2024. M81BC 2024L562A2EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2024

Design & Communication Graphics

Higher Level
Section B and C (180 marks)

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

This examination has three sections:	
Section A	Core - Short Questions
Section B	Core - Long Questions
Section C	Applied Graphics - Long Questions

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

Section C	• Five questions are presented. • Answer **one** question (i.e. the option you have studied) on drawing paper. • All questions in 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.

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Section B - Core

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

B-1 The image on the right shows the Virgin Media sports studio desk. The desk consists of a truncated square based pyramid which has been cut using an inclined plane.

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

(a) Draw the given plan and elevation of the desk.

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

(c) (i) Determine the angle of inclination of the surface **B** to the horizontal plane.

(ii) Determine the true shape of surface **B**.

(d) Draw the elevation and plan of a line on surface **B**, which is drawn from point **P** and is inclined at 50° to the horizontal plane.

Scale 1:15

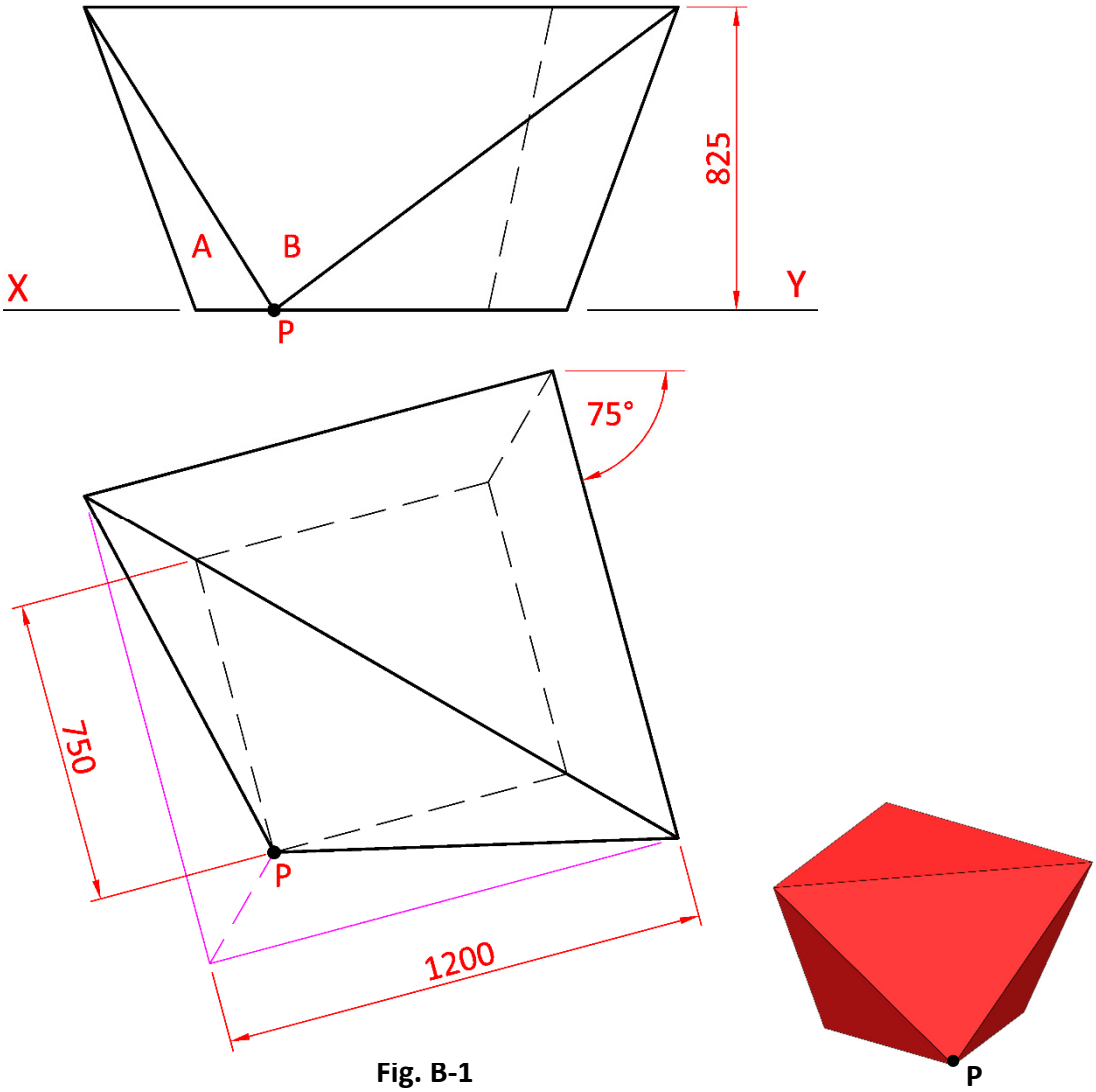


Fig. B-1

B-2 The image on the right shows a salad packaging box. The salad box includes a series of planar surfaces and a clear plastic window as shown.

Fig. B-2 shows the development of a similar salad box, including the clear window which is in the shape of an ellipse.

(a) Draw the given surface development of the salad box (without the elliptical window).

(b) **RS** is the major axis of the elliptical window. **P** is a point on the curve. Determine the length of the minor axis and draw the curve.

(c) On a separate drawing, draw the orthographic projections, as follows, of the salad box when the box has been assembled.

(i) An elevation in the direction of the arrow.

(ii) A plan projected from the elevation. Include all hidden detail.

