



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2017

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

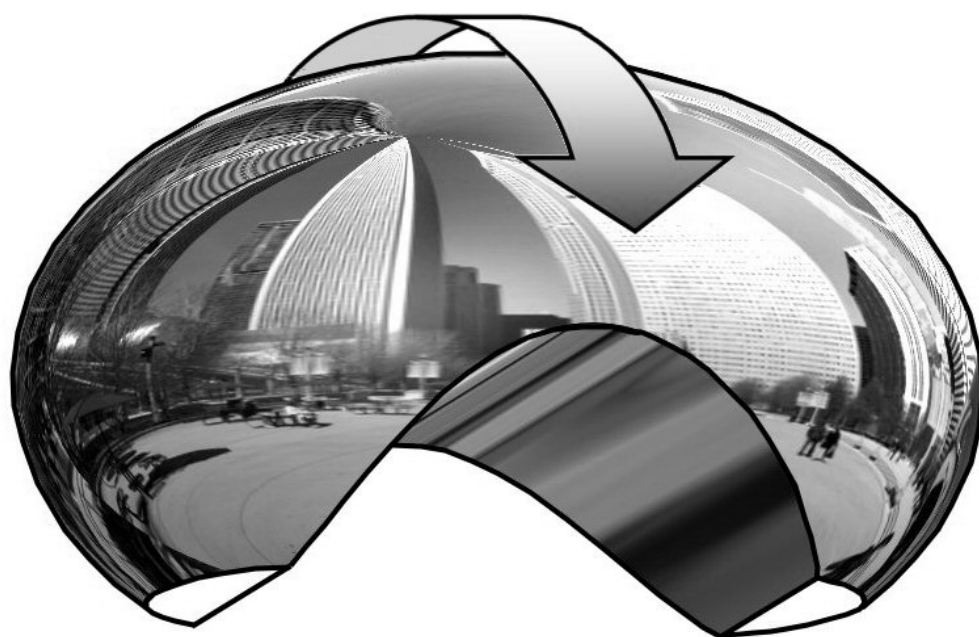
Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in 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.



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Leaving Certificate Examination 2017

***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) **Completion of axonometric projection of cube and lines (16)**
- (i) Location of required vertex on top of cube6
 - (ii) Complete outline of cube (3 lines)4
 - (iii) Determine axonometric projection of the six additional lines on the cube6
- (b) **Determination of the true angle between ab and cd (4)**
- (iv) X_1Y_1 parallel to correct cube face in plan1
 - (v) Projections perp. to X_1Y_1 1
 - (vi) Location of points a, b, c and d in the required auxiliary view1
 - (vii) Drawing of lines to indicate required true angle1

Total = 20

QUESTION A-2

MARKS

- (a) **Vertex and Curve (17)**
- (i) Locate vertex6
 - (ii) Locate points outside latus rectum (2,4)6
 - (iii) Locate points inside latus rectum2
 - (iv) Draw curve (Any = 2)3
- (b) **Normal (3)**
- (v) Identify point 30mm from directrix1
 - (vi) Required correct construction and draw normal ... (1,1)2

Total = 20

QUESTION A-3

MARKS

- (a) **Dihedral angle (15)**
- (i) Projections perp. to X_1Y_1 2
 - (ii) True length of line of intersection in required auxiliary view3
 - (iii) Locate another point on surface A and on B in the auxiliary view2
 - (iv) X_2Y_2 perp. to line of intersection2
 - (v) Projections perp. to X_2Y_2 2
 - (vi) Location of points on surface A and B in 2nd Auxiliary3
 - (vii) Determination of required dihedral angle1
- (b) **Projections of sphere (5)**
- (viii) Construction to locate centre of face B in plan1
 - (ix) Determination of edge view of surface B1
 - (x) Location of required centre in 'edge view'1
 - (xi) Drawing of required circle in plan and elevation (incl. hidden detail)2

Total = 20

QUESTION A-4

MARKS

- (a) **Projections of first arrow (8)**
- (i) Draw line PA in end view and elevation 8
- (b) **Projections of first arrow when it hits target (9)**
- (ii) Locate point of penetration in plan4
 - (iii) Draw arrow in required final position in plan2
 - (iv) Draw arrow in required final position in elevation3
- (c) **Angle between flight paths (3)**
- (v) Join P to 'bull's eye'2
 - (vi) Correct construction to determine true angle between flight paths1

Total = 20

QUESTION B-1

		<u>MARKS</u>
(a)	Draw given elevation (18)	
(i)	Draw major and minor axes	2
(ii)	Use of correct construction to locate points on ellipse	5
(iii)	Draw elliptical curve(any = 2)	3
(iv)	Use of correct construction to draw parabola	5
(v)	Draw parabolic curve(any = 2)	3
(b)	Outline plan (6)	
(vi)	Use of appropriate method to locate points on ellipse in plan	3
(vii)	Draw required elliptical curve in plan(any = 2)	3
(c)	Outline end view (2)	
(viii)	Draw circular outline in end view	2
(d)	Inner detail in end view and plan (19)	
(ix)	Use of vertical sections and their circular outlines to determine points on 'inner' curves in end view	4
(x)	Draw 'inner' curves in end view(any = 2)	2
(xi)	Use of vertical sections to determine points on 'horizontal cut' in plan (min 5).....	6
(xii)	Use of vertical sections to determine points on 'parabolic cut' in plan (min 3)	3
(xiii)	Draw curves in plan....(any = 2)	2
(xiv)	Completion of plan, incl. hidden detail	2
		Total = 45

QUESTION B-2

	<u>MARKS</u>
(a) Plan and Elevation of intersecting planes (14)	
(i) Use given coordinates to draw required plan	8
(ii) Use given coordinates to draw required elevation	6
(b) Dihedral Angle (19)	
(iii) X_1Y_1 parallel to line of intersection AB	5
(iv) Projection of planes and line of intersection on new X_1Y_1	5
(v) New X_2Y_2 perpendicular to line of intersection AB	4
(vi) Projection of ABCD and ABEF as lines and indicating dihedral angle	5
(c) True shape of ABCD, incl. porthole (6)	
(vii) Use of appropriate construction to determine true shape	1
(viii) Determination of true shape (four correct lines)	2
(ix) Drawing of porthole in correct position(1,1,1)	3
(d) Drawing of seat and traces (6)	
(x) Joining of required midpoints in plan and elevation	2
(xi) Completion of 'seat' in elevation and plan	2
(xii) Drawing and indicating required horizontal trace	1
(xiii) Determine and indicate vertical trace	1
Total =	45

