Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination

Design & Communication Graphics

Higher Level
Sections B and C *(120 marks)*

3 Hours

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 A3 sheet overleaf.
	• All questions in Section A carry **20 marks** each.

SECTION B **and** **SECTION C**	• Eight questions are presented.
	• Answer **any two** on drawing paper.
	• All questions in Section B and Section C carry **60 marks** each.

General Instructions:

- *Construction lines must be shown on all solutions.*
- *The graphics presented are not necessarily drawn to scale and must not be used for scaling purposes.*
- *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.*

Do not hand this up.

This document will not be returned to the
State Examinations Commission.

SECTION B - Core

Answer **any two** questions from the eight questions presented in **Section B** and **Section C** on drawing paper.

B-1. The 3D graphic on the right shows a piece of sculpture to represent basic geometrical shapes.

The sculpture consists of a cube and a prism based on an equilateral triangle, which intersect each other as shown.

Fig. B-1 shows the incomplete elevation and plan of a similar sculpture.

(a) Draw the given plan and elevation.

(b) Complete the projections of the sculpture showing all lines of interpenetration.

Scale 1:1

Leaving Certificate
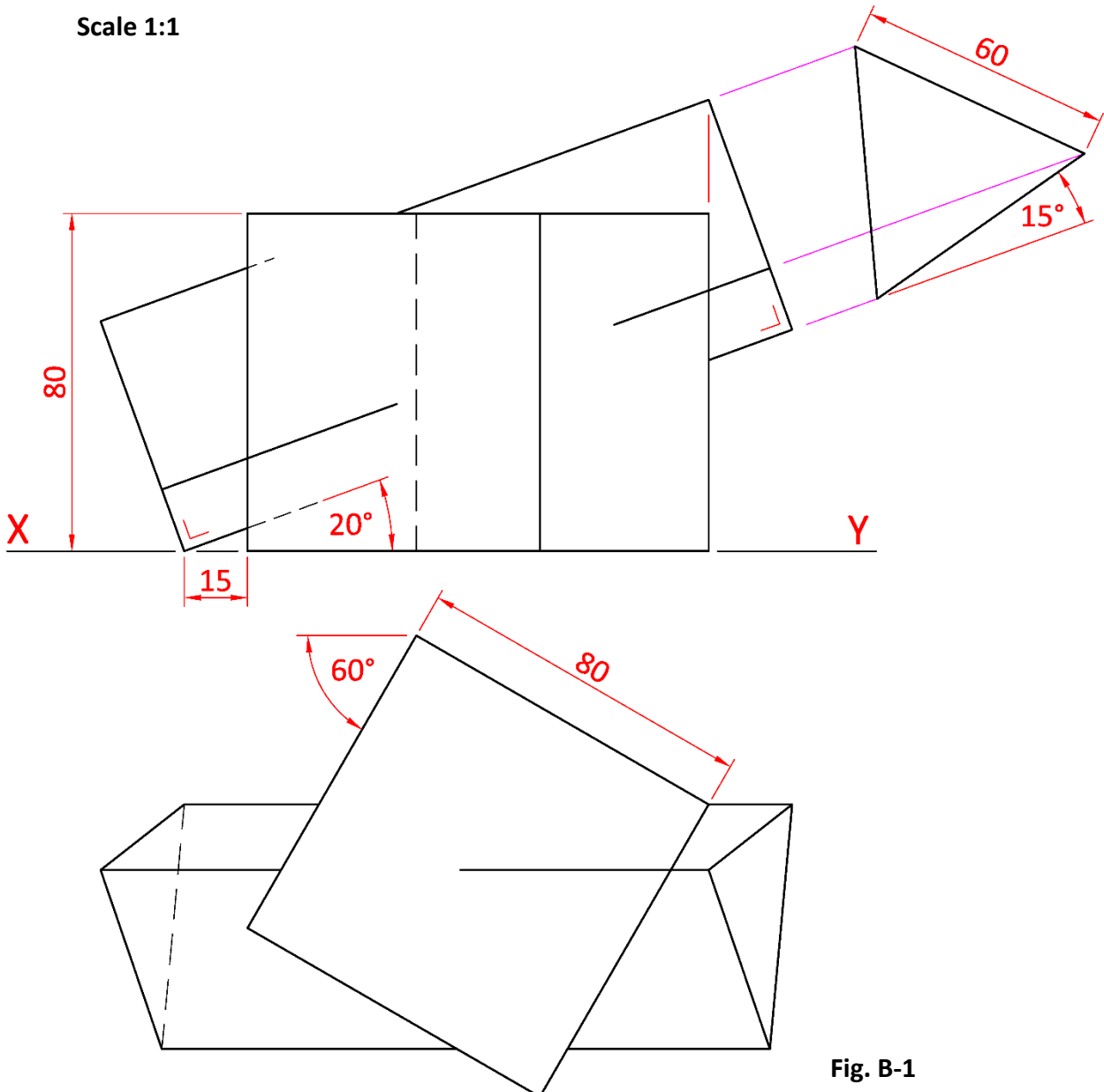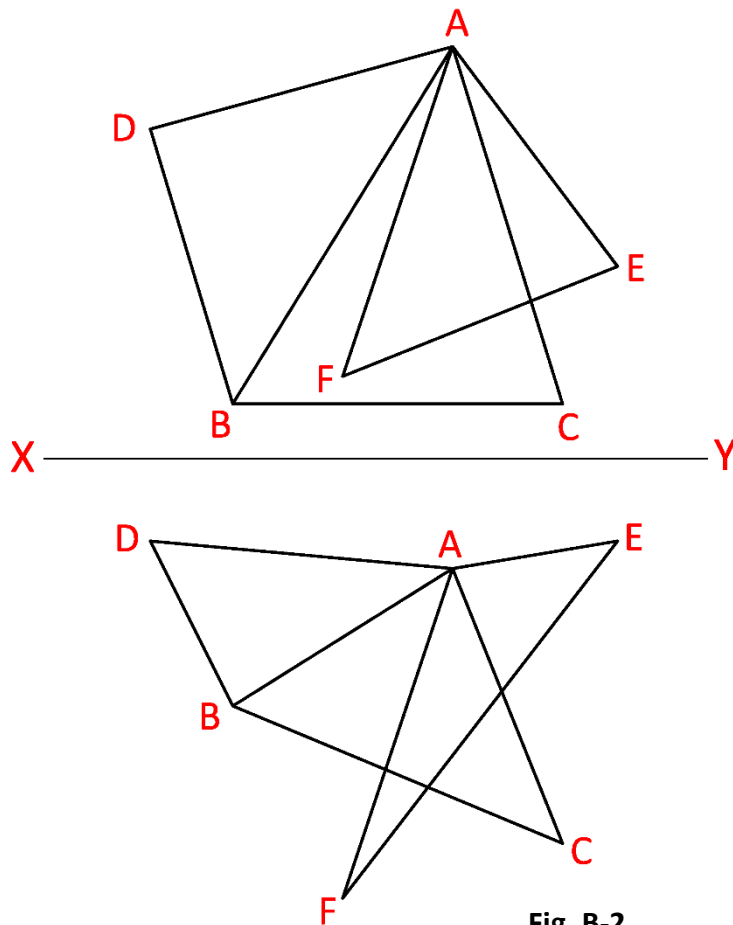*Design & Comm. Graphics, Section B - Higher Level*

2

Fig. B-1

B-2. The image on the right shows a lamp and shade. The shade is made from a number of intersecting triangles.

Fig. B-2 shows the plan and elevation of three of the intersecting triangular planes **ABC**, **ABD** and **AEF**.

The horizontal and vertical coordinates of the three planes are given.

