

J Sheet metal design

- 1 There are many processes in sheet metal design (fabrication), including:
 - (a) stamping;
 - (b) drawing;
 - (c) punching;
 - (d) cutting;
 - (e) rolling; and
 - (f) other complex operations.
- 2 Sheet metal work can be considered as:
 - (a) a metal blank folded into a finished shape; and
 - (b) 'thin plate' work (i.e. less than 1 inch thick).
- 3 With Inventor[®], the general procedure with sheet metal work is to:
 - (a) create a sheet metal part using faces;
 - (b) create key features of the sheet metal part;
 - (c) add/create corner seams;
 - (d) cut shapes from the faces;
 - (e) add standard features (e.g. chamfers and fillets);
 - (f) create a flat pattern model of the part; and
 - (g) create a drawing layout of the folded part and flat pattern.
- 4 The procedure for the sheet metal exercises is:
 - (a) Open a new metric sheet metal (mm) .ipt file.
 - (b) Using Applications, check that the sheet metal environment is active.
 - (c) Set Styles (and Save) as required for the Sheet, Bends, Rounds and Corners.
 - (d) Use the information given in each exercise to create the part model and/or layout as required.
 - (e) Save the completed models/layouts.

Terminology

Thickness

This is the thickness of the flat stock used to create the sheet metal part.

Unfold method

This is the method used to calculate bend allowance – material stretching during bending.

Transition

- 1 This is the control of the intersection of edges across a bend in the flattened sheet.
- 2 The transitions available with Inventor include:
 - (a) none;
 - (b) intersection;
 - (c) straight line; and
 - (d) arc.

Relief

- 1 This is a small notch cut next to the end of a bend if the bend does not extend the full width of an edge.
- 2 The notch can have a straight or round end.

Corner

- 1 Occurs where three faces meet and corner relief is added to the flat sheet before bending.
- 2 There are different types of corner relief, including:
 - (a) round;
 - (b) square;
 - (c) tear; and
 - (d) trim to bend.

Flange

A sheet metal flange is a simple rectangular face created from an existing face.

Hem

- 1 Used to eliminate sharp edges or strengthen an open edge of a face.
- 2 Hem types include:
 - (a) single;
 - (b) double;
 - (c) teardrop; and
 - (d) rolled.

Bend

Connects two faces with a straight, angled or curved face.

Fold

Allows flat faces to be folded along sketched lines on a face.

Cut

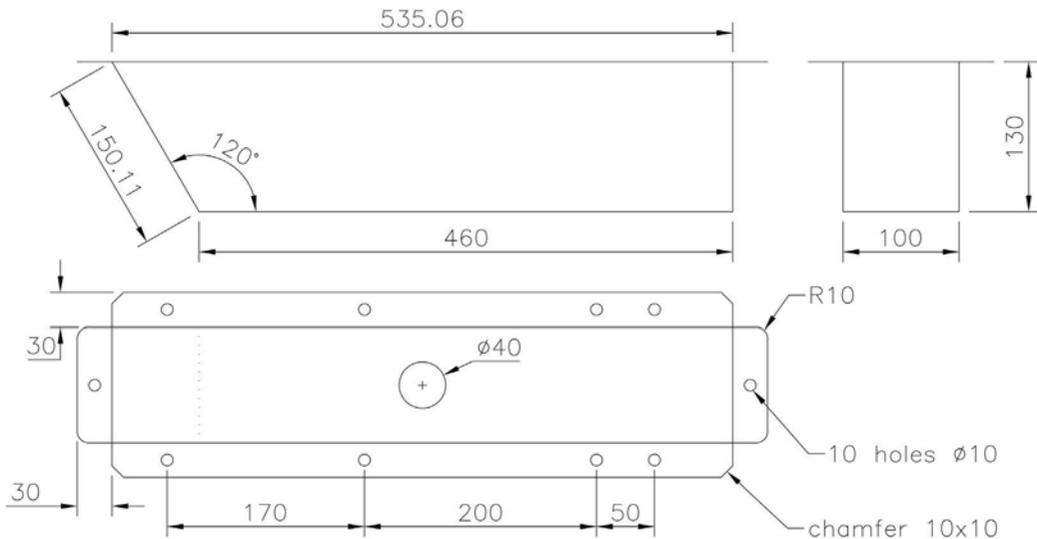
- 1 Used to 'extrude' a cut shape usually created on a sketched face.
- 2 The cut can 'cross' bends and folds.