QUESTION B-3

MARKS

(a) Required Plan (11)

- | | |
|---|---|
| (i) Draw hexagon as given | 6 |
| (ii) Plan of required Picture Plane, Spectator Point and Vanishing Points(2,1,2) ... | 5 |

Perspective Drawing of Prism (21)

- | | |
|---|---|
| (iii) Draw Ground Line and Horizon Line | 2 |
| (iv) Establish VP ₁ and VP ₂ in Perspective Drawing..... | 2 |
| (v) Draw rectangular 'Front Face' in Perspective Drawing | 4 |
| (vi) Complete Perspective of other two front faces | 4 |
| (vii) Project and use height to establish perspective of point on back surface ..(1,1,1) .. | 3 |
| (viii) Draw perspective of top edges of back surfaces | 3 |
| (ix) Complete Perspective Drawing of truncated prism(inner detail) | 3 |

Perspective of required lines on surfaces B, A and C (6)

- | | |
|--|---|
| (x) Perspective of 15° line on surface B and horizontal line on surface A(1,1)..... | 2 |
| (xi) Use of AVP to establish and draw sloping line on surface C ...(2,1,1) | 4 |

(b) Development of Display Box (7)

- | | |
|--|---|
| (xii) Draw development of surfaces A, B and C(1,1,1)..... | 3 |
| (xiii) Lines on surfaces A, B and C in Development (incl. collinearity of 15° lines) | 4 |

Total = 45

QUESTION C-1

MARKS

(a) Earthworks on Northern side of ski run/piste (30)

Earthworks between A and B (Level) - Cutting

- (i) Draw parallel lines at 7.5mm intervals4
- (ii) Identify intersections with contours and draw curve(4×1)4

Earthworks between B and C (Falling) - Cutting

- (iii) Draw required 22.5mm arc at edge of ski run at C (perp.)3
- (iv) Draw parallel lines at 7.5mm intervals5
- (v) Identify intersections with contours and draw curve3

Earthworks between C and D (Level, widening portion) - Embankment

- (vi) Draw parallel lines at 10mm intervals3
- (vii) Identify intersections with contours and draw curve(2×1)2

Earthworks between C and D (Level, wide portion) - Embankment

- (viii) Draw parallel lines at 10mm intervals3
- (ix) Identify intersections with contours and draw curve2
- (x) Accurate Intersections between earthwork curves1

(b) Profile through ski run/piste and maximum height of cable (6)

- (xi) Projectors from plan (3 points), establish heights and draw required profile2
- (xii) Draw towers at E and F at 15m and 20m respectively2
- (xiii) Draw cable and establish required maximum height2

(c) Strike and Dip of stratum (9)

- (xiv) Establish points P_h, Q_h and R_h in elevation and draw required triangle4
- (xv) Draw required triangle in plan and establish Strike Line, S2
- (xvi) Establish required Dip.....3

Total = 45

QUESTION C-2

MARKS

(a) Plan of Canopy (8)

- (i) Draw four required arcs in plan4
- (ii) Locate points of contact (eight) and draw required tangential edges4

(b) End View of Generating Parabola (9)

- (iii) Establish required rectangular outline for curve ABC.....2
- (iv) Construction to locate points on required parabola4
- (v) Draw parabolic curve(Any = 1-2)3

(c) Elevation of Canopy (22)

- (vi) Establish required rectangular outline for curve DBE2
- (vii) Construction to locate points on required parabola4
- (viii) Draw parabolic curve(Any = 1-2)3
- (ix) Use of appropriately spaced vertical sections and transfer of widths
from plan to end view5
- (x) Transfer of heights from end view onto corresponding vertical
section lines in elevation5
- (xi) Draw required curve in elevation(Any = 1-2)3

(d) Extended Canopy (6)

- (xii) Redraw the required construction for parabola ABC2
- (xiii) Extend construction horizontally and vertically2
- (xiv) Draw required extended curve2

Total = 45

QUESTION C-3

MARKS

- (a) Plan and Elevation (14)**
- (i) Draw plan as given.....10
- (ii) Draw elevation as given.....4
- (b) Dihedral angle between surfaces A and B (18)**
- (iii) Establish true length of line of intersection in auxiliary view ..(3,3,3).....9
- (iv) Establish plane perp. to AB (X₂Y₂ or triangular lamina)3
- (v) Construction to determine required dihedral angle6
- (c) True Length of shortest diagonal on Surface C and Surface Development (9)**
- (vi) Construction to determine true length of required diagonal2
- (vii) Draw development of surface A2
- (viii) Use of true length (or alternative correct construction) to determine required development of surface C (or B)2
- (ix) Draw development of attached rectangular portion1
- (x) Use of symmetry to complete development of Transition Piece2
- (d) Openings in surfaces B and C in Plan and Elevation (4)**
- (xi) Offset edges 10mm inwards in True Shape view1
- (xii) Locate opening on Surface C in plan and elevation using correct construction2
- (xiii) Use of symmetry to draw projections of second opening1

Total = 45

QUESTION C-4

MARKS

- (a) Cam and Displacement Diagram (25)**
- (i) Draw camshaft1
 - (ii) Establish 'nearest approach' on diagram of cam1
 - (iii) Divide circle into 12 equal parts (30° divisions)2
 - (iv) Horizontal divisions on displacement diagram2
 - (v) Construction to determine U.A.R. on disp. diag. (min. 7 incl. end points)4
 - (vi) Draw Uniform Velocity on displacement diagram.....2
 - (vii) Construction to determine S.H.M. on displacement diagram.....4
 - (viii) Transfer of heights from displacement diagram to cam diagram4
 - (ix) Draw rollers on 30° division lines2
 - (x) Complete cam diagram3
- (b) Combined Movement Locus (20)**
- (xi) Draw lines AB, BC and C-C₂ (incl. point C₁) as required3
 - (xii) Division of first 60° angle into equal parts (min. 6)2
 - (xiii) Division of C-C₁ into corresponding no. of equal parts2
 - (xiv) Use of points established at (xii) & (xiii) above to determine points on locus.....3
 - (xv) Draw required locus ...(any = 1)3
 - (xvi) Division of second 60° angle into equal parts (min. 6)1
 - (xvii) Division of C₁-C₂ into corresponding no. of equal parts1
 - (xviii) Use of points established at (xvi) & (xvii) above to determine points on locus.....2
 - (xix) Draw required locus ...(any = 1)3

