



Leaving Certificate Examination, 2018

Design & Communication Graphics
Higher Level

Section A (60 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 A3 sheet overleaf.
- 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:

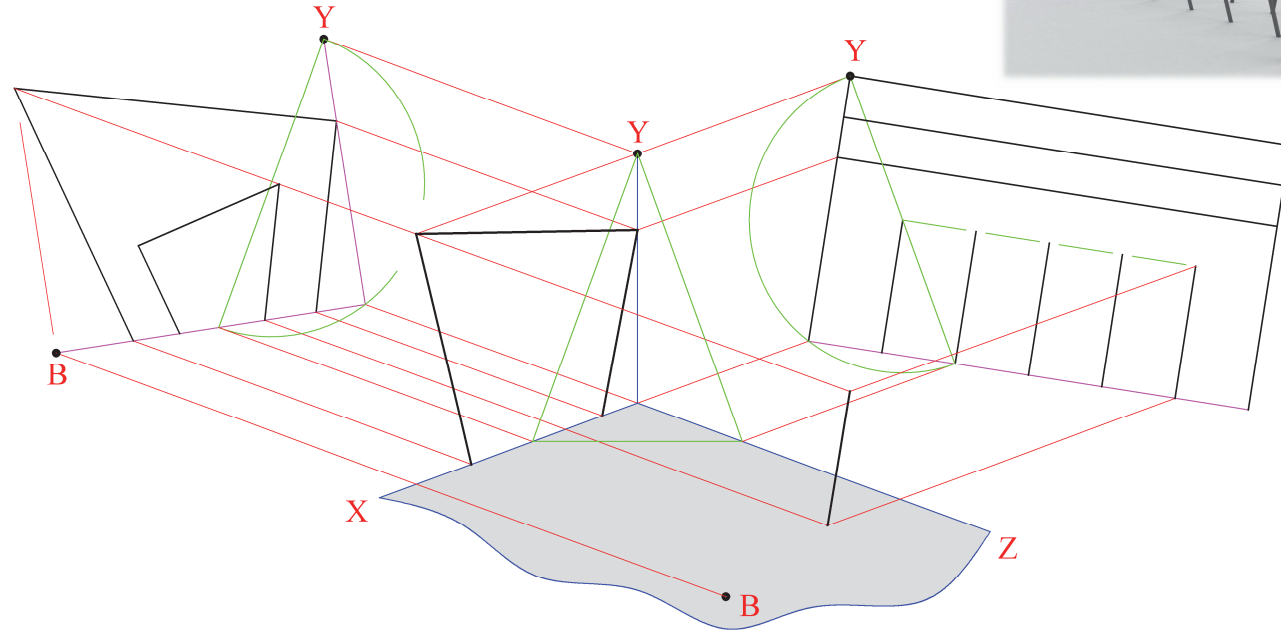
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box below and on all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

Examination Number:

SECTION A - Core - Answer any three of the questions on this A3 sheet.

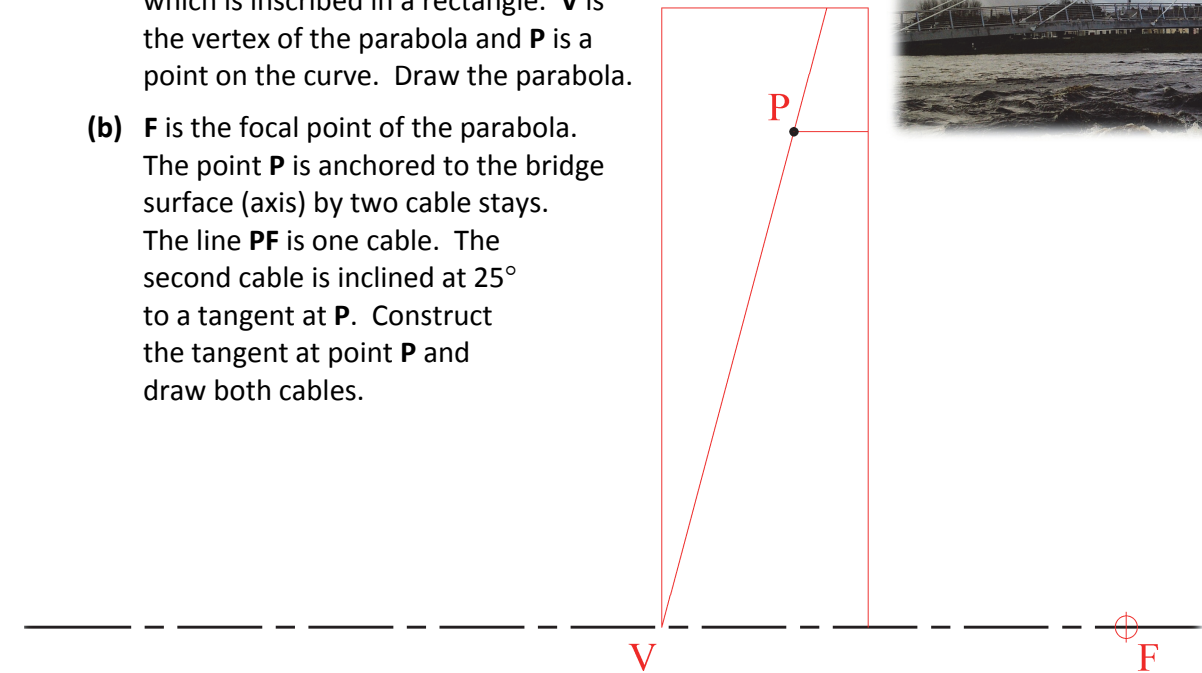
A-1. The 3D graphic shows a bicycle shelter. The drawing shows an incomplete dimetric projection of a similar shelter using the axonometric axes method. The horizontal plane is also included.

- Complete the axonometric projection of the bike shelter.
- A line joining **Y** to **B** represents the straight line path of a football. Show the point of impact of the ball with the glass roof in the axonometric view.