Scale 1:1

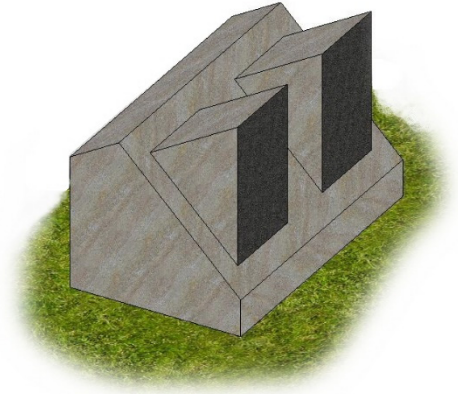| A: | 150 | --- | 75 | --- | 20 |
B:	110	---	10	---	45
C:	170	---	10	---	70
D:	95	---	60	---	15
E:	180	---	35	---	15
F:	130	---	15	---	80

Fig. B-2

(a) Draw the given elevation and plan of the intersecting planes.

(b) Determine the dihedral angle between the planes **ABC** and **ABD**.

(c) Determine the line of intersection between the planes **ABC** and **AEF**.

(d) Determine the horizontal and vertical traces of the plane **AEF**.

Leaving Certificate
Design & Comm. Graphics, Section B - Higher Level

3

B-3. The 3D graphic on the right shows a memorial sculpture to commemorate the participants in an historic battle.

Fig. B-3 shows the plan and elevation of a model of the structure.

A pictorial view of the structure is also shown.

(a) Draw the given plan.

(b) Make a perspective drawing of the structure given the following:

- The spectator point **S**, is 160mm from corner **A**
- The picture plane is touching corner **A**
- The horizon line is 80mm above the ground line.

Use an auxiliary vanishing point to determine the top sloping lines of the windows in the perspective drawing.
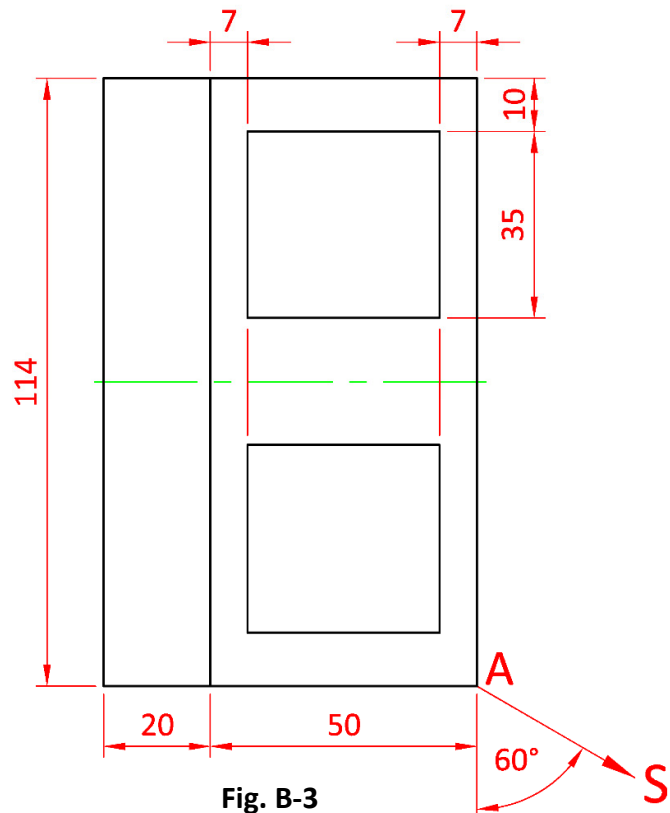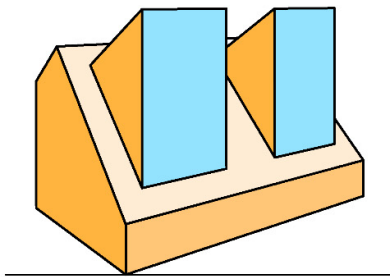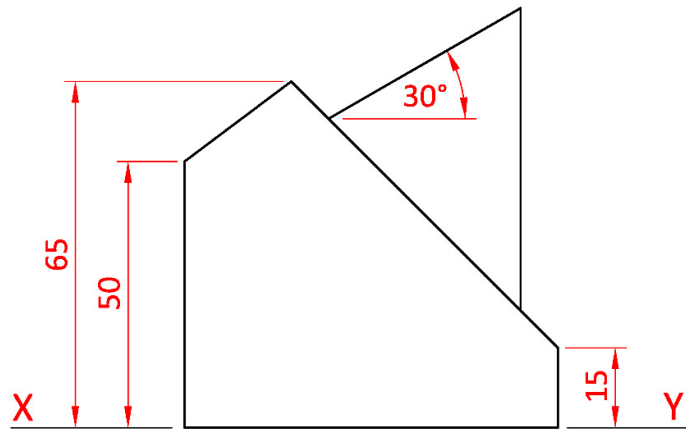
Scale 1:1

