2019. M81A

2019L562AAEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2019

Design & Communication Graphics

Higher Level

Section A (60 marks)

Centre No.

Thursday, 20 June
Morning, 9:30 - 12:30

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:

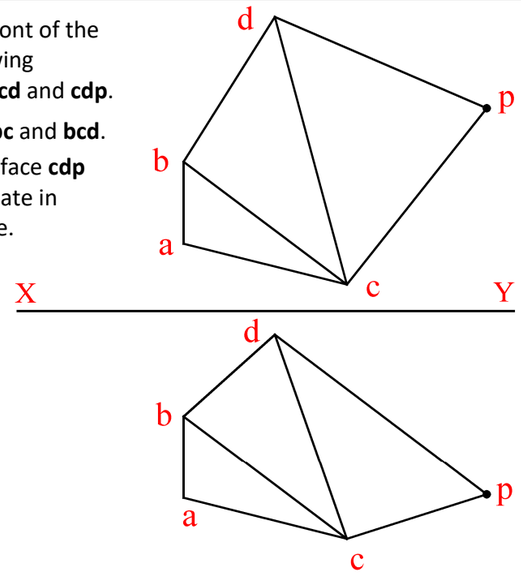
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box below and on all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

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

A-1. The image shows a mutli-storey building in Chicago. The front of the structure is comprised of a series of glass panels. The drawing shows the projections of three similar glass surfaces **abc**, **bcd** and **cdp**.

(a) Determine the dihedral angle between the surfaces **abc** and **bcd**.

(b) Draw the elevation and plan of a horizontal line on surface **cdp** which shall pass through point **P**. Determine and indicate in degrees, the inclination of this line to the vertical plane.

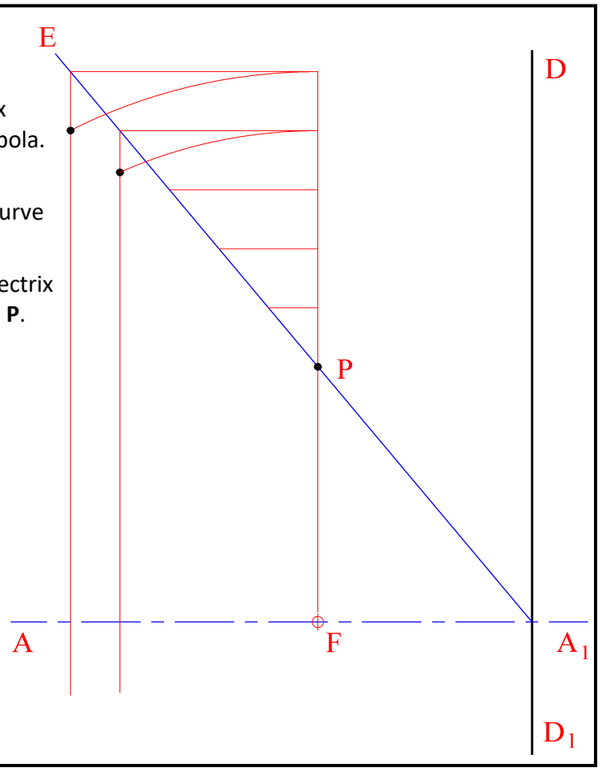


A-2. The image below shows the ***'AOL'*** building in Dublin. The curve is a hyperbola.

The drawing on the right shows the axis $\mathbf{AA_1}$, directrix $\mathbf{DD_1}$, focus **F** and eccentricity line **E** of a similar hyperbola. A number of points on the curve are also given.

(a) Locate the vertex, five additional points on the curve and draw the top portion of the hyperbola.

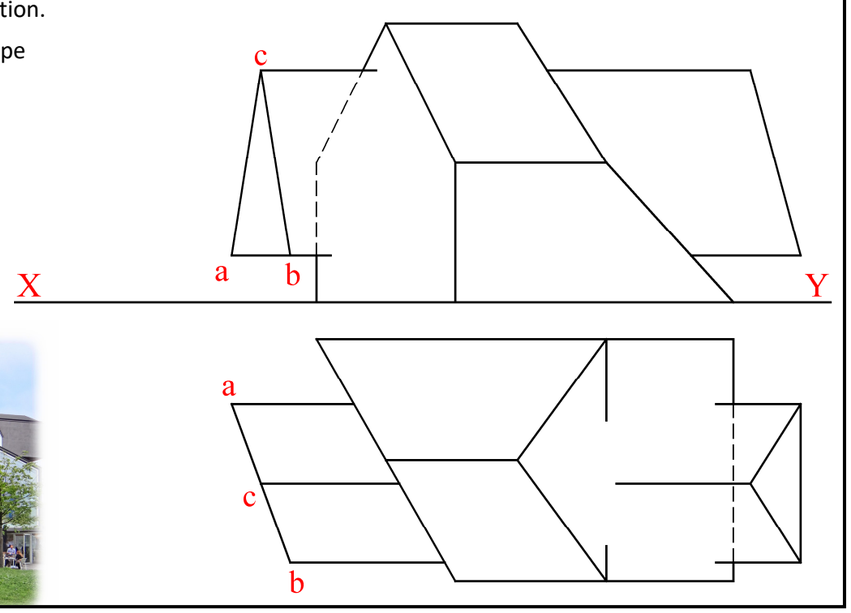
(b) Draw a circle which shall be tangential to the directrix and also tangential to the hyperbola at the point **P**.



