University of Bristol   Design & Computing 1   AENG11600

Computer Aided Design   Task 5

Subject areas
To include areas covered in previous sessions.
Accessing standard content such as fasteners.
Parts lists on assembly drawings.
Sheet metal parts (in stage 2).

This is the fifth assessed exercise in the CAD part of this module, and aims to re-visit some of
the areas already practiced, introduce using standard content and creating assembly drawings
containing a list of parts and quantities used in the assembly. In stage 1, the assembly to be
created is a scale model of an undercarriage leg. In stage 2 the undercarriage leg is mounted on
an airframe section and raised and lowered by a retract cylinder.

Stage 1: Create a project file and the initial sub-assembly
Create a new, separate Inventor project (.ipj) file for this work, called **UC leg** pointing to a
dedicated folder called **UC leg files** which will contain all of your work. Make this project file
current.

Create the following parts:
- Outer cylinder as shown in Fig. 1
- Piston/axle as shown in Fig. 2
- Linkage as shown in Fig. 3

Any unspecified dimensions or features may be estimated. Remember to rename your extrusions.

Assemble the parts
Using appropriate constraints assemble the piston/axle within the cylinder and control the
piston's movement with two linkages.

Add fasteners from the Content Centre
Using the Content Centre, insert three M20x65 DIN 7968 hex head shoulder bolts and secure
with M20 DIN 935 hex slotted nuts. Assemble with **mate** constraints between axes and faces.
Your assembly should resemble Fig. 4.

