Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2021

Marking Scheme

Design and Communication Graphics

Higher Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2021

Design and Communication Graphics
Higher Level

Marking Scheme and Sample Solutions

(Other valid solutions are acceptable and are marked accordingly)

QUESTION A-1

MARKS

(a) Perspective Projection of Boxing Ring ***(14)***

(i) Perspective projection of ring post **3**

(ii) Perspective projection of corner pad **4**

(iii) Perspective projection of ropes **3**

(iv) Perspective projection of turnbuckle **2**

(v) Completion of perspective projection of raised platform **2**

(b) Perspective Projection of Steps ***(6)***

(vi) Determine rise of each step **2**

(vii) Establish thread of each step **2**

(viii) Completion of perspective projection of steps **2**

Total = ***20***

QUESTION A-2

MARKS

(a) Location of vertex, additional points and draw curve ***(17)***

(i) Location of vertex **4**

(ii) Location of 2 points outside latus rectum **4**

(iii) Location of 3 points inside latus rectum **6**

(iv) Draw curve …. (any = 1) **3**

(b) Draw tangent to the curve at P ***(3)***

(v) Drawing tangent to curve at point **P** **3**

Total = ***20***

QUESTION A-3

MARKS

(a) Dihedral angle between planes ABC and ABD *(16)*

(i) X_1Y_1 parallel to line of intersection **AB** **2**

(ii) Projections of planes **ABC** and **ABD** in 1st auxiliary view **4**

(iii) X_2Y_2 perp. to AB (in auxiliary view) **4**

(iv) Projections of planes **ABC** and **ABD** (edge views) on X_2Y_2.....**4**

(v) Determination of required dihedral angle **2**

(b) Determination of true angle between lines BN and CN *(4)*

(vi) Required construction to determine true shape of triangle BCN **3**

(vii) Identification of required true angle between lines BN and CN.....**1**

Total = 20

QUESTION A-4

MARKS

(a) Completion of Elevation *(16)*

(i) Location of penetration points on horizontal edges of pentagonal prism **4**

(ii) Use of appropriate method to determine points on sloping surfaces **2**

(iii) Location of penetration points of edges of rectangular prism.....**4**

(iv) Joining of penetration points incl. hidden detail **4**

(v) Completion of elevation incl. hidden detail **2**

(b) Draw true shape of Surface A (*4)*

(vi) Use of appropriate method to determine true shape **1**

(vii) Determining correct vertices **2**

(viii) Draw correct true shape of surface A **1**

Total = 20

QUESTION B-1

MARKS

(a) Elevation and End View as given *(33)*

(i) Establish required rectangular outline of supports and for curve **ABC** **4**

(ii) Construction to locate points on parabola **ABC** in elevation **10**

(iii) Draw Curve ... (Any = 1) **3**

(iv) Draw base of bridge and vertical 'tension cables' **4**

(v) Complete bridge supports **4**

(vi) Draw outline of End View **4**

(vii) Completion of End View (including 'cross members) **4**

(b) Project the given plan *(20)*

(viii) Projections to determine points on upper parabolic curve as given **5**

(ix) Mirror to lower curve **3**

(x) Draw Curves ... (Any = 1) **3**

(xi) Draw base of bridge, 'tension cables' and 'cross members' **3**

(xii) Projections to determine bridge supports **4**

(xiii) Complete bridge supports **2**

(c) Determine the true shape of the curve ABC *(7)*

(xiv) Rabatment of **ABC** in End View **2**

(xv) Projections to determine points on true shape of curve **ABC** **3**

(xvi) Draw correct true shape **2**

Total = 60

QUESTION B-2

MARKS

(a) Elevation and Plan of intersecting planes ABC, ABD and BDE *(15)*

(i) Use given coordinates to draw elevation of ABC, ABD and BDE **8**

(ii) Use given coordinates to draw plan of ABC, ABD and BDE..... **7**

(b) Dihedral Angle between planes ABC and ABD *(18)*

(iii) X_1Y_1 parallel to line of intersection AB **4**

(iv) Projection of planes and line of intersection on new X_1Y_1 ..... **4**

(v) New X_2Y_2 perpendicular to line of intersection **5**

(vi) Projection of planes as lines and indicating dihedral angle **5**

(c) Draw projections of line EP and Inclination to HP *(11)*

(vii) Draw EP parallel to AC in elevation **3**

(viii) Determine EP parallel to AC in plan **3**

(ix) Determine inclination of EP to HP **5**

(d) Complete the projections of ACF *(16)*

(x) Draw arc of 70mm in plan from A to locate position of F **3**

(xi) Determine true length of CF (80mm) in position in elevation **5**

(xii) Determine the position of point F in plan and elevation..... **5**

(xiii) Complete correct projections of plane ACF **3**

Total = ***60***

QUESTION B-3

MARKS

(a) Axonometric axes and scalene triangle *(8)*

(i) Draw axonometric axes Y and Z orientated as shown (1,1) **2**

(ii) Draw scalene triangle 'abc' (2,1,1) **4**

(iii) Draw X axis **2**

(b) Draw Elevation, End View and Trimetric Projection *(44)*

(iv) Correct development of XY plane in required orientation **4**

(v) Draw elevation as given **4**

(vi) Correct development of YZ plane in required orientation **4**

(vii) Draw end view as given **6**

(viii) Projections from elevation and end view (2,2) **4**

(ix) Draw axonometric of table top and net **5**

(x) Determine points on curves in axonometric view **8**

(xi) Draw curves **5**

(xii) Draw table top supports **4**

(c) True Length of Diagonal *(8)*

(xiii) Draw true shape of table top **5**

(xiv) Draw diagonal to determine true length **3**

Total = 60

QUESTION C-1

MARKS

(a) Earthworks on curved portion of river bank ***(40)***

Earthworks on curved section between A and B (Level) - Embankment

(i) Draw parallel arcs at 7.5mm intervals **5**

(ii) Identify intersections with contours and draw curves **4**

Earthworks on curved section between A and B (Level) - Cutting

(iii) Draw parallel arcs at 10mm intervals **5**

(iv) Identify intersections with contours and draw curves **4**

Earthworks between B and C (Level) – Cutting

(v) Draw a parallel line at 10mm interval..... **3**

(vi) Identify intersections with contours and draw curve **1**

Earthworks between C and D (falling embankment)

(vii) Draw required 7.5mm arc at **C** and draw tangent **3**

(viii) Draw parallel lines at 7.5mm intervals **5**

(ix) Identify intersections with contours and draw curve **3**

Earthworks between C and D (falling cutting)

(x) Draw required 10mm arc at **D** and draw tangent **3**

(xi) Draw parallel lines at 10mm intervals **3**

(xii) Identify intersections with contours and draw curve **1**

(b) Strike, Dip and Thickness of Stratum ***(20)***

(xiii) Locate points P_h, Q_h and R_h in elevation and draw triangle..... **4**

(xiv) Locate points P_h and Q_h in plan and draw triangle **4**

(xv) Determine Strike line **4**

(xvi) Establish Dip Angle **4**

(xvii) Determine thickness of Stratum …..... **4**

Total = 60

QUESTION C-2

MARKS

(a) Draw required plan of hyperbolic paraboloid structure *(26)*

(i) Establish major and minor axis of ellipse **4**

(ii) Construction to determine points on ellipse..... **8**

(iii) Draw elliptical curve in plan …… (Any = 1) **3**

(iv) Draw plan of outline elements (parallelogram ABCD) **5**

(v) Draw inner elements extended in both directions **6**

(b) Draw required elevation of structure *(22)*

(vi) Draw elevation of corresponding outline elements **3**

(vii) Draw inner elements in elevation **3**

(viii) Construction to determine lower curve in elevation **6**

(ix) Construction to determine point P in elevation..... **4**

(x) Draw lower curve in elevation …… (Any = 1) **3**

(xi) Draw upper curve in elevation…… (Any = 1) **3**

(c) Surface curvature along vertical cutting plane containing B and D *(12)*

(xii) Line joining B and D in plan **2**

(xiii) Projections from intersections with elements in plan to auxiliary or end view **3**