A-3. The image on the right shows the *Salmon Weir Bridge* over the river Moy in Co. Mayo. The drawing below shows an incomplete elevation of the bridge.

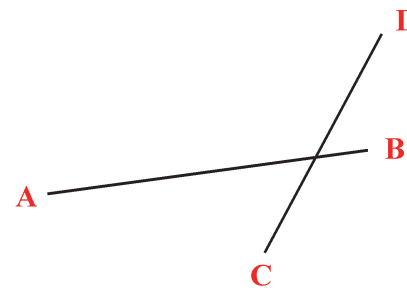
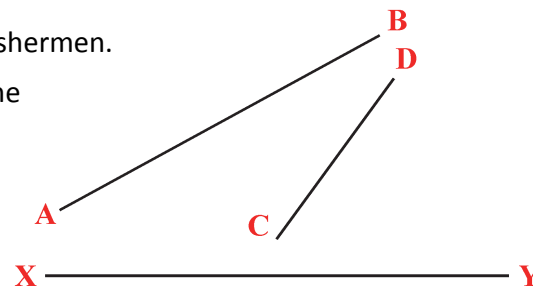
- The curved support pillar is based on a parabola which is inscribed in a rectangle. **V** is the vertex of the parabola and **P** is a point on the curve. Draw the parabola.
- F** is the focal point of the parabola. The point **P** is anchored to the bridge surface (axis) by two cable stays. The line **PF** is one cable. The second cable is inclined at 25° to a tangent at **P**. Construct the tangent at point **P** and draw both cables.



A-2. The graphic below shows a group of fishermen.

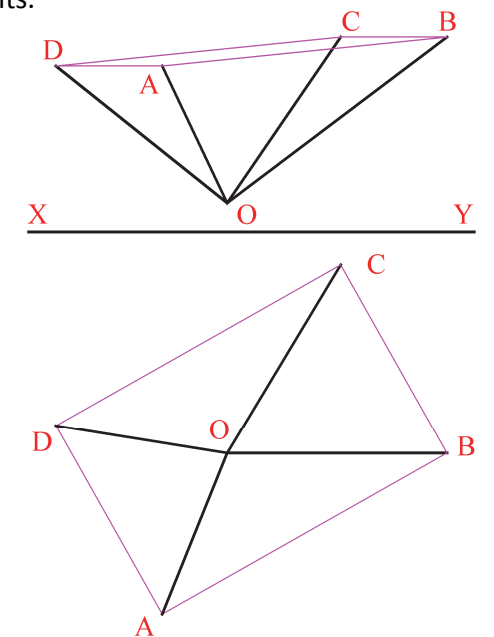
Two fishing rods are represented by the skew lines **AB** and **CD** on the right.

- Determine the projections of the shortest horizontal line between the two skew lines.
- Determine, and indicate the distance from this line to the horizontal plane.



A-4. The graphic shows a *spidercam* used for aerial coverage of sports events. It is supported by four cables. The drawing shows the projections of the cables.

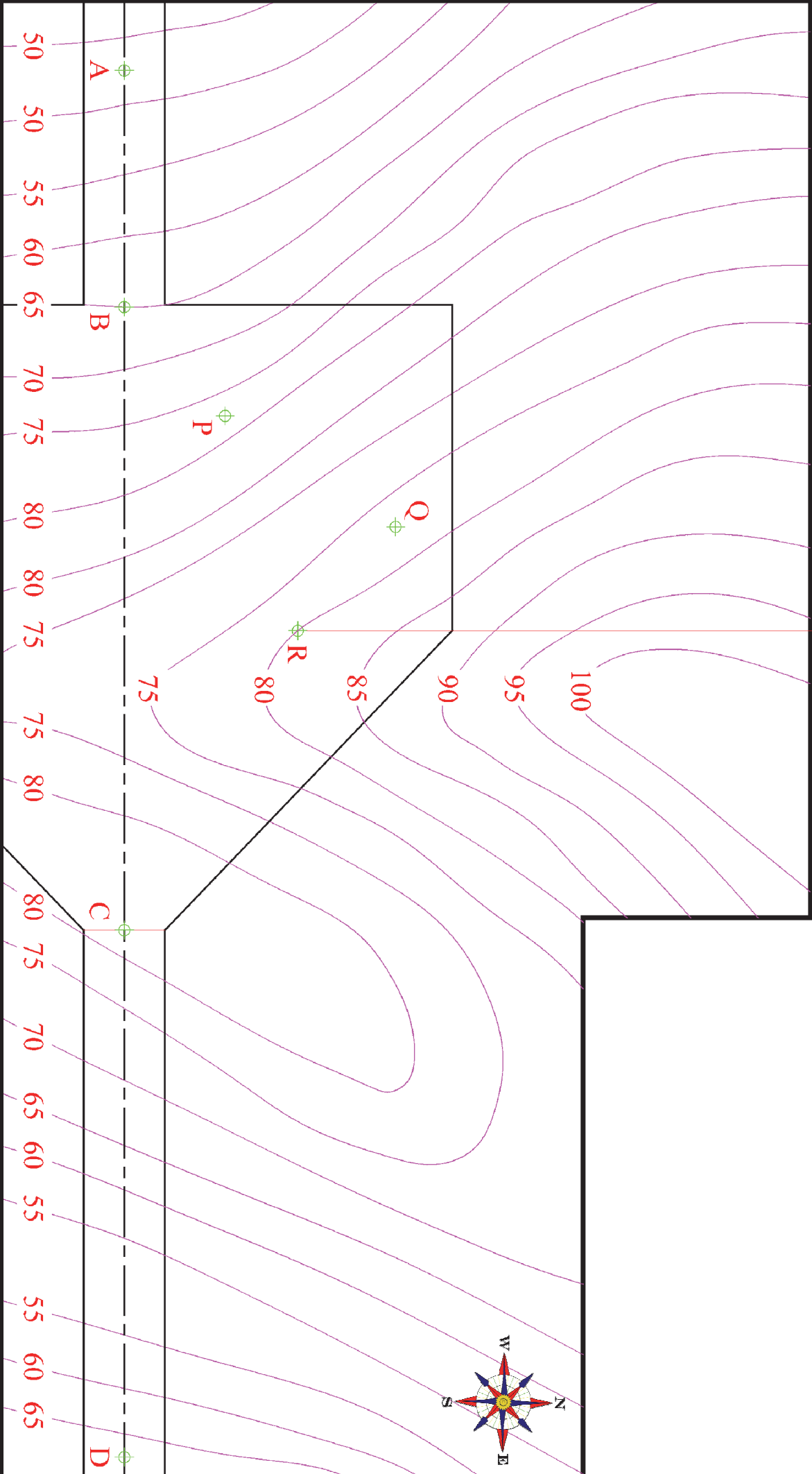
- Find the dihedral angle between the planes **OAB** and **OAD**.
- Determine the angle between the cables **OA** and **OB**.



