



Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate Examination, 2022

Design & Communication Graphics

Higher Level

Section A (60 marks)

Centre No.

Thursday, 23 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
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:

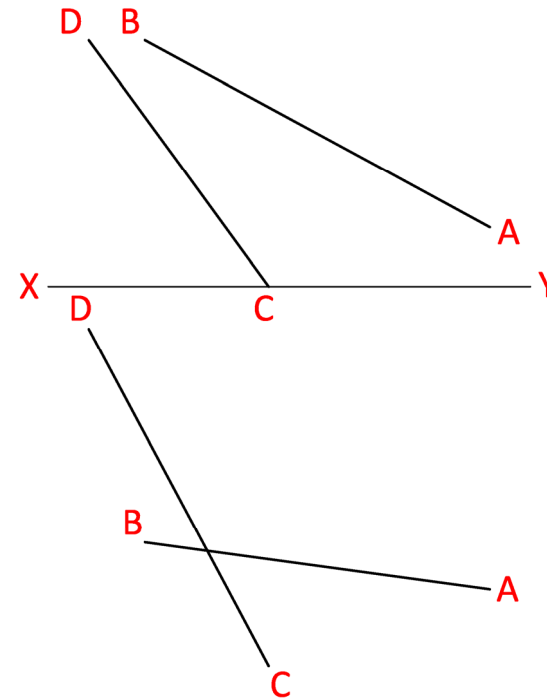
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box below and on all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

Examination Number

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

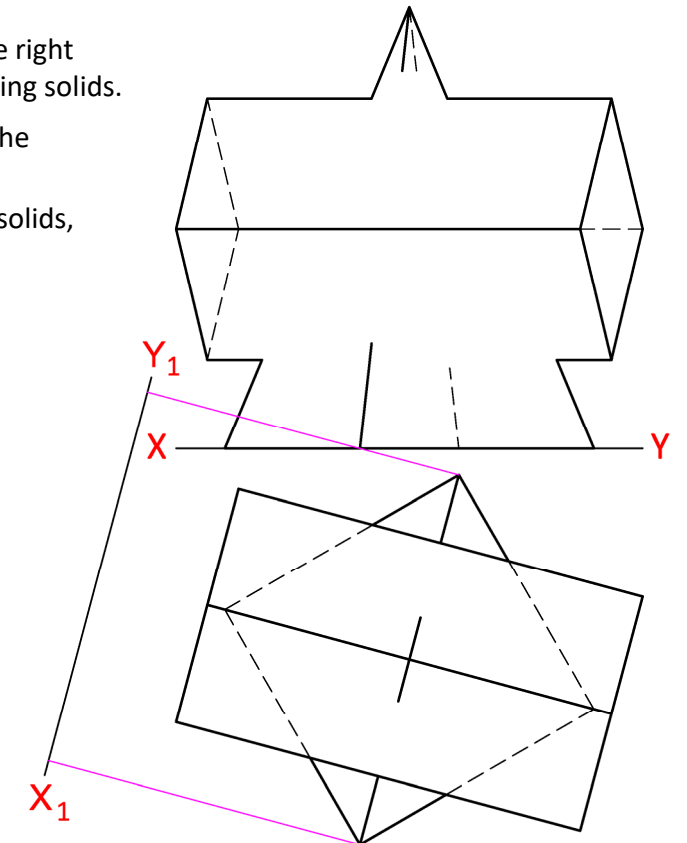
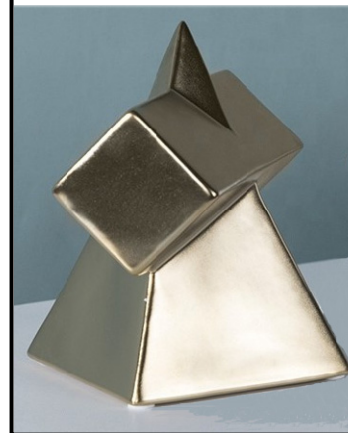
A-1. The image below shows the booms of two cranes. The crane booms are represented by the skew lines **AB** and **CD** on the right.

- (a) Determine the projections of the shortest horizontal line between the skew lines.
- (b) Determine, and indicate in millimetres, the true length of this line.