(xiv) Establish heights in auxiliary or end view **4**

(xv) Draw required curvature …… (Any = 1) **3**

Total = 60

QUESTION C-3

MARKS

(a) Draw Plan and Elevation of the surfaces A, B, C and D *(18)*

(i) Draw plan of surfaces A, B, C and D **10**

(ii) Draw elevation of surfaces A, B, C and D..... **8**

(b) Dihedral angle between surfaces A and B *(20)*

(iii) X_1Y_1 parallel to line of intersection **4**

(iv) Projection of surfaces A and B and line of intersection on new X_1Y_1 ..... **5**

(v) New X_2Y_2 perpendicular to line of intersection **5**

(vi) Projection of surfaces as lines and indicating dihedral angle **6**

(c) One-piece Surface Development of Surfaces C and D *(12)*

(vii) Determine true shape of vertical surface **D** **4**

(viii) Determine true shape of oblique surface **C** **5**

(ix) Draw one-piece development **3**

(d) Draw the projections of the line PQ *(10)*

(x) Determine correct orientation of line PQ in plan **5**

(xi) Determine the projections of the line PQ **5**

Total = 60

QUESTION C-4

MARKS

(a) Determine portion of Archimedean Spiral and Locus of Point C *(30)*

(i) Draw outline as given (LL_1, Wheel, Arm AB and Skip) **7**

(ii) Draw the line AB_1 ..... **3**

(iii) Establish min of 5 angular divisions lines (30°) **3**

(iv) Establish corresponding intermediate radii on angular division lines **4**

(v) Draw Archimedean spiral through required points… (Any = 1) **3**

(vi) Draw line BC **1**

(vii) Determine points on locus of C **5**

(viii) Draw required locus **4**

(b) Cam Profile and Displacement Diagram *(30)*

(ix) Draw camshaft, two circular arcs and line as given **3**

(x) Divide circle into 12 equal parts **3**

(xi) Horizontal divisions at 15mm and vertical lines on displacement diagram **3**

(xii) Establish heights in displacement diagram from 0° to 180° **4**

(xiii) Draw ‘Rise’ curve **2**

(xiv) Draw correct ‘Fall’ and ‘Dwell’ **5**

(xv) Construction to determine S.H.M (min. 7 incl. end points) **4**

(xvi) Draw S.H.M. curve … (any = 1) **3**

(xvii) Complete cam profile **3**

Total = 60

QUESTION C-5

MARKS

(a) Sectional Elevation ***(60)***

Assembly (6)

(i) Relative positioning of components.....**6**

Main Body ***(19)***

(ii) Locating correct centres of 5 arcs **6**

(iii) Determining points of contact.....**3**

(iv) Complete outline of Main Body **6**

(v) Inner detail of Main Body **4**

Clamping Jaw ***(14)***

(vi) Locating centres of 4 arcs **6**

(vii) Determine points of contact.....**2**

(viii) Complete outline of Clamping Jaw.....**3**

(ix) Inner detail of Clamping Jaw.....**3**

Clamp Coupling/M8 Stud ***(3)***

(x) Outline of Clamp Coupling/M8 Stud.....**2**

(xi) Complete Clamp Coupling/M8 Stud **1**

Jaw Clamping Nut/Washer ***(4)***

(xii) Outline of Jaw Clamping Nut /Washer.....**3**

(xiii) Complete Jaw Clamping Nut /Washer.....**1**

Camera Swivel (4)

(xiv) Outline of Camera Swivel.....**3**

(xv) Inner detail of Camera Swivel **1**

GoPro Lock Nut and M6 Stud (4)

(xvi) GoPro Lock Nut.....**2**

(xvii) M6 Stud.....**2**

Completion of drawing (6)

(xviii) Presentation, hatching and centrelines **6**

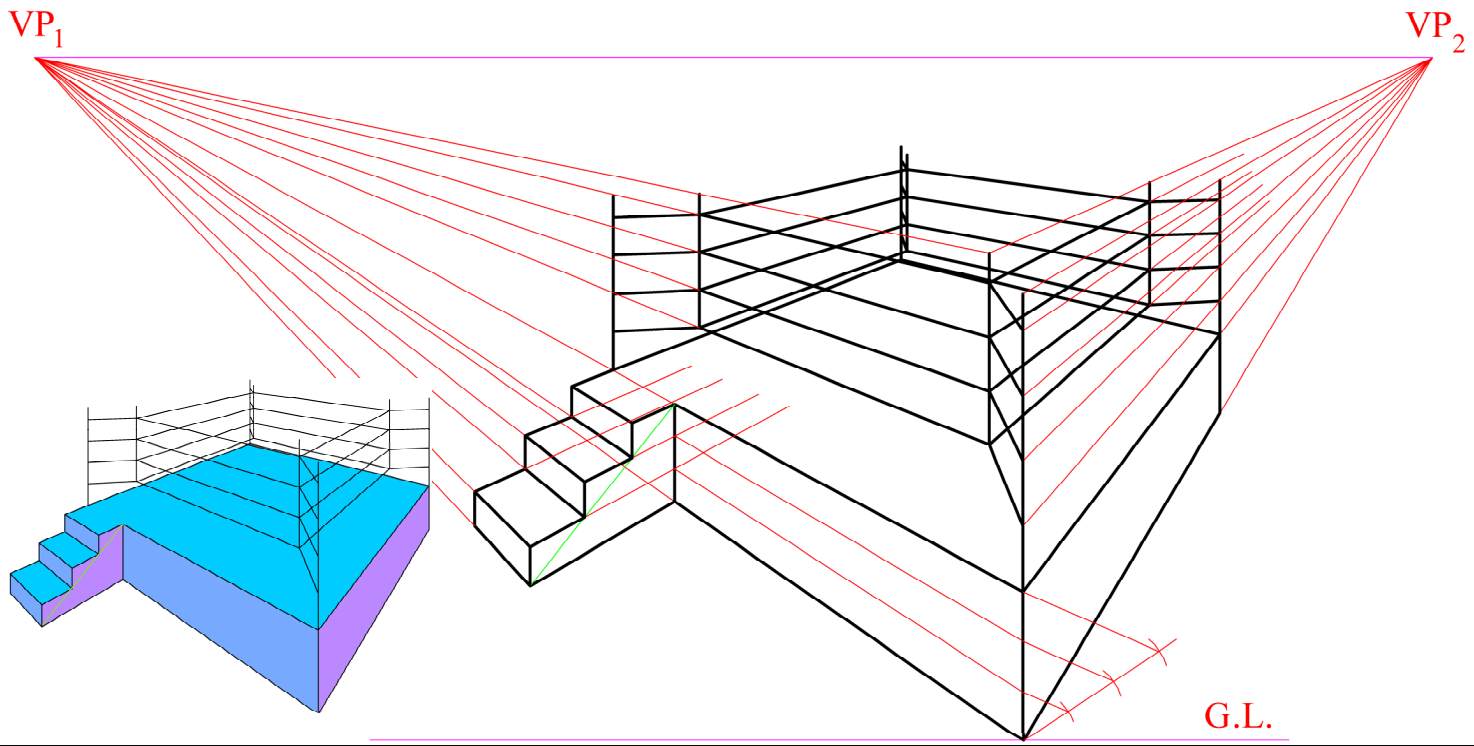
Total = 60

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

A-1. The 3D graphic shows a boxing ring with steps. Shown below is an incomplete perspective drawing of the ring and steps. The positions of the ground line and the vanishing points are given.