Create an assembly drawing
The initial process is the same as for a part drawing, but you will need to add balloons and a
parts list from the ribbon's **Annotation** tab**.** Use an **A4 size, Landscape, 1 view** sheet.
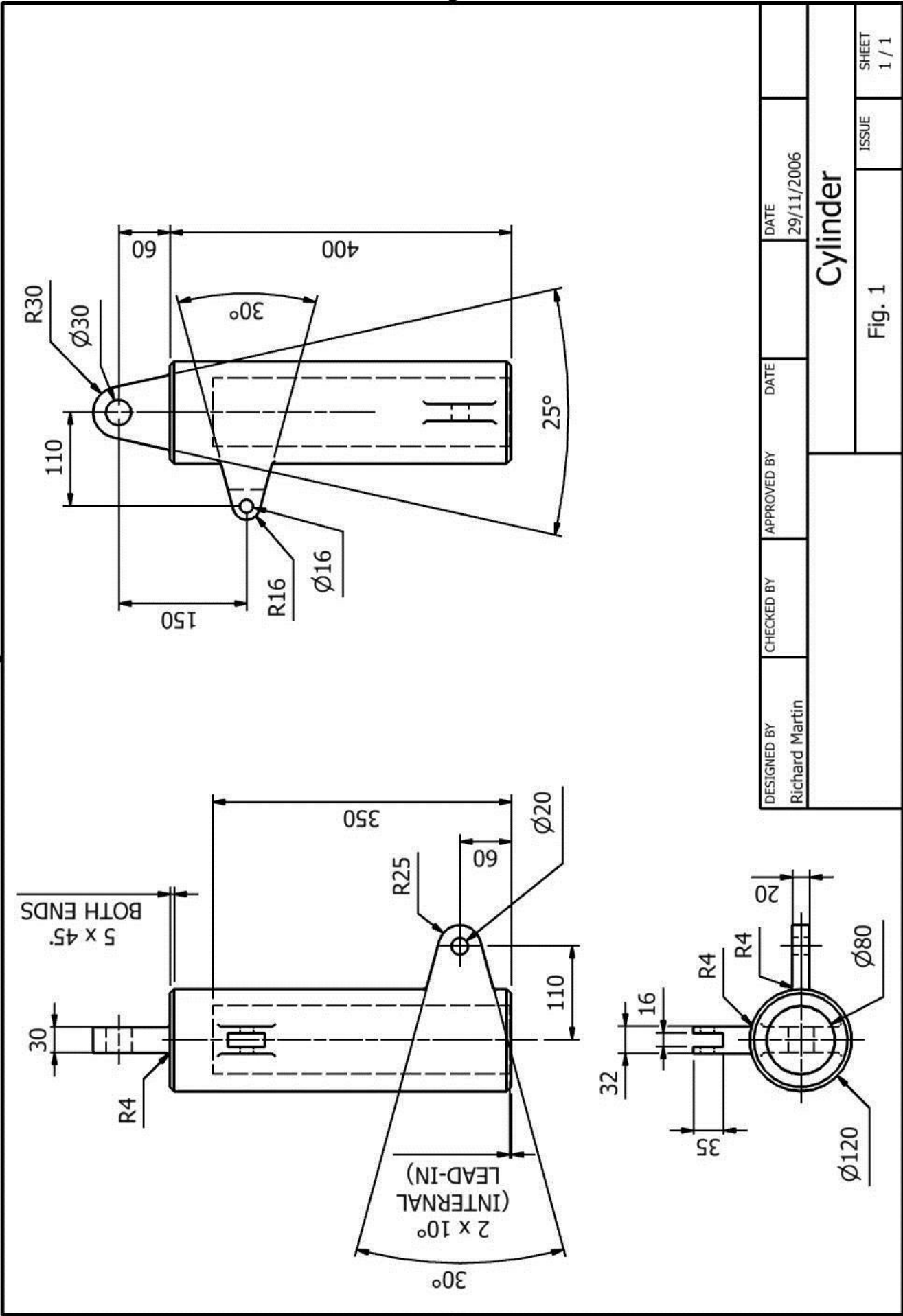
Adding to parts lists
The slotted nuts need to be secured using split pins which are a special type that are not available