This Contour Map is part of Section C and should only be used for the answering of the Geologic Geometry Option (Question C-1).

(Scale 1:1000)

35 _____





Leaving Certificate Examination, 2018

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.*

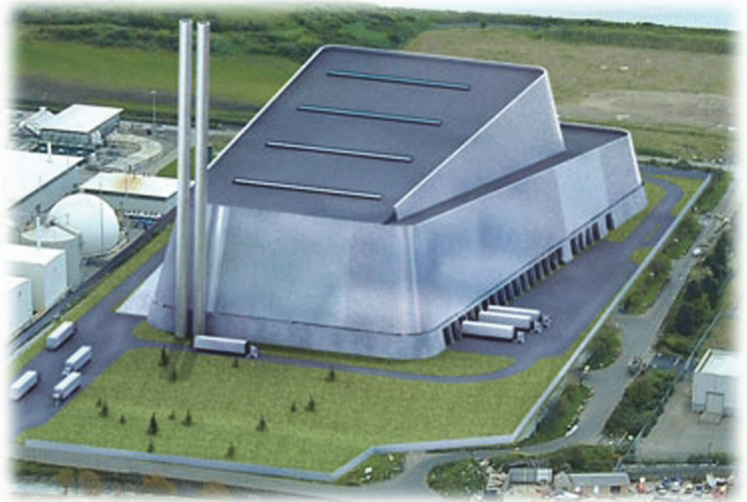
SECTION B - Core

Answer **any two** questions from this section on drawing paper.

B-1. The image on the right shows the new *Poolbeg Incinerator* in Dublin.

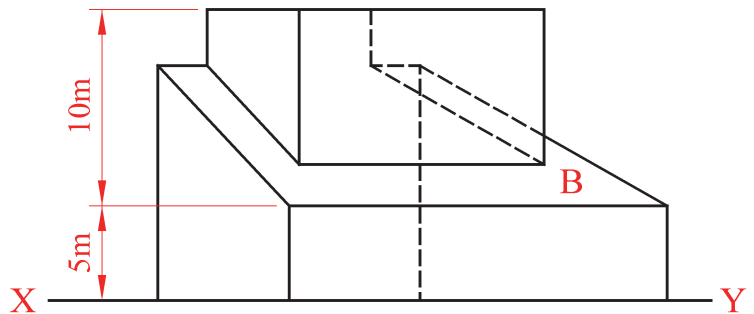
Fig. B-1 shows the plan and elevation of a similar structure.

A pictorial view of the structure is also shown.



- (a) Draw the given plan and make a perspective drawing of the structure, given the following:
- The spectator point, **S**, is 20m from the corner **A** as shown
 - The picture plane passes through the corner **A**
 - The horizon line is 10m above the ground line
 - The sloping lines on surface **B** are inclined at an angle of 20° to the horizontal plane.

*Use auxiliary vanishing points to determine the sloping lines on surface **B** in the perspective drawing.*



- (b) A vertical chimney is located at position **C**. It has a height of 20m. Draw the chimney in the perspective view.
- (c) Determine the *angle of elevation* when viewing the top of the chimney from point **S**.

Scale 1:200

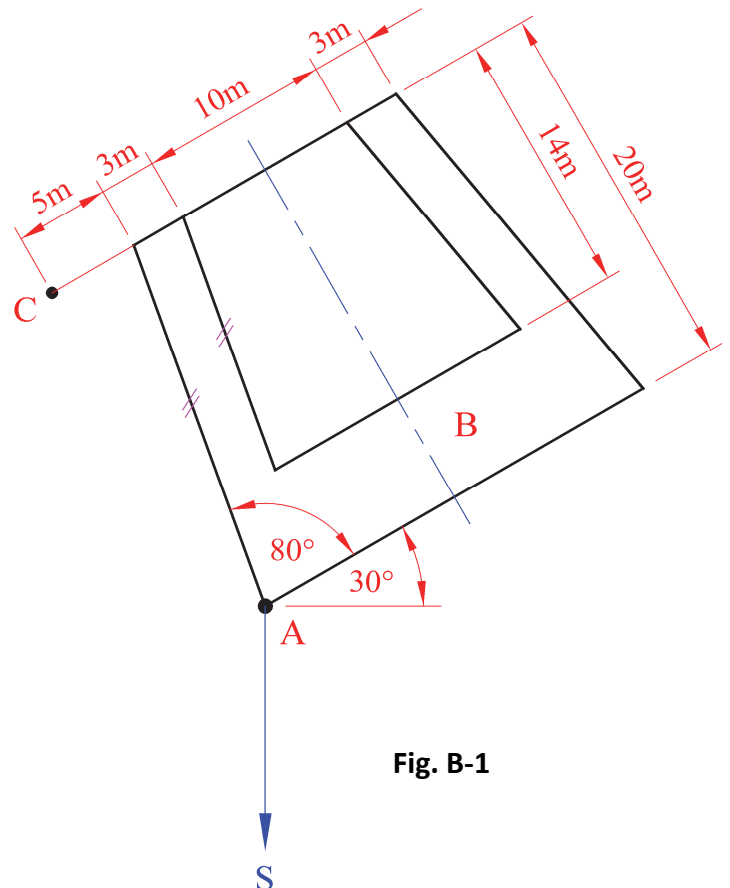
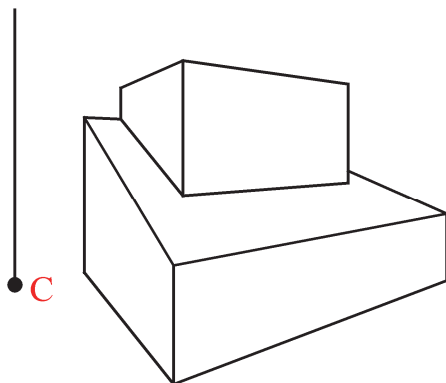