Punch

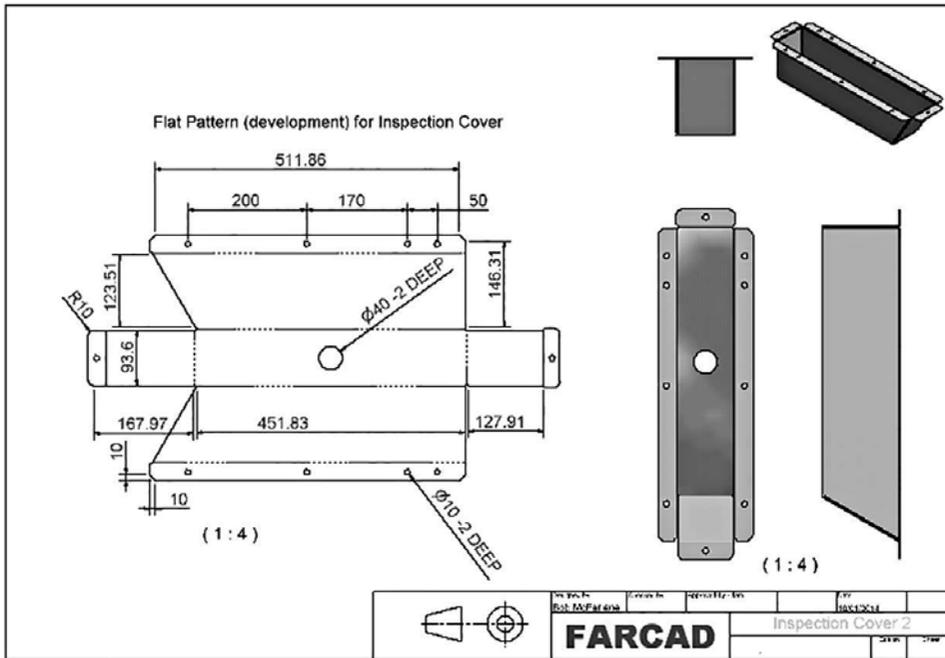
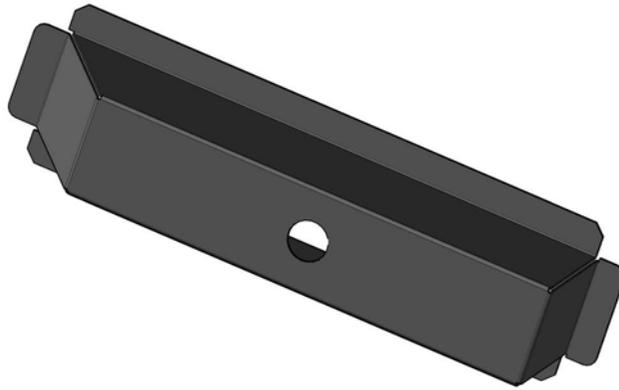
Used to create cut-out shapes in flat faces but requires specifically designed iFeatures on sketches.

Exercise J1: inspection cover

- 1 With a new metric sheet metal (mm) .ipt file, refer to the orthographic layout below and create an open-topped inspection cover (made for 1.6mm aluminium) using the 'overall' dimension given (remember that this diagram does not take any account of bends, tabs, etc.).
- 2 Each side is to have a 30mm wide mounting flange at 90 degrees to the side.
- 3 The following features are also required:
 - (a) 10 \varnothing 10mm holes positioned to your specification on the flanges;
 - (b) a single \varnothing 40mm inspection hole in the 'centre' of the top face;
 - (c) the long flanges to be chamfered 10×10 at the corners;
 - (d) the shorter flanges to have an R10 corner fillet; and
 - (e) four corner seams to be added.
- 4 Save the model when complete, still with the gaps between sides – we may refer to it in another section.
- 5 When the model of the inspection cover model is complete:
 - (a) Create a flat pattern of the enclosure and save.
 - (b) Create a drawing layout (either in First or Third Angle projection) to display:
 - three 'basic' orthographic views;
 - a 3D view of the enclosure; and
 - the flat pattern with dimensions.

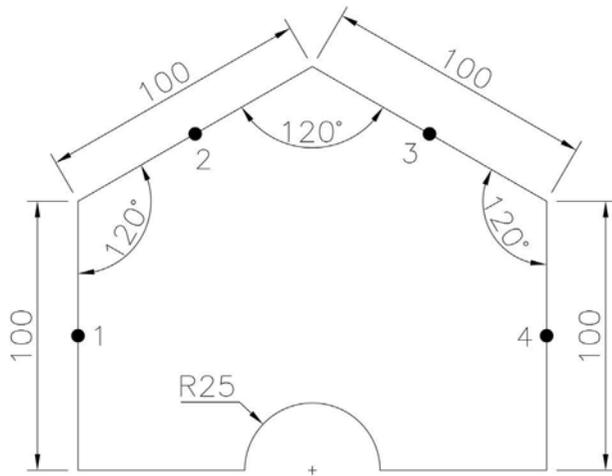


Note: Dimensions do not take account of bends/folds, etc.



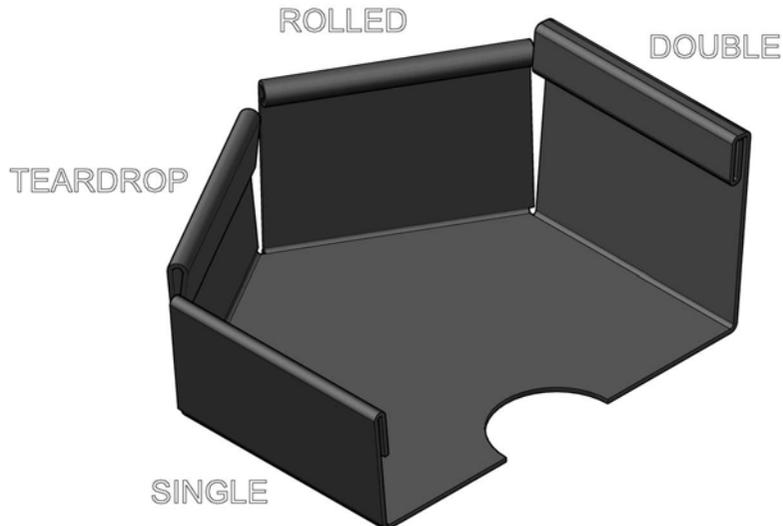
Exercise J2: sheet metal FOLLY

- 1 A sheet metal 'FOLLY' model has to be created from 1.6mm brass using the basic drawing information given below.
- 2 The 'free ends' of the four sides of the folly have to be 'hemmed' as follows:
 - (a) single, length 20, gap 2;
 - (b) teardrop, radius 2, angle 190°;
 - (c) rolled, radius 3, angle 290°; and
 - (d) double, length 20, gap 2.
- 3 Create and save the FOLLY sheet metal part model.