Total = 45

QUESTION C-5**MARKS****(a) Sectional Elevation (42)*****Assembly (8)***

- (i) Relative positioning of components.....8

Base (8)

- (ii) Outline of base (excluding cylindrical boss)3
 (iii) Cylindrical boss including detail at top2
 (iv) Inner detail (relief, fillets and hole)3

First Vertical Hinge Post & Pin (7)

- (v) Outline of cylindrical portion.....2
 (vi) Flange on RHS (incl. fillets and holes)3
 (vii) Pin (incl. cylindrical hole)2

Parallel Arm Rails (4)

- (viii) Circles x 62
 (ix) Horizontal arms x 22

Second Vertical Hinge Post (3)

- (x) Outline of cylindrical portion.....1
 (xi) Flange on LHS (incl. fillets)2

Top Cranked Arm and Pin (5)

- (xii) Cylindrical portion on LHS, incl. detail at bottom1
 (xiii) Cranked link bar2
 (xiv) Cylindrical portion on RHS, incl. hole and pin on LHS2

LCD Mount Bracket (3)

- (xv) Hinged Portion.....1
 (xvi) Vertical 'Face Plate' portion2

Drawing Completion (4)

- (xvii) Presentation, hatching and centrelines4

(b) Maximum Horizontal Travel (3)

- (xviii) Determination of required internal tangent1
 (xix) Use of distance 'arm length'1
 (xx) Establish and indicate required horizontal travel distance.....1

Total = 45

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

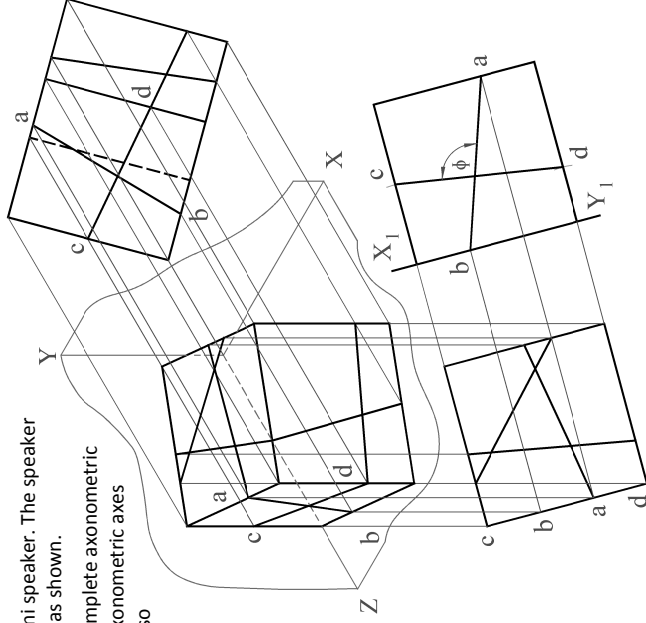
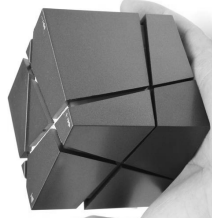
A-1. The image below shows a bluetooth mini speaker. The speaker is based on a cube, with its faces cut as shown.

The drawing on the right shows an incomplete axonometric projection of a similar cube using the axonometric axes method. The planes of reference are also included.

The elevation and plan are shown in their required positions with lines drawn on the three visible faces.

(a) Complete the axonometric projection of the cube and the given lines.

(b) Determine the true angle between the lines **ab** and **cd**.



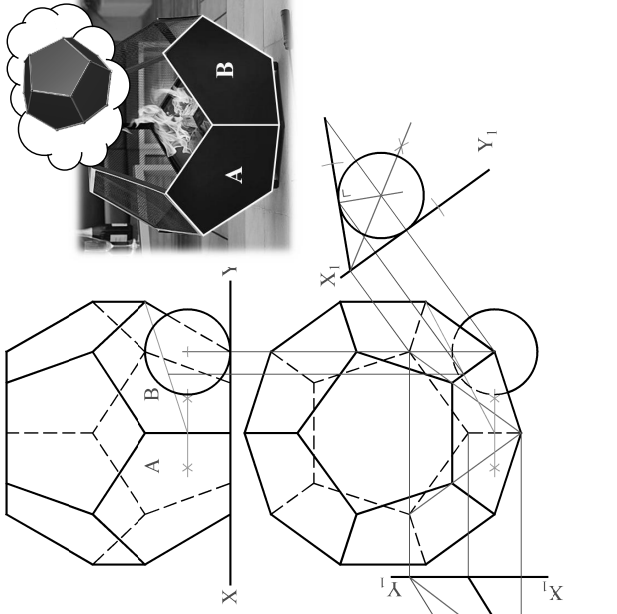
A-3. A design for a patio fireplace based on a regular solid is shown.

The drawing shows the elevation and plan of a similar solid.

All faces are regular pentagons.

(a) Using the given X_1Y_1 , draw the true length of the line of intersection between faces **A** and **B**, and hence determine the dihedral angle between the two faces.

(b) Determine the centrepoint of face **B** in plan and draw the projections of a sphere which rests on the horizontal plane and is also in tangential contact with the centre point of face **B**.

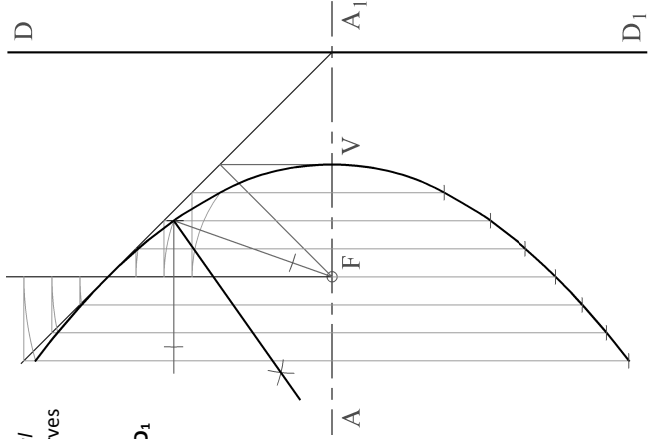


A-2. The graphic below shows the logo for the *Ladies Professional Golf Association*. It contains a combination of geometric curves depicting a female golfer. The main curve is a parabola and the club shaft is a **normal** to the parabola.