A-3. The image below shows a building which is based on a series of intersecting prisms. The drawing shows the incomplete elevation and plan of a similar structure, where two prisms penetrate each other.
In the drawing a triangular prism intersects an irregular pentagonal prism, which has been cut as shown.

(a) Complete the elevation and plan, showing all lines of interpenetration.

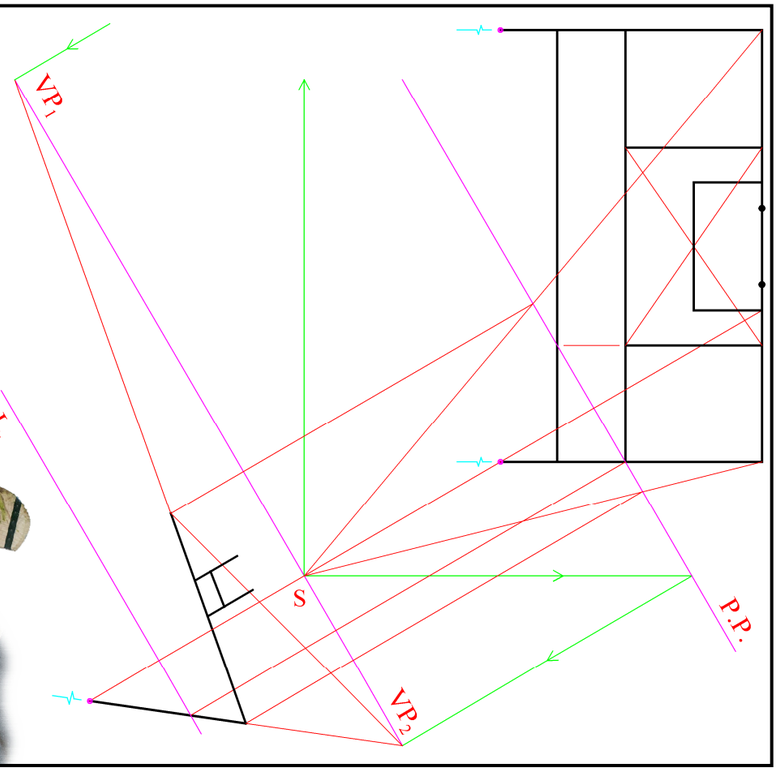
(b) Determine the true shape of the triangle **abc**.



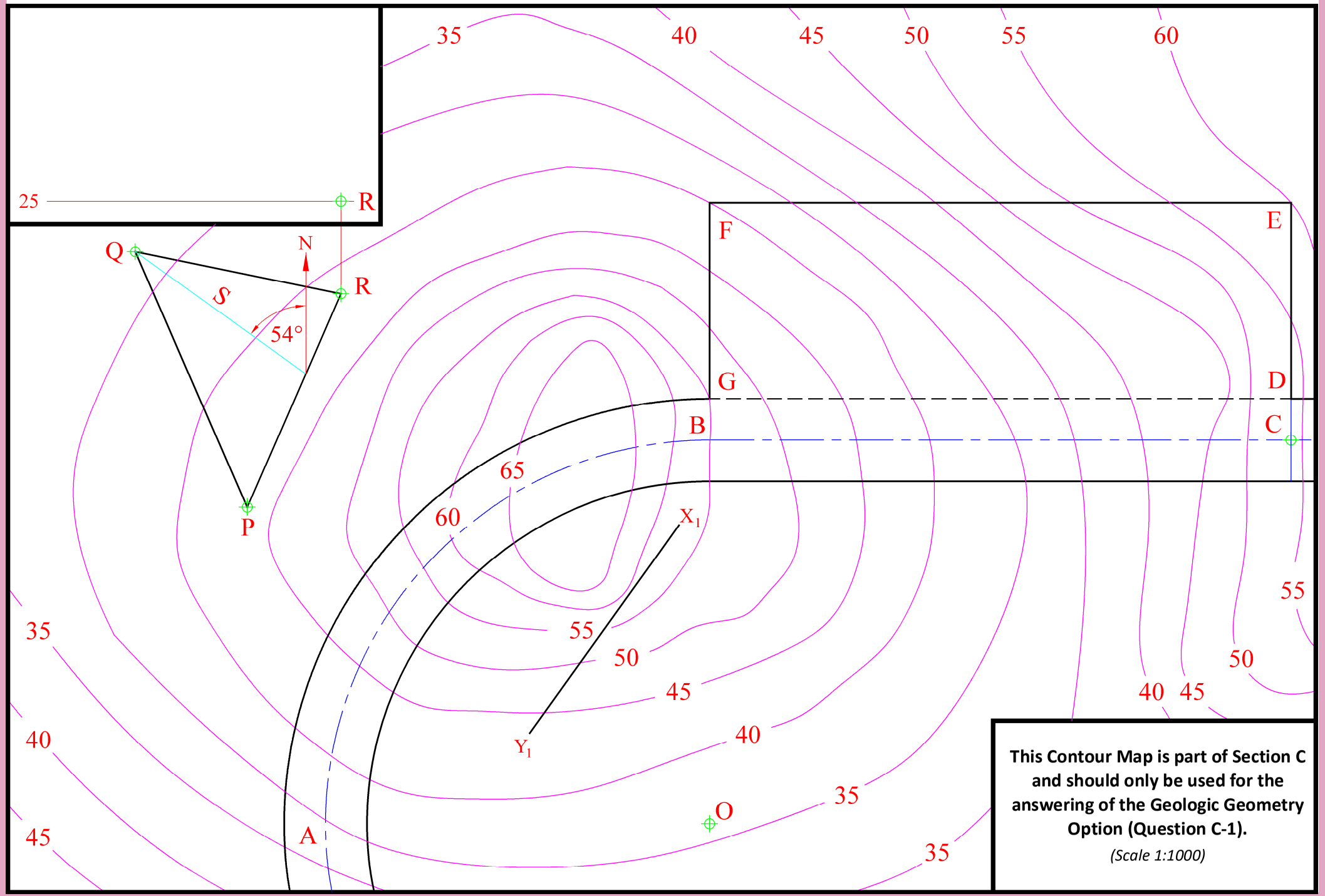
A-4. The drawing on the right shows the plan and the partially completed perspective drawing of the end portion of a GAA pitch.
The goalposts are also shown.
The position of two vanishing points are given in the perspective drawing.