Side 1 Height 50, Single hem
 Side 2 Height 60, Teardrop hem
 Side 3 Height 70, Rolled hem
 Side 4 Height 80, Double hem

All sides are 'inclined' at 95° to the horizontal



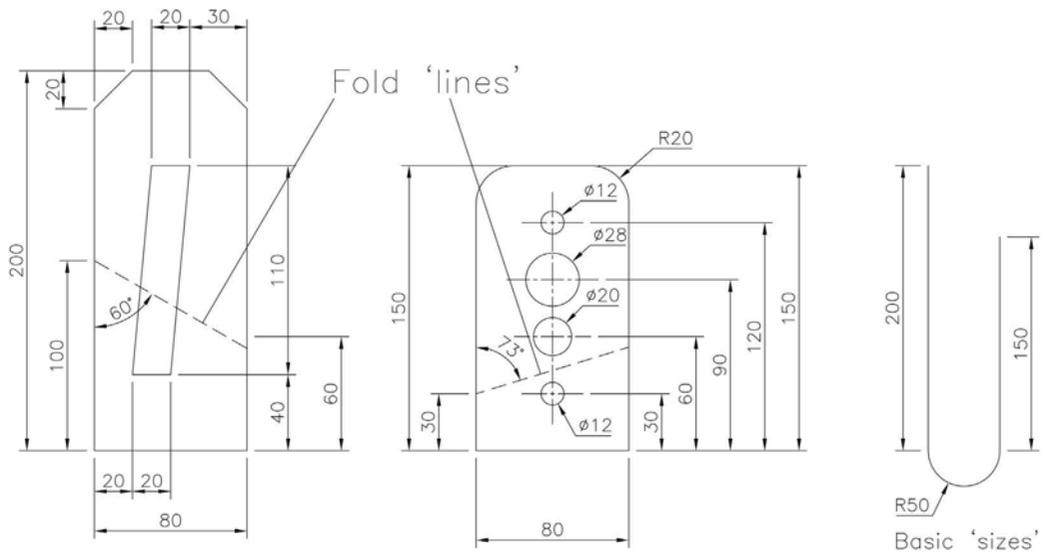
Exercise J3: cable grip

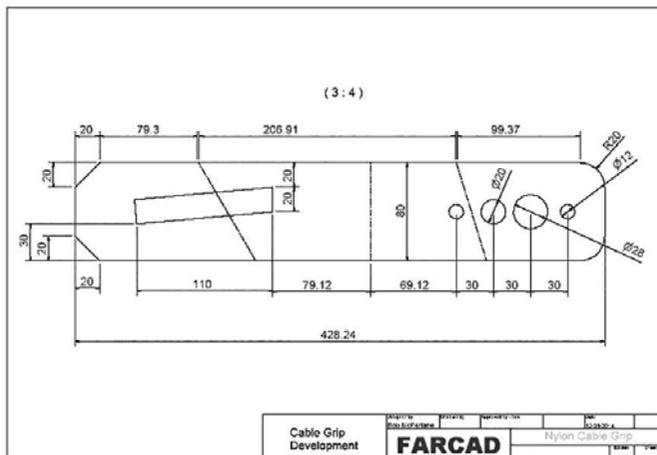
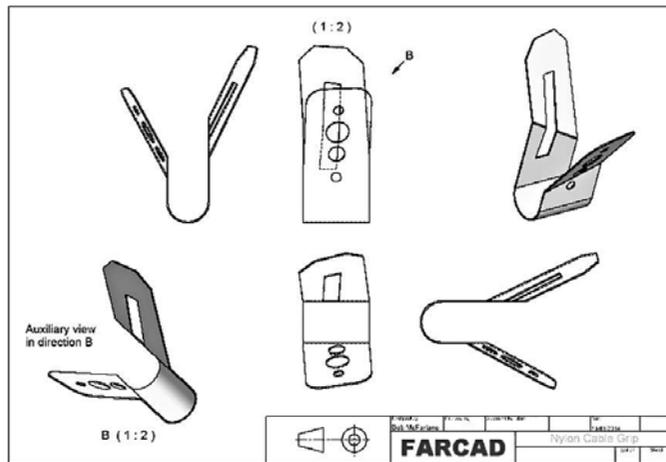
- 1 A nylon cable grip has to be created from the following information:
 - (a) Two vertical 'plates' with sizes $200 \times 80 \times 1.6$ and $150 \times 80 \times 1.6$.
 - (b) The plates are 50mm apart at the 80mm edge.
 - (c) The longer plate has a 110×20 cut slot.
 - (d) The shorter plate has four holes cut in it.
 - (e) Each plate has a fold along a given line for 30 degrees.

- 2 Using the information given above and the drawing dimensions below:
 - (a) Create a sheet metal model of the cable grip.
 - (b) Create a drawing layout to include:
 - the three traditional orthographic views at either First or Third Angle;
 - a 3D view of the model; and
 - any auxiliary view.

- 3 Using a new drawing layout, produce the flat pattern development with dimensions that will assist manufacture.