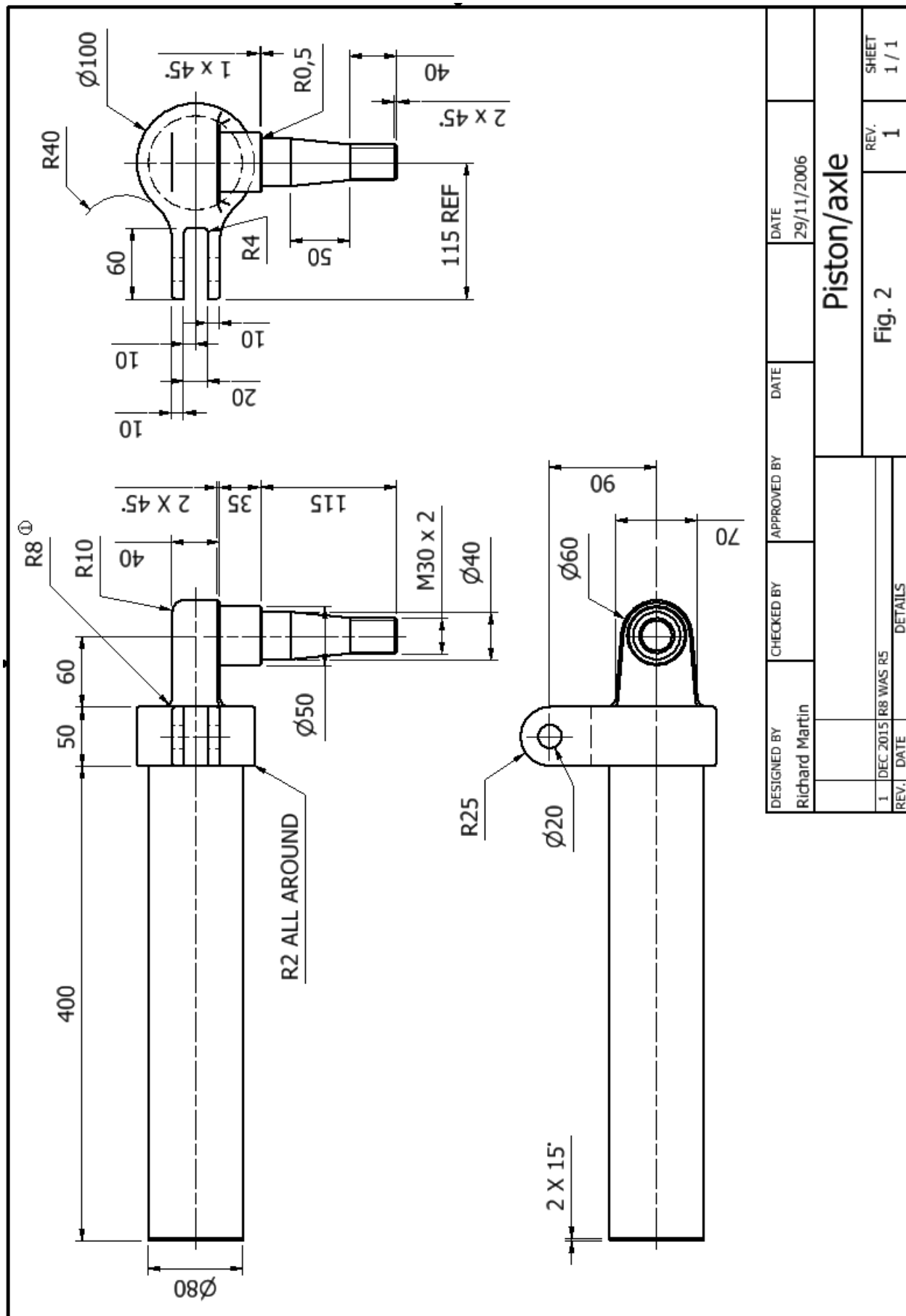in the Content Centre. Also, there is little point in showing them in the drawing.
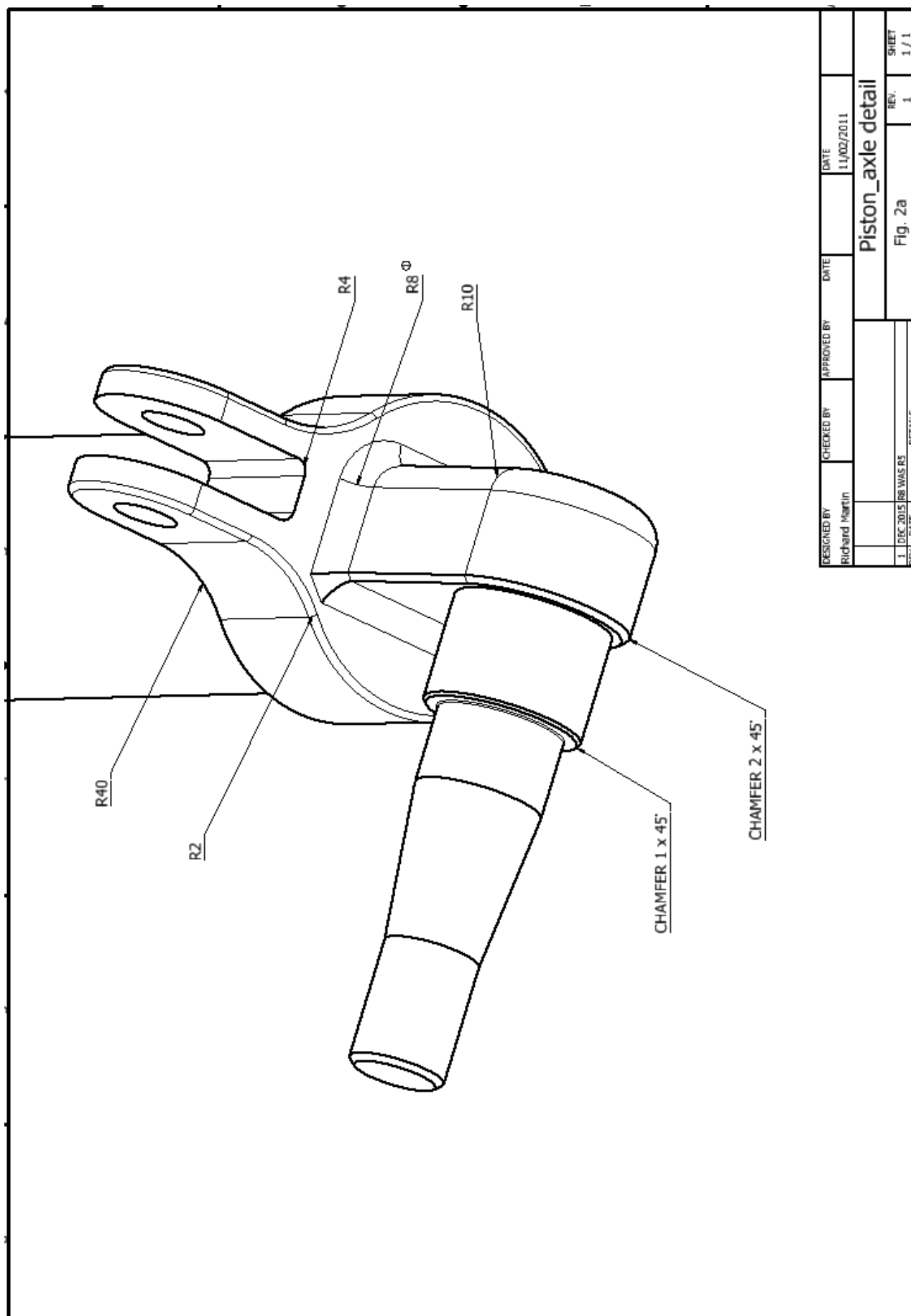Edit the parts list and **insert a custom part**.
Attach a balloon from list to the flanged nut balloon and add a note with assembly instructions.
Your assembly drawing and parts list should be similar to Fig. 5.