Scale 1:1

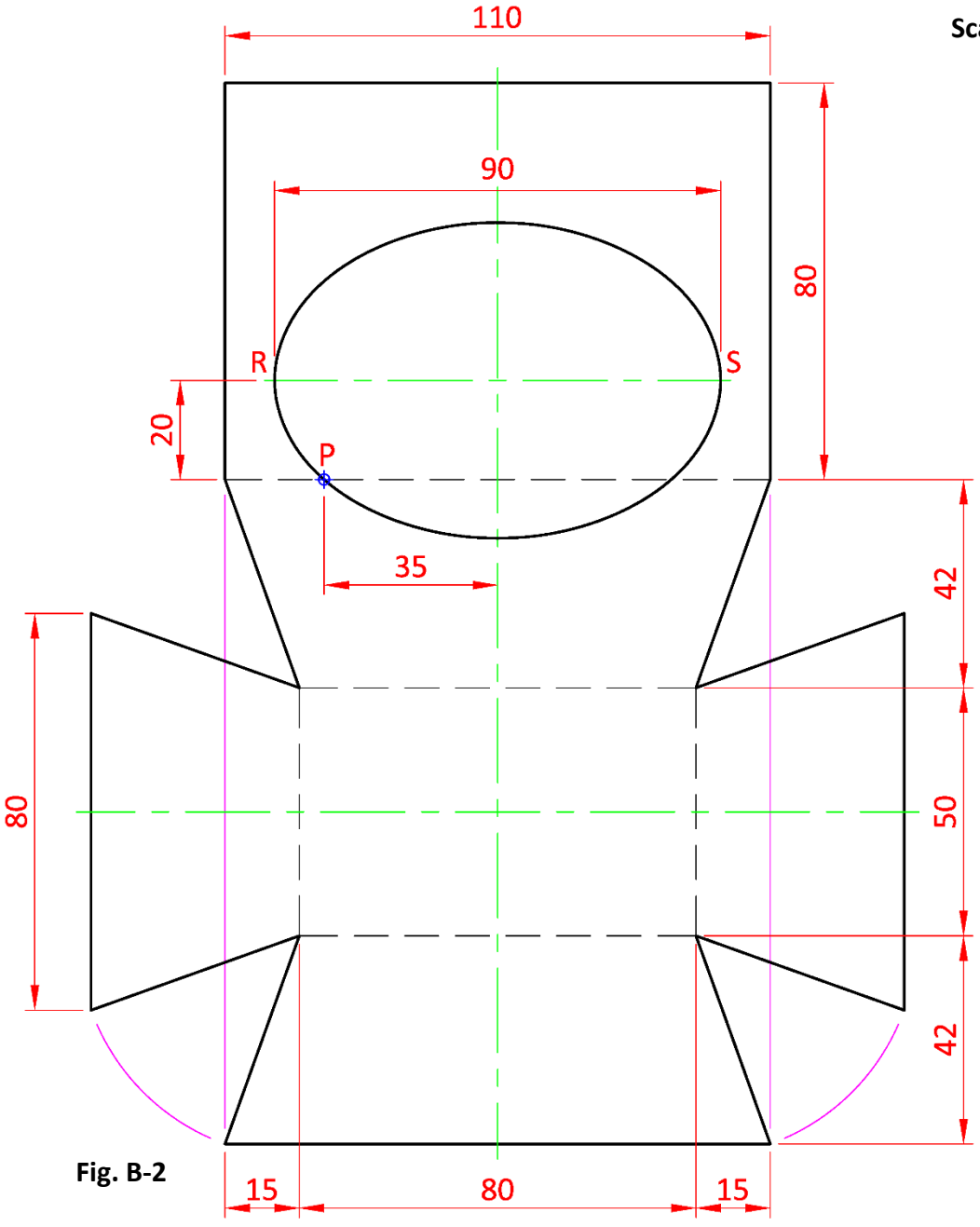


Fig. B-2

B-3 The image on the right shows the V-sphere spherical puzzle game. The game includes a stand and a spherical puzzle.

Fig. B-3 shows an incomplete trimetric projection, using the axonometric axes method, of a similar puzzle. The plan and end view are shown in their required positions.

A pictorial view of the game is also shown.

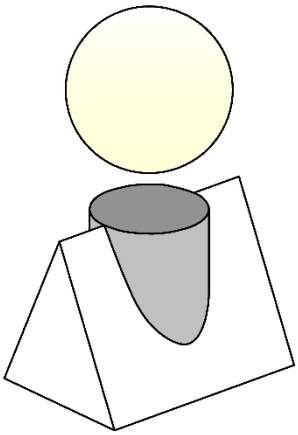
(a) Draw the axonometric axes **X**, **Y**, and **Z** and the scalene triangle **abc**.

(b) Draw the plan and end view, orientated as shown.

(c) Complete the trimetric projection of the puzzle stand.

(d) The sphere is presented above the stand as shown. Complete the trimetric projection of the sphere.