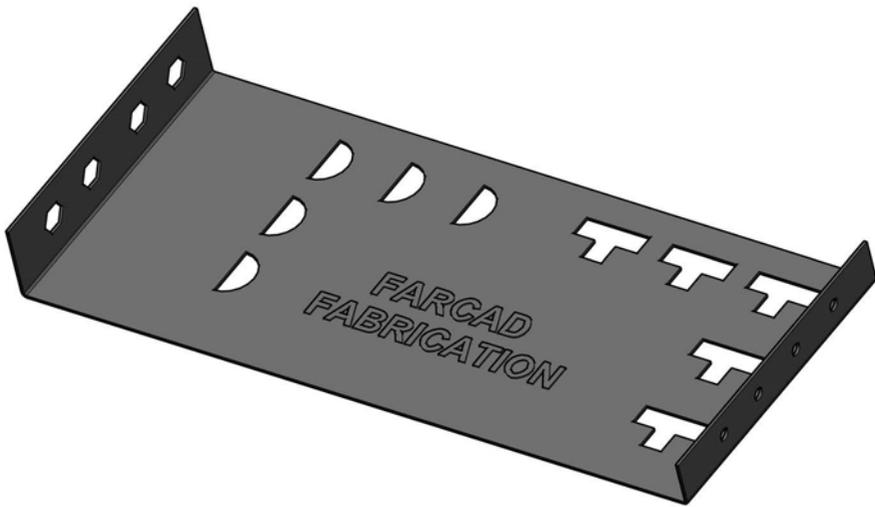
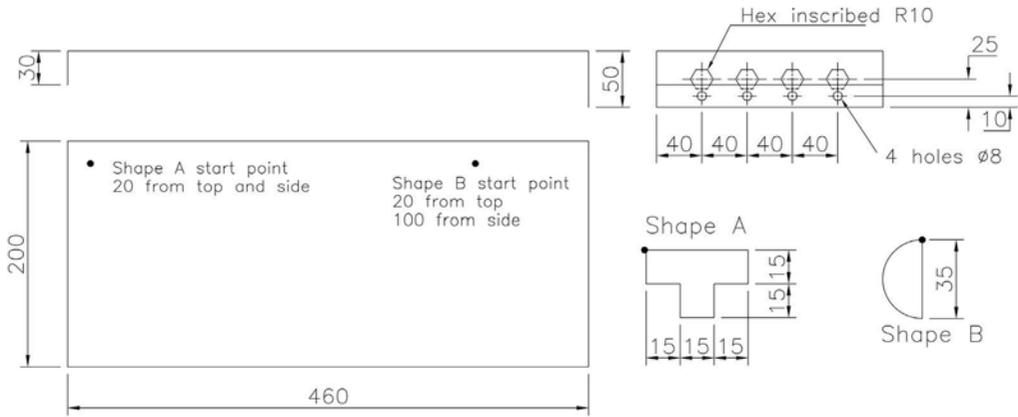
- 4 Remember to save all work.





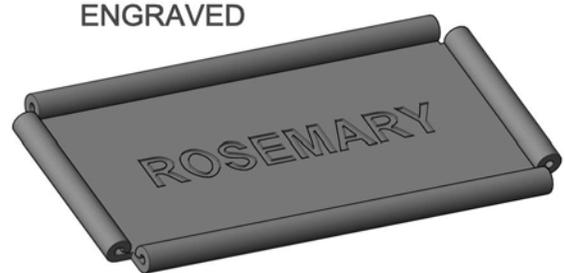
Exercise J4: patterned panel

- 1 Information:
 - (a) Aluminium plate 540 × 200 and 1.6mm thick.
 - (b) 30mm and 50mm folds at the ends.
 - (c) Various shapes cut out of the flat and ends.
- 2 Using the information given above and the dimensions in the sketch below, create a sheet metal model of the panel, and:
 - (a) shape A pattern distances are 70 horizontal and 60 vertical; and
 - (b) shape B pattern distances are 50, both horizontal and vertical.
- 3 Save your model when complete.



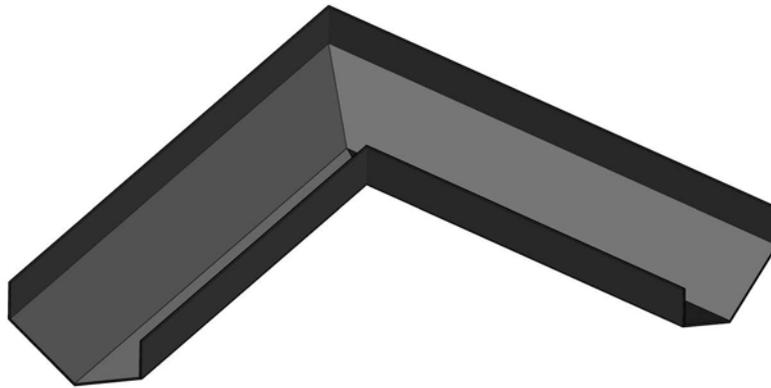
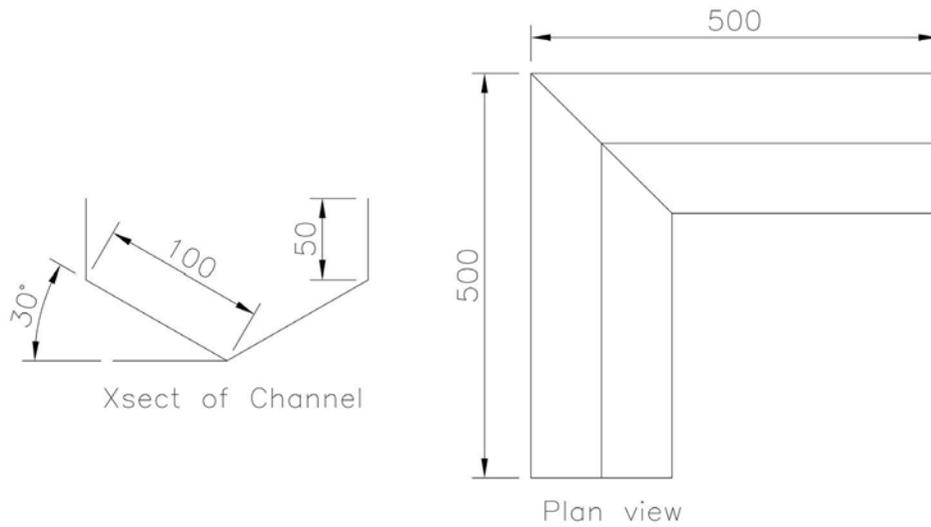
Exercise J5: herb labels