(a) Complete the perspective drawing of the given end portion of the pitch.

(b) Determine and show the true height of the goalpost upright.



This examination paper must be returned at the end of the examination – You must include your Examination Number on the front cover.


35
40
45
50
55
60
25
R
Q
N
R
S
54°
P
F
E
G
D
B
C
65
60
55
50
45
40
35
X_1
Y_1
O
A
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)

2019. M81BC

2019L562ABEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2019

Design & Communication Graphics

Higher Level
Sections B and C (180 marks)

Thursday, 20 June
Morning, 9:30 - 12:30

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.*
- *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.*

SECTION B - Core

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

B-1. The image on the right shows a package for *Doritos* tortilla chips.
It is based on a regular hexagonal prism which has been shaped as shown.

Fig. B-1 shows the incomplete dimetric projection (using the axonometric axes method) of the package. The plan and elevation are shown in their required positions.

(a) Draw the axonometric axes **X**, **Y** and **Z** and the isosceles triangle **abc**.

(b) Draw the plan and elevation orientated as shown.

(c) Draw the axonometric projection of the portion of the package as given.

(d) Complete the remainder of the package in the axonometric projection.

Scale 1:1

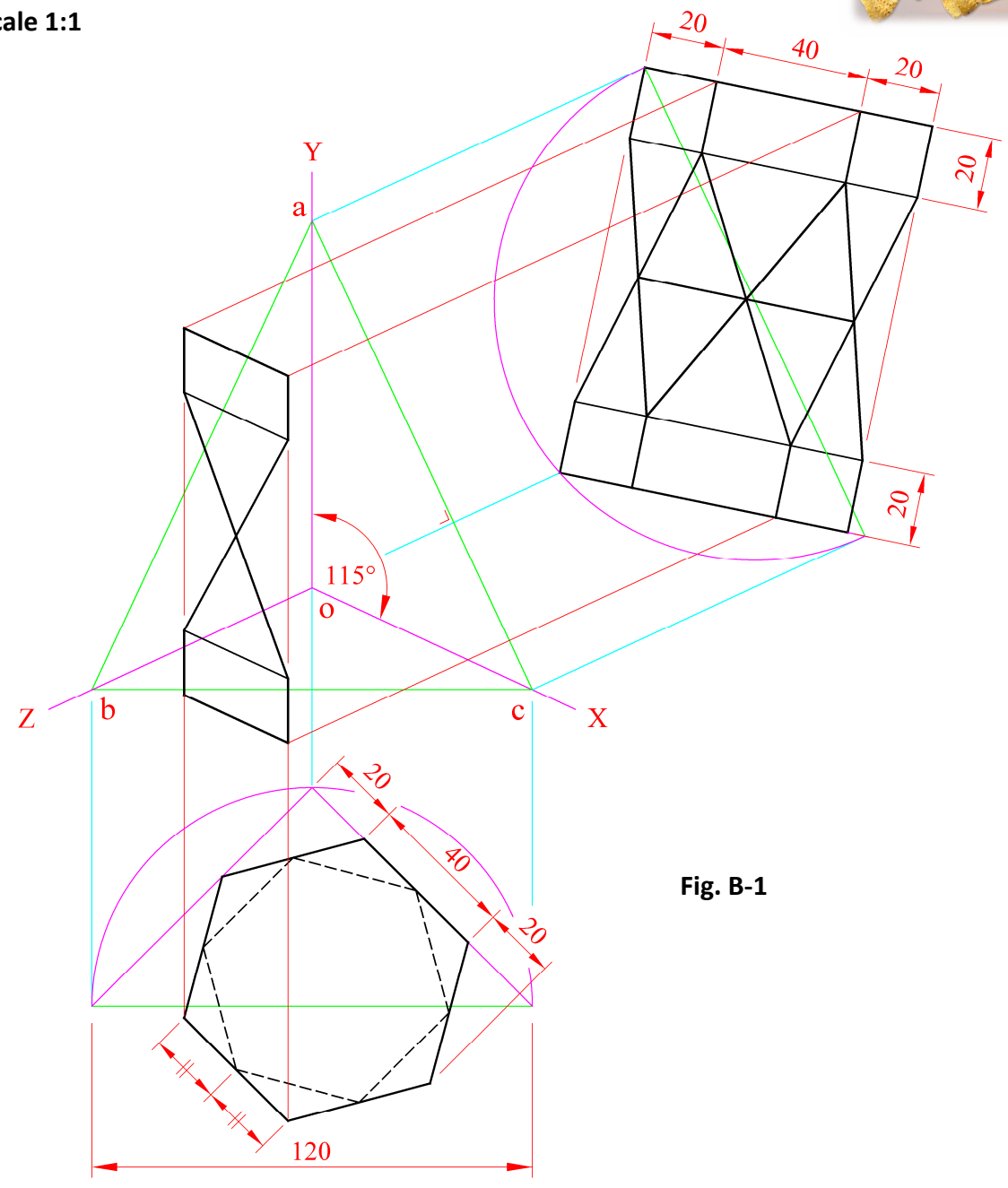


Fig. B-1

B-2. The image on the right shows the ***de Lacy Bridge*** in Drogheda, Co. Louth.