Scale 1:1



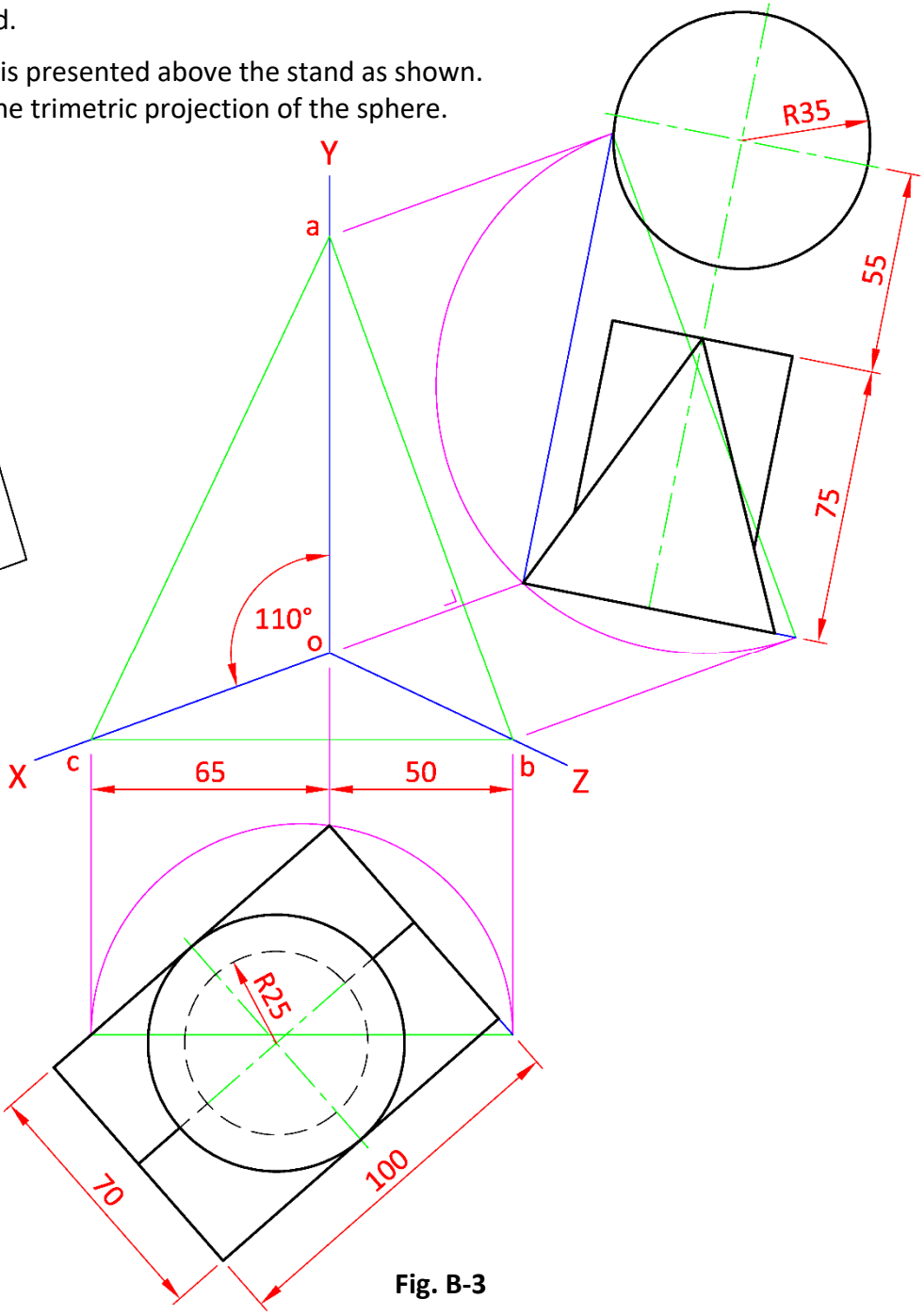


Fig. B-3

Section C - Applied Graphics

Answer **one** question (i.e. the option 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 for a white-water rafting course.

ABCD is the centreline of the course and **O** is the centre of the circular curve which forms part of the course edge.

The course has the following specifications:

- the portion from **A** to **C** is level at an altitude of 60 m
- the portion from **C** to **D** is falling uniformly at a rate of 1 in 20
- side slopes of 1 in 2 for the cuttings and 1 in 1.5 for the embankments.

Complete the earthworks necessary to accommodate the course on the northern side.

***Note**: The earthworks on the southern side have already been completed.*

(b) In the space provided to the right of the map, draw a vertical section (profile) on the line **EF after** the earthworks for the course have been completed.

(c) A zipline is to be constructed over the rafting course along the line **EF**. The zipline is to be supported by poles at points **E** and **F**. The top of the pole, located at **E**, has an altitude of 95 m.

Determine, and indicate in metres, the height of the support pole at point **F** to provide a minimum clearance of 10 m for the zipline from the ground.

Scale 1:1000

C-2. The image on the right shows a golf practice net. The shape of the net is based on a hyperbolic paraboloid.

The projections of a similar practice net are shown in Fig. C-2 below. The surface of the net is formed by extending the hyperbolic paraboloid surface **ABCD**.

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

(b) Project the end view of the hyperbolic paraboloid surface **ABCD**.

(c) Complete the end view by extending the elements of the hyperbolic paraboloid. Show clearly how to locate the point **P**.