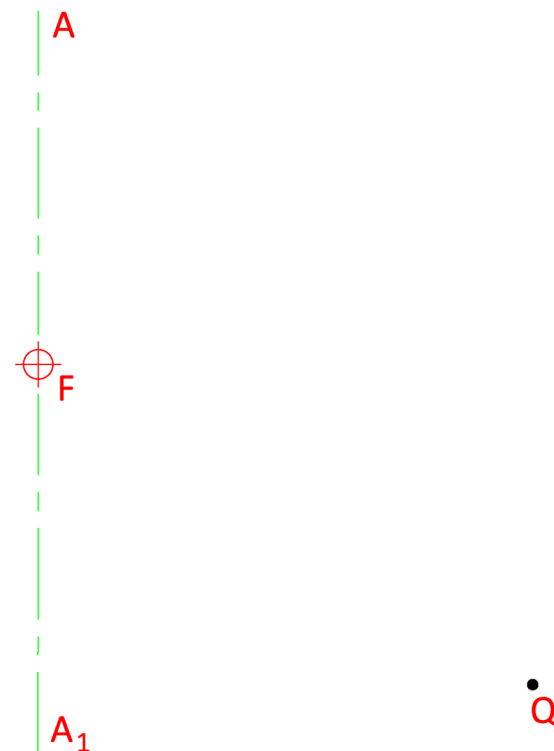
A-3. The image below shows a design based on a prism intersecting a square-based pyramid. The drawing on the right shows the incomplete elevation and plan of the intersecting solids.

- (a) Using the given X_1Y_1 , draw an auxiliary elevation of the intersecting solids.
- (b) Complete the elevation and plan of the intersecting solids, showing all lines of interpenetration.



A-2. The image below shows the parabolic bridge at Mizen Head in Cork. The drawing below shows the axis AA_1 , focus **F**, and two points **P** and **Q** on a similar parabola.

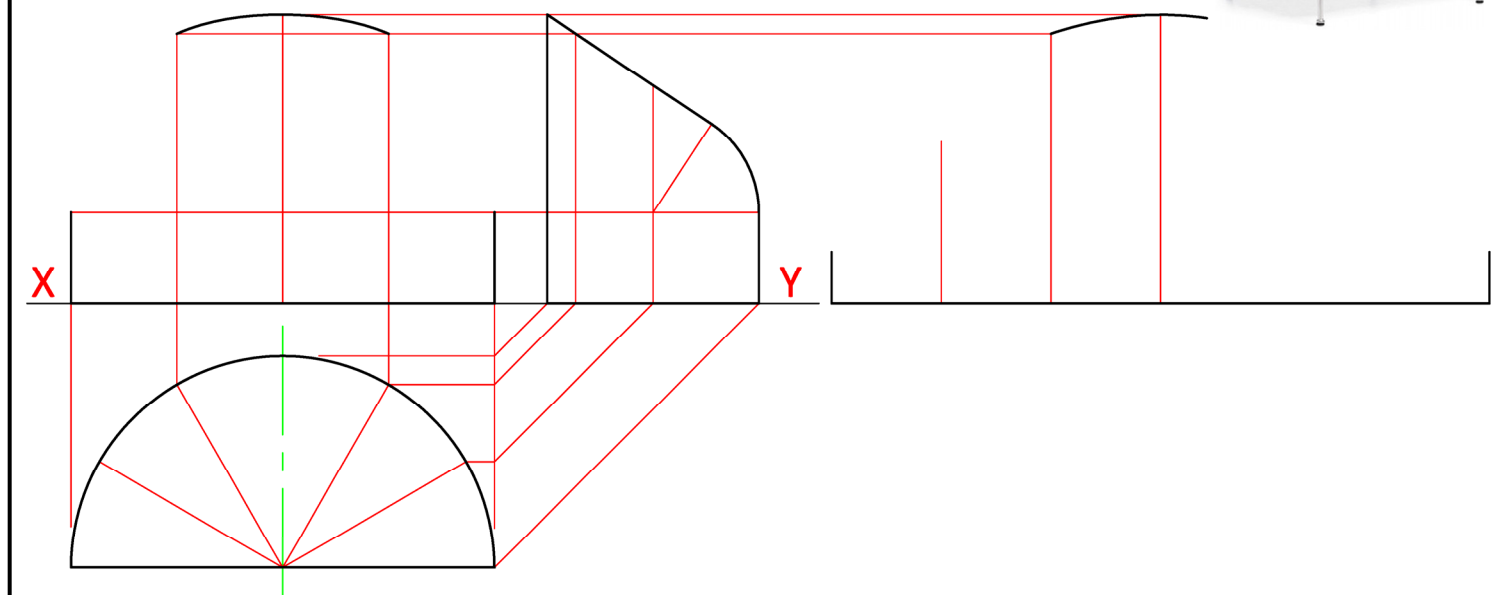
- (a) Locate the directrix and the vertex and draw a portion of the parabola which shall pass through **P** and **Q**.
- (b) Draw a tangent to the curve at point **Q**.



A-4. The image on the right shows a modern chair design. It includes a curved plywood back, based on a cylinder which is truncated and shaped as shown.

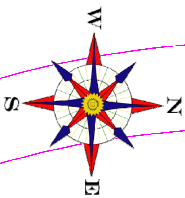
The drawing shows the plan, incomplete elevation and end view of the plywood back of a similar chair. The partially completed surface development of the back has been projected from the end view.

- (a) Complete the elevation.
- (b) Complete the surface development.



