Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2012

Design & Communication Graphics
Higher Level
Sections B and C (180 marks)

Wednesday, 20 June
Afternoon, 2:00 - 5:00

This examination is divided into three sections:

SECTION A   (Core - Short Questions)
SECTION B   (Core - Long Questions)
SECTION C   (Applied Graphics - Long Questions)

SECTION A
- Four questions are presented.
- Answer **any three** on the accompanying A3 examination paper.
- All questions in Section A carry **20 marks** each.

SECTION B
- Three questions are presented.
- Answer **any two** on drawing paper.
- All questions in Section B carry **45 marks** each.

SECTION C
- Five questions are presented.
- Answer **any two** (i.e. the options you have studied) on drawing paper.
- All questions in Section C carry **45 marks** each.

General Instructions:
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box provided on section A and on all other sheets used.*

Answer **Any Two** questions from this section on drawing paper

B-1. The *Convention Centre*, shown in the image on the right, is a landmark building in Dublin. Its stunning design includes a glass front in the form of a right cylinder which intersects the vertical front face of the building.

Fig. B-1 shows the elevation and end view of part of the structure. It consists of a portion of a right cylinder with its axis inclined at 60° to the horizontal plane, as shown in the end view. The cylinder intersects the vertical front face of the building, producing elliptical curves as shown in the elevation.

(a) Draw the given end view. Include the straight line elements on the surface of the cylinder as shown.

(b) Project the given elevation showing all construction lines clearly.
(Use the given elements to establish points on the curves.)

(c) Locate the **two** focal points of the semi-elliptical curve ABC and determine the centre of curvature for the point B.

Scale 1:100
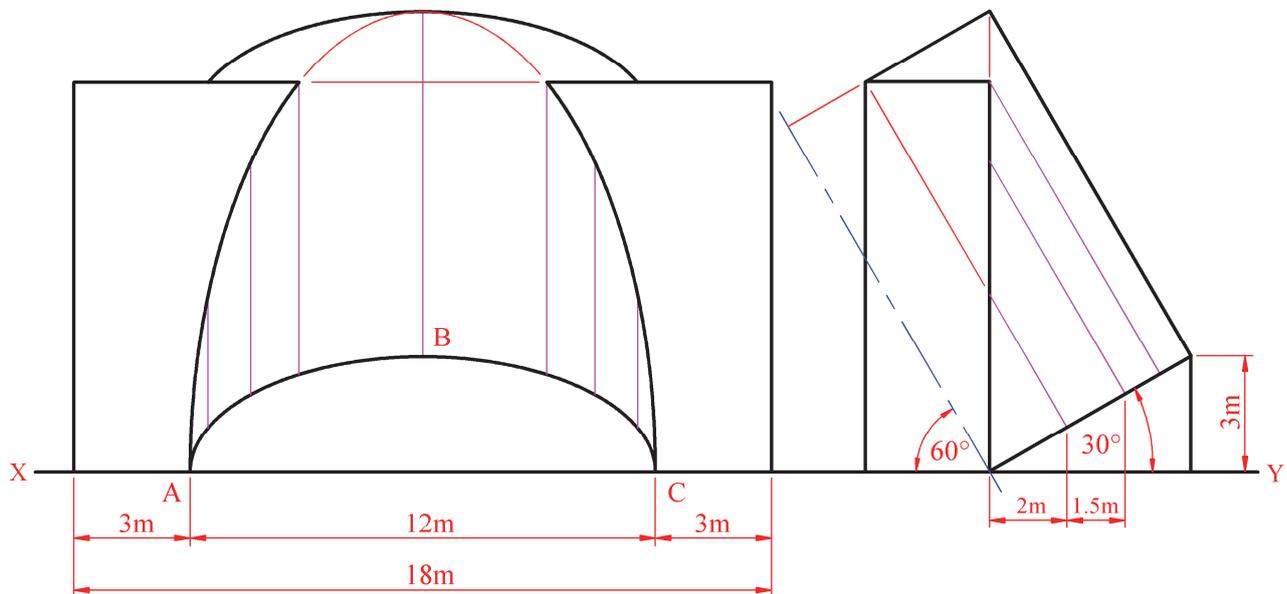
Fig. B-1

B-2. The image on the right shows an abstract metal sculpture which is made from several intersecting solids.