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

Scale 1:10

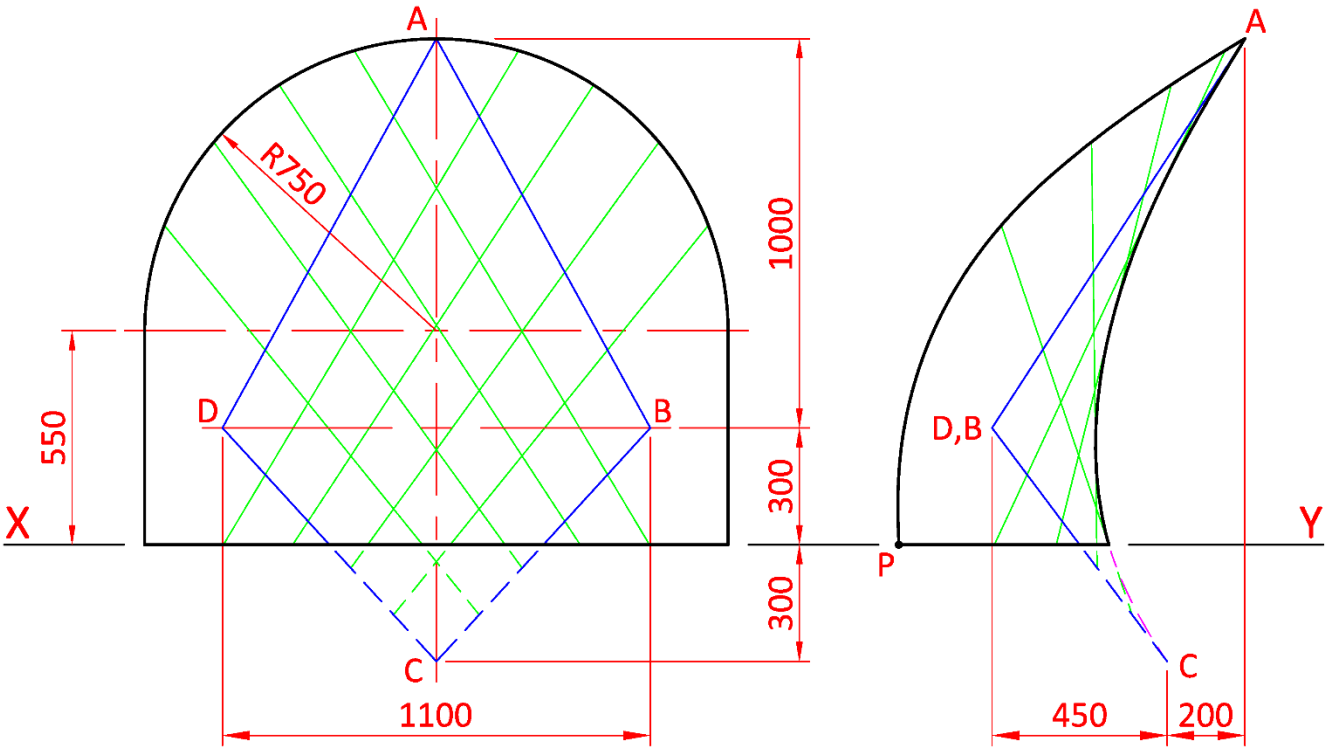


Fig. C-2

C-3. The image on the right shows a chiminea.

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

(a) Draw the given plan and elevation.

(b) Draw the surface development of the conical surface **A**.

(c) Draw the surface development of the cylindrical surface **B**, including the opening.

(d) Determine and indicate the inclination of one of the chiminea legs to the horizontal plane.