The drawing on the right shows the axis **AA₁**, the directrix **DD₁** and the focus **F**, of a similar parabola.

(a) Locate the vertex and draw a portion of the parabola.

(b) Locate a point **P** on the curve which is 30mm from the directrix and construct a normal to the curve at point **P**.



A-4. The plan, elevation and end view of an archery target are shown.

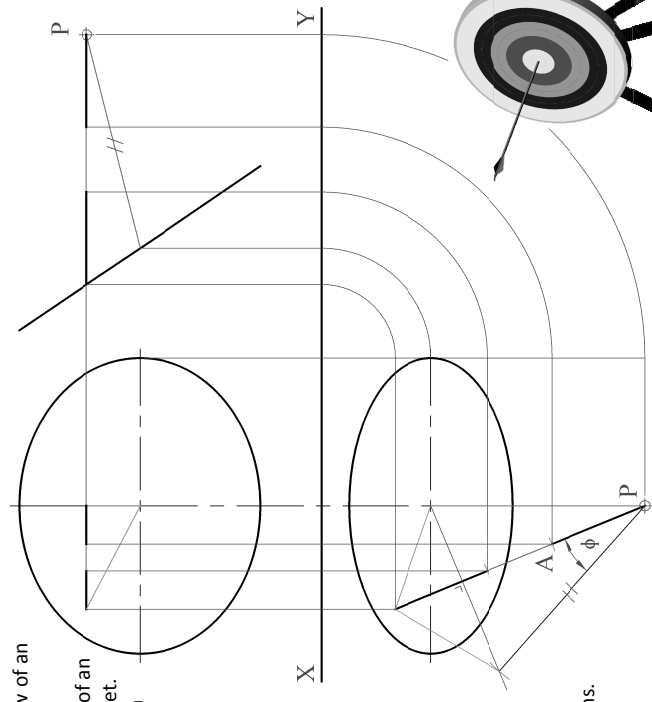
The line **PA** represents the plan of an arrow just before it hits the target.

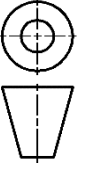
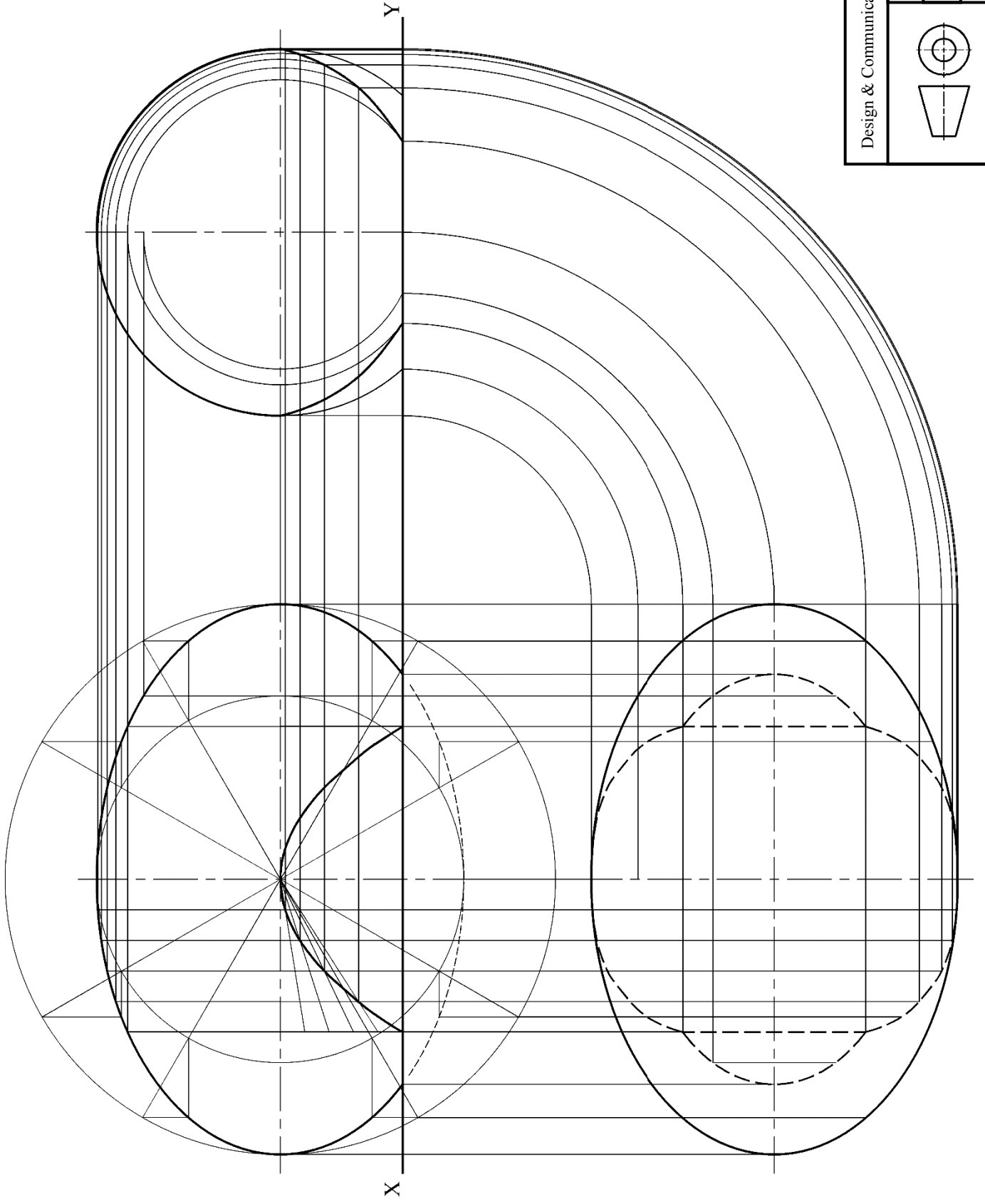
The arrow travels horizontally in a straight flight path.