Fig. B-2 below shows the incomplete projections of two such solids which penetrate each other.

(a) In the diagram a triangular-based pyramid is positioned with its base inclined at 30° to the horizontal plane. Draw the plan and elevation of this pyramid.

(b) An equilateral triangular prism, of 65mm side, penetrates the pyramid as shown. Draw the outline elevation and plan of this triangular prism.

(c) Complete the drawing, showing all lines of interpenetration.

Scale 1:1
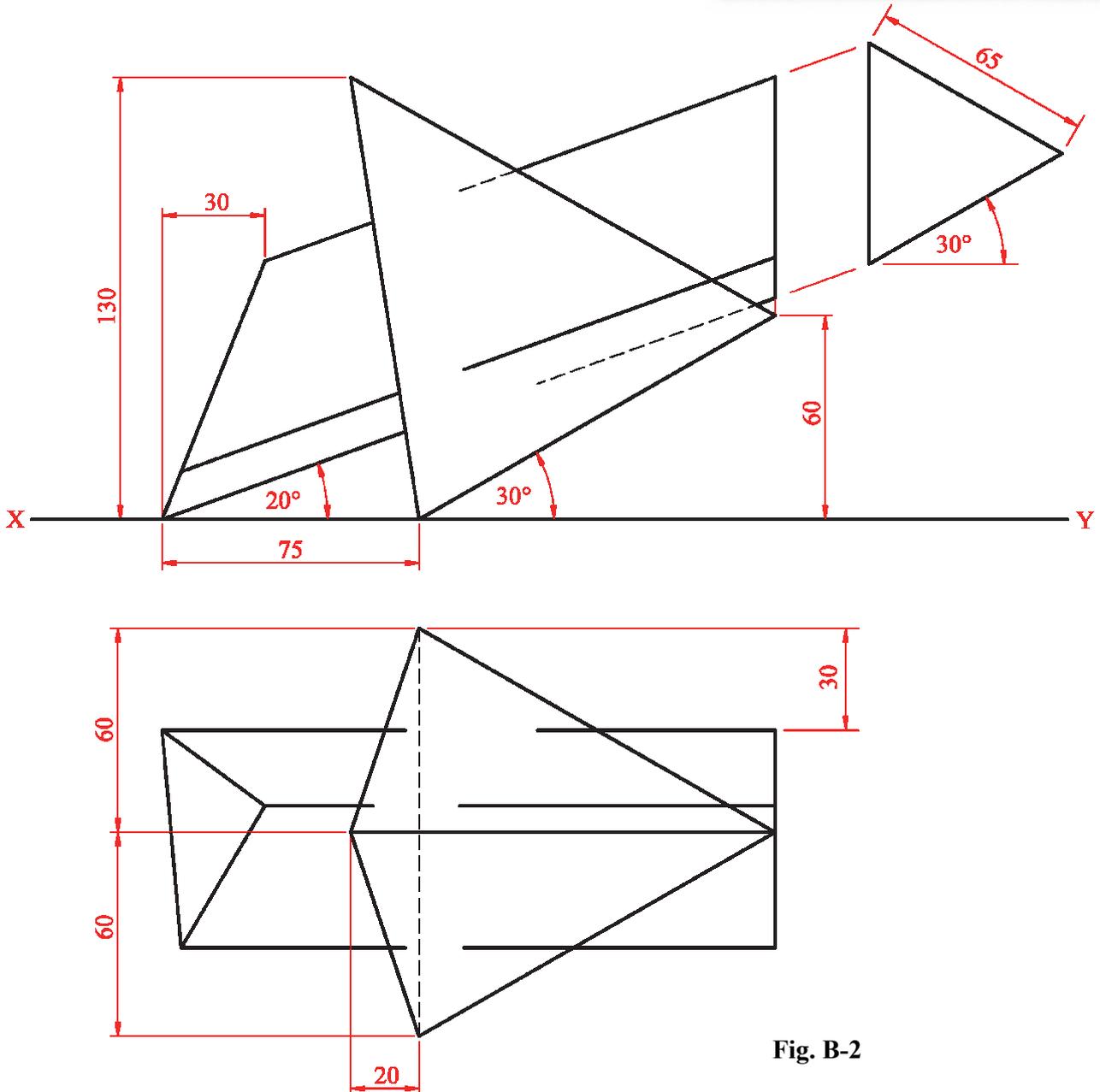
Fig. B-2

B-3. 2012 marks the centenary of the sinking of the Titanic, the world's most famous ocean liner, which was built in Belfast.