The projections of the bridge are shown in Fig. B-2 below.

(a) The curve **ABC** is a parabola in elevation with vertex at **B**. Draw the given elevation.

(b) The curves **DEF** and **PQS** in plan are branches of a double hyperbola. The vertices are at **E** and **Q**. The construction for the portion **DE** of one branch is shown. **HLG** is a straight line. Draw the given plan.

(c) In elevation, the focus of the parabola **ABC** is located 4.9m from the vertex **B**.
Locate the focus and draw a line which is tangential to the parabola at the point **C**.

Scale 1:100

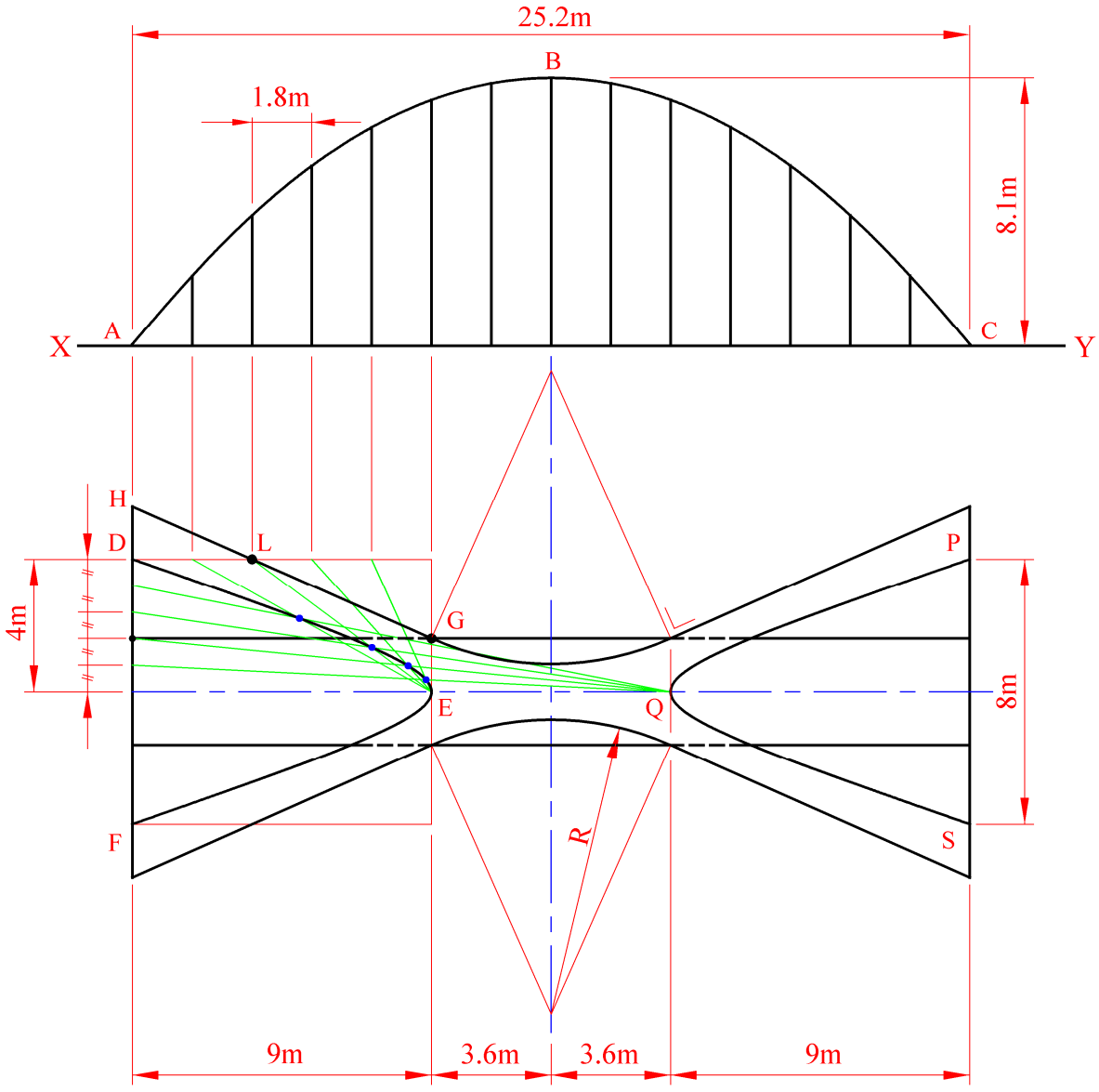


Fig. B-2

B-3. The image on the right shows the entrance structure to the ***Pilo Hotel*** in Co. Meath. It comprises a series of planar glass surfaces.