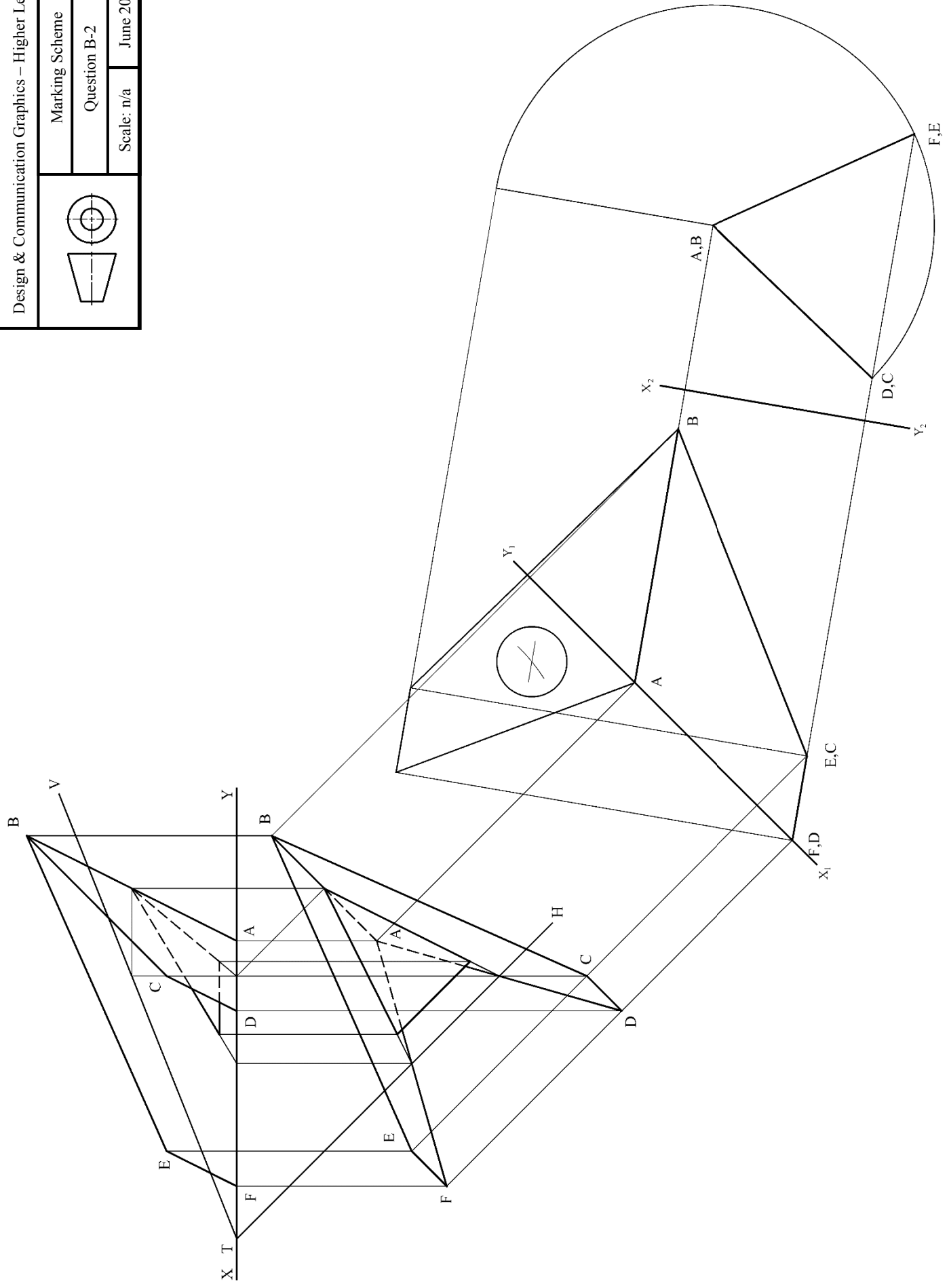
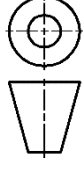
(a) Draw the arrow **PA** in the end view and in the elevation.

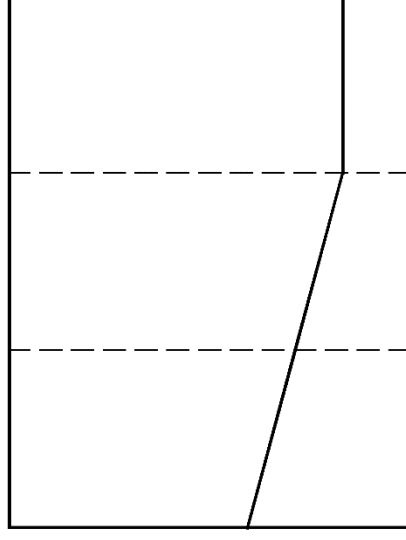
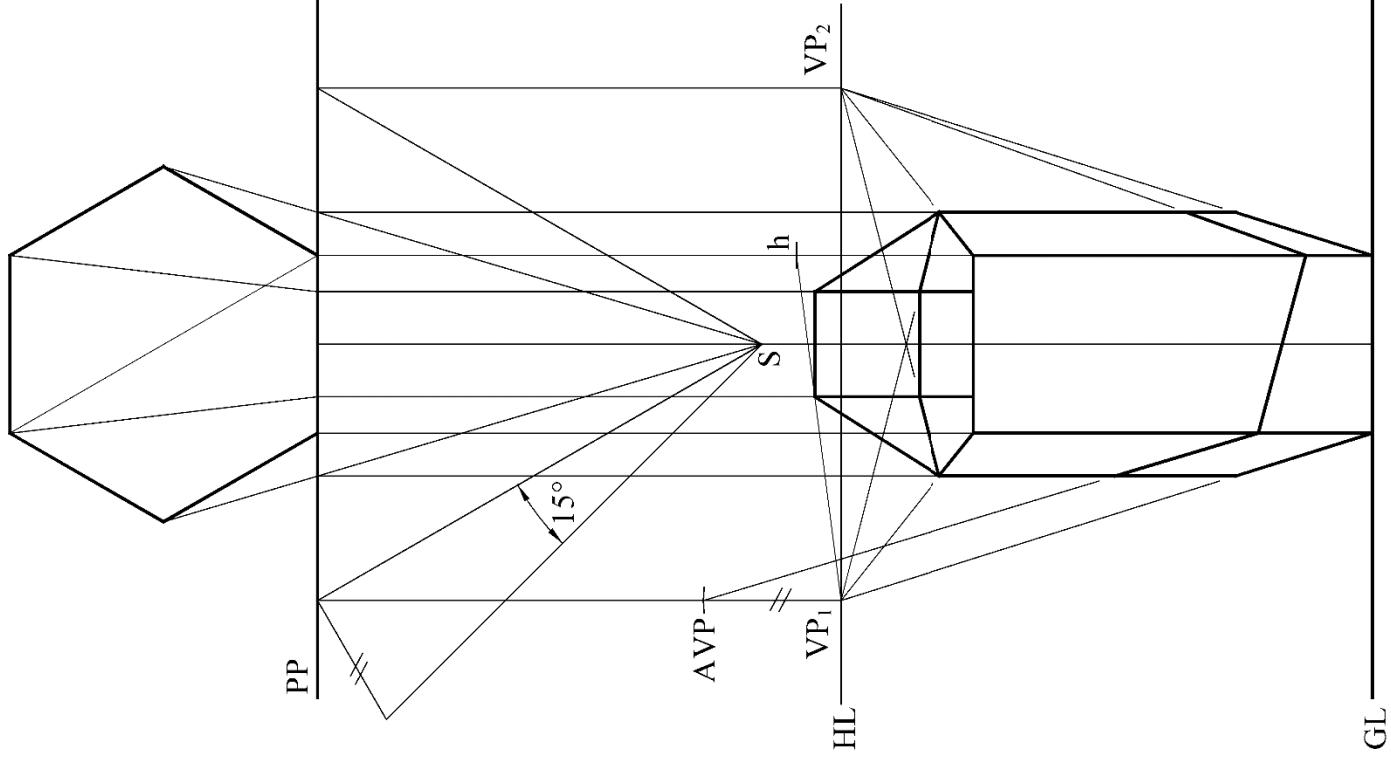
(b) Determine the projections of the arrow when it hits the target.