- 1 A company produces kitchen utensils and one of its products is a label with the name of a herb, made from different materials.
- 2 Information:
 - (a) The plate is $100 \times 50 \times 1.6$.
 - (b) The plate has:
 - a 6×6 square cut-out at each corner; and
 - a rolled hem (R1mm and angle 290 degrees on the four sides).
 - (c) The herb name can be embossed, engraved or 'cut through'.
- 3 Design a herb label for the three (c) options.



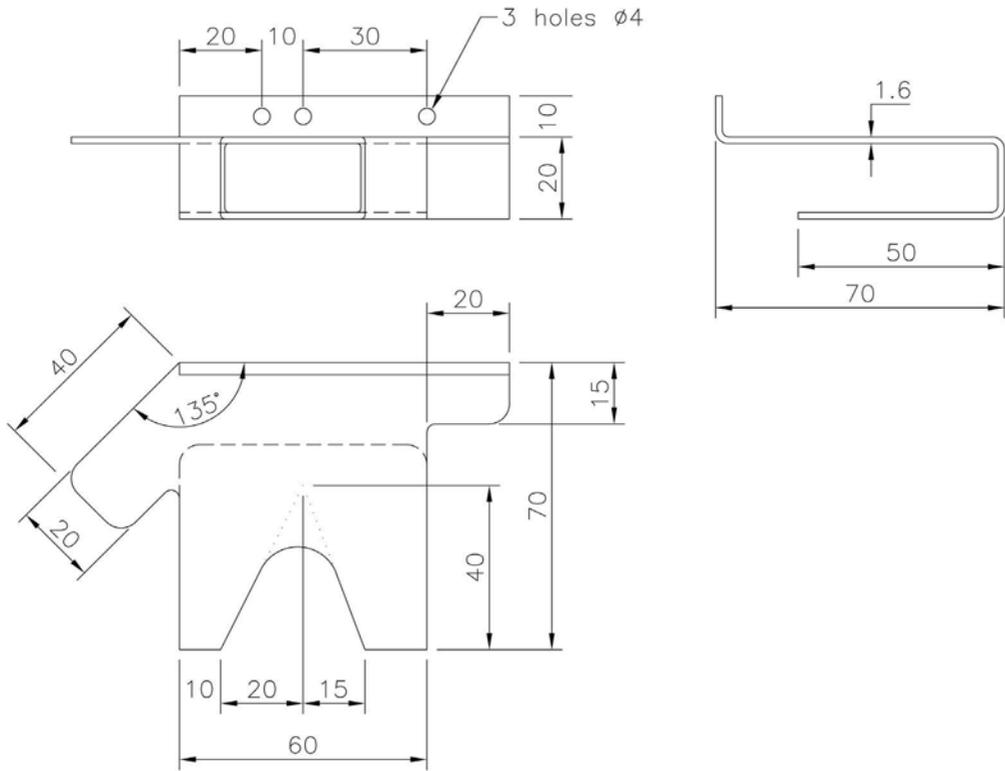
Exercise J6: 90-degree corner V channel

- 1 A channel system is made from 1.6mm thick aluminium, and the X-section and plan view of part of the channel are displayed below.
- 2 Create a sheet metal model for this component, which is open at both ends.