(a) Complete the perspective drawing of the boxing ring.

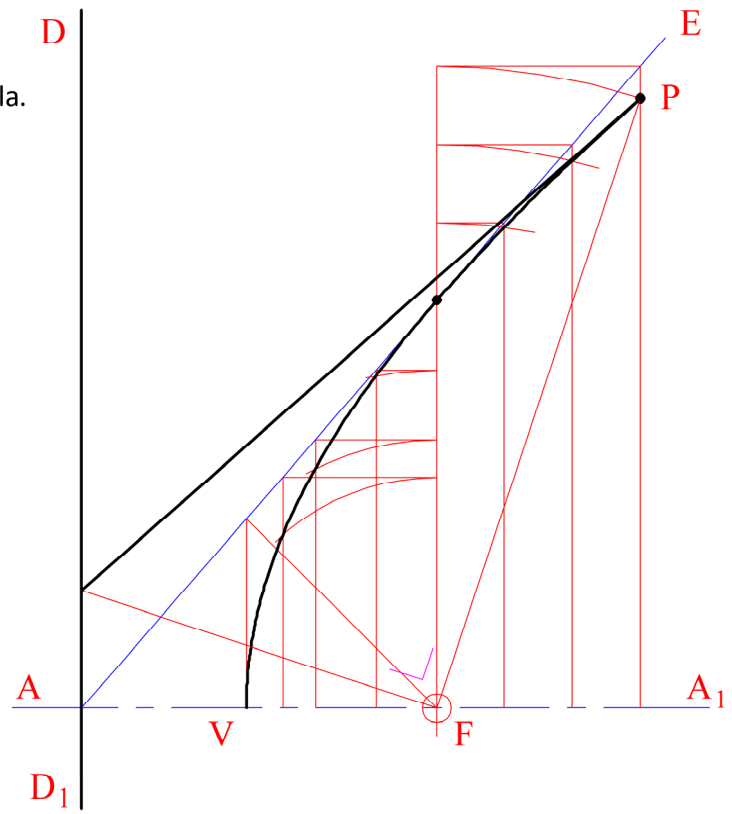
(b) The steps are of equal height. Complete the perspective drawing of the steps.



A-2. The image below shows the Spinnaker Tower in Portsmouth. The design includes two hyperbolas. The drawing on the right shows the axis AA_1, directrix DD_1, focus **F** and eccentricity line **E** of a similar hyperbola. Two points on the curve are given.

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

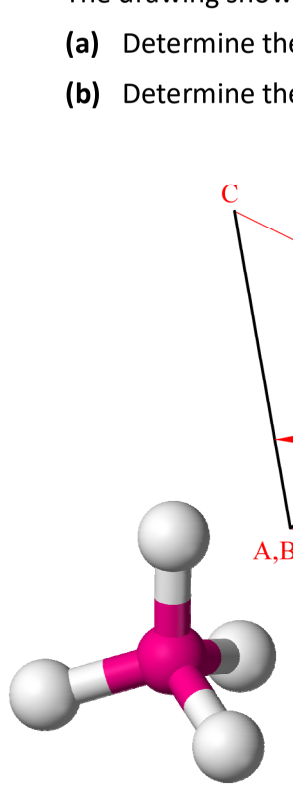
(b) Draw a tangent to the curve at point **P**.

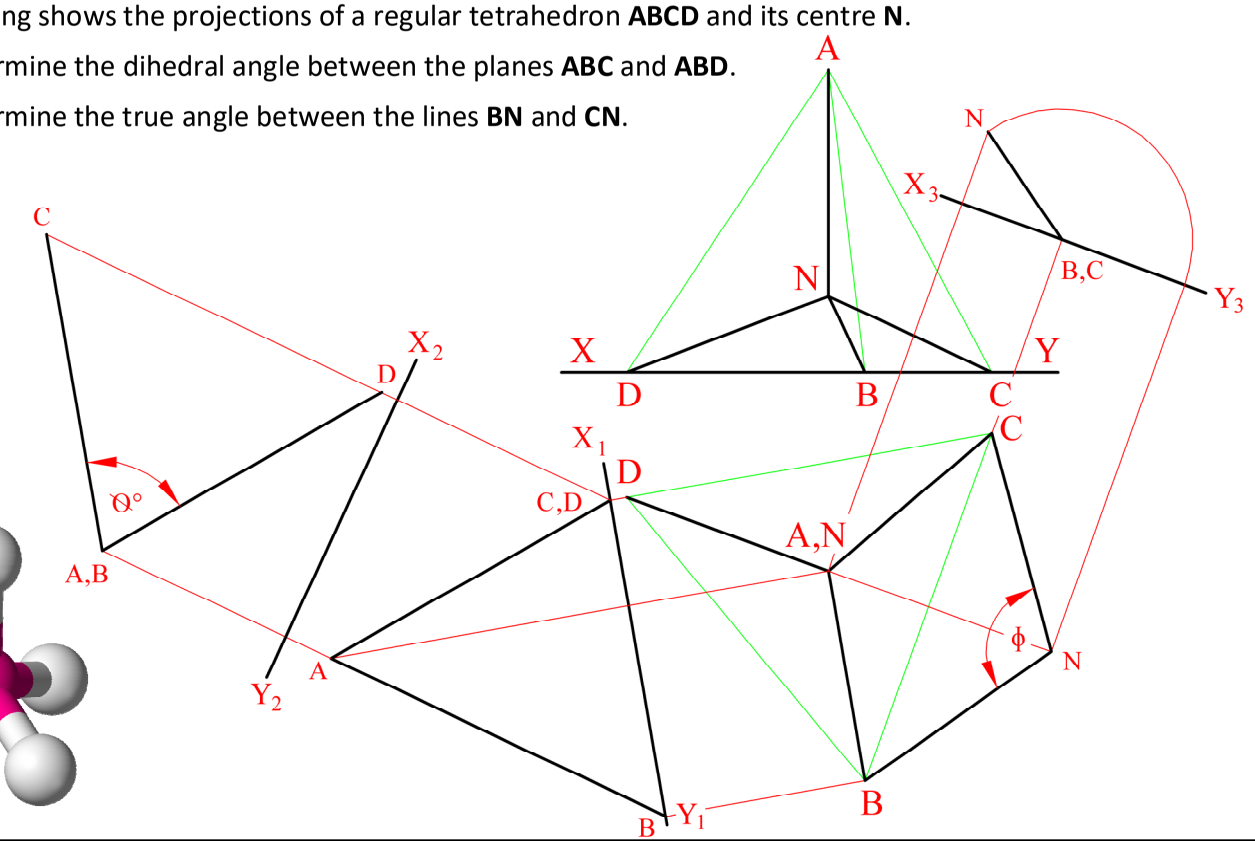


A-3. The image below shows an ammonium ion which has the shape of a regular tetrahedron. A Nitrogen atom is located at the centre of the tetrahedron and four Hydrogen atoms are located at the vertices.
The drawing shows the projections of a regular tetrahedron **ABCD** and its centre **N**.

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

(b) Determine the true angle between the lines **BN** and **CN**.





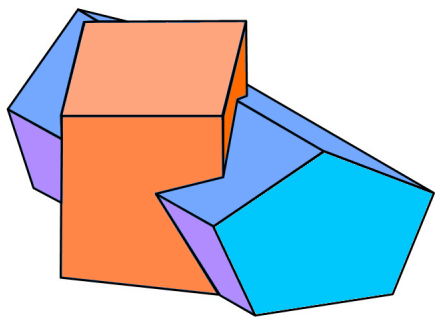
A-4. The image below shows a modern house design which is based on intersecting prisms.