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)



50 45 45 50 55 60 65

60

45 40 40 45 50 55 60 65

E

F

D

C

B

A

65 60 55 50 50 55 60 65 70 75 80 75 70 65 60 55 50



Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate Examination, 2022

Design & Communication Graphics

Higher Level

Sections B and C (120 marks)

Thursday, 23 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

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
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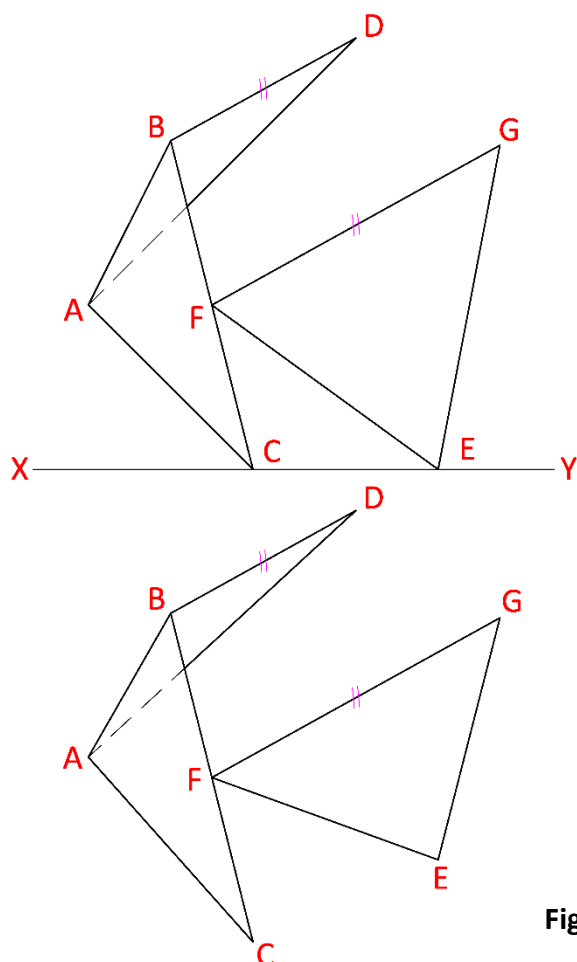
SECTION B - Core

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

B-1. The image on the right shows the Hooker sculpture in Eyre Square Galway. The geometry of the design comprises a series of planar surfaces.

Fig. B-1 shows the plan and elevation of three intersecting planar surfaces.

The horizontal and vertical coordinates for points **A, B, C, D, E** and **F** are given. Partial coordinates for the point **G** are also given. The edges **BD** and **FG** are parallel.



Scale 1:1

A:	160	---	40	---	70
B:	180	---	80	---	35
C:	200	---	0	---	115
D:	225	---	105	---	10
E:	245	---	0	---	95
F:	190	---	40	---	75
G:	260	---	?	---	?

Fig. B-1

- Draw the given elevation and plan of the intersecting planes **ABC**, **ABD** and **EFG**.
- Determine the dihedral angle between the planes **ABC** and **ABD**.
- Draw the elevation and plan of a horizontal line on the surface **EFG** and project an auxiliary elevation which will show an edge view of the plane **EFG**.
Indicate the angle of inclination of the plane **EFG** to the horizontal plane.
- Locate the position of a point **P** on the plane **EFG** which is a distance of 40mm from the horizontal plane and 68mm from the vertical plane.
Determine and indicate the true length of **FP**.

B-2. The image on the right shows a horsebox coffee-dock.

Fig. B-2 shows the plan and elevation of a coffee-dock, based on this image. A pictorial view of the coffee-dock is also shown. The surfaces **B** and **C** are inclined at 25° .



(a) Draw the given plan.

(b) Make a perspective drawing of the coffee-dock given the following:

- The spectator point **S**, is 16m from point **A**
- The picture plane is touching point **A**
- The horizon line is 7m above the ground line.

*Use an auxiliary vanishing point to determine the surfaces **B** and **C** in the perspective drawing.*