Fig. B-1

B-2. The image shows a cardboard carry-box for a child's novelty toy. A complete surface development of a similar box (without 'glueing tabs') is given in Fig. B-2 below. When the box is assembled, point **C** coincides with point **C₁** and point **A** coincides with point **A₁**. **AB** is a straight line.

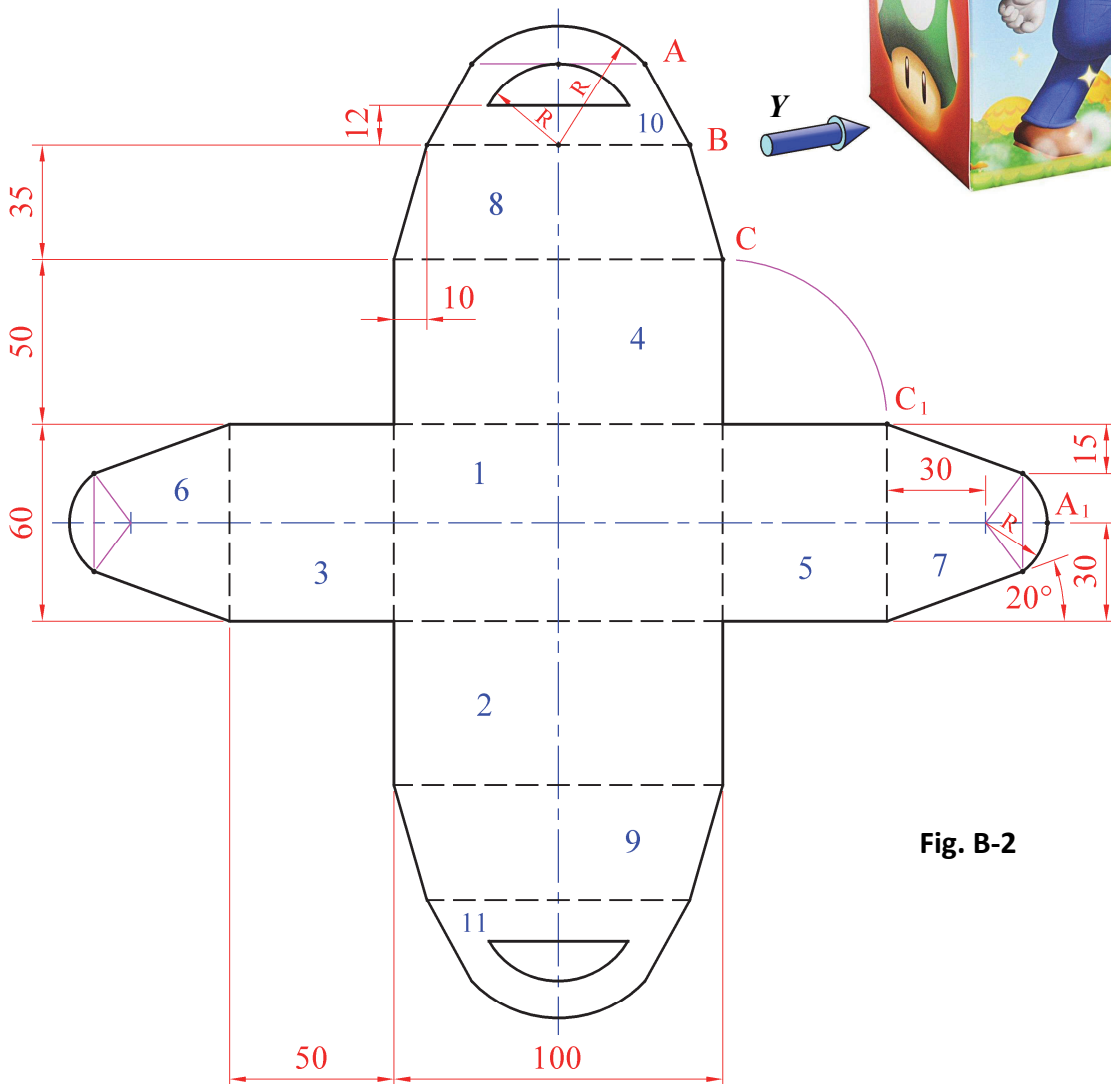


Fig. B-2

- (a) Draw the given development of the surfaces labelled 1, 2, 3, 4 and 5.

Note: Position this view carefully to ensure that the entire answer fits on one drawing sheet.

- (b) On a separate diagram draw the orthographic projections, as follows, of those five surfaces, when the box has been **assembled**:

- An elevation in the direction of arrow **X**.
- An end view in the direction of arrow **Y**.
- A plan projected from the elevation.

- (c) Draw surfaces 6, 7, 8 and 9 in your development and also in the elevation, end view and plan.

- (d) Draw the remaining vertical 'handle' surfaces (10 and 11) in the elevation, end view and plan and hence complete your surface development.

Note: Both surfaces (10 and 11) meet to form the vertical carry-handle.