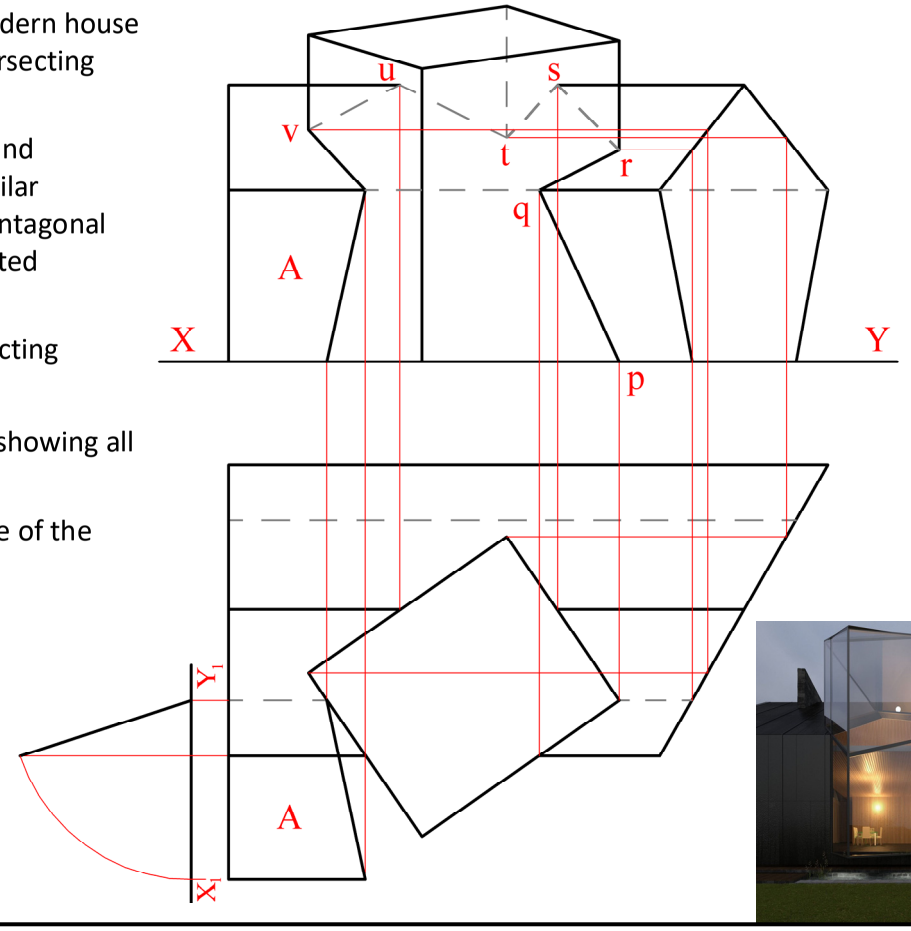
The drawing shows the plan and incomplete elevation of a similar structure which includes a pentagonal prism intersected by a truncated rectangular prism.

A pictorial view of the intersecting solids is given.

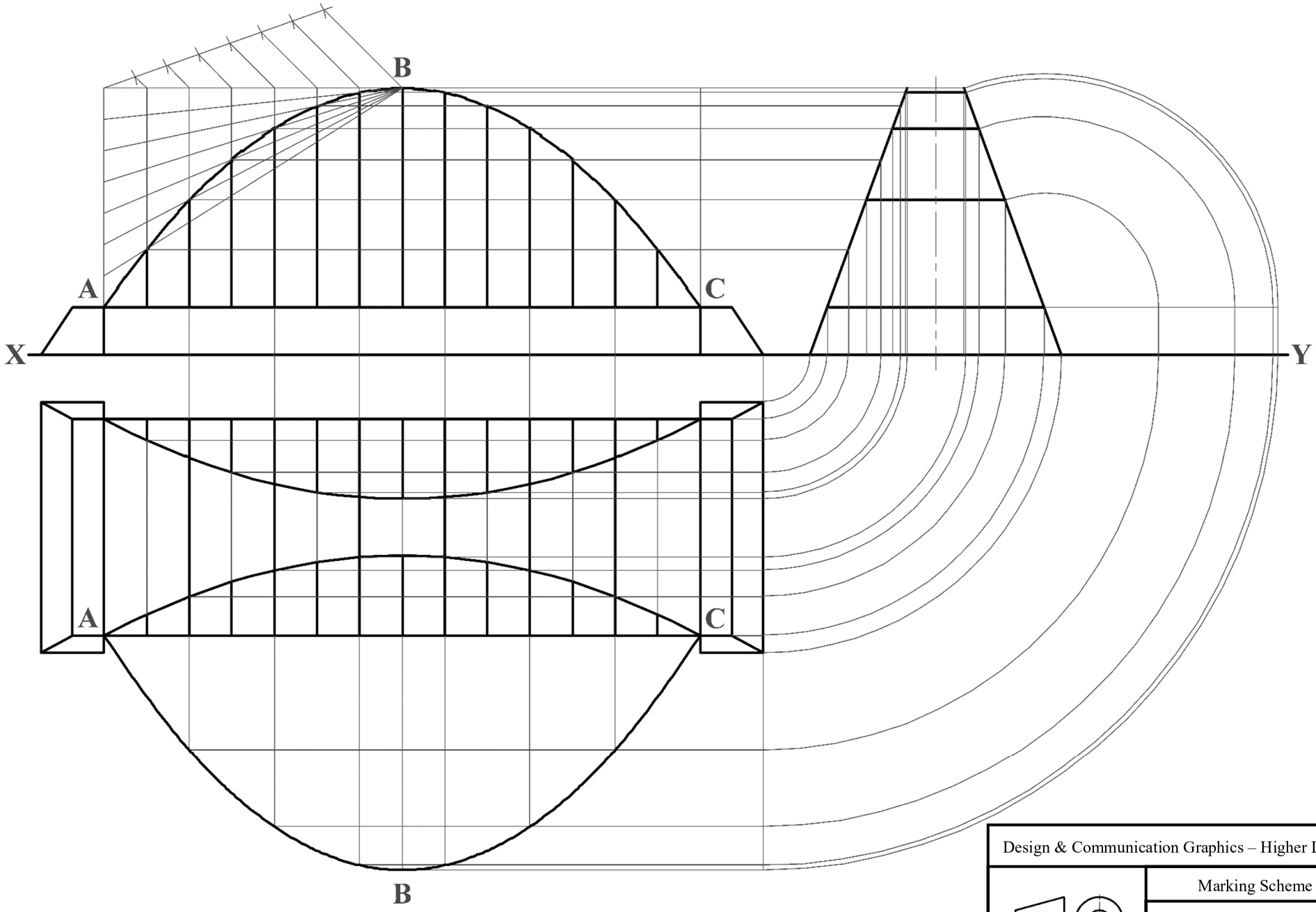
(a) Complete the elevation, showing all lines of interpenetration.

(b) Determine the true shape of the surface **A**.