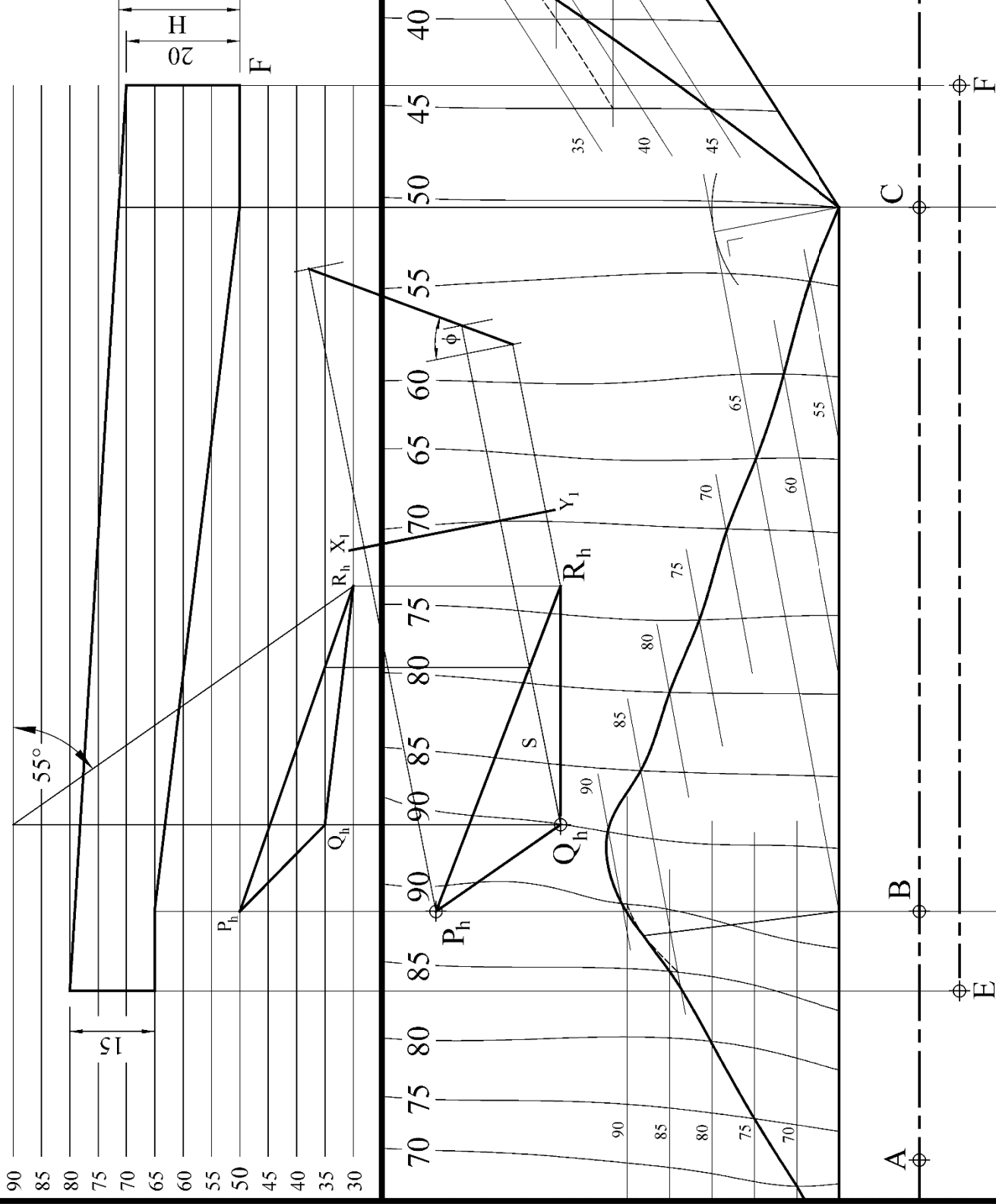
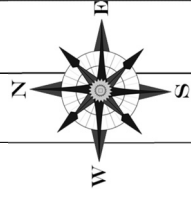
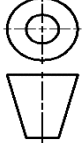
(c) A second arrow, travelling in a straight line, also passes through point **P** and hits the target at the bull's eye (centre point). Determine the true angle between the two flight paths.