Fig. B-3 shows the plan and elevation of two of the surfaces **A** and **B**. The surfaces are identical and the plan is constructed on a square grid as shown.

(a) Draw the plan and elevation of the intersecting planes **A** and **B**.

(b) Determine the dihedral angle between the planes **A** and **B**.

(c) Project an auxiliary elevation of plane **A** on the $\mathbf{X_1Y_1}$ line.

Hence determine, and indicate in degrees, the inclination of plane **A** to the horizontal plane.

(d) Laser lighting is used to enhance the entrance to the hotel at night. The inclined straight line **PQ** represents the path of a laser beam. Determine the points of intersection of the line **PQ** with the planes **A** and **B**.

Scale 1:1

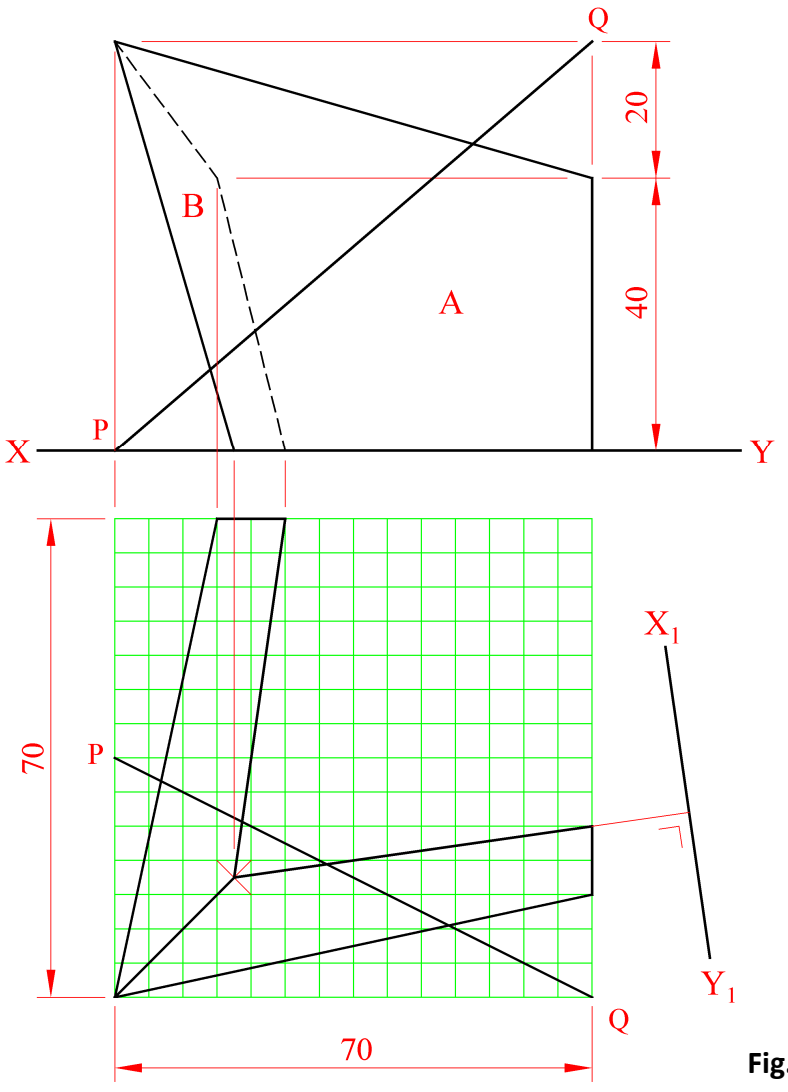


Fig. B-3

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.

ABC is the centreline of a proposed track for motocross bikes. **DEFG** is a proposed pit stop area. **O** is the centre of the circular curve.

The track has the following specifications:

- the portion from **A** to **B** is level at an altitude of 55m
- the portion from **B** to **C** is rising uniformly to a level of 60m at the finish line **C**
- the formation level at **F**, in the pit stop area, is 55m and the gradient from **F** to **E** is the same as that of the track from **B** to **C**.

Using side slopes of 1 in 1 for the cuttings and 1 in 2 for the embankments, complete the earthworks necessary to accommodate the track and pit stop area between **A** and **C** on each side.

(b) On the map, **P**, **Q** and **R** are three points on the top surface of a stratum of ore. **Q** and **R** are at altitudes of 40m and 25m respectively. The stratum has a strike of north 54° west as indicated by the given strike line **S**.

(i) Using the given $\mathbf{X_1Y_1}$ line already drawn on the map, determine the dip of the stratum.

(ii) Find the altitude of point **P**. In the space provided at the top of the map, draw the elevation of the triangular portion of the top surface of the stratum.
*(Point **R** is already located for you in the elevation).*

(iii) Determine the true angle between the line **PR** and the strike line **S**.

Scale 1:1000

Structural Forms

C-2. The image on the right shows a structure designed to provide shade for a seating area in a garden.
The projections of a similar structure are shown in Fig. C-2 below.

The curved surface is produced by translating the generating parabola **ABC**, in a vertical position, along the parabolic curve **DEF**, which is shown in elevation.

In the outline end view, the dotted line shows the generating parabola **ABC**.

B is the vertex of the parabola **ABC** and **E** is the vertex of the parabolic curve **DEF**.

(a) Draw the given elevation of the structure.

(b) Draw the end view of the generating parabola **ABC**.