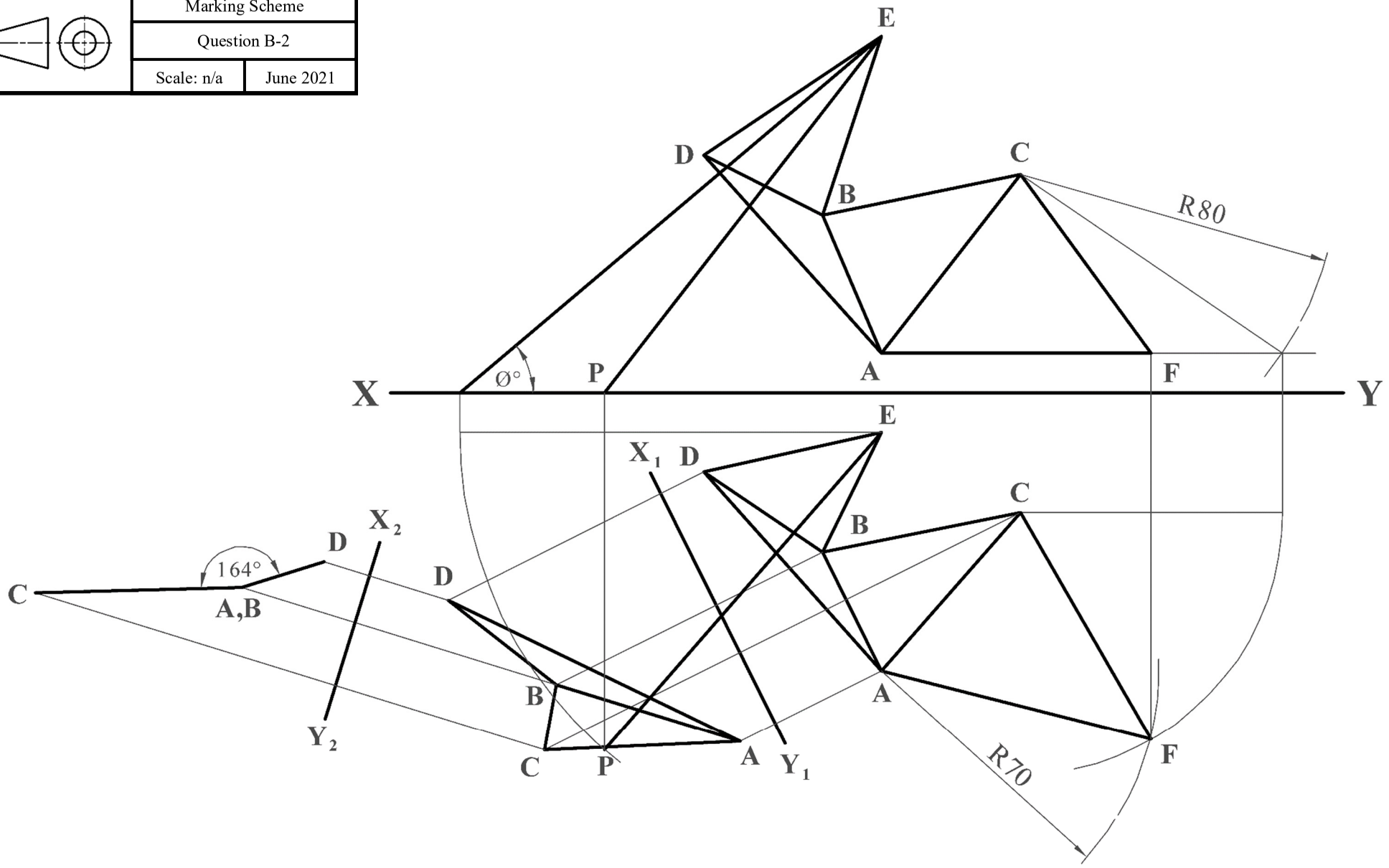


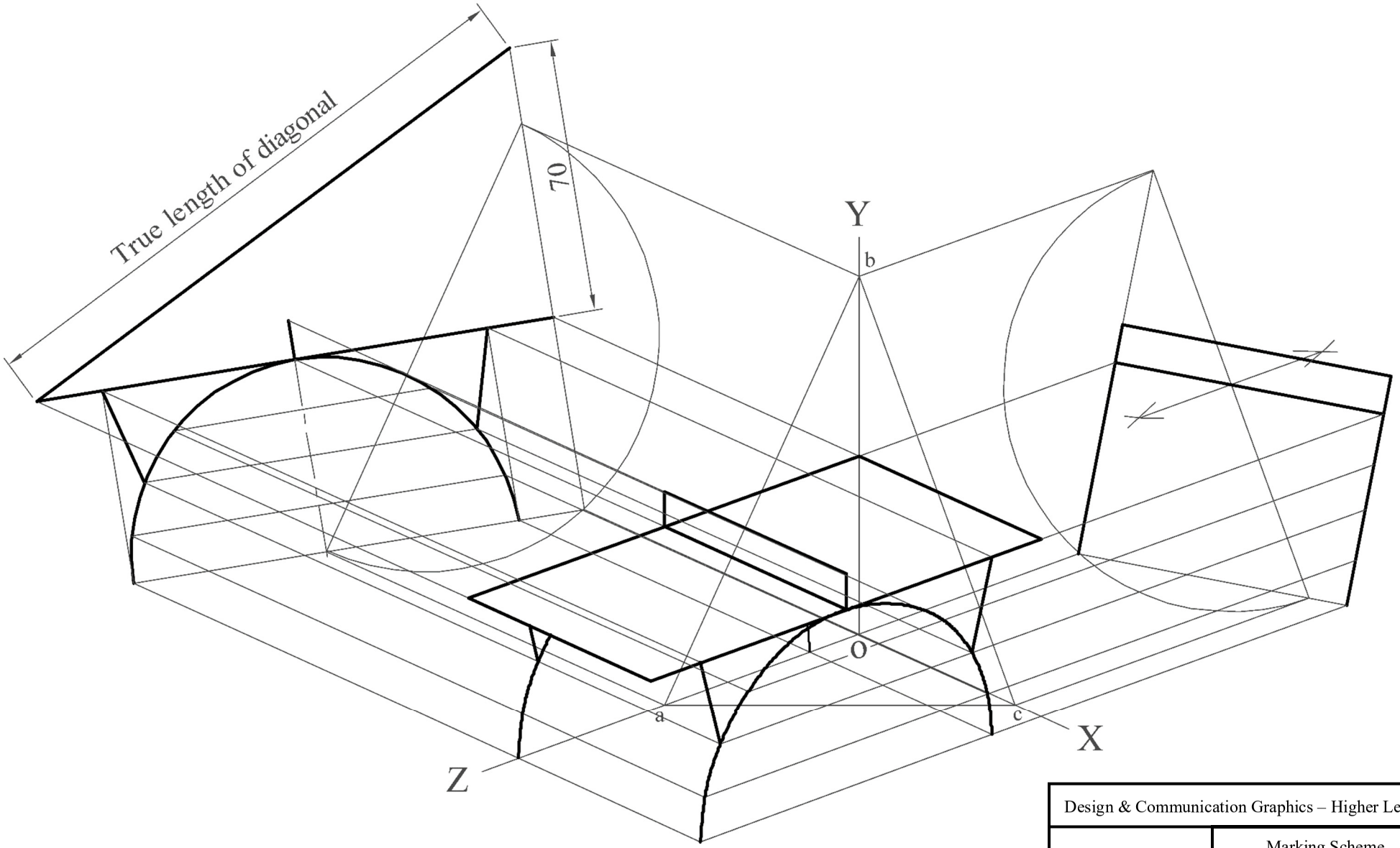
This examination paper must be returned at the end of the examination – You must include your Examination Number on the front cover.