The image on the right shows the new *Titanic Signature Building* which was opened in the city to commemorate the anniversary in April.

The building incorporates planar faces which intersect as shown to represent the bow of the ill-fated ship.

Fig. B-3 below shows the plan and elevation of a model of two such intersecting planes, **ABCD** and **ABEF**. The horizontal and vertical coordinates for the outer points of the two planes are also given.
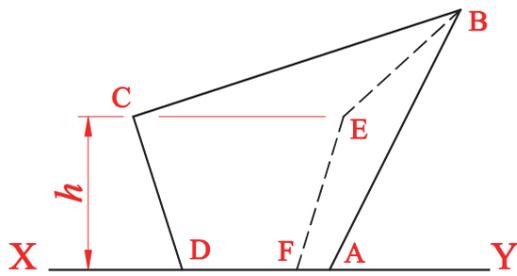
Fig. B-3

A	=	165	---	0	---	70
B	=	205	---	80	---	110
C	=	105	---	h	---	75
D	=	120	---	0	---	60
E	=	170	---	h	---	10
F	=	155	---	0	---	25
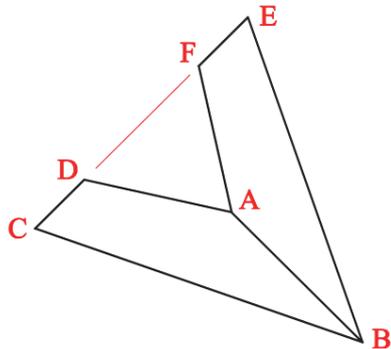
(a) Draw the given plan of the two intersecting planes and locate points **A**, **B**, **D** & **F** in elevation.

(b) Determine the height, *h*, for points **C** and **E** and complete the elevation.

(c) Determine the dihedral angle between the two planes.

(d) Determine and indicate the horizontal and vertical traces of the oblique plane that contains the surface **ABEF**.

Scale 1:1

SECTION C - Applied Graphics
Answer **Any Two** questions (i.e. the options you have studied)
from this section on drawing paper.

Geologic Geometry

C-1. (a) The accompanying map, located on the back page of Section A, shows ground contours at five metre vertical intervals.

ABCDE is the centreline of a proposed roadway. **O** is the centre of the circular curves of a proposed roundabout.

The roadway has the following specification:

(i)   the section of the roadway between **A** and **D** is level at an altitude of 50m

(ii) the section from **D** to **E** is falling uniformly to a level of 35m at **E**.

Using side slopes of 1 in 1 for the cuttings and 1 in 2 for the embankments complete the earthworks necessary to accommodate the roadway on its eastern and southern sides.

Note: The earthworks on the western and northern sides of the roadway have already been completed.

(b) The line **PQR** shows the plan of an underground mineshaft. The entrance to the mineshaft is located at **P** at an altitude of 35m and the shaft slopes downwards into the ground at an angle of 10° to the horizontal plane.

A section of the mineshaft, near point **Q**, has collapsed leaving a group of miners trapped underground.

It is proposed to drill a vertical borehole somewhere between points **Q** and **R** in order to rescue the miners. Determine, in plan, the position on the mineshaft that will require the shortest possible vertical borehole.

Scale 1:1000

Structural Forms

C-2. The 3D graphic on the right shows a fireplace in the form of a semi-hyperboloid of revolution. The copper structure has been cut as shown to form the sloping top. A vertical opening accommodates the fire.

Fig. C-2 below shows the plan and elevation of the fireplace.

(a) Draw the outline plan and elevation of the semi-hyperboloid of revolution, including the semi-circular base.

(b) Draw the projections of the sloping top in elevation and plan.

(c) Draw the projections of the vertical opening.