(c) Project the plan of the structure.

(d) The projections of an overhead telephone line **PQ** are also shown.
Draw the elevation and plan of the line **PQ** and determine the vertical distance from the point **R** on the surface of the structure to the line **PQ**.

Scale 1:100

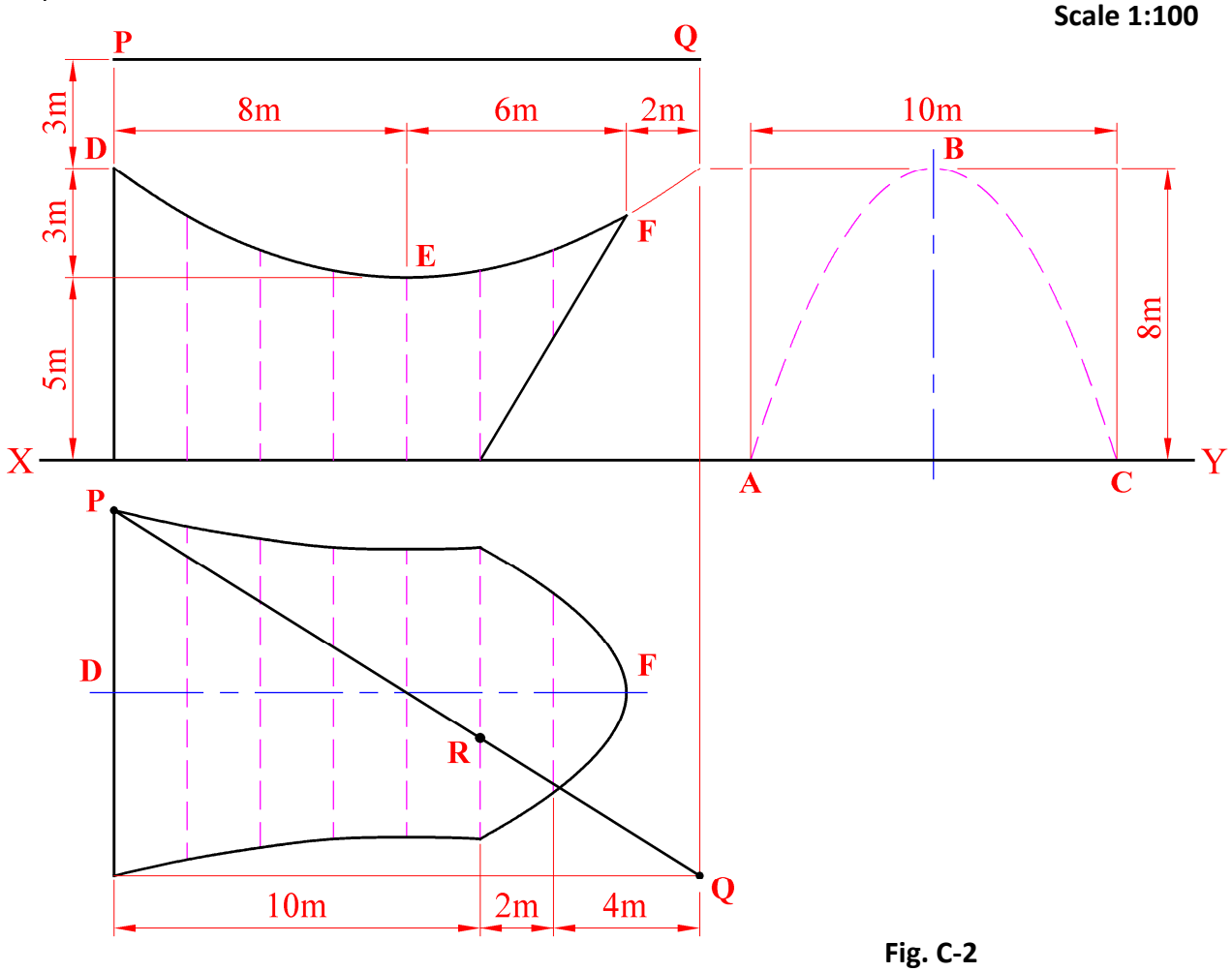


Fig. C-2

Surface Geometry

C-3. The image on the right shows the ***Louis Vuitton*** retail store in Singapore.
The design comprises a steel-framed glass building with irregularly shaped faces.

Fig. C-3 shows the elevation, plan and end view of a model of part of the building.

(a) Draw the given elevation, plan and end view.

(b) Determine the dihedral angle between surfaces **A** and **B**.

(c) Determine the true shape of the vertical surface **C** and the true shape of the inclined surface **B**.

(d) Determine the horizontal and vertical traces of surface **B**.