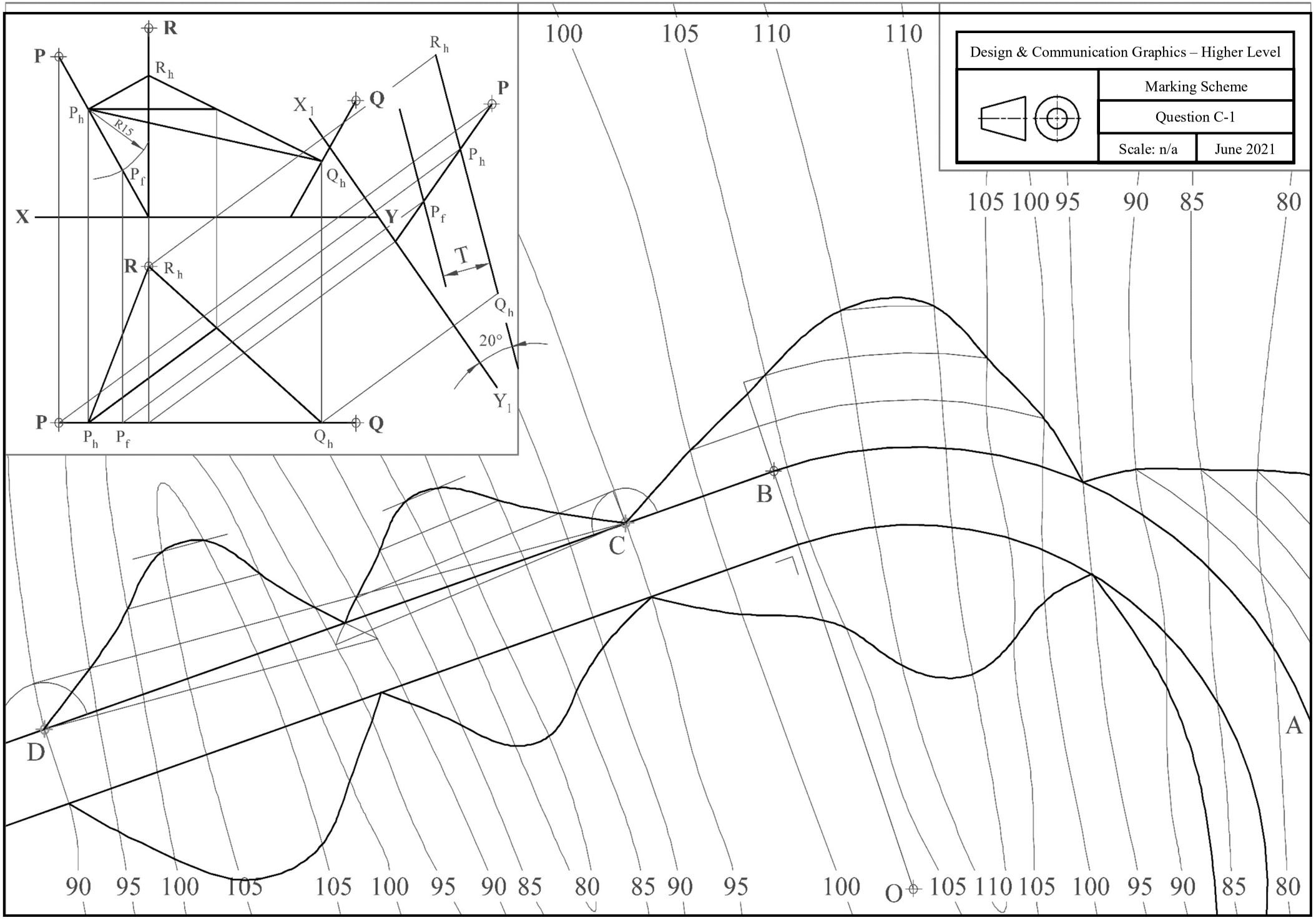
Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question B-1
	Scale: n/a | June 2021

Design & Communication Graphics – Higher Level		
	Marking Scheme	
	Question B-2	
	Scale: n/a	June 2021





Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question B-3
	Scale: n/a | June 2021


Design & Communication Graphics – Higher Level
Marking Scheme
Question C-1
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June 2021
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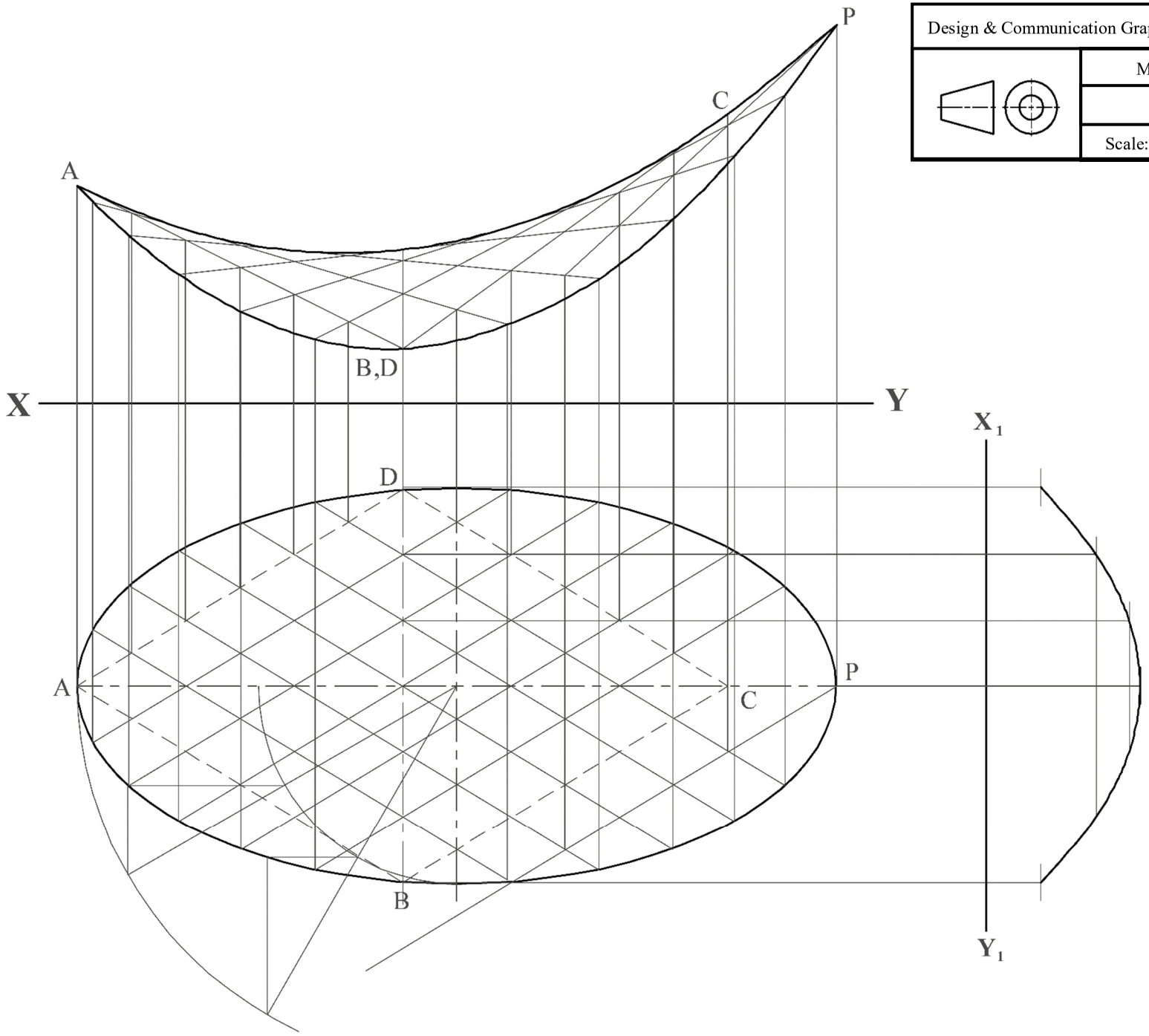
	Marking Scheme	
	Question C-2	
	Scale: n/a	June 2021