Scale 1:10

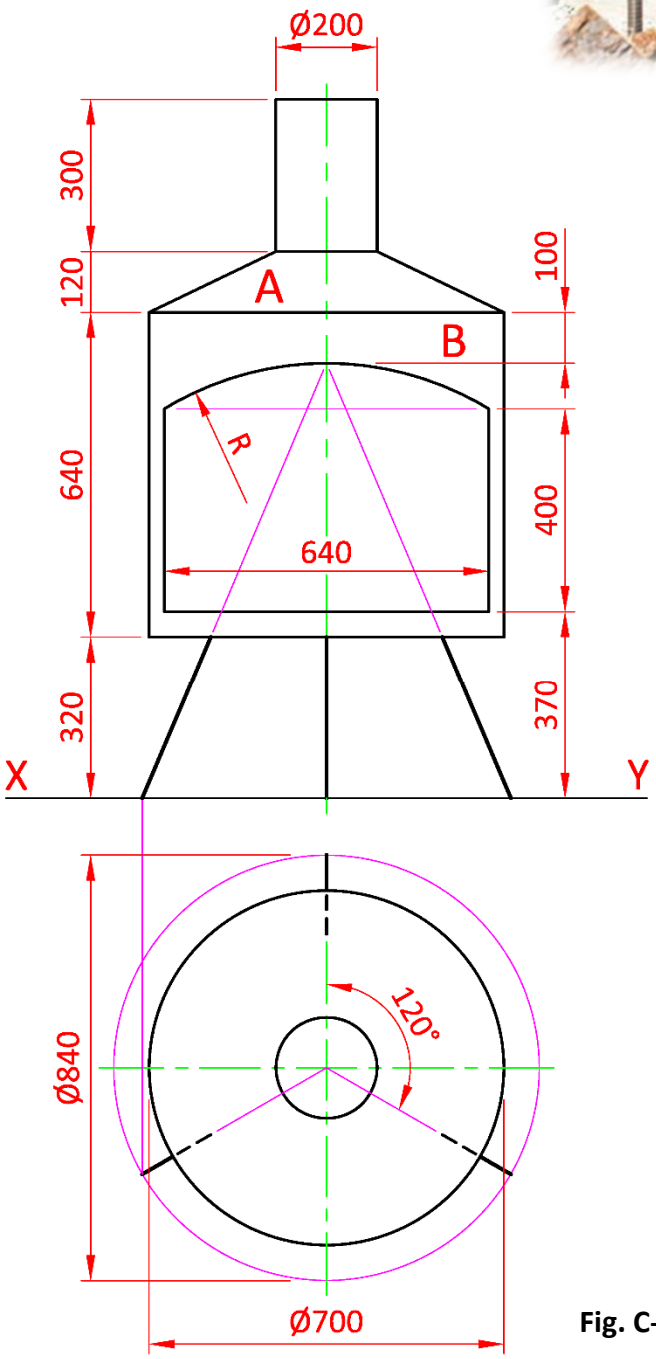


Fig. C-3

C-4. **(a)** The image below shows a cycle and pedestrian arch bridge in Melkwegbruk, Netherlands.

Fig. C-4(a) on the right shows a circle **C** and an arc **PA** representing a bicycle wheel and the bridge. Point **P** is the point of contact between the circle and the arc.

(i) Draw the given diagram.

(ii) Plot the locus of point **P** as the circle **C** rolls along the arc **PA** for one complete revolution without slipping.

Scale 1:1

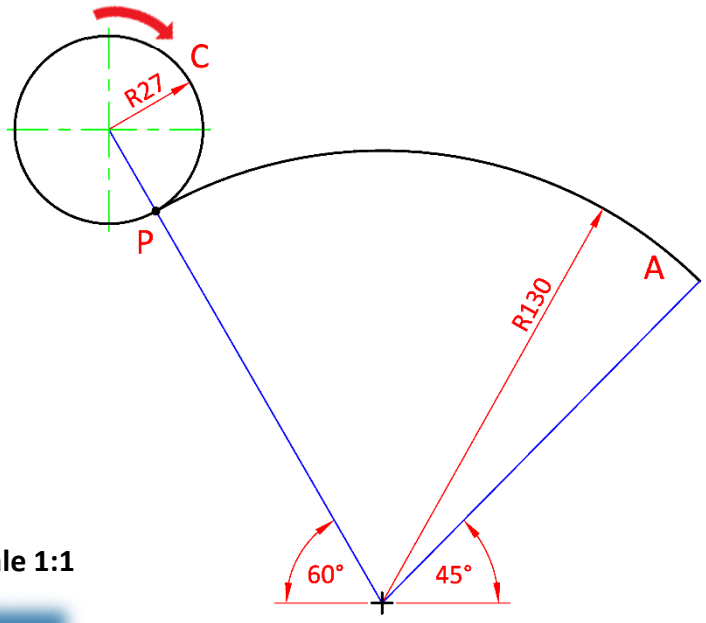


Fig. C-4(a)

(b) A spiral galaxy, shown in the image on the right, is a collection of stars, gas and dust in a Archimedean spiral formation.

Points **O**, **A**, **B**, and **C** are shown in the Fig. C-4(b) below.

OA is the initial radius vector of an Archimedean spiral. **B** is a point on the spiral. **OC** is the final radius vector of the spiral.

(i) Draw the given diagram, showing clearly how to locate point **C**.

(ii) Construct one convolution of the Archimedean spiral.