Fig. B-3

SECTION C - Applied Graphics

Answer **any two** questions from the eight questions presented in **Section B** and **Section C** 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.

ABC is the centreline of a proposed roadway.

The roadway has the following specifications:

- the section of the roadway between **A** and **B** is level at an altitude of 35m

- the section from **B** to **C** has a gradient of 1 in 15 rising.

Using side slopes of 1 in 1 for the cuttings and 1 in 1.5 for the embankments, complete the earthworks necessary to accommodate the roadway on its southern side.

Note: The earthworks on the northern side of the roadway have already been completed.

(b) On the map, **D**, **E** and **F** are outcrop points on the top surface of a stratum of ore.

(i) Draw the plan of the triangular portion **DEF** of the top surface of the stratum.

(ii) Draw the elevation of the triangle **DEF** on the given XY line and determine the strike and dip of the stratum.

(iii) Determine the true angle between the lines **DE** and **DF**.

Scale 1:1000

Structural Forms

C-2. The image on the right shows the roof of an ice rink in Germany. The shape of the roof is based on a hyperbolic paraboloid.

The projections of the roof are shown in Fig. C-2 below. The curve **EBF** in elevation is a parabola. **B** is the vertex of the parabola.

The surface of the roof is formed by extending the hyperbolic paraboloid surface **ABCD** as shown in elevation.

(a) Draw the given elevation including the elements as shown.

(b) Project the given plan from the elevation.

(c) Show the curvature of the surface when intersected by a vertical cutting plane passing through points **B** and **D**.

