to represent the curved edge.

If we state that we want every column (i.e. x-values) to be populated then we can define the range of column indicies to be:

```
cols = 43:105;
```

We can then use the equation to determine the row numbers (y-coordinates)

```
rows = m * cols + c
```

```
rows = 1×63
  150.0000  148.5161  147.0323  145.5484  144.0645  142.5806  141.0968  139.6129 ···
```

```
rows = floor(rows)
```

```
rows = 1×63
   150   148   147   145   144   142   141   139   138   136   135   133   132 ···
```

Knowing the rows and columns, we can now set those values to be true

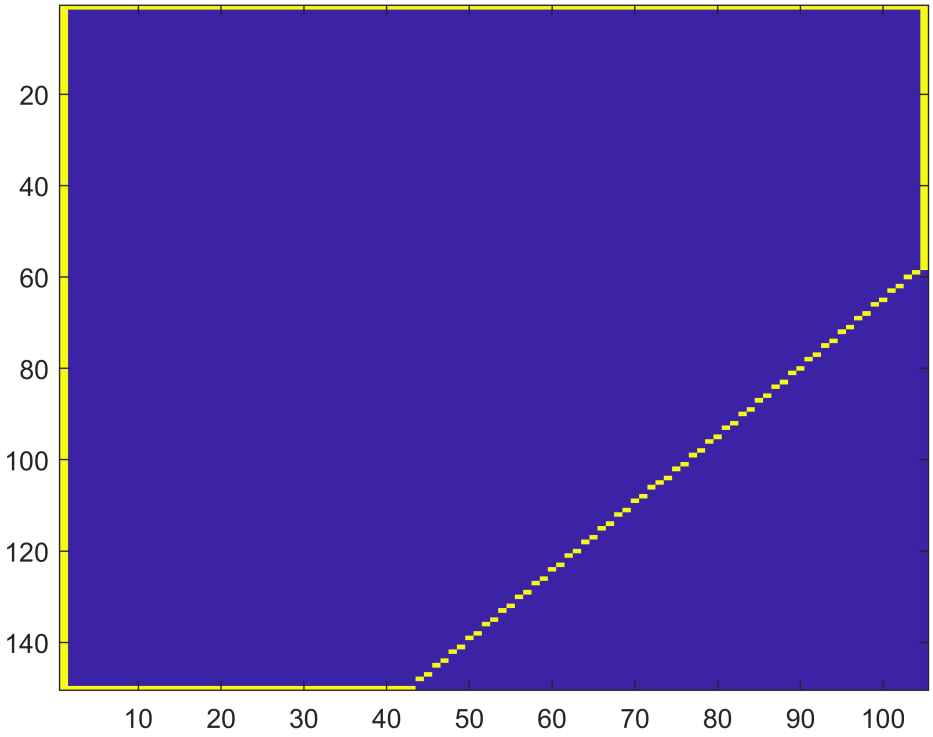
```
coords = [rows; cols]'
```

```
coords = 63×2
   150    43
   148    44
   147    45
   145    46
   144    47
   142    48
   141    49
   139    50
   138    51
   136    52
     ⋮
     ⋮
```

```
for idx = 1:length(coords)
    currentCoordinate = coords(idx, :);
    deskAreaMap(currentCoordinate(1), currentCoordinate(2)) = true;
end
```

Visualise the result

```
imagesc(deskAreaMap)
```



Start determining board lengths required for each row

First of all we can very easily determine the number of rows of boards required because this is simply the height divided by the board width.

```
boardWidth = 220;    % mm
nBoards = yDimension / boardWidth;
nBoards = ceil(nBoards)
```

```
nBoards = 7
```

Create a board map

```
boardMap = zeros(size(deskAreaMap));

for boardIdx = 1:nBoards
    startingDimension = ((boardIdx - 1) * boardWidth) / 10 + 1;
    startingDimension = floor(startingDimension);
    endDimension = startingDimension + boardWidth / 10;
    boardMap(startingDimension:endDimension, :)= boardIdx;
```

Now we want to work out the length that each board will need to be to span the full width that it is expected to cover. First of all let us extract the rows from the boardMap that relate to the area that this board will cover.

```
    if endDimension > yDimension / 10
        % CASE: The lower edge of the board wil "hang off" the bottom
        % ACTION: Cap "endDimension" to yDimension / 10 for now
        endDimension = yDimension / 10;
    end
    thisBoardMap = deskAreaMap(startingDimension:endDimension, :);

    %imagesc(thisBoardMap)
```

Next we need to identify the column that represents the right-most true value. There will always be at least two values, the first value will represent the left-hand edge, the second, or more precisely the largest value represents the coordinate of the right most edge.

```
    % First row
    pks = find(thisBoardMap(1,:) == true);
    firstEdge = max(pks);

    % Second row
    pks = find(thisBoardMap(2,:) == true);

    if length(pks) == 1
        % CASE: right-hand value was now present
        % ACTION: use the above row value
        secondEdge = firstEdge;
    end
    secondEdge = max(pks);

    % Third row
    pks = find(thisBoardMap(3,:) == true);
    thirdEdge = max(pks);
```

Now we have co-ordinates for the right-hand edge across the width of the board. We will take the maximum of these, plus we will add an excess to the required board length to give some "wiggle room".

```
    excess = 1;
    reqdBoardLength(boardIdx) = max([firstEdge secondEdge thirdEdge]) + excess * 10;
end
```

Final Calculation

We have worked out the length of each board (with some excess) that would cover each "row" of the desk. Now we want the total board length required.

```
totalBoardLength = sum(reqdBoardLength)
```

```
totalBoardLength = 690
```

```
imagesc(boardMap)
```