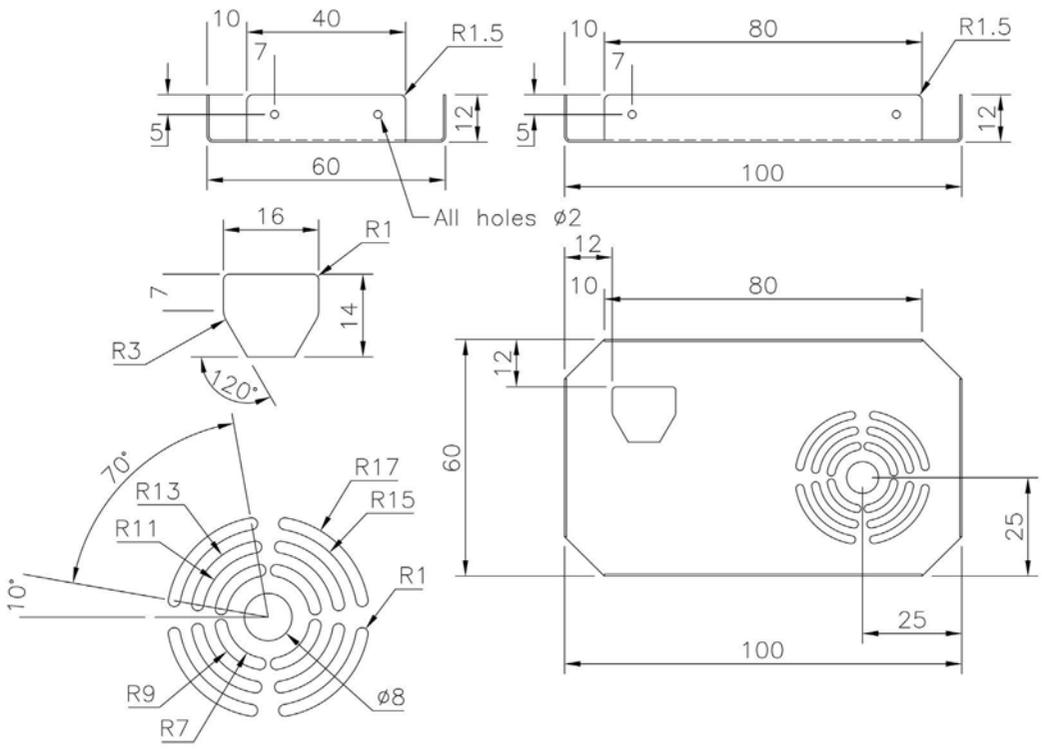
Exercise J7: bracket

Create a sheet metal bracket from 1.6mm material using the drawing information given in the First Angle orthographic views below.



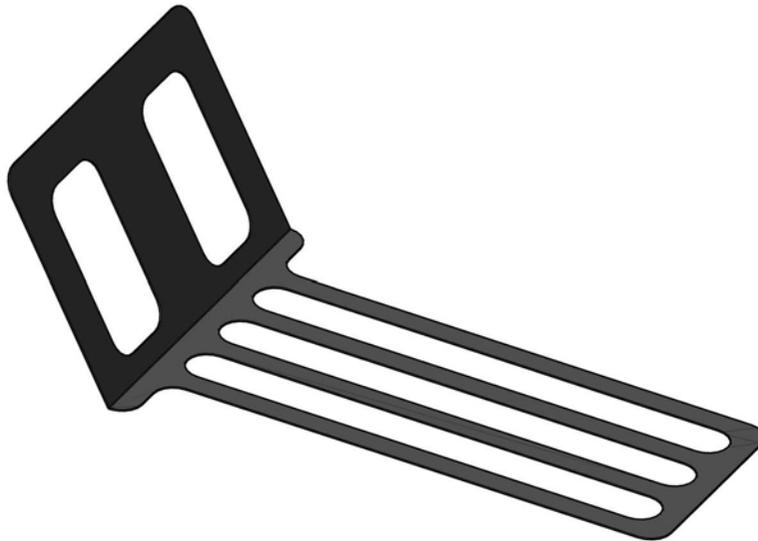
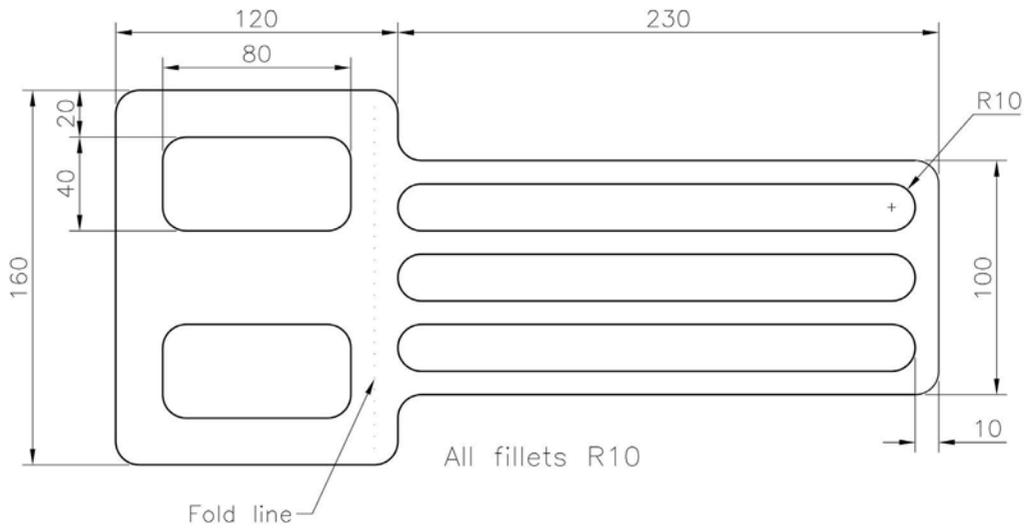
Exercise J8: vent panel

- 1 A computer vent panel is made from 0.5mm mild steel plate.
- 2 Using the orthographic drawings below, create the vent panel.