Submission
Your completed assembly (.iam) and assembly drawing (.idw) should be available for marking,
with stage 2, during session 8.

Cylinder

Fig. 1

DESIGNED BY	CHECKED BY	APPROVED BY	DATE	DATE 29/11/2006
Richard Martin				

ISSUE

SHEET
1 / 1

R30
Ø30
60
400
30°
110
150
R16
Ø16
25°

350
5 X 45°
BOTH ENDS
R25
60
Ø20
R4
30
110
35
2 X 10°
(INTERNAL
LEAD-IN)
30°
32
16
R4
R4
20
Ø80
Ø120

Ø100

R40

1 X 45°

R0,5

40

2 X 45°

R4

60

50

115 REF

10

20

10

10

R8

R10

40

2 X 45°

35

115

M30 x 2

Ø40

50

60

Ø50

400

R2 ALL AROUND

Ø80

90

Ø60

70

Ø20

R25

2 X 15°

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Richard Martin					29/11/2006	
					Piston/axle	

					REV.	SHEET
				Fig. 2	1	1 / 1

1	DEC 2015	R8 WAS R5		DETAILS
REV.	DATE			

R4

R8 Φ

R10

R40

R2

CHAMFER 1 x 45°

CHAMFER 2 x 45°

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DATE

DATE
11/02/2011

Piston_axle detail

Fig. 2a

REV.
1

SHEET
1 / 1

1 DEC 2015 R8 WAS R5
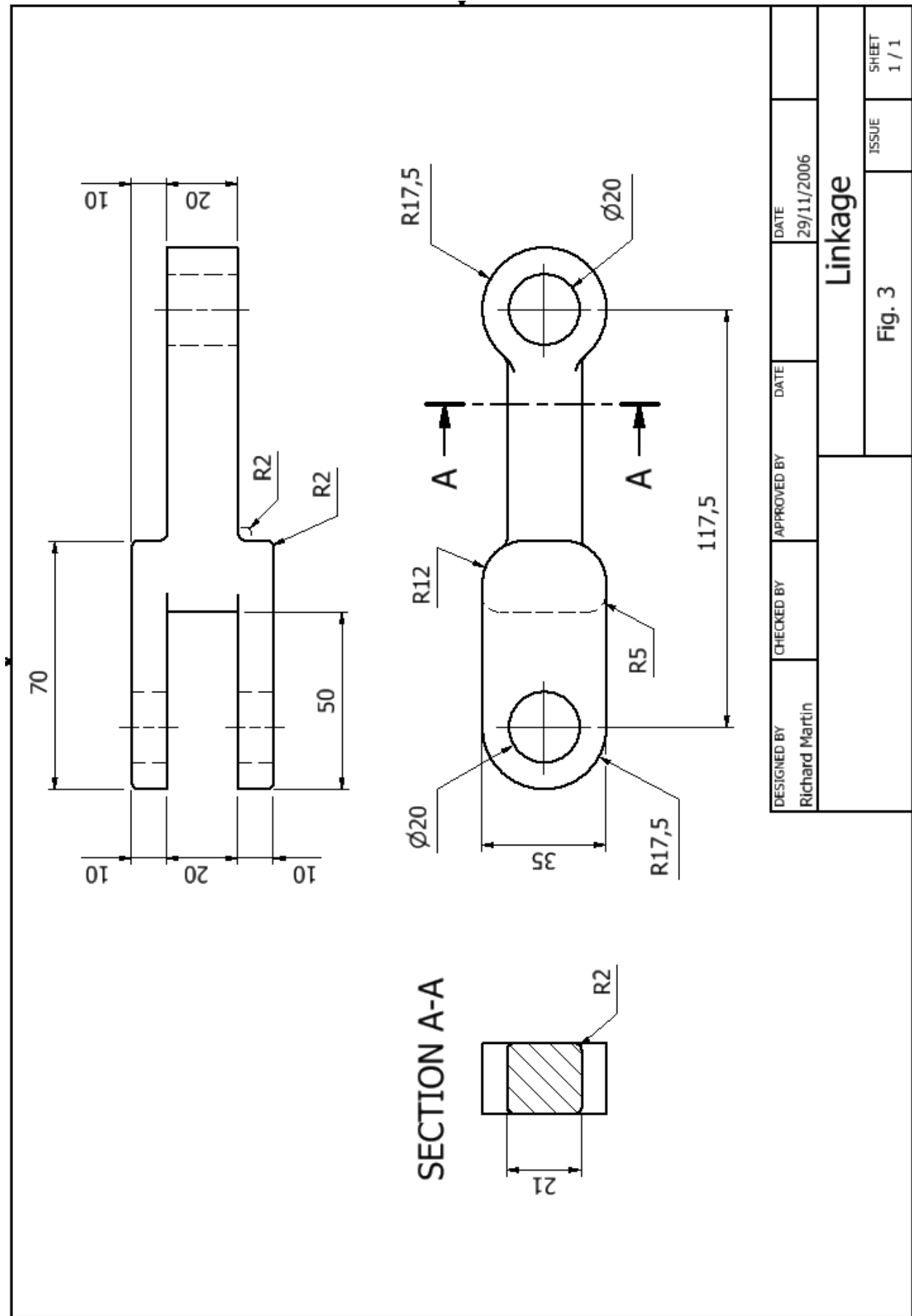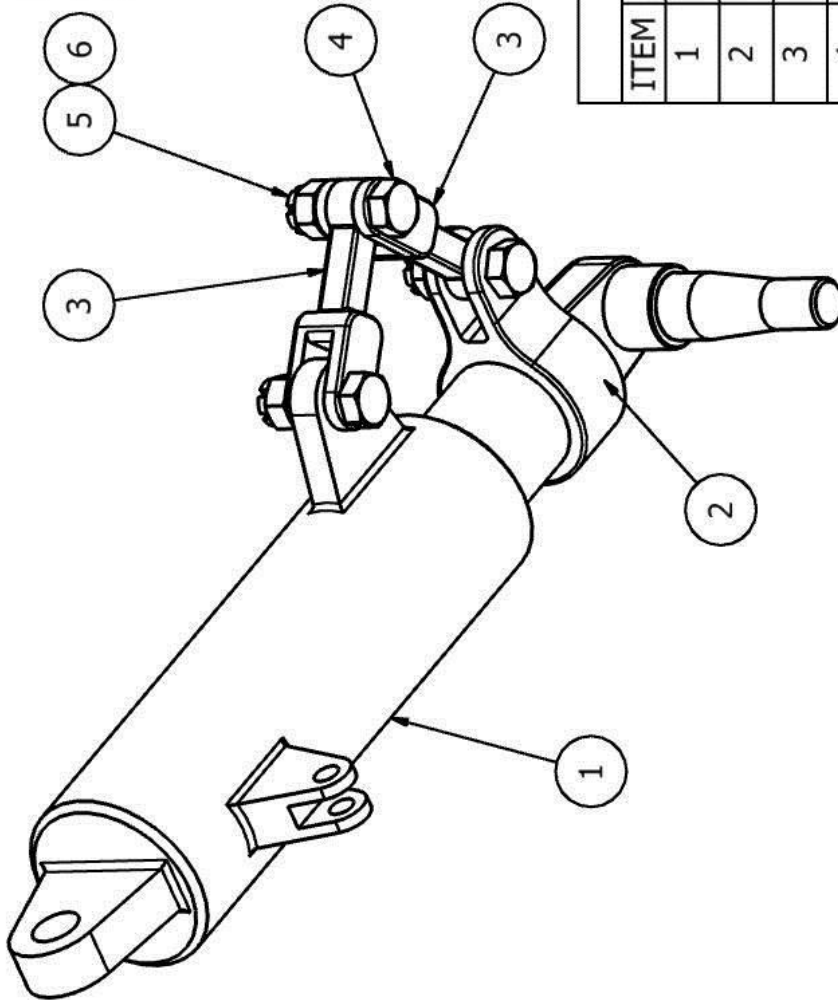REV. DATE

DETAILS

10
20

R2
R2

70
50

10
20
10

R17,5
Ø20

A
A

117,5

R12
R5

Ø20
R17,5

35

SECTION A-A

R2

21

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Linkage

Fig. 3

ISSUE

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1 / 1

Fig. 4

ON ASSEMBLY, DRILL ⌀4 THRO' CASTELLATIONS & BOLT. SECURE NUT WITH SPLIT PIN

		Parts List	
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Cylinder	
2	1	Piston_axle	
3	2	linkage	
4	3	DIN 7968 - M20 x 65	Hexagon Fit Screw
5	3	DIN 935 T1 - M20	Slotted Hex Nut
6	3	4 dia x 40 long	Split pin

DESIGNED BY	DATE	CHECKED BY	DATE		Undercarriage Assy	
Richard Martin						
APPROVED BY	DATE					
	11/11/2013				ISSUE	SHEET
				Fig. 5		1 / 1

Stage 2: Create the following parts
Any unspecified dimensions or features may be estimated and some creativity can be employed with pivots/fasteners.
- Retract cylinder as shown in Fig. 6
- Retract piston also shown in Fig. 6
- Mounting plate - Fig. 7
- Leg bracket - Fig. 8
- Closing plate - Fig. 9
- Retract bracket - Fig. 10