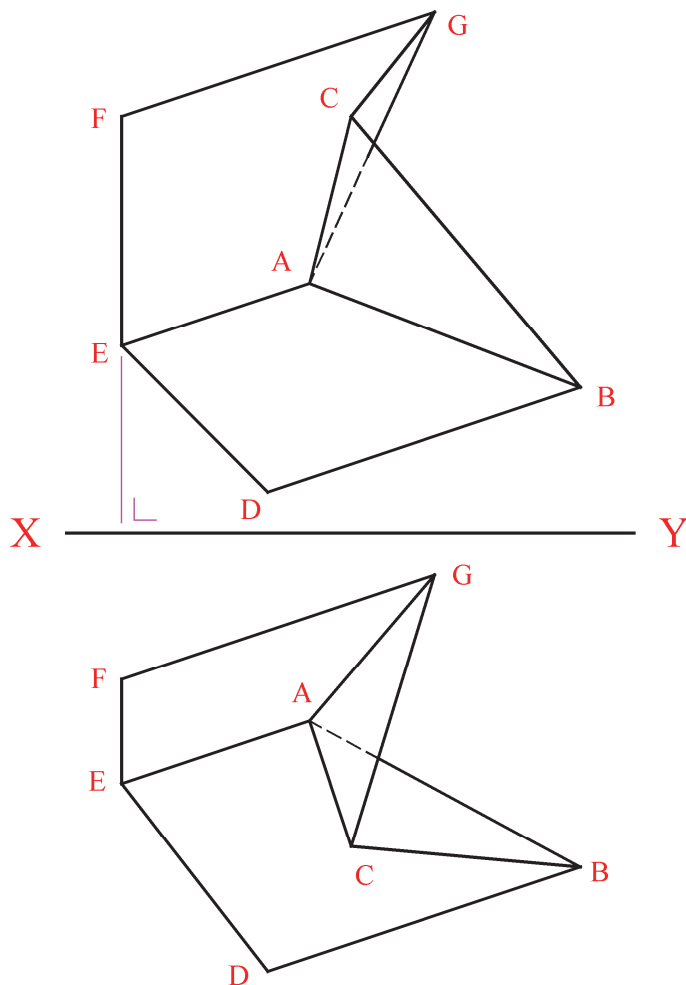
Scale 1:1

B-3. The image on the right shows a piece of roadside sculpture, in the form of a steel hedgehog, which is located on the M11 in Co. Wexford.

It comprises a series of planar surfaces, each carefully angled to allow for the run-off of rainwater.

Fig. B-3 shows the plan and elevation of four such intersecting surfaces.

The horizontal and vertical coordinates for points **A**, **B**, **C**, **D**, **E** and **G**, defining the four planes, are also given.



A:	145	---	60	---	45
B:	210	---	35	---	80
C:	155	---	100	---	75
D:	135	---	10	---	105
E:	100	---	45	---	60
G:	175	---	125	---	10

Fig. B-3

- Draw the given elevation and plan of the intersecting planes **ABC** and **ABDE**.
- Determine the dihedral angle between the planes **ABC** and **ABDE**.
- Draw the elevation and plan of point **G** and determine the distance between points **G** and **B**. The opposite edges **AE** and **GF** of the surface **AEFG** are parallel. Complete the elevation and plan of the surfaces **AEFG** and **ACG**.
- Determine the projections of a horizontal line drawn from **C** which will touch the plane **AEFG** at a point which is 55mm from **C**. Hence determine and indicate, in degrees, the true angle between this horizontal line and the vertical plane.

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. **AD** is the centreline of a proposed motorway. The motorway is widened between **B** and **C** to form a toll plaza as shown.



The motorway has the following specifications:

- the portion from **A** to **B** is level at an altitude of 65m
- the portion from **B** to **C** is level at an altitude of 65m and is widened as shown
- the portion from **C** to **D** is rising uniformly at a rate of 1 in 15.

Using side slopes of 1 in 1.5 for the cuttings and 1 in 2 for the embankments, complete the earthworks necessary to accommodate the motorway between **A** and **D** on the northern side.

(You may ignore the southern side.)

- (b)** On the map, **P**, **Q** and **R** are three points on the surface of the earth. Vertical boreholes at these three points reveal a triangle on the top surface of a stratum of ore at altitudes of 45m, 60m and 35m respectively.
- In the space provided at the top of the map, draw the elevation of the triangular portion of the top surface of the stratum.
 - Draw the plan of the triangle and determine the strike and dip of the stratum.
 - Determine, and indicate in metres, the length of the shortest skew borehole from **R** to the top surface of the stratum.
- (c)** Determine, in plan, the line of intersection between the top surface of the stratum and the surface of the widened portion of the toll plaza.

Scale 1:1000

Structural Forms

- C-2.** The graphic shows a footbridge near Liverpool which is based on a hyperbolic paraboloid. The projections of the bridge are given in Fig. C-2 below.

The elements of the hyperbolic paraboloid surface **ABCD** are extended outwards to form the curved outline loop of the supporting steel structure.



- Draw the given plan and elevation of the hyperbolic paraboloid **ABCD**, using the number of elements shown and include the projections of the walkway.
- Curve **ABC** is a parabola in elevation with vertex at **B**. Draw the elevation of this parabola.
- Project, from the elevation, the given plan of the curved outline loop and project an end view. Draw the walkway in the end view.
- The line **CE** is a normal to the parabola at point **C** in elevation. Determine the focal point and the directrix of this parabola in elevation.