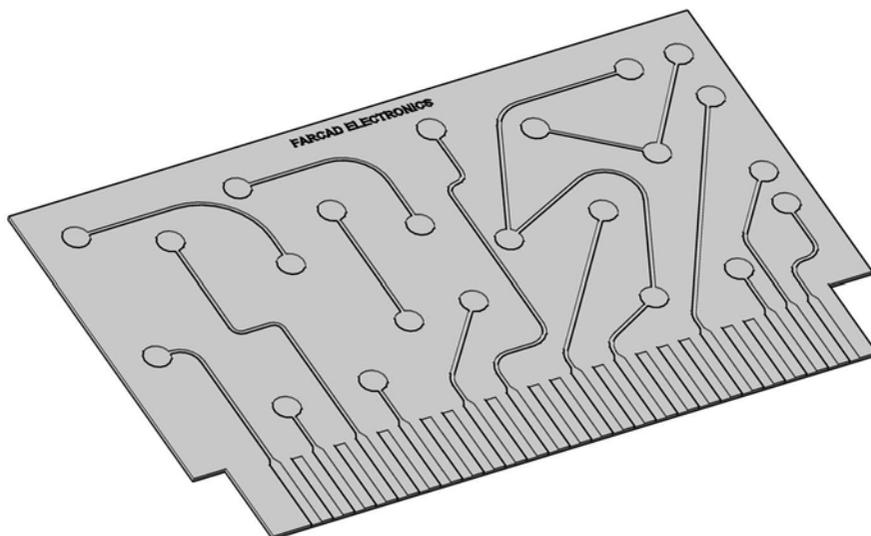
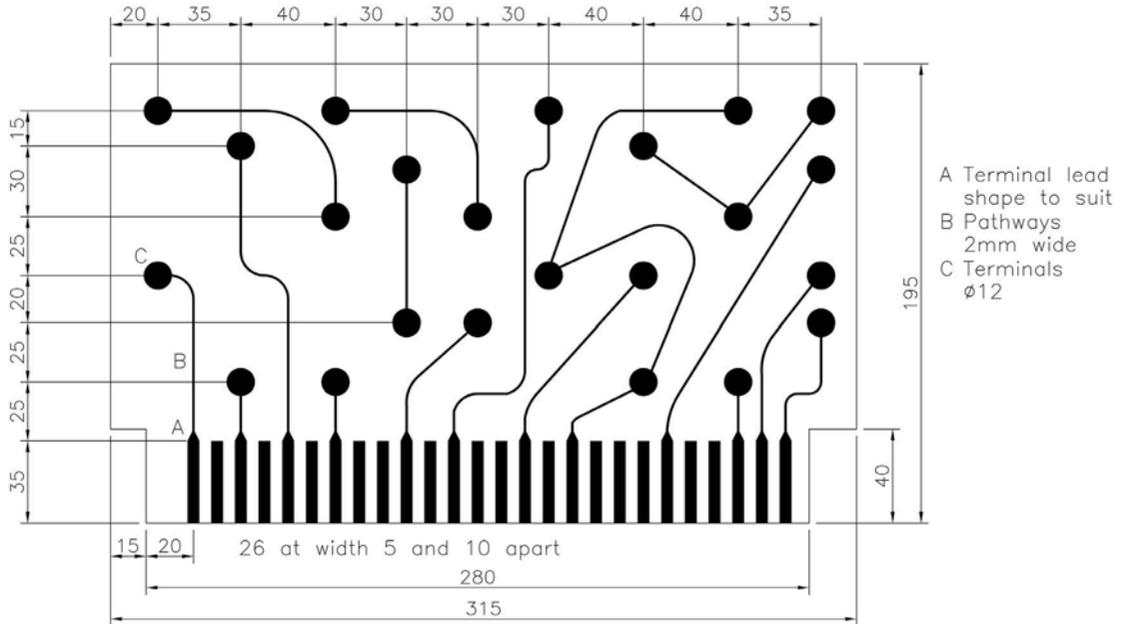
Exercise J9: brass gasket

Create a sheet metal model of the unusual shaped 0.5mm brass gasket using the dimensioned drawing below. The gasket has a 60-degree fold, as indicated.



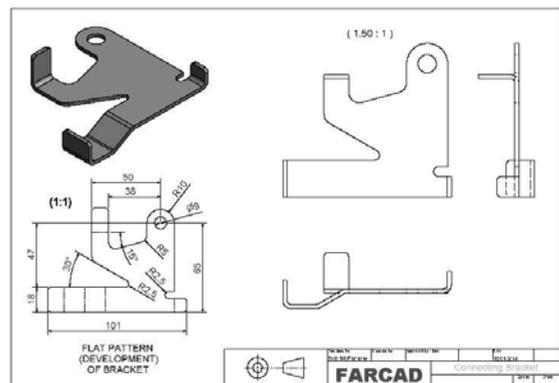
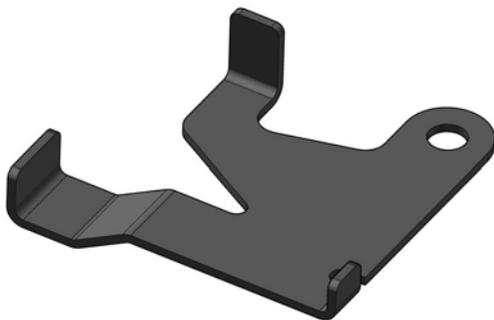
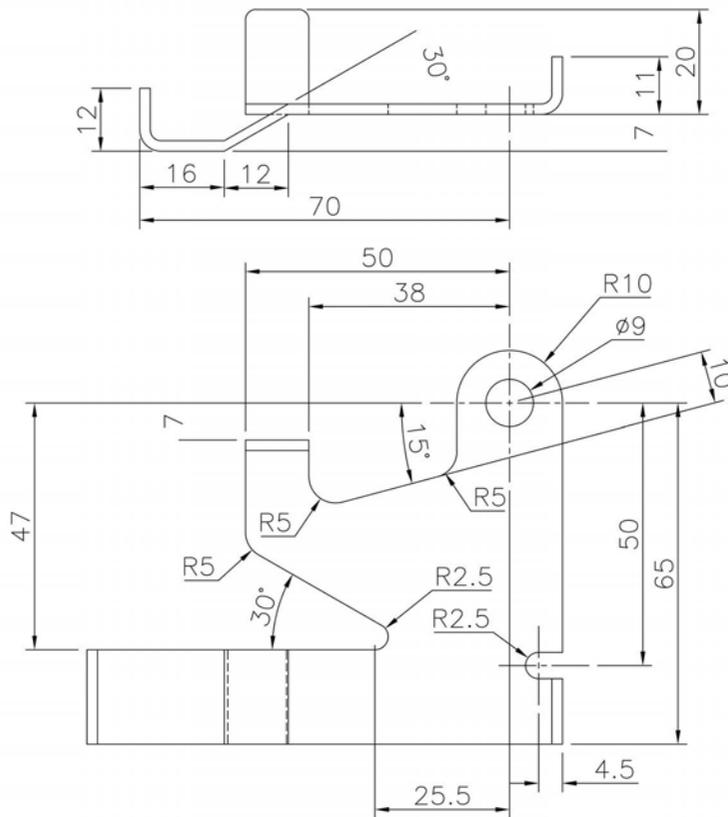
Exercise J10: printed circuit board