The last 4 items are sheet metal parts (use Sheet Metal (mm).ipt part files). You should do the sheet metal tutorials before attempting these, but the following hints might be helpful:
- *Decide first whether a sheet metal folded part is the best option. Sometimes a Standard (mm).ipt is the better, where you draw the folded sheet profile with an offset for it's thickness and then extrude it and use other sketches to trim away unwanted material. The retract bracket could be created with this approach. The "bend radius" in your sketch should equal the material thickness.*
- *Sometimes the default values within Inventor can be restrictive. In a sheet metal part file, click the **Sheet Metal Defaults** button, remove the tick from **Use thickness from rule** and enter your desired sheet thickness. In sheet metal parts the bend radius is generated for you.*
- *It's best to work with overall, outside of flange dimensions. Inventor will work out the material required for bends when folded sheets are flattened.*
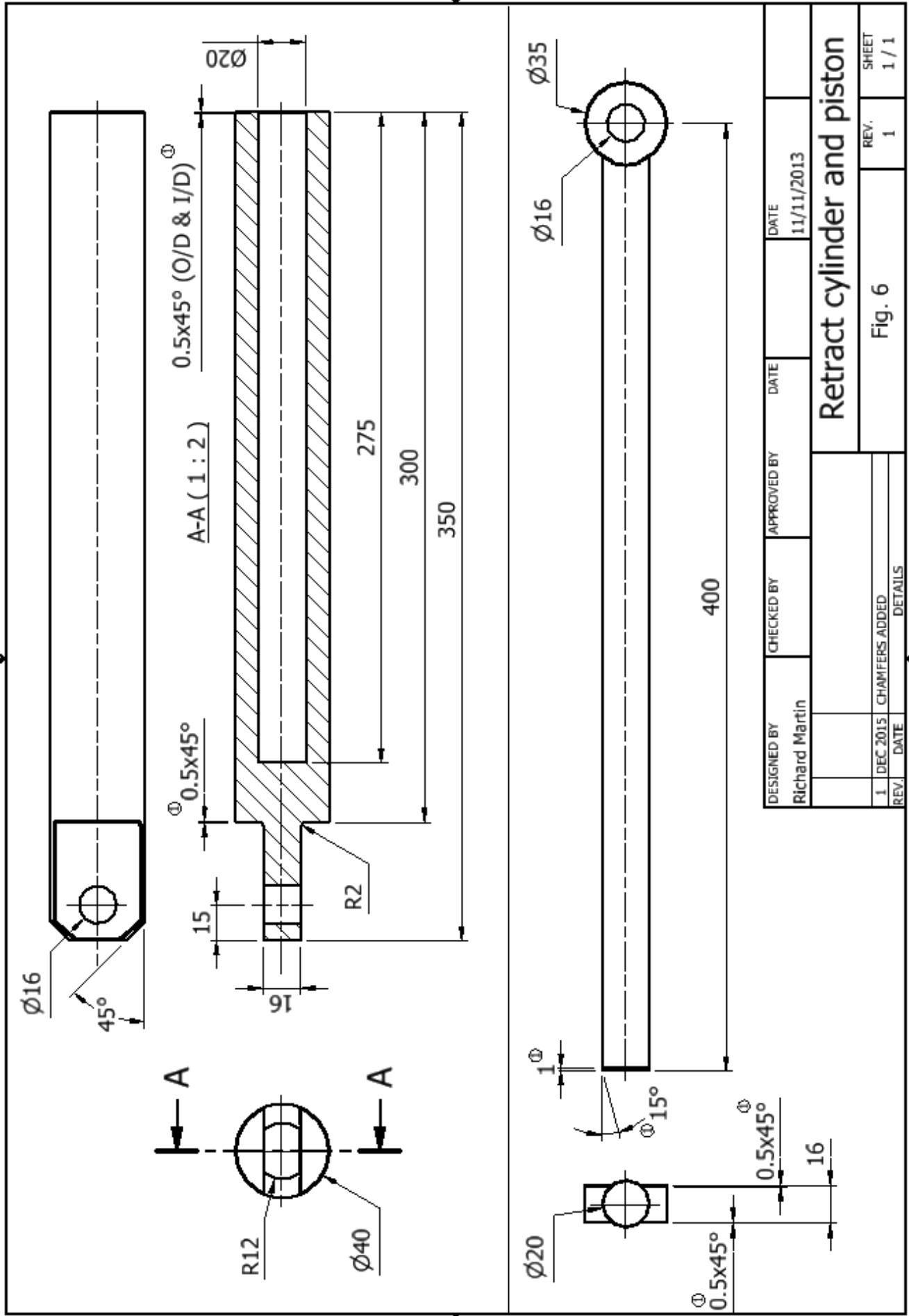
Assemble the parts
Create a new assembly containing the two leg brackets (mirrors of each other and 30mm apart) and two closing plates flush with the tops of the leg brackets. This "sub-assembly" forms the **cylinder bracket**.
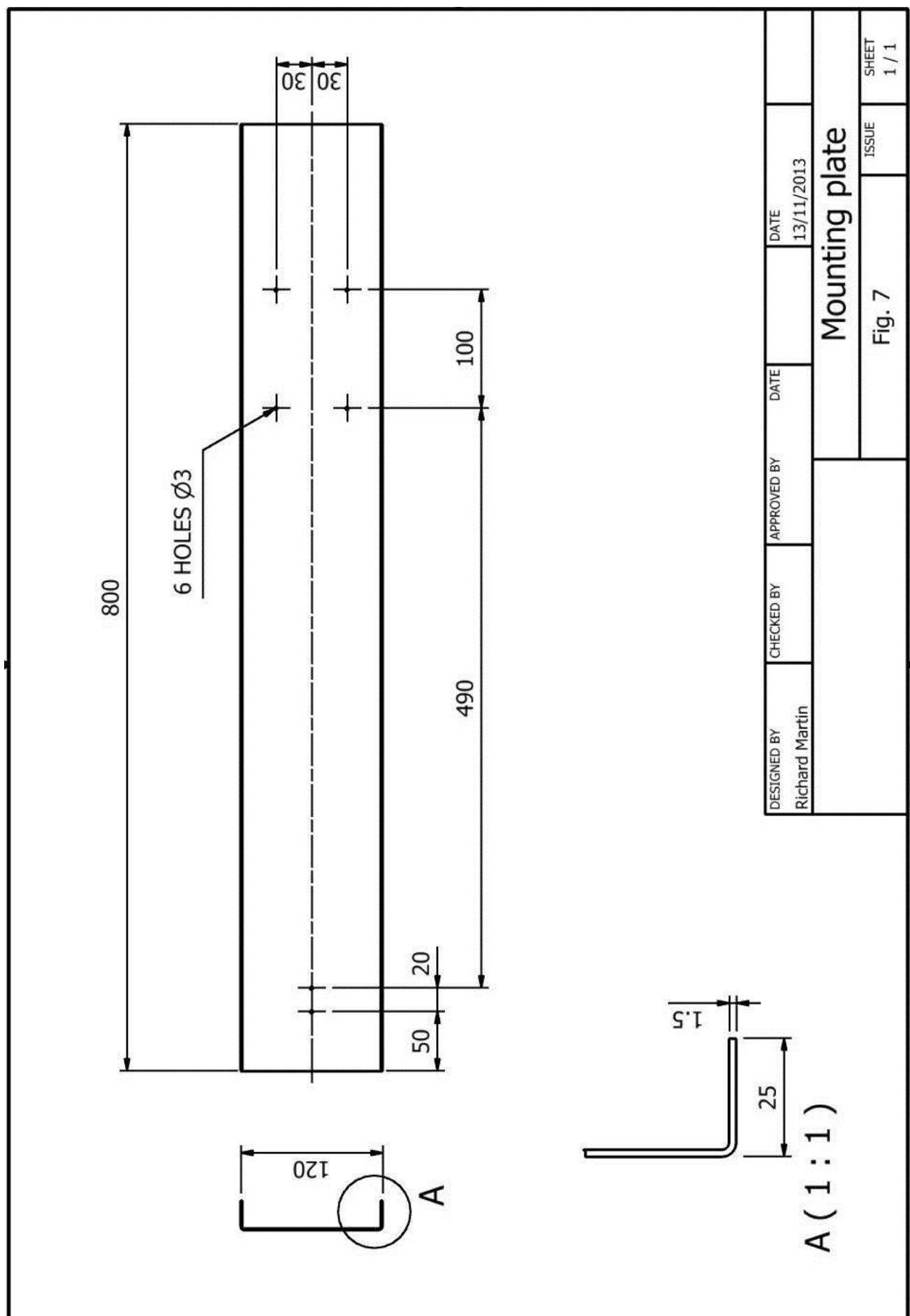
Create another assembly with the cylinder bracket assembly constrained to the mounting plate and add your retract bracket. (The 3mm diameter holes in the plates are only for location prior to welding). This **mounting** assembly will itself become a sub-assembly next.
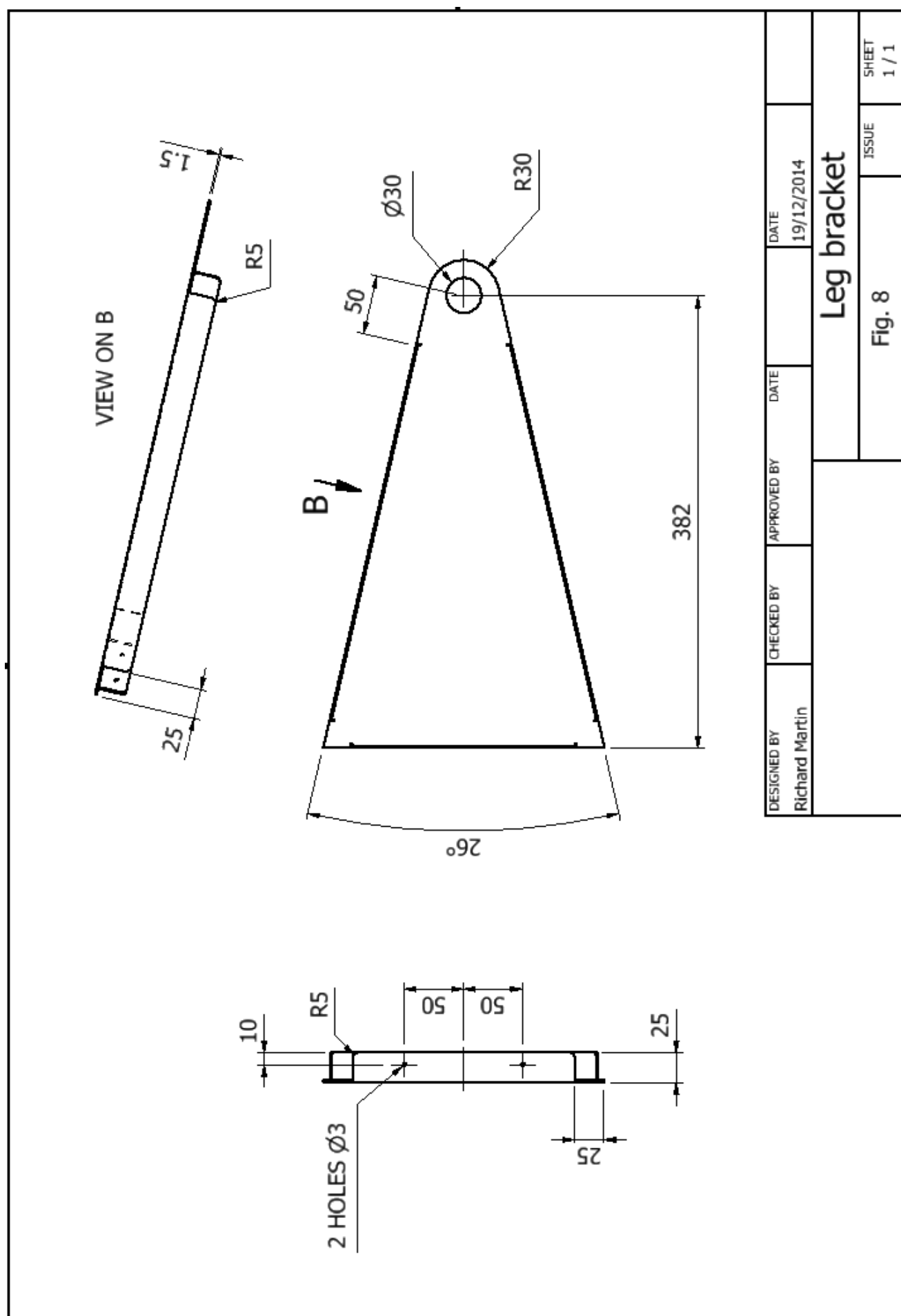
Finally, create a new assembly called **Retractable UC leg assy**. Place **mounting.iam** (and ground it), then your **UC leg.iam** from stage 1, mating it's upper lug with the cylinder bracket. Using appropriate constraints add the retract cylinder and piston to the remaining lug on the main cylinder, and the mounting assembly to locate all of the parts/sub-assemblies.