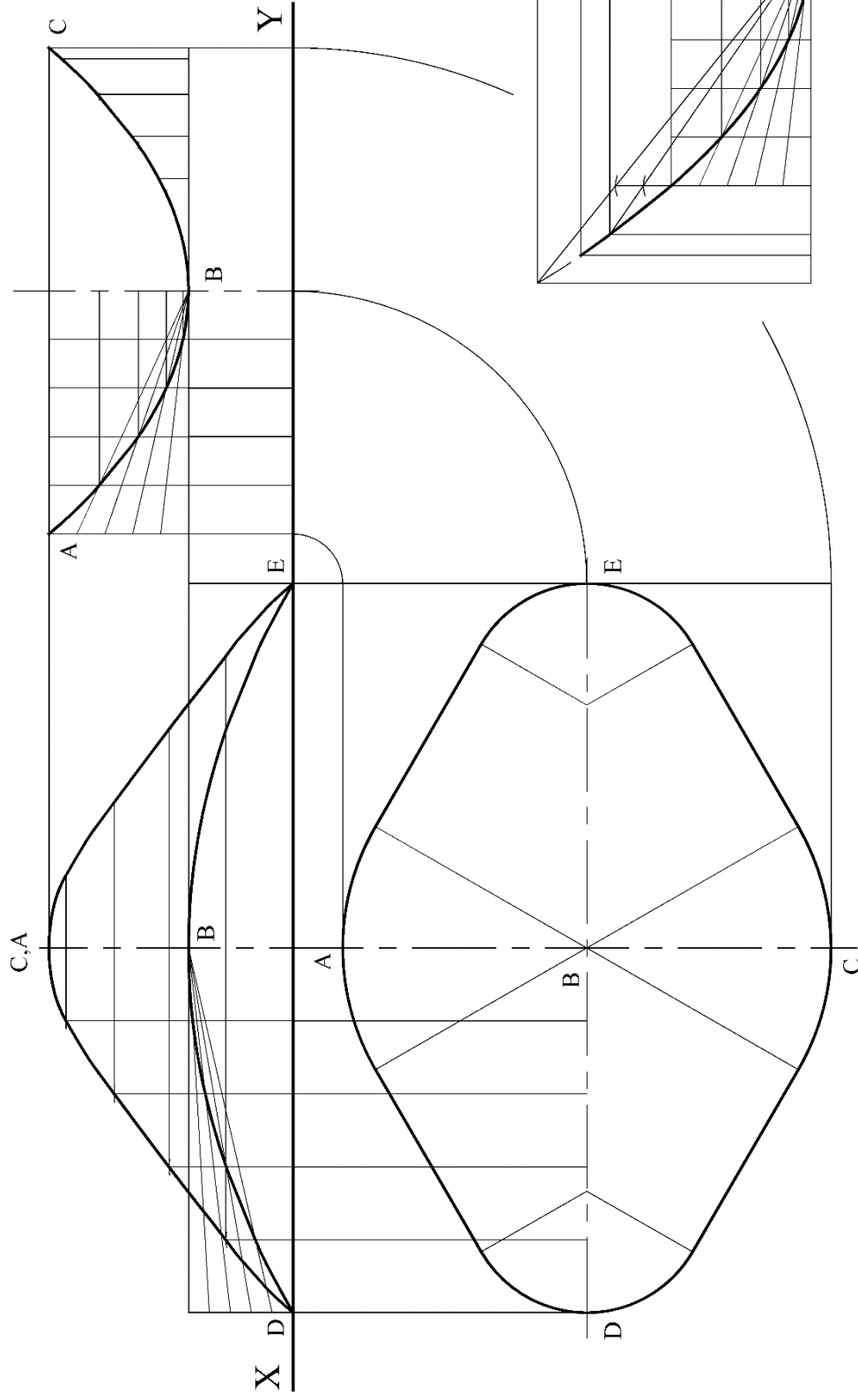


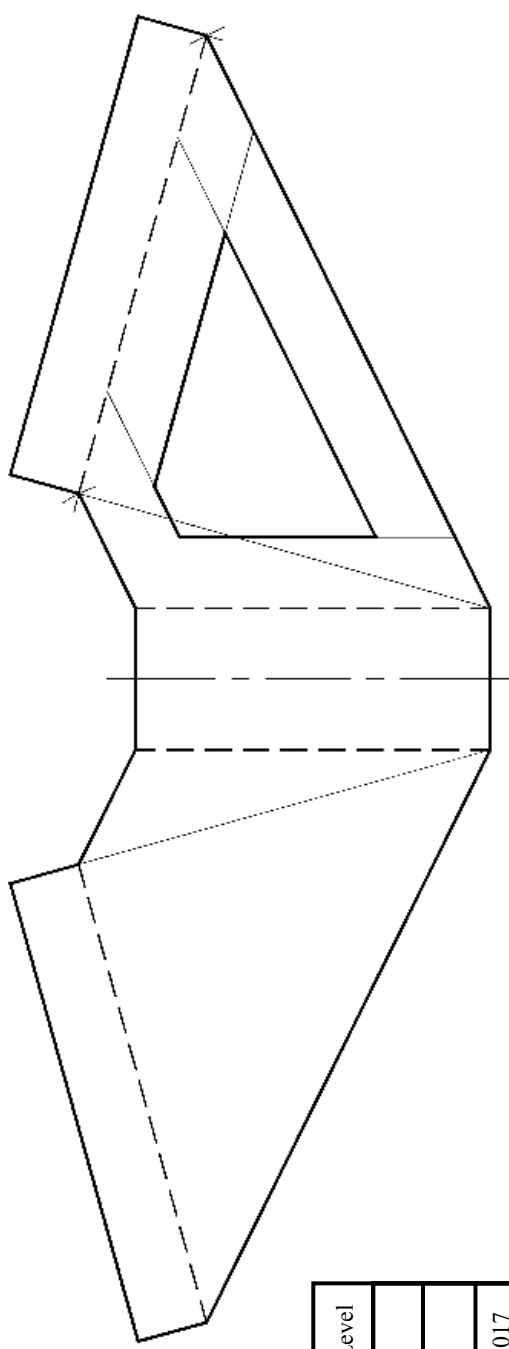
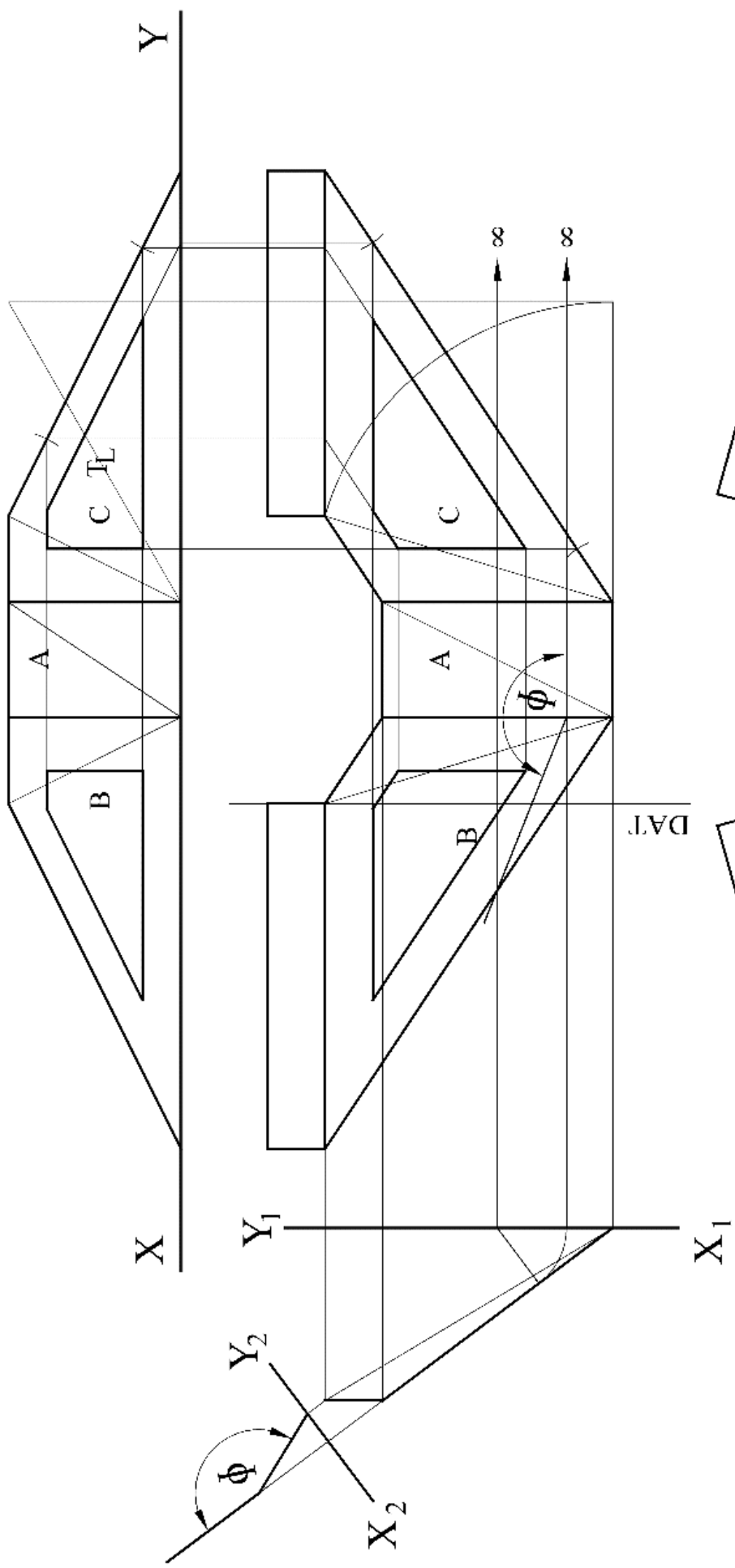