Scale 1:500

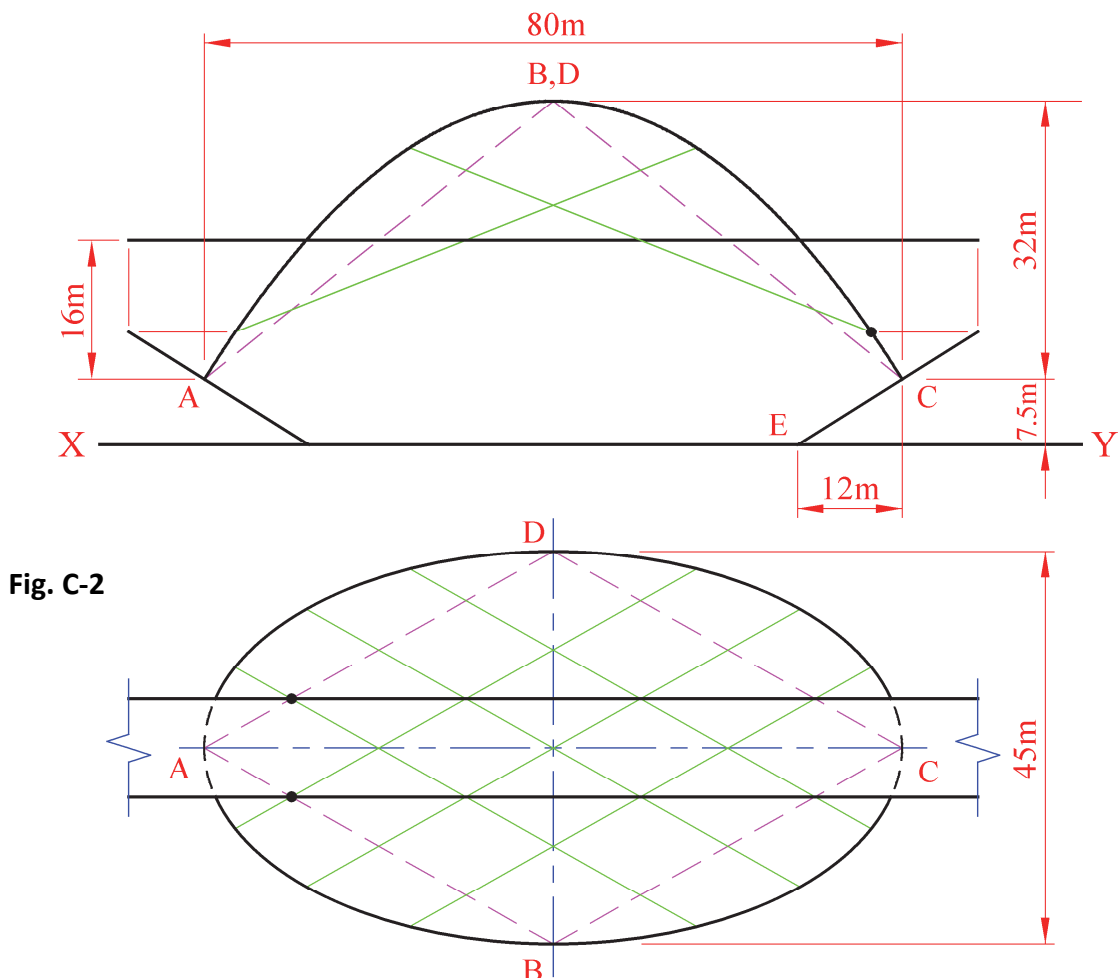


Fig. C-2

Surface Geometry

C-3. A **terrarium** is a glass container for soil and plants as shown.

Fig. C-3 shows the plan and elevation of two geometric terrariums.

The terrarium on the left is based on a square-based pyramid and is shaped as shown.



- (a) Draw the plan and elevation of this terrarium and determine the dihedral angle between surfaces **A** and **B**.
- (b) Develop the surface **C**.
- (c) The terrarium on the right is a cube which is tilted and shaped as shown. The outline plan is a regular hexagon of 150mm side. Draw the given plan of this terrarium and project the elevation.
- (d) Determine the true inclination of the surface **D** to the horizontal plane. Hence, or otherwise, determine the true shape of surface **D**.