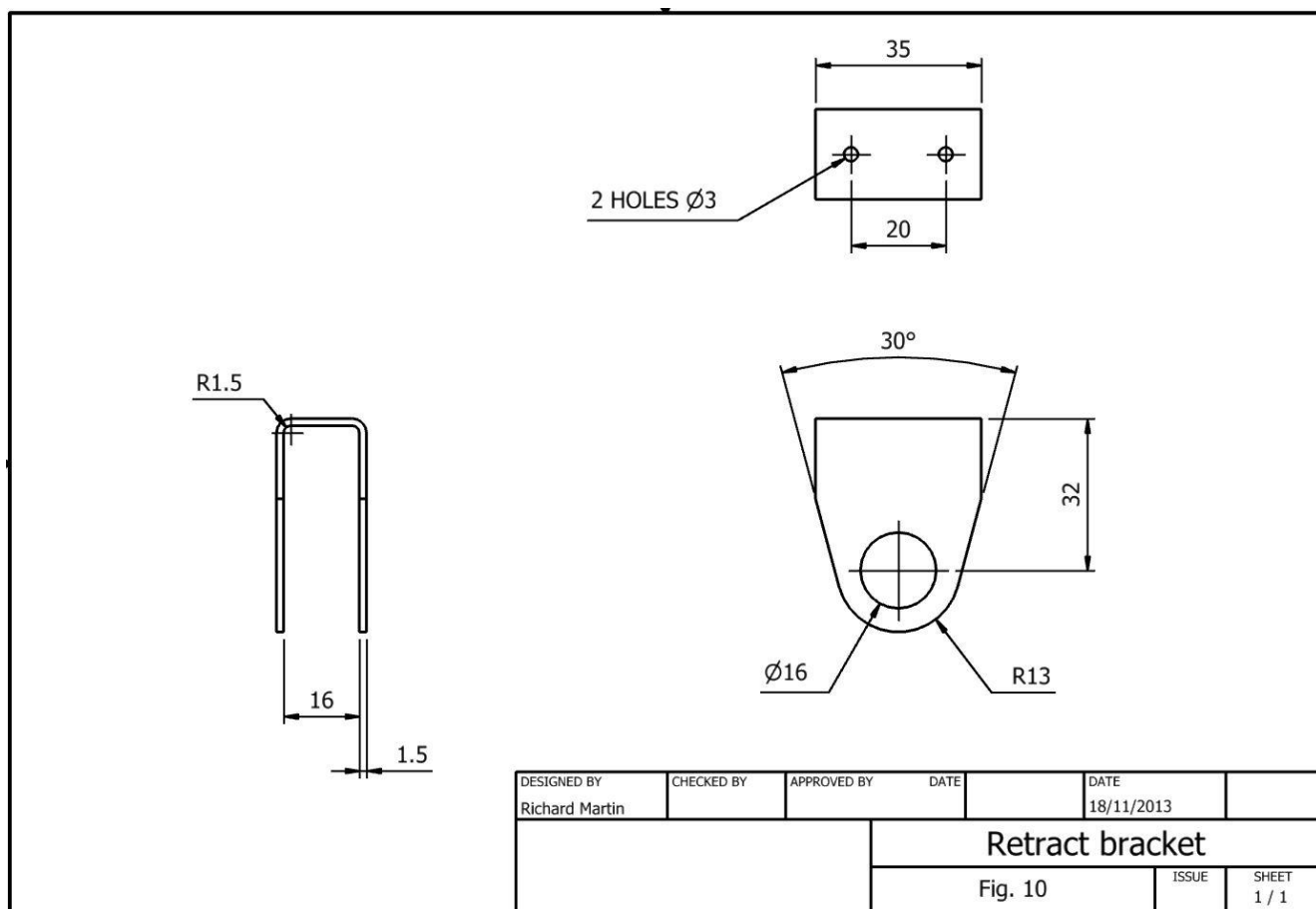Add some fasteners to the pivot points – these are up to you, you may even need to create or adapt them.