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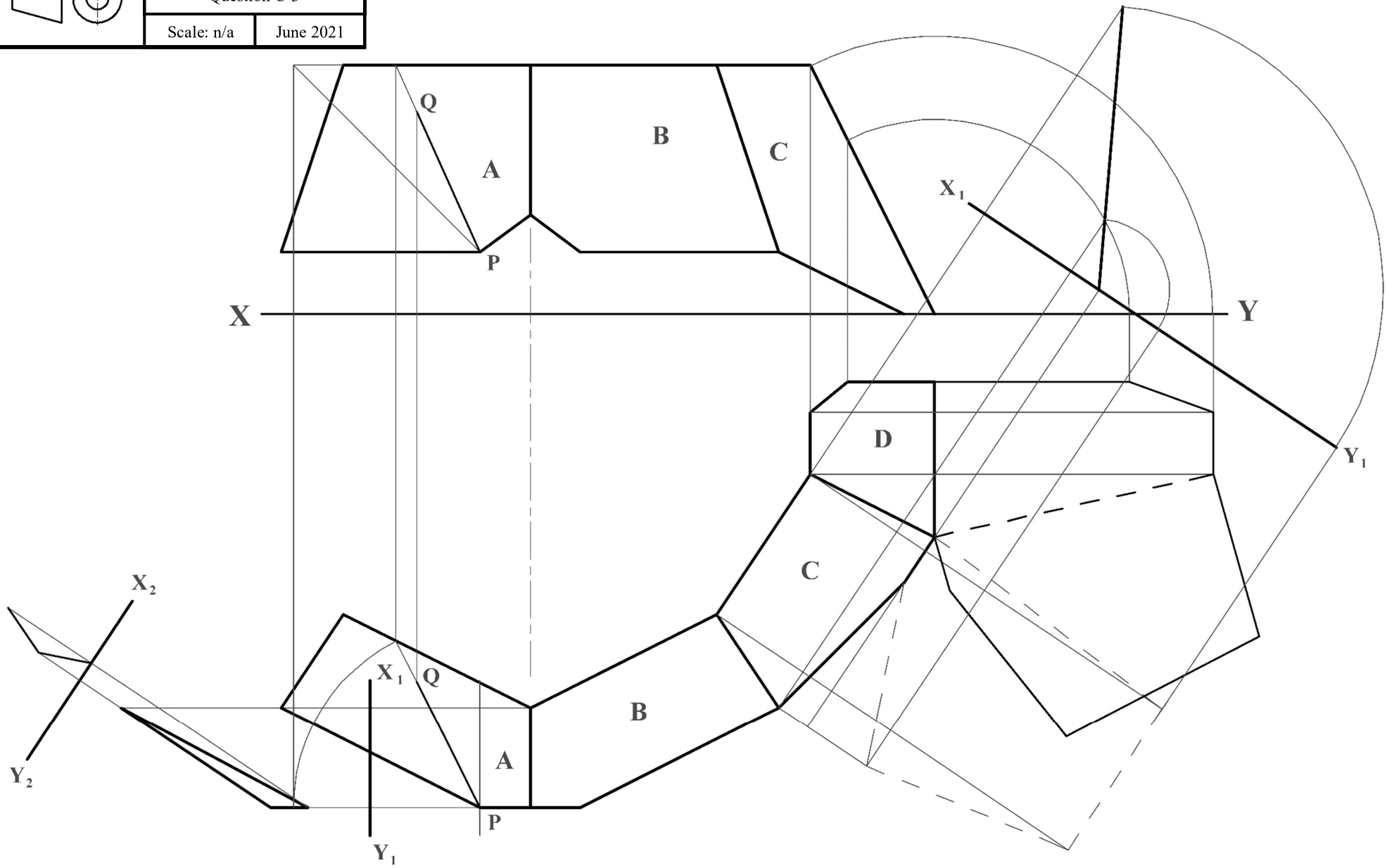
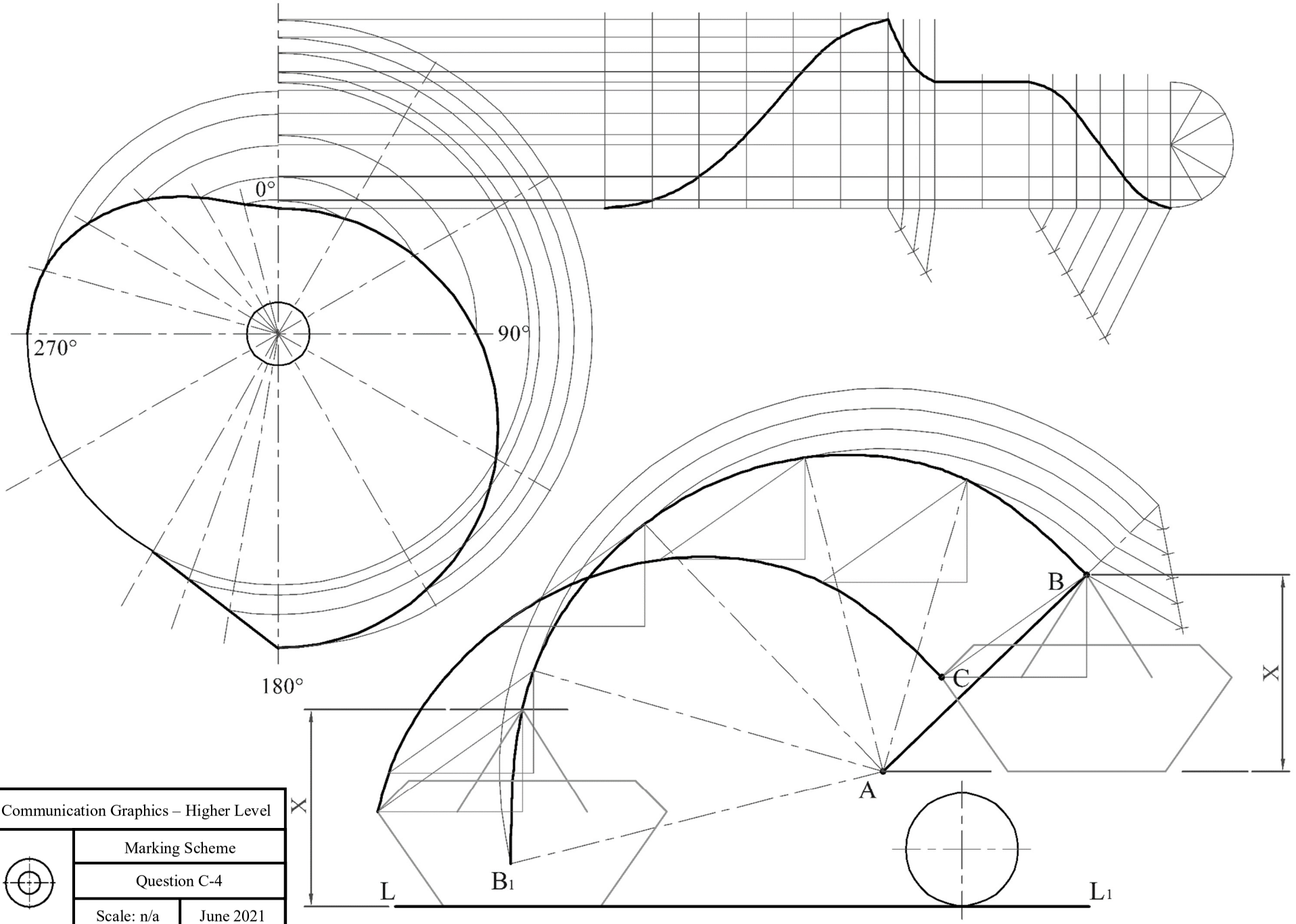
	Marking Scheme	
	Question C-3	
	Scale: n/a	June 2021