Scale 1:3

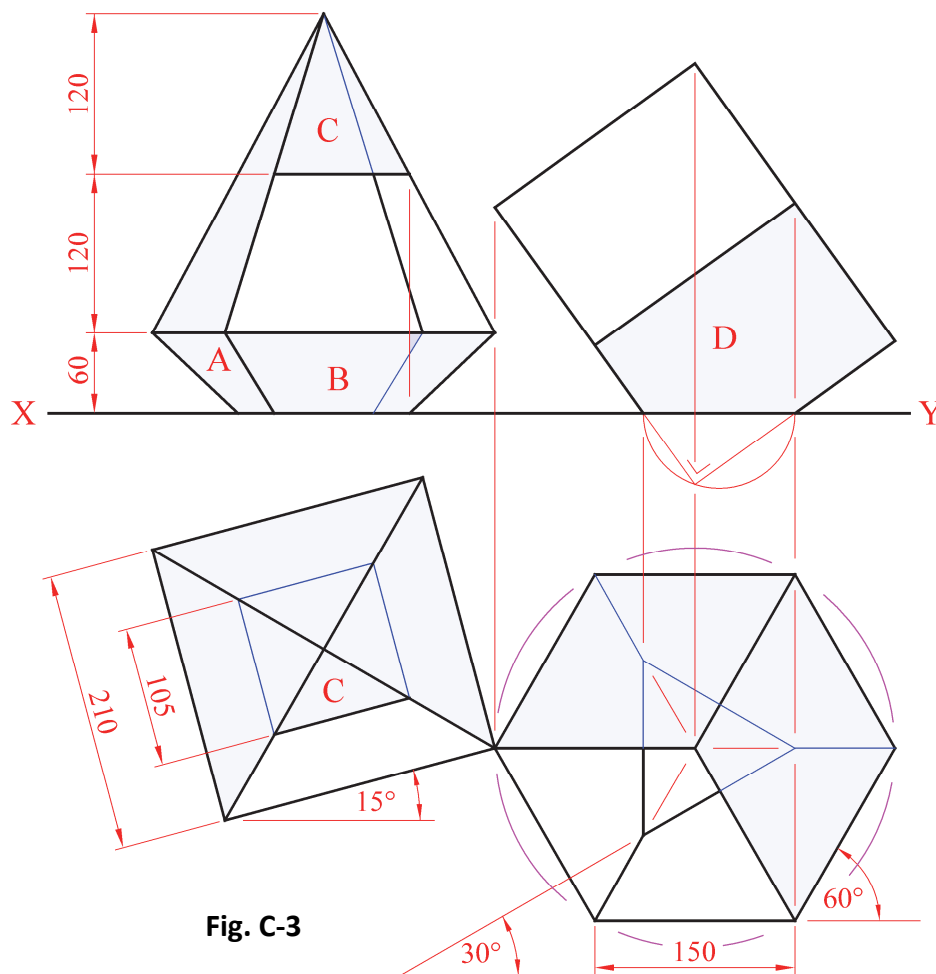


Fig. C-3

Dynamic Mechanisms

- C-4. (a)** The graphic on the right shows a *Fluid Agitator*, as used when donating bodily fluids. Movement is generated by a link mechanism, which causes the tray to rock to-and-fro preventing coagulation of the fluid.

The link mechanism is similar to the one shown in Fig. C-4 (a).

Crank **OA**, which is 48mm long, rotates in an anti-clockwise direction about point **O** as shown.

Link **CB** pivots about the fixed point **C**.

AB and **CB** are both 110mm long and are pin-jointed at **A** and **B**.

- Plot the locus of point **P**, which is the midpoint of link **AB**, for a full revolution of crank **OA**.
- Determine and indicate, in degrees, the maximum angle of rotation of link **CB**.

Scale 1:1

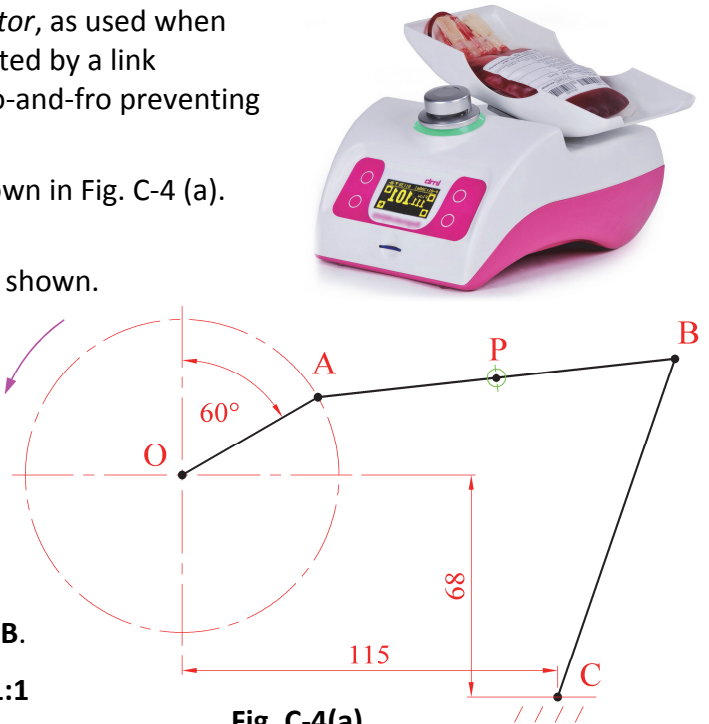


Fig. C-4(a)

- (b)** The image of the ocean on the right shows an aerial view of a group of *Humpback Whales* engaged in a technique called 'Bubble Net Fishing'.

The whales start underneath the fish and entrap them by blowing a 'net' of bubbles, which move upwards in a **Conical Archimedean Spiral**, as shown in the 3D graphic.

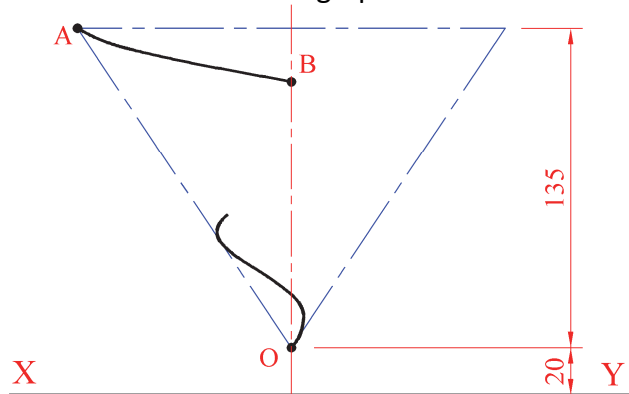


Fig. C-4(b)

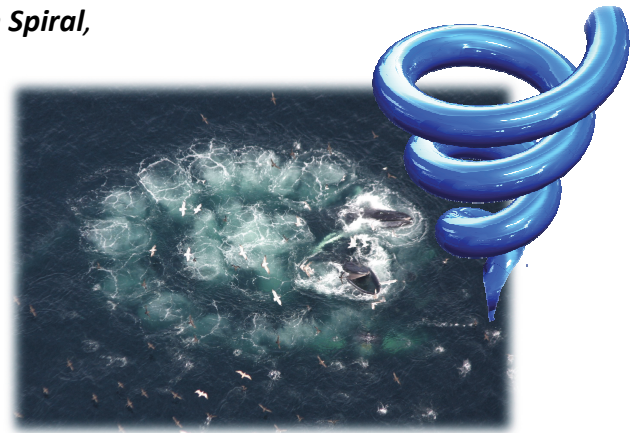
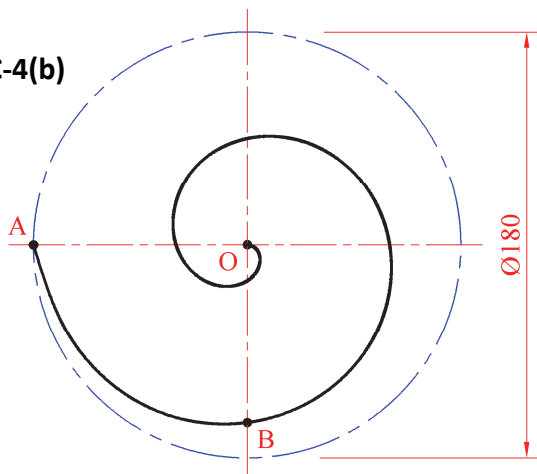


Fig C-4(b) on the left shows the projections of an inverted cone. An Archimedean Spiral moves clockwise from **O** to **A** in 1.5 revolutions, as shown in plan.