Scale 1:100

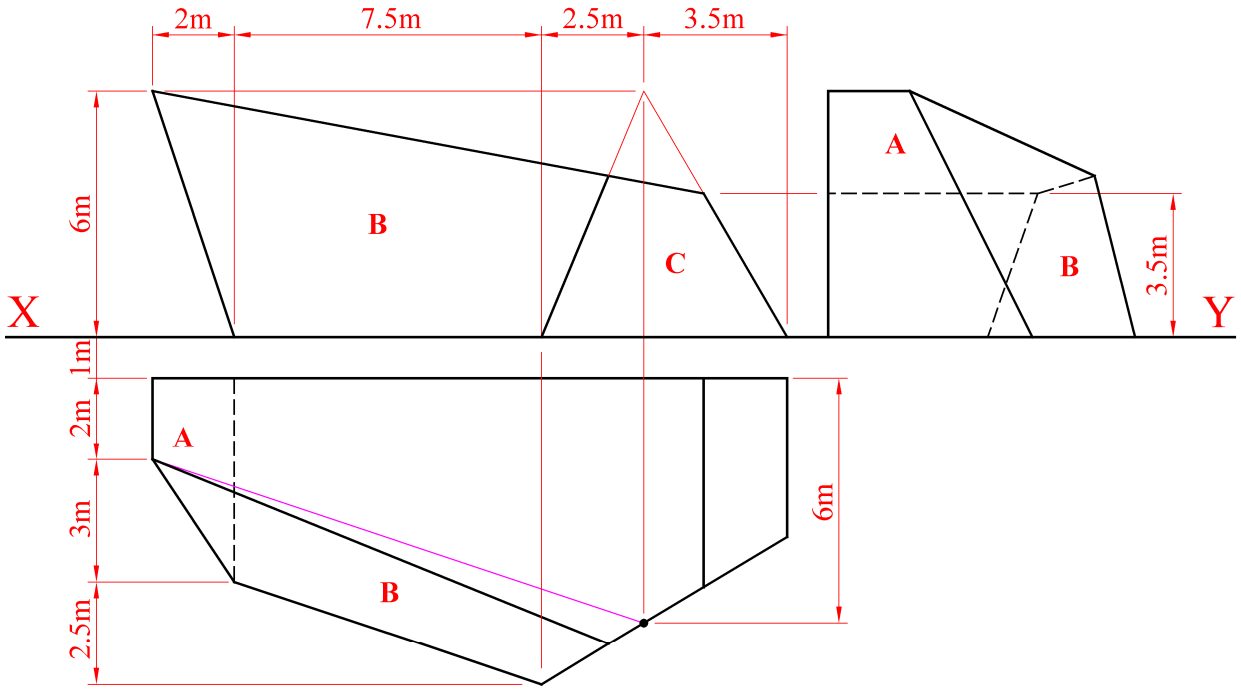


Fig. C-3

Dynamic Mechanisms

C-4. **(a)** The image on the right shows a toy which uses a series of cams and inline flat followers to create linear vertical movement.

Draw the displacement diagram for a similar cam mechanism which will impart the following motion to an inline follower given the following data:

0°	to	60°	Rise 90mm with uniform velocity;
60°	to	90°	Dwell;
90°	to	270°	Fall 60mm with Uniform Acceleration and Retardation (UAR);
270°	to	360°	Return to initial position with uniform velocity.

Note: It is not necessary to draw the cam profile.

(In the displacement diagram, use a distance of 15mm to represent each 30° interval.)

(b) The image on the right shows a modern Penny Farthing bicycle.

The front wheel has a radius of 350mm.
The wheel is shown in line diagram format in Fig. C-4(b) below.
The spokes are at 30° intervals.
A reflector, as shown, is located on one of the spokes at a height of 220mm above the ground.

The wheel rolls along the horizontal line **AB**.

Plot the locus of the reflector for one full clockwise revolution of the wheel.

Scale 1:10

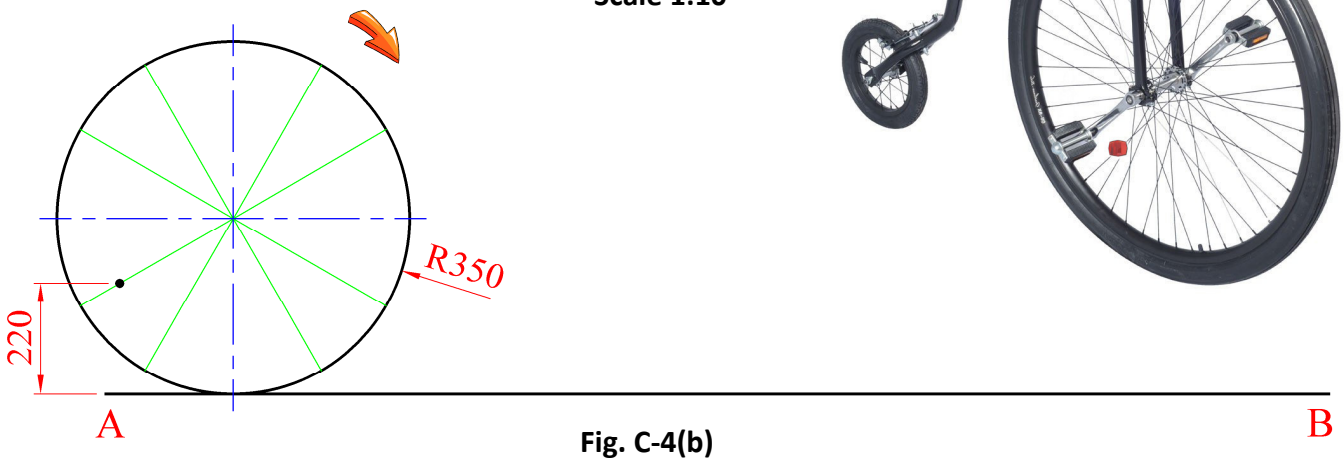
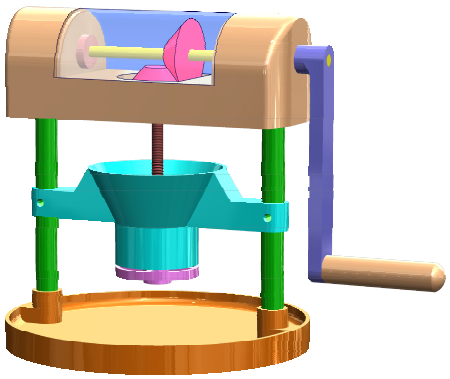