Scale 1:10
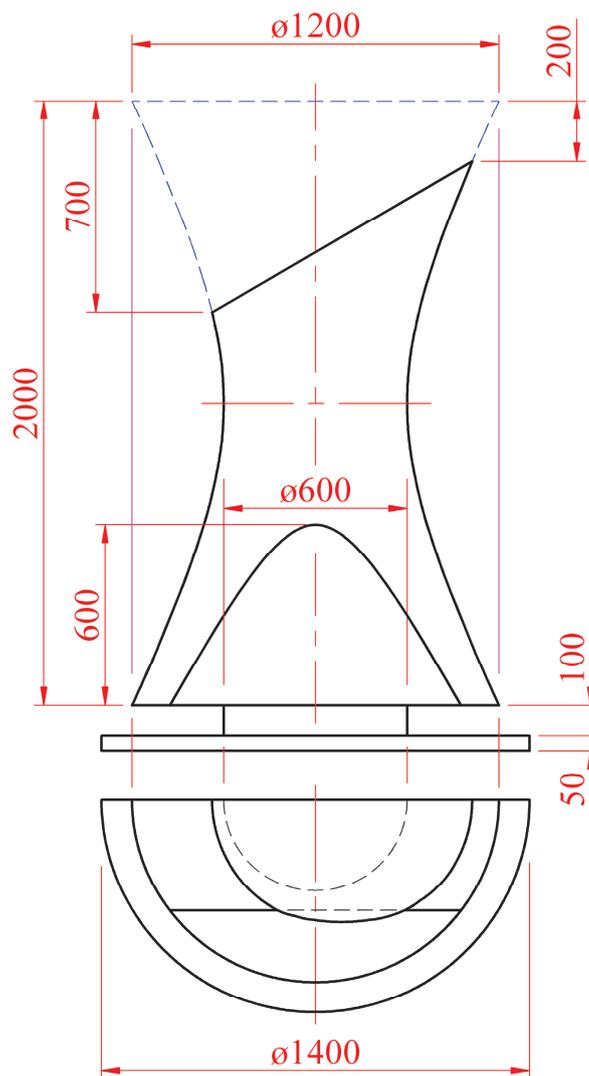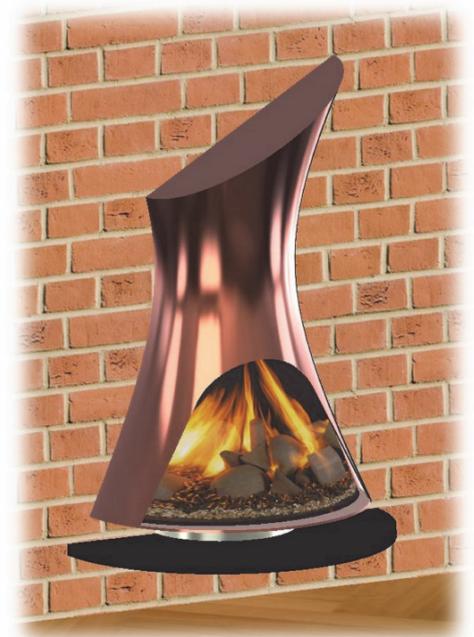
Fig. C-2

Surface Geometry

C-3. The graphic on the right shows the *Arigna Mining Experience Centre* in Co. Roscommon. The modern design of the angular building reflects its rugged surroundings.

Fig. C-3 below shows the plan and elevation of a portion of the structure which also includes two dormer windows.

(a) Surfaces **A** and **C** have a pitch of 60° and surfaces **B** and **D** have a pitch of 40°.
Draw the elevation and plan of surfaces **A**, **B**, **C** and **D**.

(b) Draw the elevation and plan of the dormer window **E** and determine the dihedral angle between the surfaces **B** and **E**.

(c) Develop the surface **E**.

(d) The dihedral angle between surfaces **D** and **F** is 120°. Complete the projections of the structure.