- Draw the given plan of the spiral.
- Two portions of this Archimedean Spiral (helix) are shown in the elevation. Draw the complete elevation.
- Develop a portion of the surface of the inverted cone to determine the true shape of the curve between points **A** and **B**.

Scale 1:1

Assemblies



- 

Note: All assembly fits are loose, push or friction fit as required.

- On your drawing insert a dimension to show the vertical distance between the top of part 7 and the bottom of part 2. (*Arrowheads, extension lines, text, etc. should be neatly included and appropriate spacing should be used, in keeping with drawing convention.*)

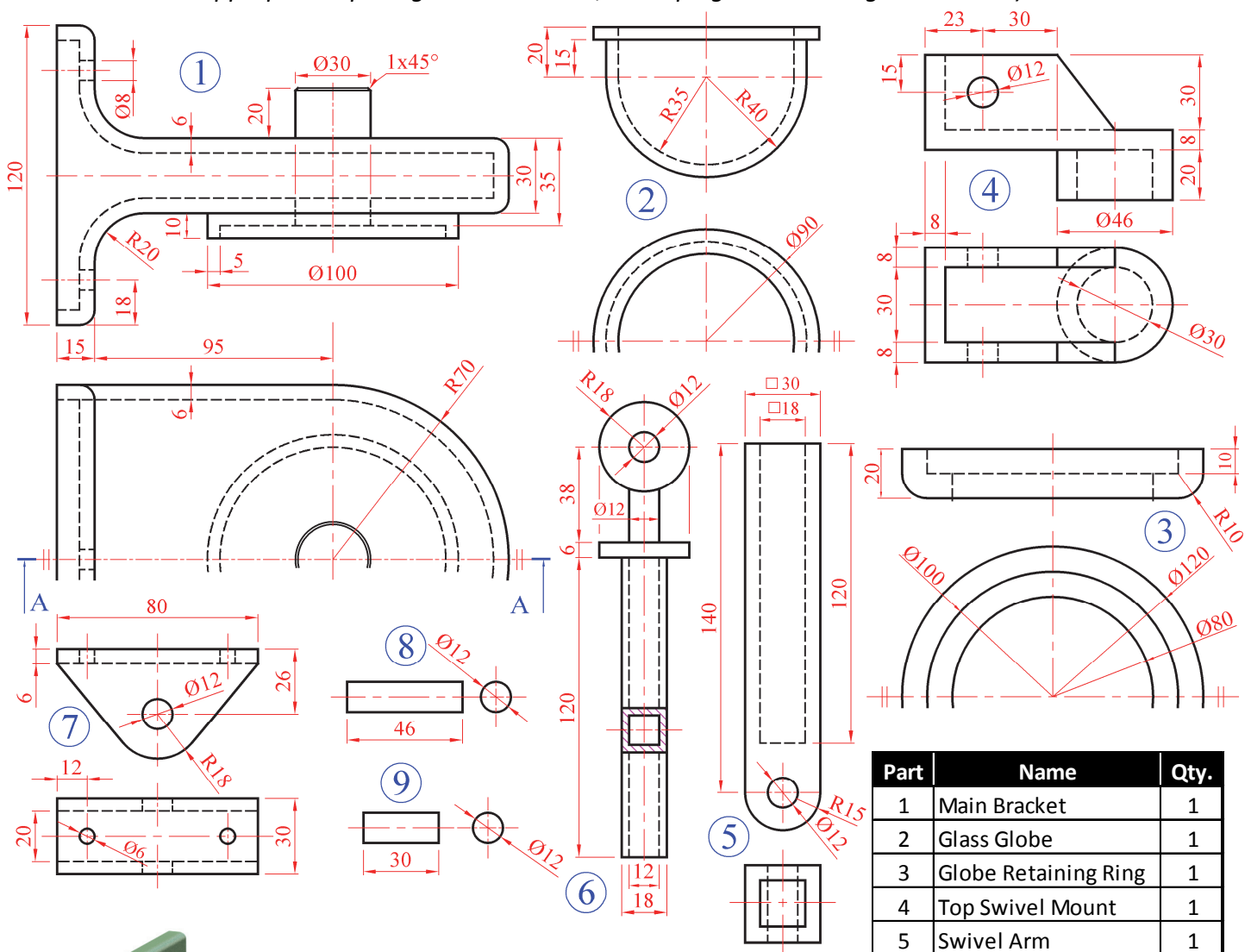
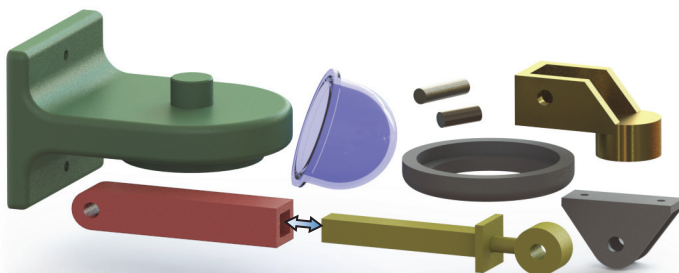


Fig. C-5

Part	Name	Qty.
1	Main Bracket	1
2	Glass Globe	1
3	Globe Retaining Ring	1
4	Top Swivel Mount	1
5	Swivel Arm	1
6	Sliding Arm	1
7	Upper Camera Mount	1
8	Pin Ø12 x 46	1
9	Pin Ø12 x 30	1



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