Scale 1:1

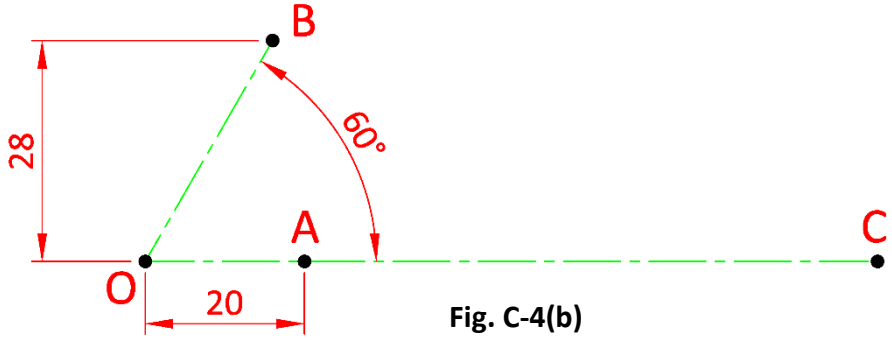


Fig. C-4(b)

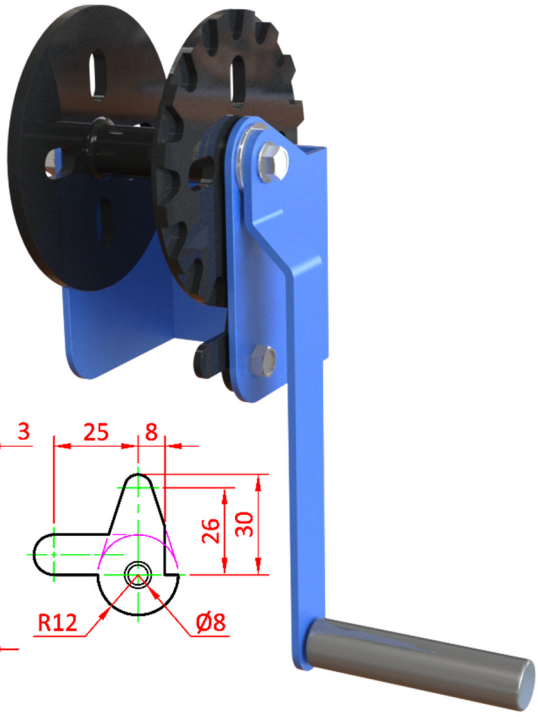
Assemblies

C-5. The 3D graphic on the right shows a clothes line winch.

The details of the winch are given in Fig. C-5 below.
The parts list is also given in a table.

Draw a sectional elevation on **A-A**, showing the parts fully assembled, with the handle in the vertical position as shown.

(Note: Any omitted dimensions may be estimated.)



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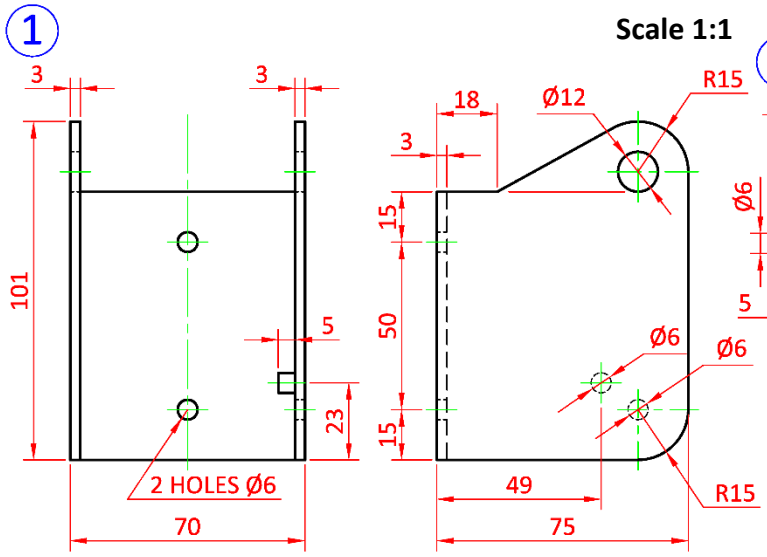
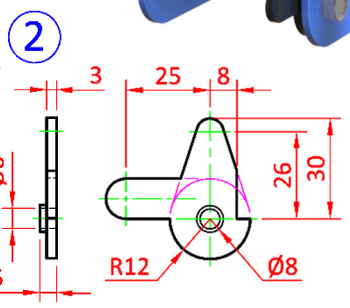
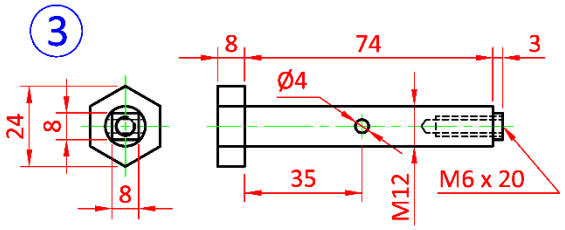
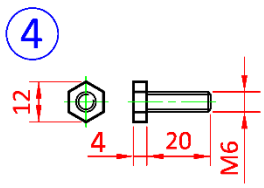
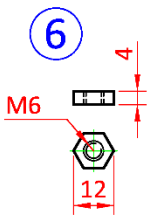