Scale 1:100

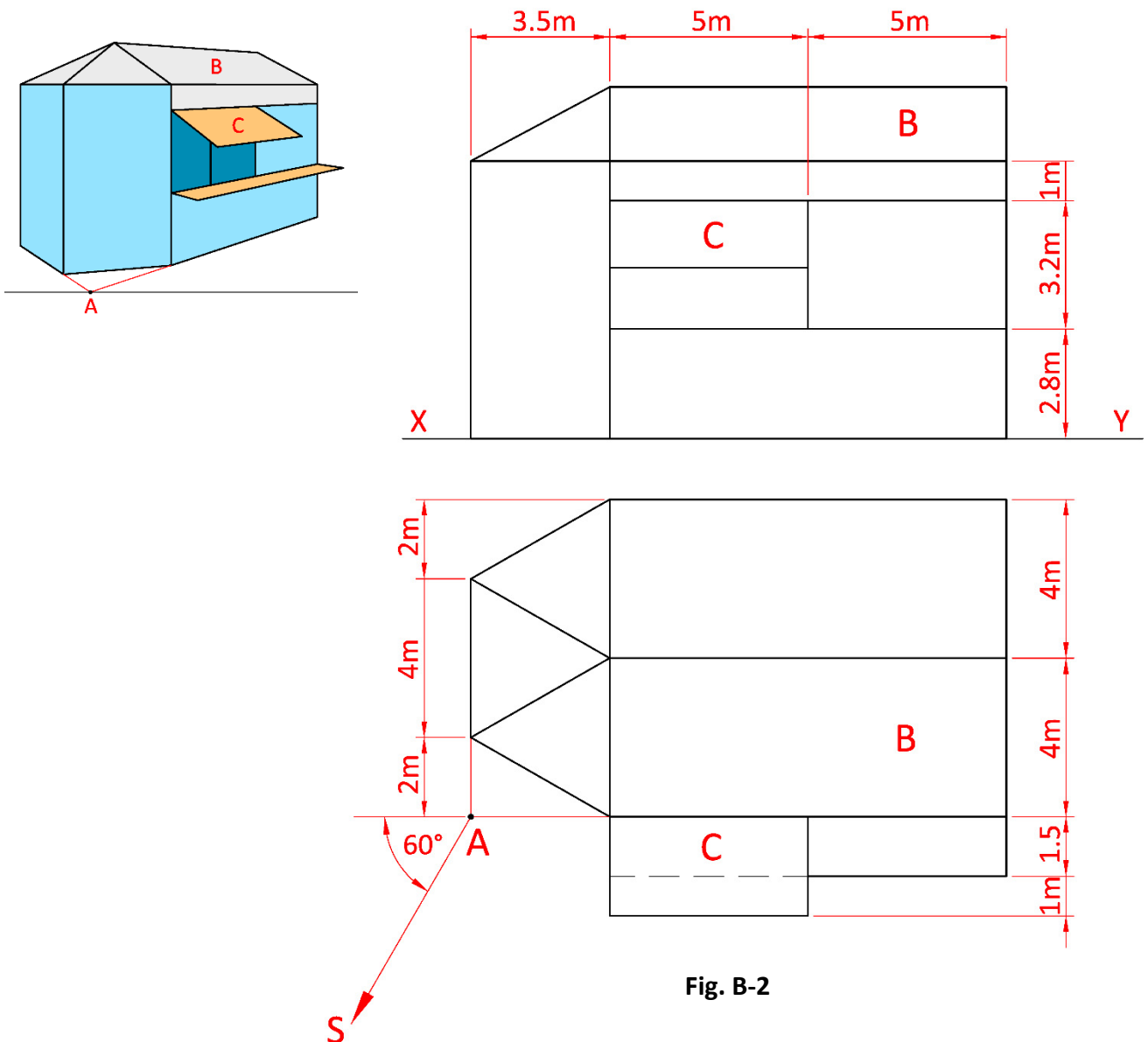


Fig. B-2

B-3. The image on the right shows a Microsoft Surface Pro. It consists of a touchscreen and a kickstand.

Fig. B-3 shows the plan and elevation of the touchscreen **ABCD** of a similar Surface Pro.



- (a) Draw the given plan and elevation of the touchscreen **ABCD**.
- (b) Determine the horizontal and vertical traces of the oblique plane that contains the touchscreen **ABCD**.
- (c) The bezel (black frame) of the touchscreen is offset by 16mm from each edge. Draw the plan and elevation of the bezel.
- (d) The line **FG** in the plan and elevation, shows the hinge position of the kickstand. The angle between the kickstand and the horizontal plane is 35° when in the open position.
 - (i) Draw the plan and elevation of the open kickstand.
 - (ii) Determine and indicate, the true angle between the touchscreen **ABCD** and the kickstand.