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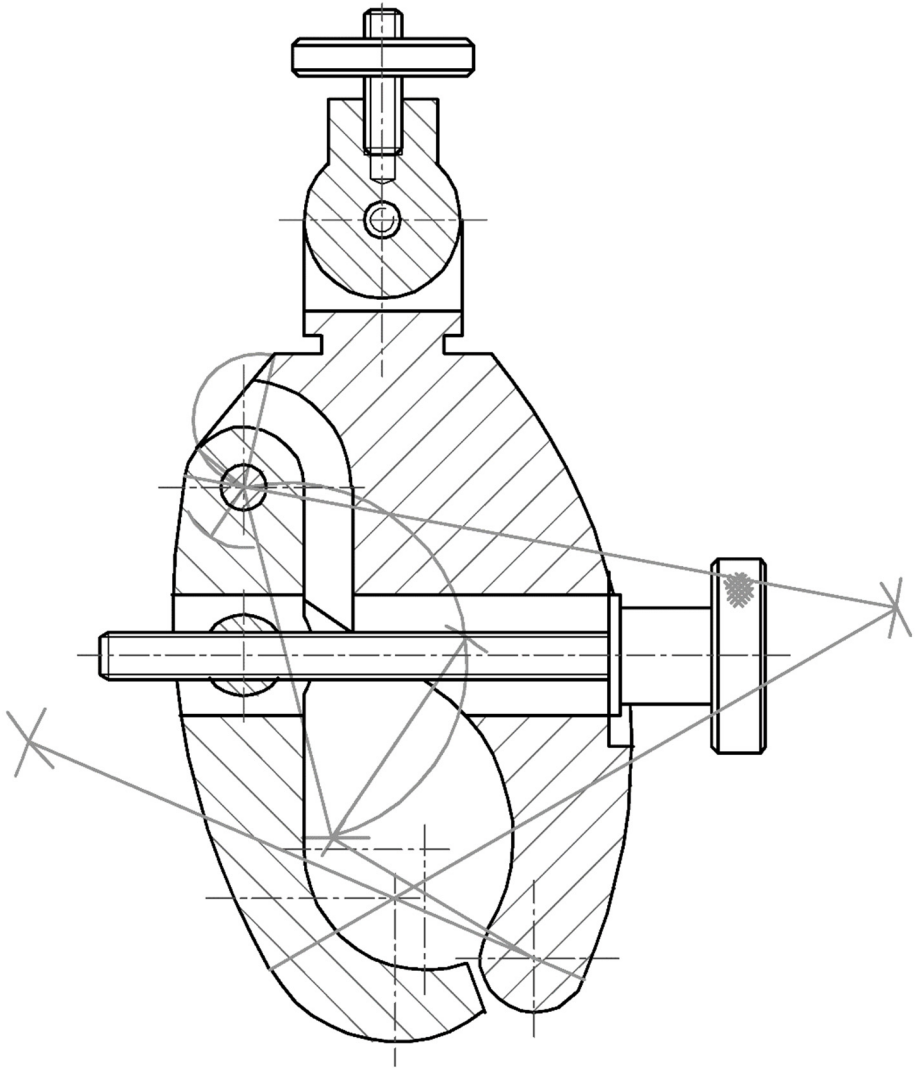
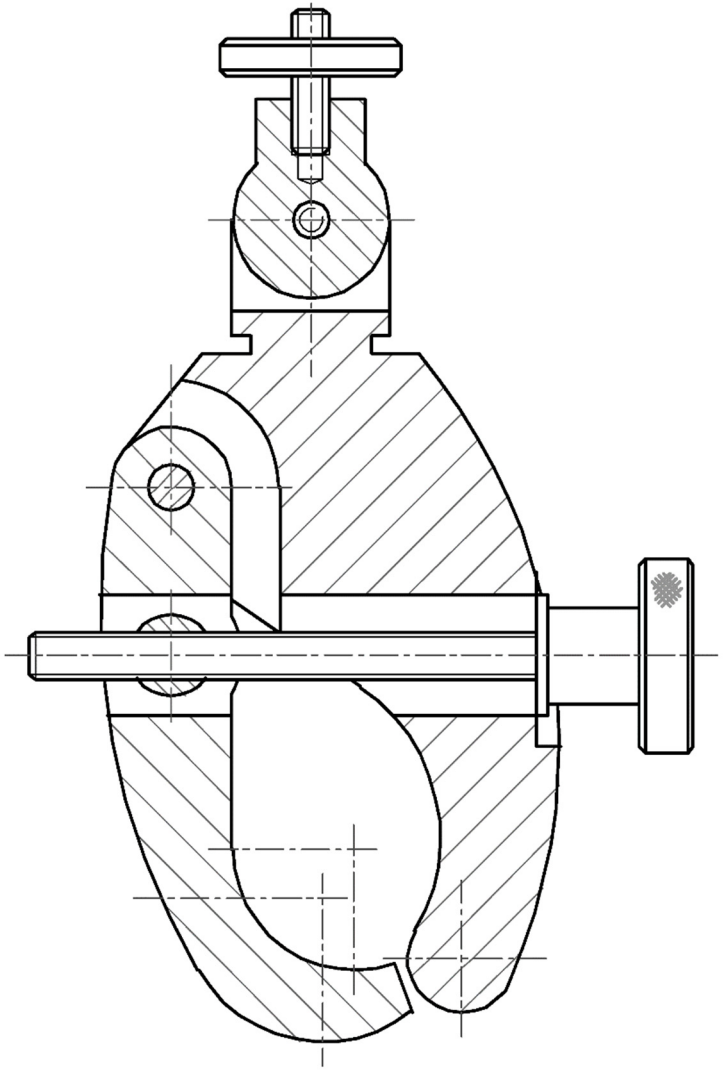
	Marking Scheme
	Question C-4
	Scale: n/a — June 2021





Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question C-5
	Scale: n/a | June 2021

Design and Communication Graphics

Student Assignment - Higher Level

Assessment Sheet 2021

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Candidate Examination No. _____

Output	Marking criteria				Marks
1	**Design Research & Design Feature Comparison**				
	Exploration of main design features using primary & secondary research; Selection of appropriate graphics; Selection of two appropriate images; Main dimensions inserted; Comparison of main design features; Contrasting of main design features; Effective layout and presentation of information combining images, sketches & annotations		**30**		
2	**Freehand Graphical Representation**				
	Proportion; Form/Volume; Use of Tone/Line for effective rendering; Detailed communication of main design features to include 3D presentation quality drawing; Layout & presentation		**20**		
3	**SolidWorks Parts, Assembly, Drawing** and **eDrawing files**				
	Adherence to required filing structure	**35**	**4**		
	Creation of a minimum of 5 Part files		**2**		
	Part models - Proficiency in Parametric CAD, including economy of design and design intent; Selection of most appropriate profiles; Sketches fully defined; Features renamed; Appropriate type of extrusions/end conditions used		**15**		
	Factor of difficulty/Design intent		**5**		
	Assembly - Creation of Assembly; Accuracy of parts to facilitate correct assembly; Correct mating of parts; Application of appropriate appearances		**7**		
	eDrawing of CAD model		**2**		
4	**Hard Copy outputs from SolidWorks**				
	Detailed orthographic views of the selected artefact; Section/Detail views where appropriate; pictorial view of the Assembly; Exploded view of the CAD model; Inclusion of main dimensions, notes and symbols; Appropriate scaling, layout and presentation to be considered		**15**		
5	**Graphical exploration of design solutions**				
	Exploration of theme/possible solution(s); Justification of chosen solution(s); Use of appropriate images/graphics; Effective layout and presentation of information combining images, sketches & annotations		**25**		
6	**Presentation of Modification/Concept Design**				
	Proportion; Form/Volume; Use of Tone/Line for effective rendering; Detailed communication of modified/concept design features; Layout and presentation		**10**		
7	**Hard copy outputs from SolidWorks**				
	CAD Model, factor of difficulty/design intent	**25**	**10**		
	Detailed orthographic views of the proposed solution; Section/Detail views where appropriate; Rendered pictorial view of the CAD model; Photorealistic images; Inclusion of main dimensions, notes and symbols; Appropriate scaling, layout and presentation to be considered		**15**		
				Sub-total	
				Marks deducted for pages in excess of maximum	
				Assignment Total	