Scale 1:100
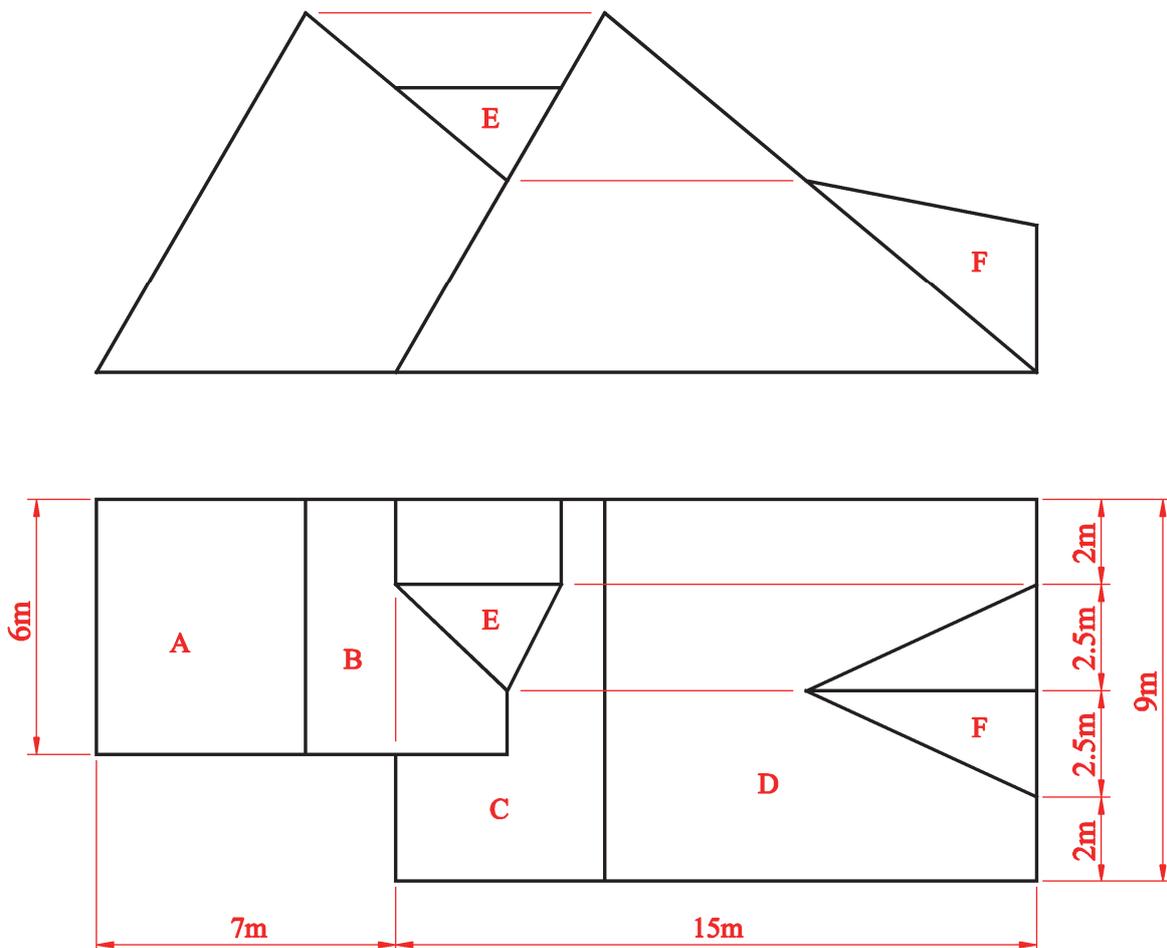
Fig. C-3

Dynamic Mechanisms

C-4. **(a)** The 3D graphic on the right shows a pedal-operated weaving machine.

A link mechanism in the machine is similar to the one shown in line diagram format in Fig. C-4(a) below.

Arm **OA** rotates anti-clockwise about point **O** for one revolution. At the same time, arm **BC** rotates clockwise about point **B** for 180° and rotates anti-clockwise to its original position for the last 180°.

A, **C** and **D** are pin joints.

Plot the locus of point **P** for the full movement.