Scale 1:200

Fig. C-2

Leaving Certificate
Design & Comm. Graphics, Section C - Higher Level
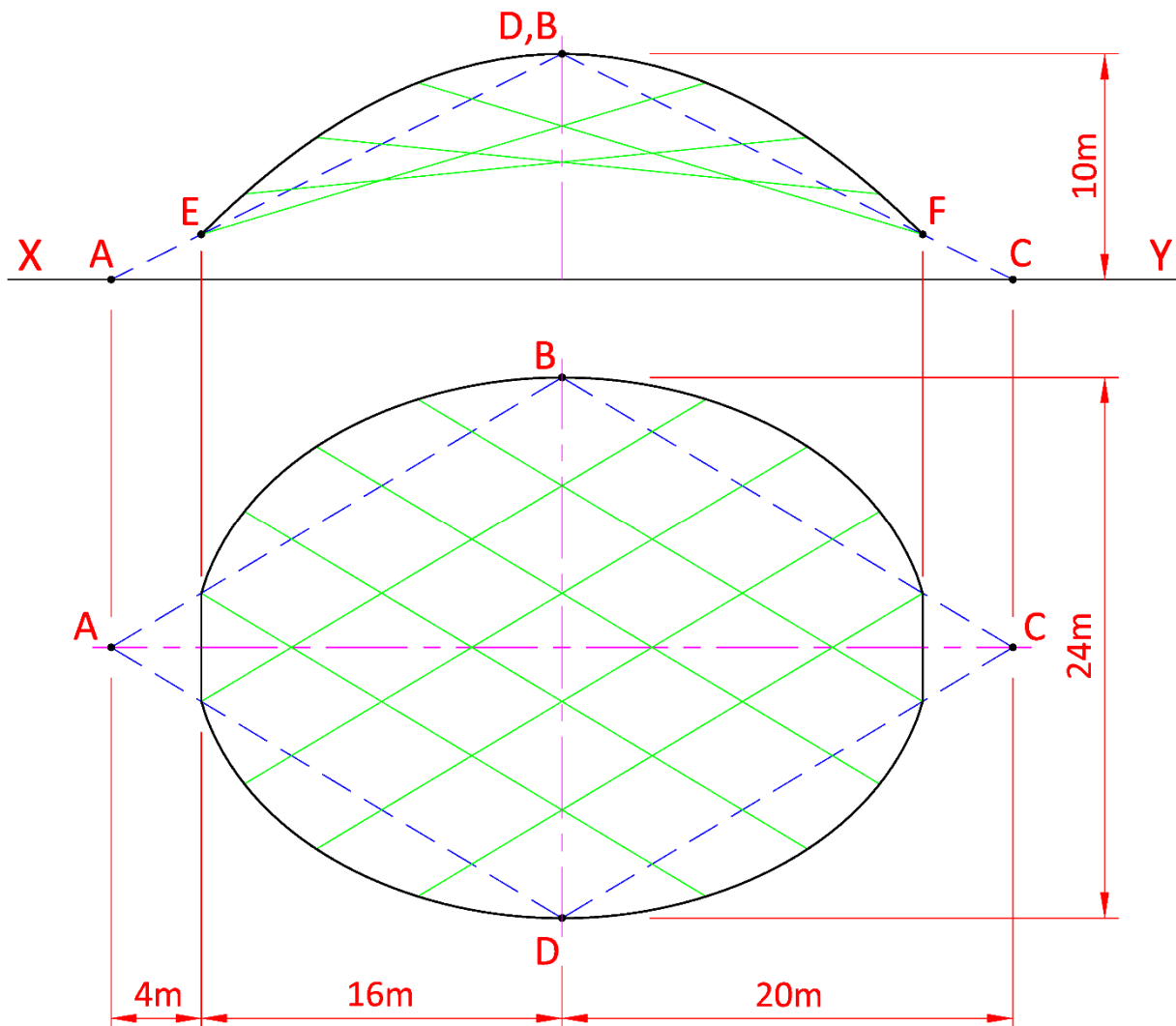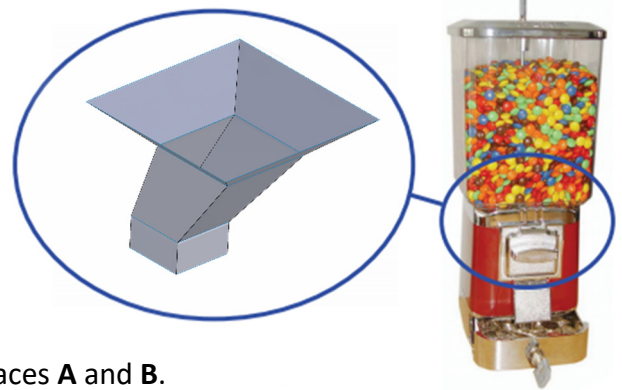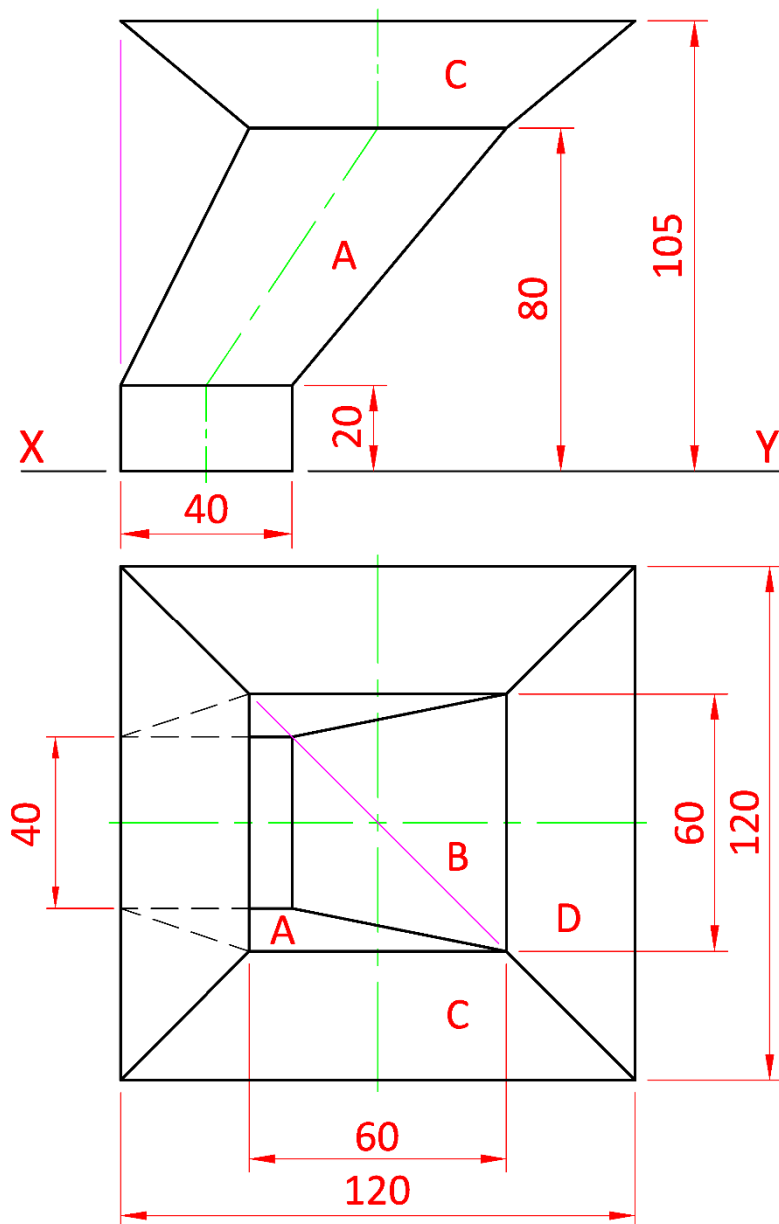
6