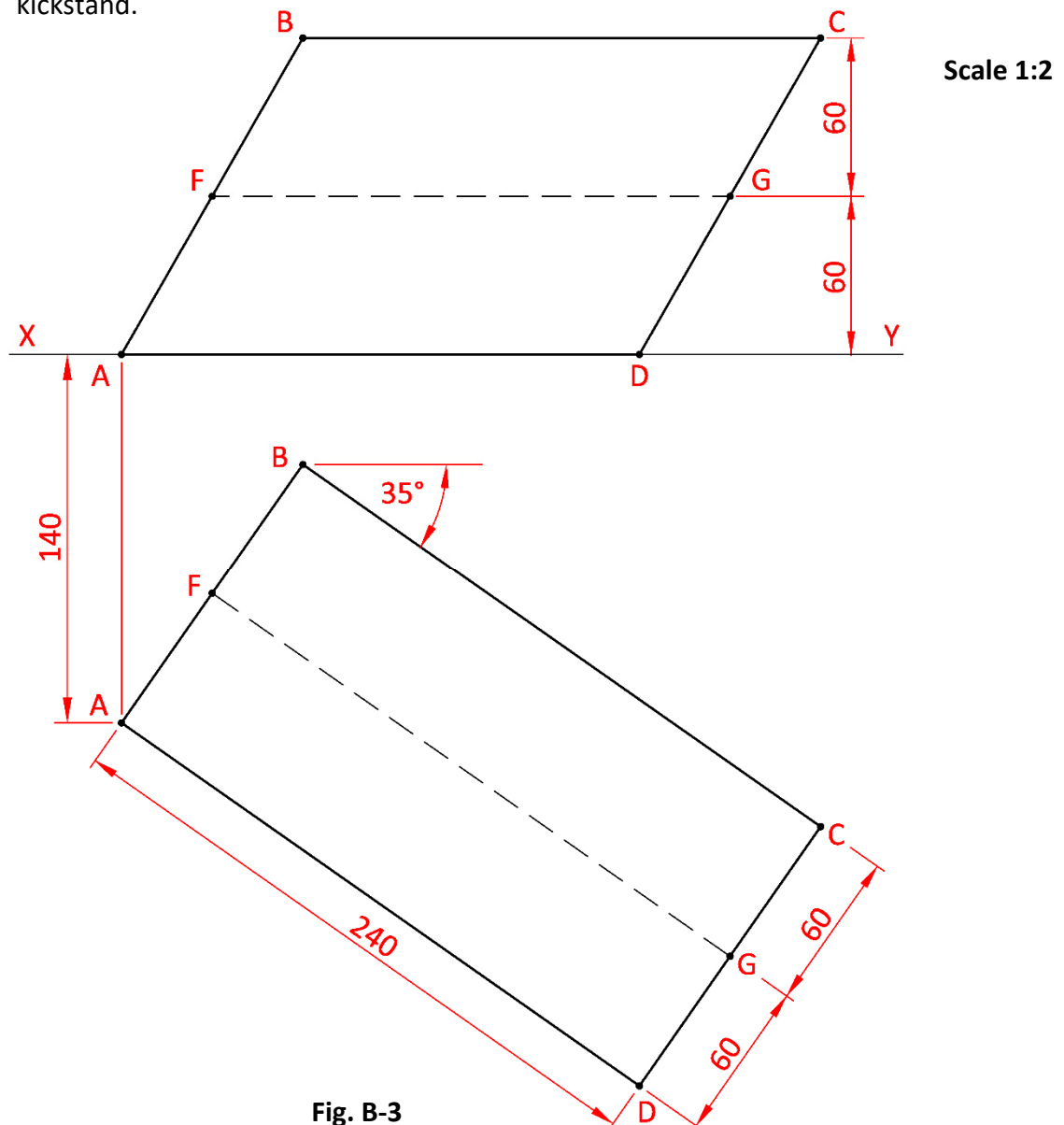


Fig. B-3

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 on a greenway.

ABCD is the centreline of a proposed path. The path is widened between **A** and **B** to form a rest area as shown.

The path and the rest area have the following specifications:

- the portion from **A** to **B** is level at an altitude of 65m and is widened as shown
- the portion from **B** to **C** is level at an altitude of 65m
- the portion from **C** to **D** is rising uniformly from a height of 65m at **C** to a height of 70m at **D**.



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 path and rest area on the northern side.

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

- (b)** In the space provided at the top of the map, draw a vertical section (profile) on the line **EF** **after** the earthworks for the path and the rest area have been completed.
- (c)** A mobile phone mast is to be built at point **E**. Determine, and indicate in metres, the maximum height for the mast if the top of the mast is not to be visible from the ground at point **F** on the rest area.

Scale 1:1000

Structural Forms

C-2. The image on the right shows a tea light holder based on a hyperboloid of revolution. A vertical opening accommodates the tea light candle.

Fig. C-2 below shows the plan and elevation of a similar tea light holder in the form of a hyperboloid of revolution.

- (a) Draw the outline plan and elevation of the tea light holder.
- (b) Draw the projections of the vertical opening.
- (c) Determine the positions of the directrix and the focal point for one branch of the double hyperbola in the elevation.