Scale 1:1
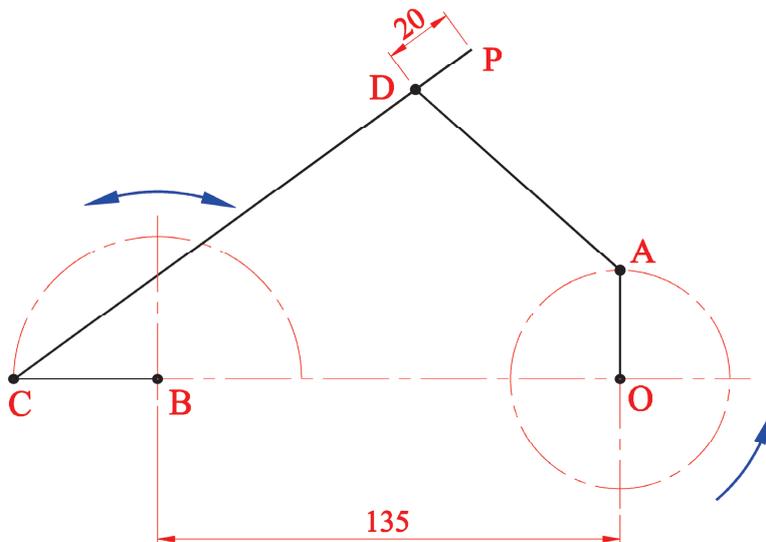
Arm Lengths

OA = 32
BC = 42
AD = 80
CP = 165

Fig. C-4(a)

(b) In Fig C-4(b), a helical slot is to be cut on the front of a cylinder starting at point **A** and finishing at point **B**.

(i) Draw the given elevation of the cylinder and project a plan.

(ii) Draw the surface development of the front half of the cylinder, including points **A** and **B**.

(iii) Determine, in the elevation, the helical path between **A** and **B**.

(iv) Determine and indicate, in degrees, the angle through which the cylinder must turn if the cutting head remains vertical as shown in the graphic below.

Scale 1:1
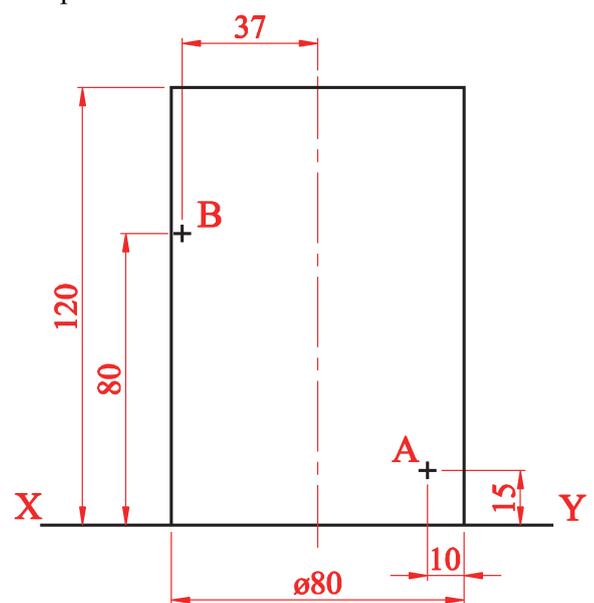
Fig. C-4(b)

Assemblies

C-5. (a) Details of a **Press** for cutting circular discs for a board game are shown in Fig. C-5. The parts list and a 3D graphic of the individual parts are also shown below. Draw a full size sectional elevation on A-A, showing the parts fully assembled with the top die fully down and the handle in the horizontal position. *(All chamfers are 1x45° and any omitted dimensions may be estimated).*