Submission
A completed assembly is shown in Fig. 11 and should be available for marking, along with stage 1, in session 8.

Ø20

0.5x45° (O/D & I/D) ①

A-A (1 : 2)

275

300

350

Ø16

45°

0.5x45° ①

R2

15

16

R12

Ø40

A

A

Ø35

Ø16

400

1 ①

15° ①

Ø20

0.5x45° ①

16

0.5x45° ①

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Richard Martin				DATE 11/11/2013	
1	DEC 2015	CHAMFERS ADDED	DETAILS	Retract cylinder and piston	
REV.	DATE			Fig. 6	REV. 1 / SHEET 1 / 1

6 HOLES ∅3

800

30 30

100

490

20

50

120

A

A (1 : 1)

25

1,5

DESIGNED BY	CHECKED BY	APPROVED BY	DATE	DATE		
Richard Martin				13/11/2013		
				Mounting plate		
				Fig. 7	ISSUE	SHEET 1 / 1

VIEW ON B

1.5

R5

25

B

50

Ø30

R30

382

26°

R5

10

50 50

25

25

2 HOLES Ø3

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Richard Martin				19/12/2014

Leg bracket

Fig. 8

ISSUE

SHEET
1 / 1

R5

30

R1.5

103°

343

1,5

A

VIEW ON A

R5

70

35

2 HOLES Ø3

20

30°

32

R1.5

Ø16

R13

16

1.5

Fig. 11