Surface Geometry

C-3. The image on the right shows an enlarged detail of a metal hopper from a sweet vending machine. Sweets are released through the hopper into the hatch at the bottom of the machine.

Fig. C-3 shows the plan and elevation of a similar hopper.

(a) Draw the given elevation and plan.

(b) Draw a one-piece surface development of surfaces **A** and **B**.

(c) Determine the dihedral angle between surfaces **C** and **D**.

(d) Determine the radius of the largest spherical sweet which would pass through the hopper.

Scale 1:1

Fig. C-3

Leaving Certificate
Design & Comm. Graphics, Section C - Higher Level

7

Dynamic Mechanisms

C-4. (a) Draw the profile and displacement diagram for a plate cam rotating in a clockwise direction and imparting the following motion to an in-line roller follower of 18mm diameter:

- 0° to 180°   Rise 48mm with Uniform Acceleration and Retardation (UAR)
- 180° to 270°   Dwell
- 270° to 360°   Fall 48mm with simple harmonic motion.

The nearest approach of the roller centre to the camshaft centre is 45mm.
The camshaft diameter is 20mm.

(In the displacement diagram, use a distance of 12mm to represent each 30° interval.)

(b) The image on the right shows a windscreen wiper. The wiper blade is represented in line diagram format in Fig. C-4 below.
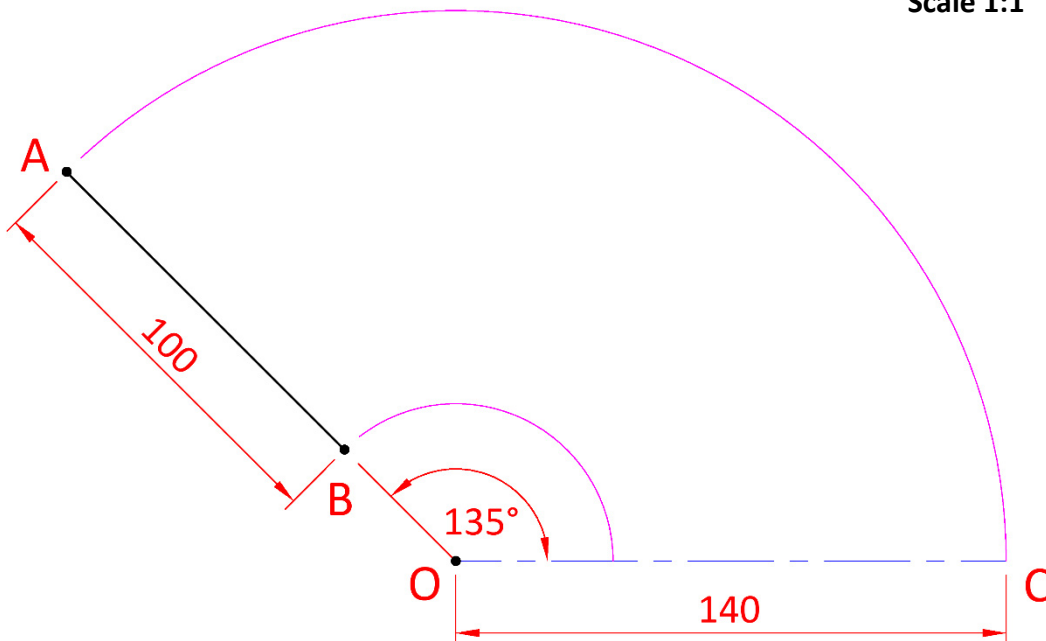
   (i) Draw the given line diagram with the wiper blade **AB** positioned as shown.

   (ii) The wiper blade **AB** pivots clockwise about point **O** through 135° and back again to its initial position. During this movement a drop of water starts at point **A** and rolls along the wiper blade to point **B** at a constant rate.

Plot the locus of the water drop for the combined movement.

(**Note:** Use 30° divisions in your solution.)