- 1 A printed circuit board has to be created from 1.6mm nylon using the drawing below for the various pathways.
- 2 Using the information from the drawing (and your discretion for radii, etc.), create the component, noting that all pathways, terminals, etc. are etched 0.5mm into the board.



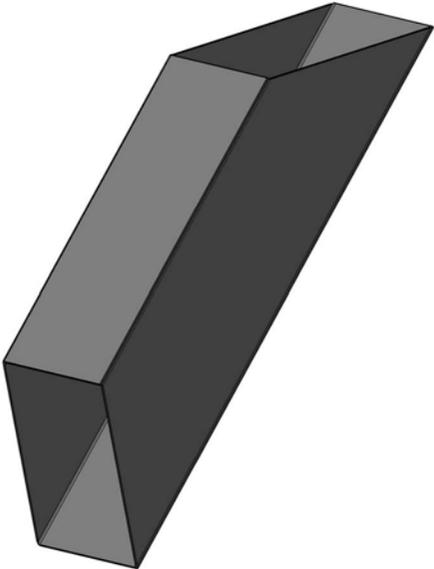
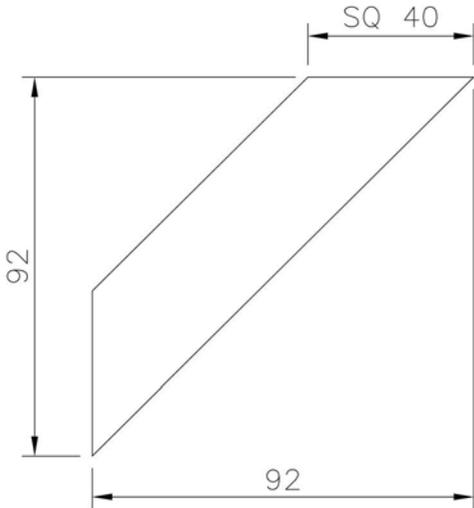
Exercise J11: connecting bracket

- 1 Use the two orthographic drawings to create a sheet metal model of the connecting bracket.
- 2 When the model has been completed, create a drawing layout in Third Angle projection with the flat pattern displayed (with dimensions) full size.
- 3 The material is 2.0mm thick mild steel with 2mm rounds and a 2mm inside bend radius.

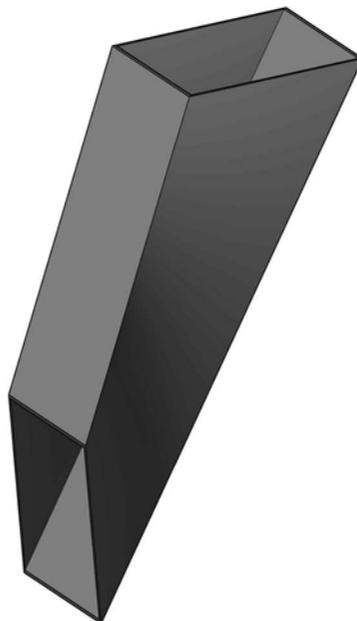
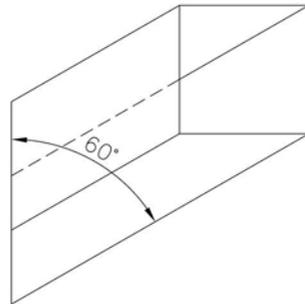
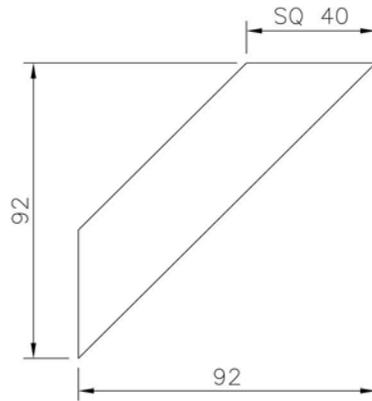


Exercise J12: square chute

- 1 Create the Mild Steel 0.5mm thick sheet metal chute using the drawing information given below.



- 2 With a slight variation in the plan view (60-degree angle included as below), create the 'new' model.



K Additional

- 1 This chapter is intended to allow the user additional practice with a variety of exercises.
- 2 The user will be creating additional part models, assemblies and drawing layouts.
- 3 There is no order to the exercises (i.e. the last is not necessarily harder than the first).
- 4 The procedure for the exercises should (by now) be obvious to the user, so I have not included any steps – it is now your choice as to how each exercise is completed.