Scale 1:1

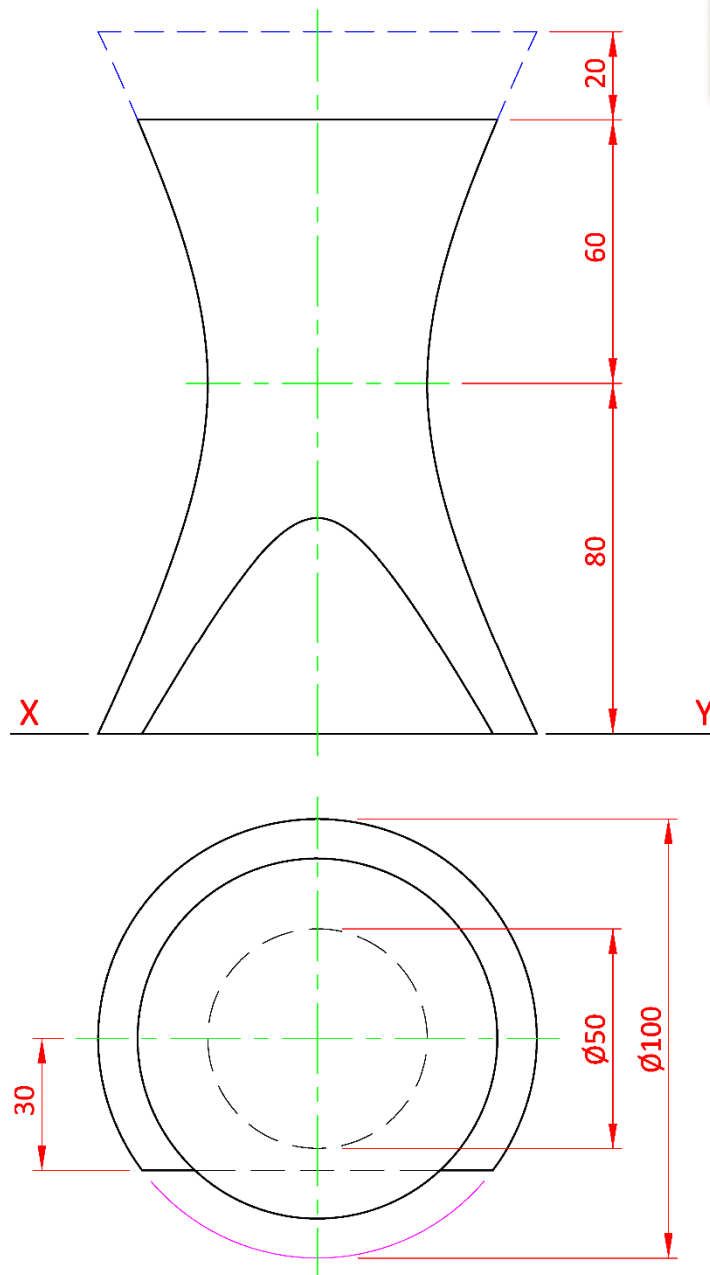


Fig. C-2

Surface Geometry

C-3. The image on the right shows a climbing wall.

Fig. C-3 shows the plan and elevation of a similar climbing wall. A pictorial view is also given.

- Draw the plan and elevation of the surfaces **A**, **B** and **C**.
- Determine the dihedral angle between the surfaces **A** and **B**.
- Draw a one-piece surface development of the surfaces **B** and **C**.
- A climber is to climb down from point **P** along the surfaces **C** and **B** to the ground at point **Q**. Determine the projections of the line on each surface that the climber must move along so that they travel the shortest possible distance.