Fig. C-4(b)

Assemblies

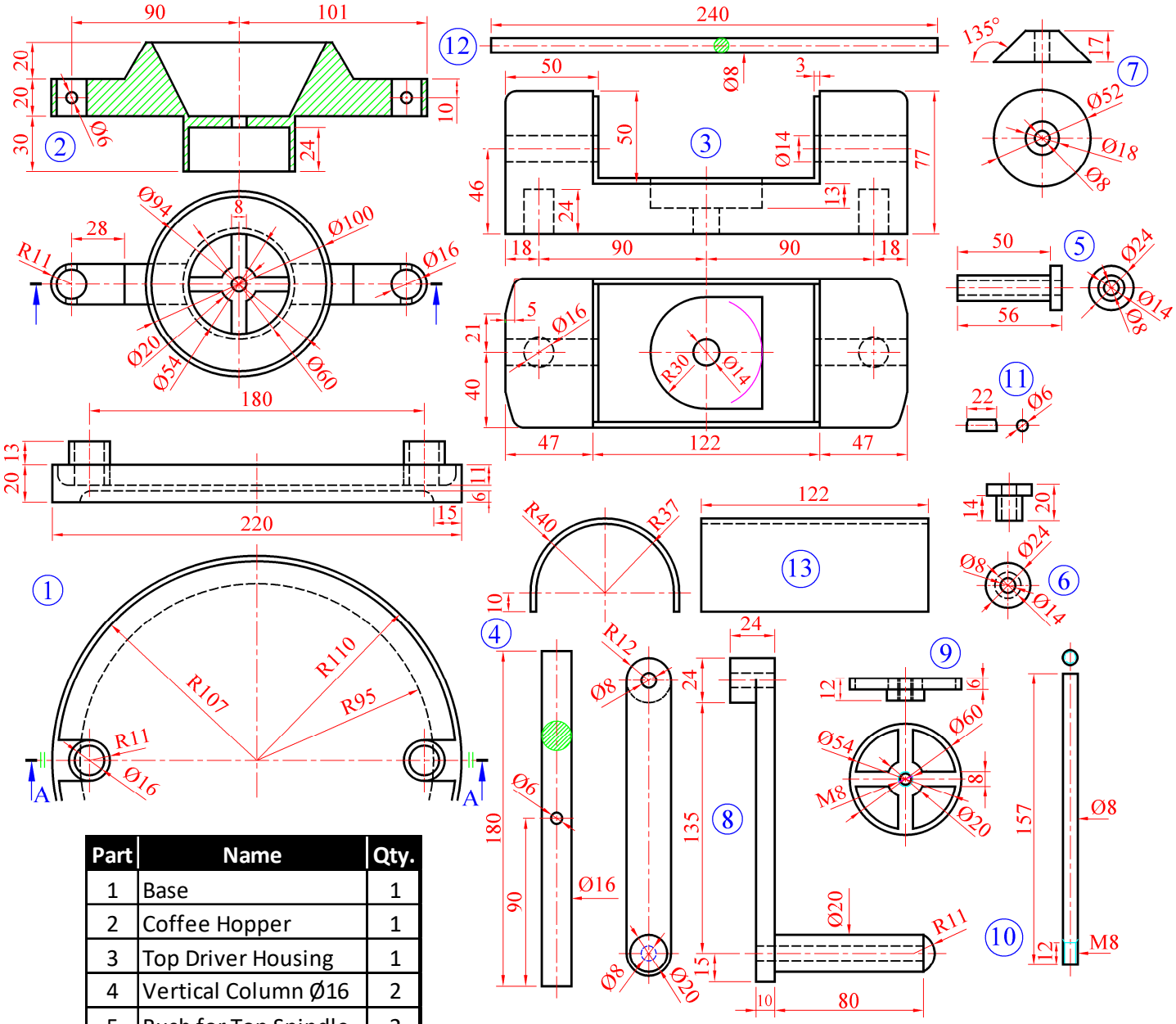
C-5. The 3D graphic on the right shows a Manual Coffee Grinder, for grinding coffee beans. The details of the grinder are given in Fig. C-5 below. The parts list is also given in two tables.



Power is transmitted from the horizontal top spindle to the vertical spindle by means of two friction cones in contact. There is a 2mm space between the hopper and the grinding disc.

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

(Unless otherwise stated, fillets are 6mm and chamfers 1×1mm. Some dimensions and inner parts have been removed for clarity. Any omitted dimensions may be estimated.)



Part	Name	Qty.
1	Base	1
2	Coffee Hopper	1
3	Top Driver Housing	1
4	Vertical Column Ø16	2
5	Bush for Top Spindle	2
6	Vertical Spindle Bush	1
7	Driver Friction Cone	2
8	Handle Assembly	1
9	Bottom Grinding Disc	1

Fig. C-5

Scale 1:1

Part	Name	Qty.
10	Vertical Spindle Ø8	1
11	Hopper Anchor Pin Ø6	2
12	Top Spindle Ø8	1
13	Transparent Top Cover	1

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