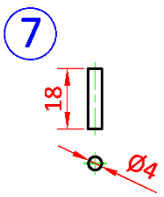


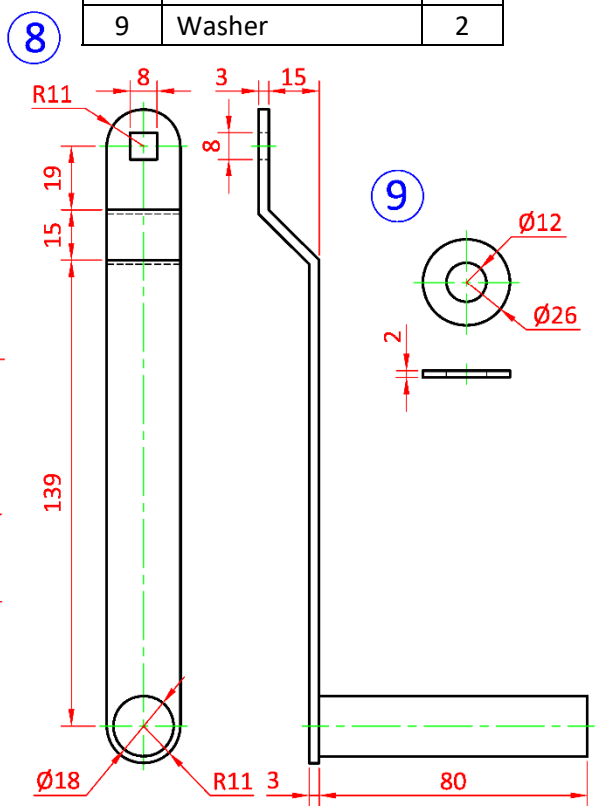
Part	Name	Qty.
1	Main Body	1
2	Pawl	1
3	Axle Bolt	1
4	M6 × 20 Set Screw	2
5	Ratchet Pulley	1
6	M6 Plain Nut	1
7	Pin Ø4 × 18	1
8	Handle	1
9	Washer	2











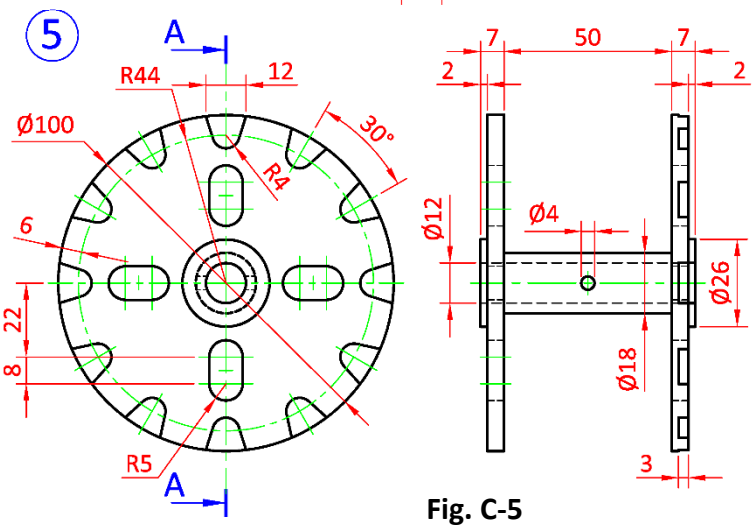


Fig. C-5

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Leaving Certificate - Higher Level

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