Scale 1:100

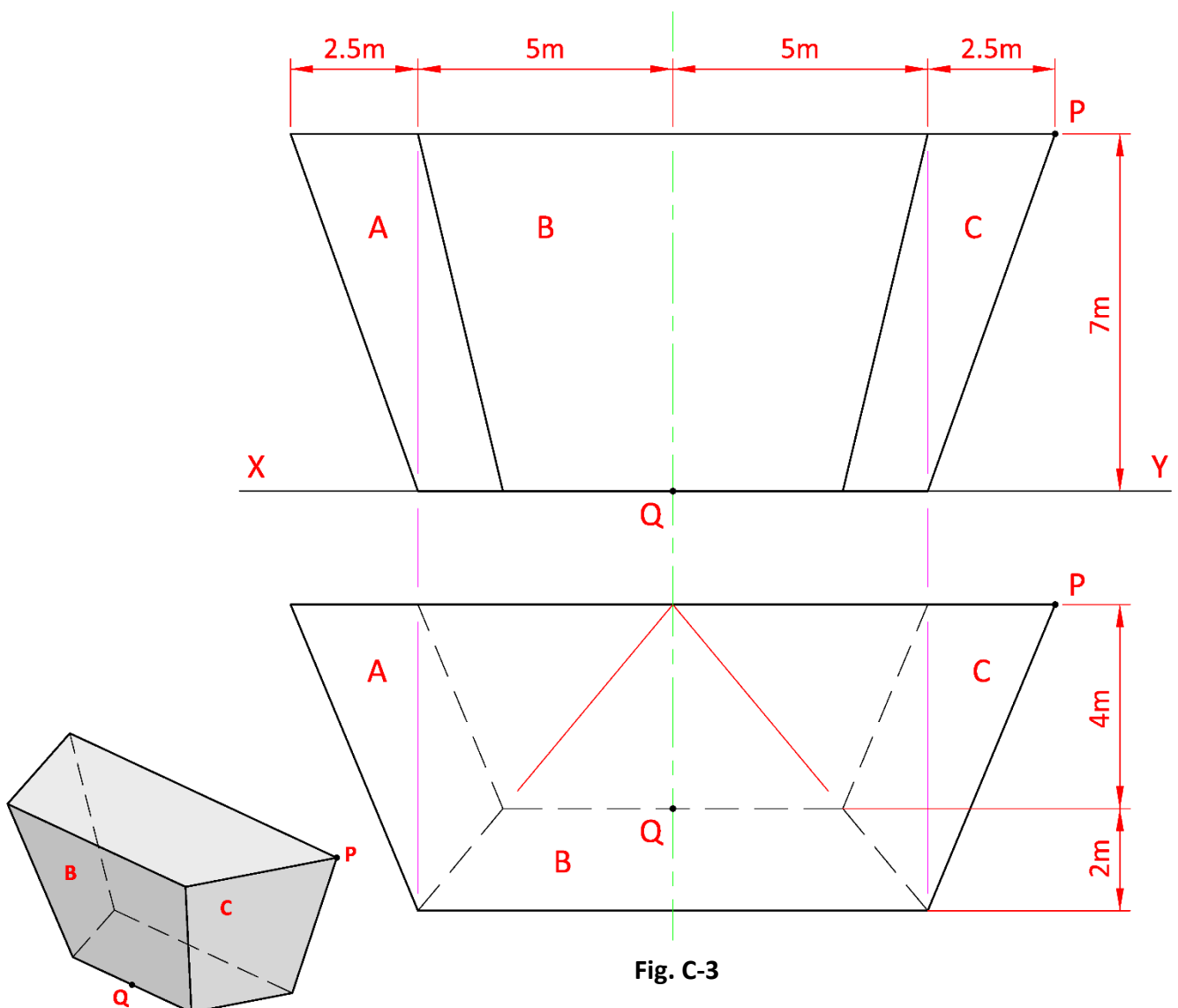


Fig. C-3

Dynamic Mechanisms

C-4. (a) The graphic on the right shows a child's toy train.

The toy train has a cam attached to the front axle which causes the smoke stack to rise and fall, through an inline roller follower, as the train moves forward.

The cam displacement diagram is shown in Fig C-4(a).

Draw the given displacement diagram and determine the cam profile to impart the following motion on a diameter 12mm inline roller follower.

- 0° to 180° uniform acceleration and retardation rise of 42mm
- 180° to 360° fall as shown in the displacement diagram.

The cam rotates in an anticlockwise direction. The nearest approach of the roller centre to the cam centre is 40mm.

Scale 1:1

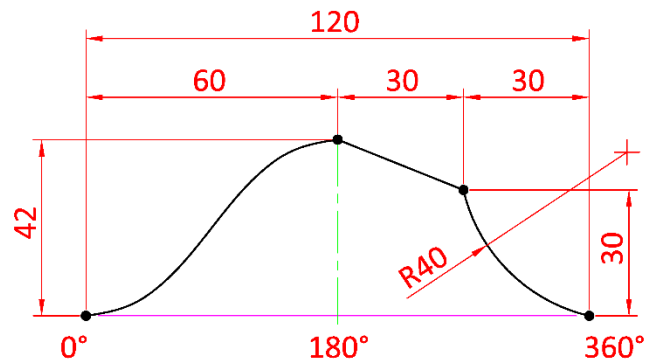


Fig. C-4(a)

(b) The image below shows a mechanical can crusher. A line diagram representing the can crusher mechanism is shown in Fig. C-4(b) on the right.

AB and **BC**, which are fixed at 30° to each other, rotate about the fixed point **B**. Points **C** and **D** are pin joints. Point **D** is constrained to move vertically only.

The crushing platform remains horizontal at all times.

- Draw the given diagram.
- On the diagram, redraw the mechanism in position when a can has been crushed to a height of 40mm.

Scale 1:2

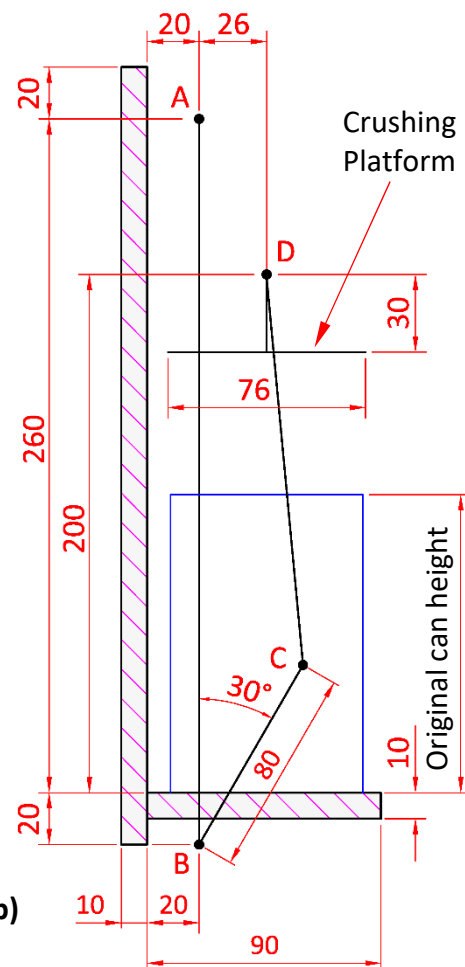


Fig. C-4(b)

Assemblies

C-5. The 3D graphic on the right shows a rotating fly-tying vice. Also shown is a classic triumph bass fishing fly held in a vice.