(b) Determine and indicate on your drawing the angle that the handle will make with the horizontal plane when the top die rises by 10mm.
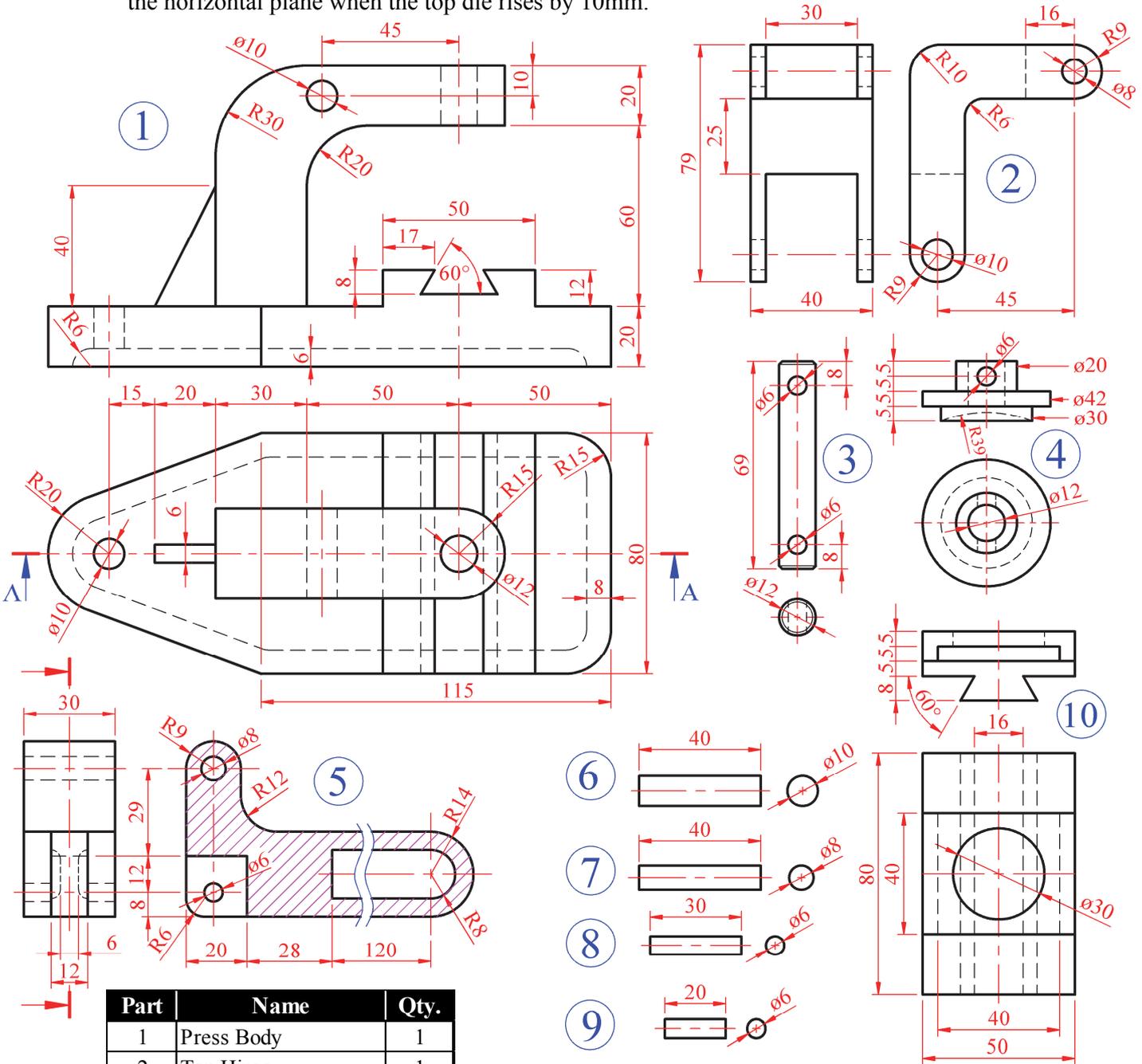
Part	Name	Qty.
1	Press Body	1
2	Top Hinge	1
3	Vertical Ram	1
4	Top Moving Die	1
5	Handle	1
6	Pin Ø10 x 40	1
7	Pin Ø8 x 40	1
8	Pin Ø6 x 30	1
9	Pin Ø6 x 20	1
10	Fixed Bottom Die	1

Fig. C-5
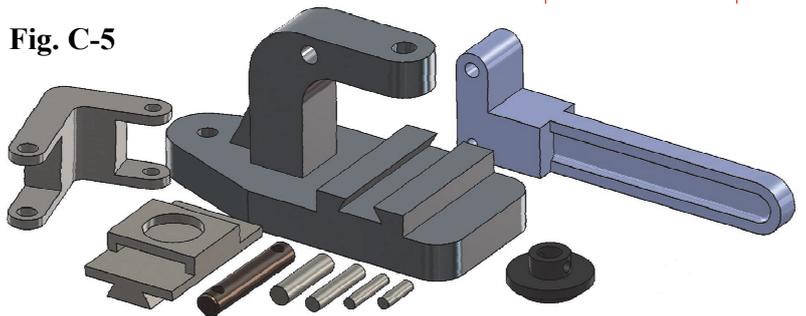
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