Scale 1:1

A

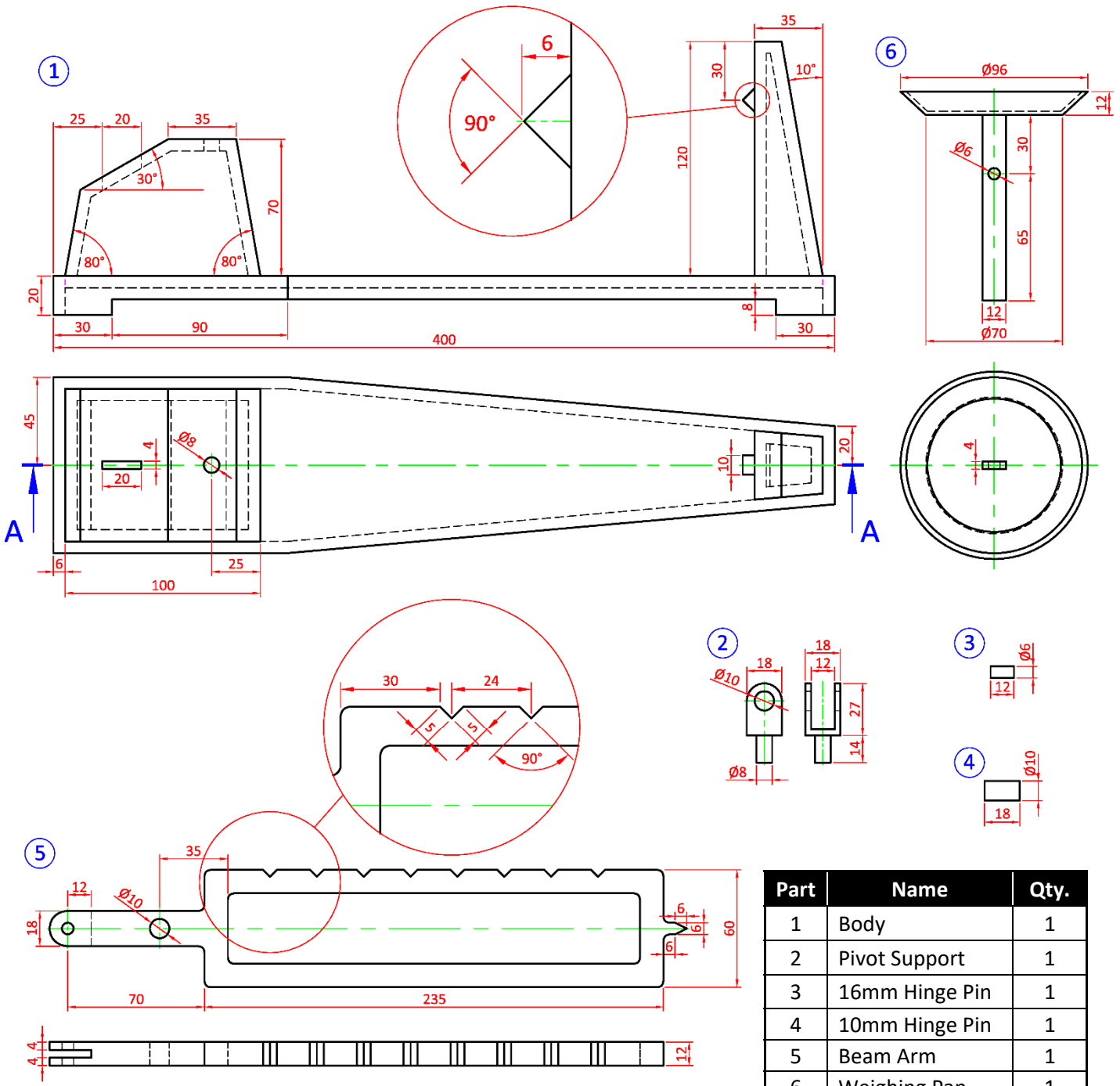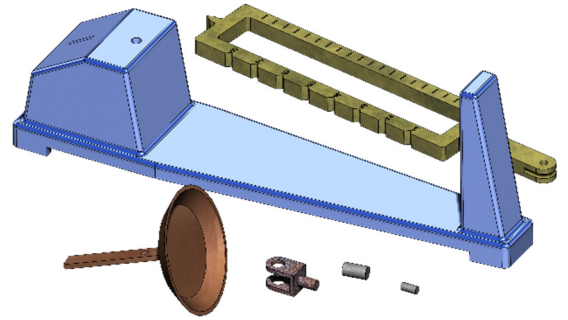100

B

135°

O

140

C

Fig. C-4

Assemblies

C-5. Details of a beam balance weighing scales are given in Fig. C-5 below with the parts list tabulated on the right.

A 3D graphic of the parts is also given.

Draw a sectional elevation on **A-A**, with the parts fully assembled.

(All fillets are 3mm.)

Scale 1:1

Fig. C-5

Part	Name	Qty.
1	Body	1
2	Pivot Support	1
3	16mm Hinge Pin	1
4	10mm Hinge Pin	1
5	Beam Arm	1
6	Weighing Pan	1

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