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

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

(Note: Any omitted dimensions may be estimated.)

Scale 1:1

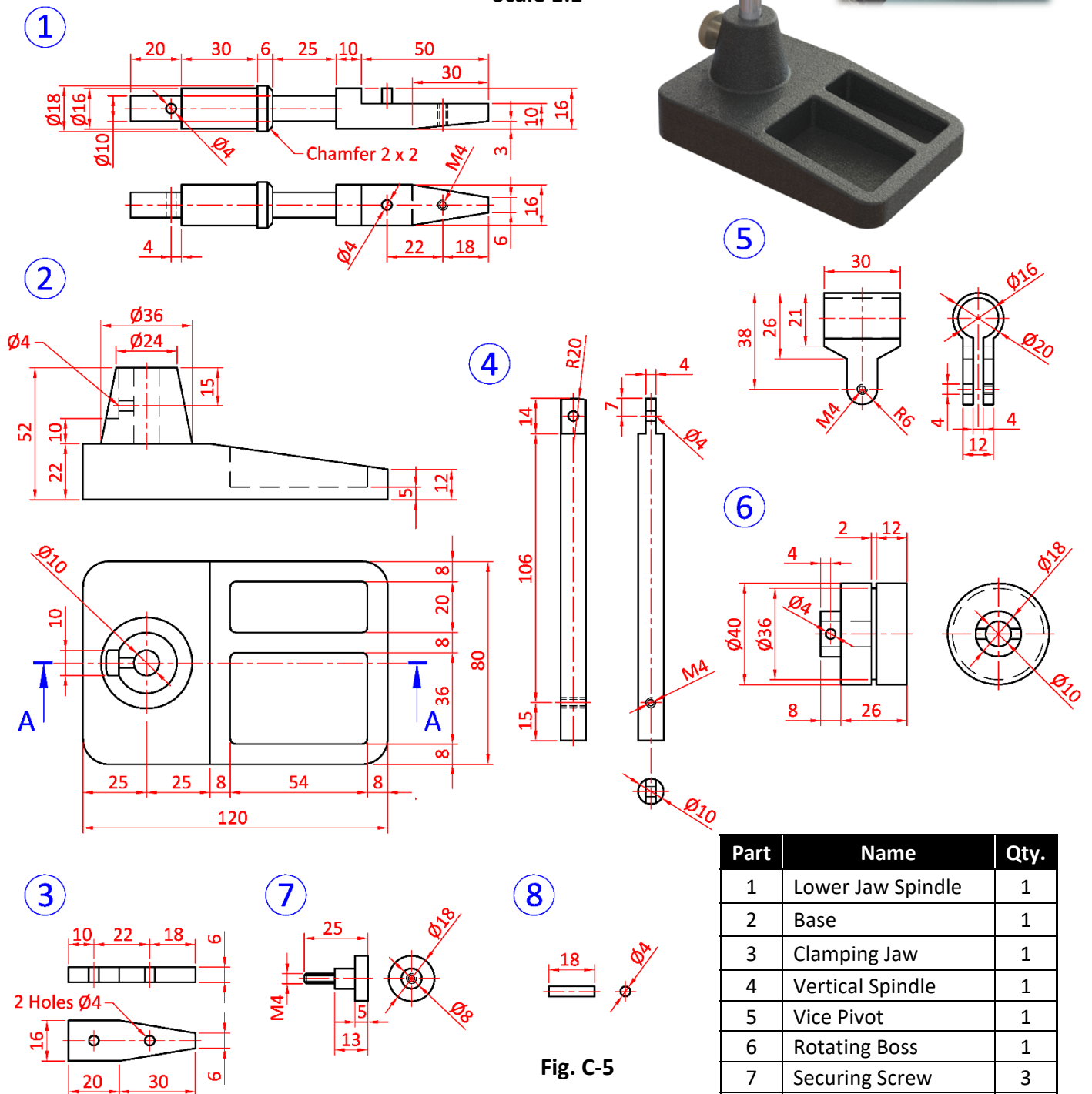


Fig. C-5

Part	Name	Qty.
1	Lower Jaw Spindle	1
2	Base	1
3	Clamping Jaw	1
4	Vertical Spindle	1
5	Vice Pivot	1
6	Rotating Boss	1
7	Securing Screw	3
8	Dowel	1

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