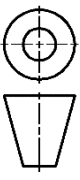


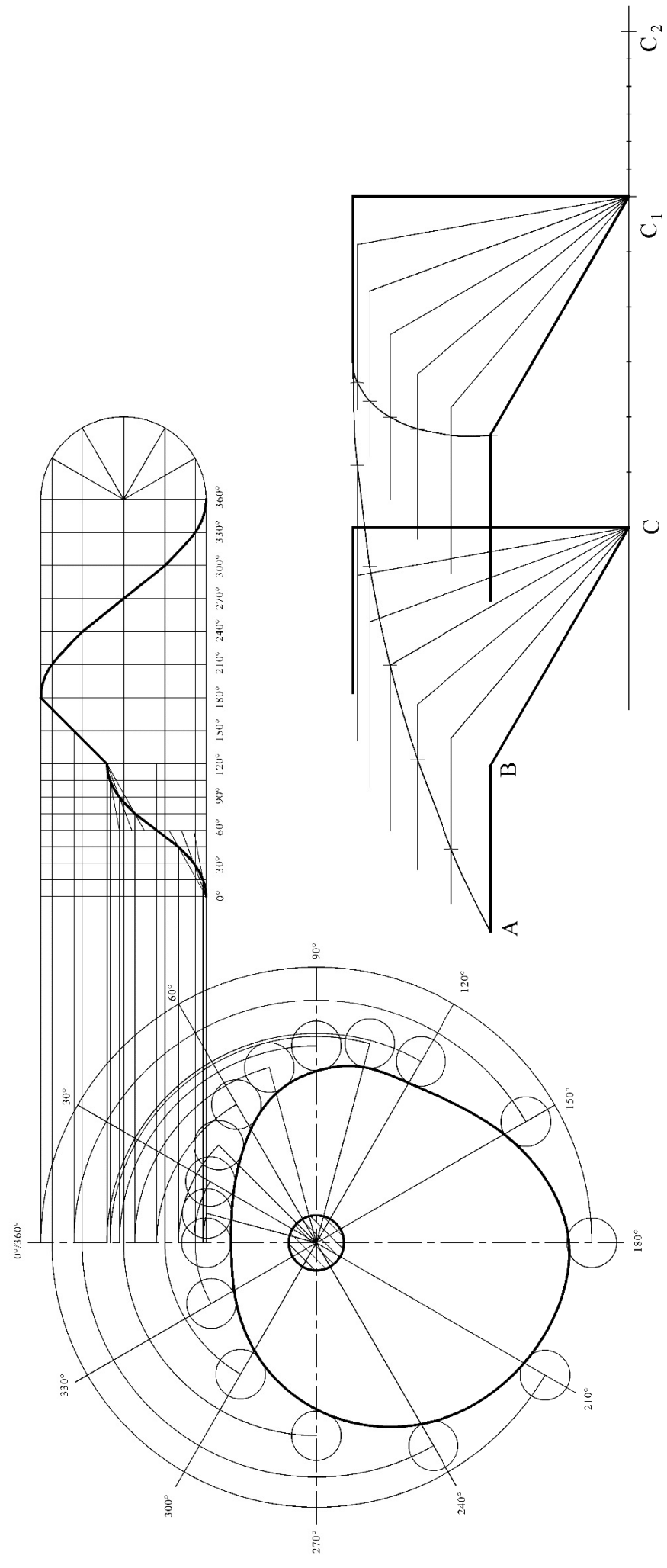
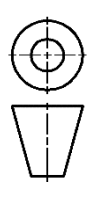


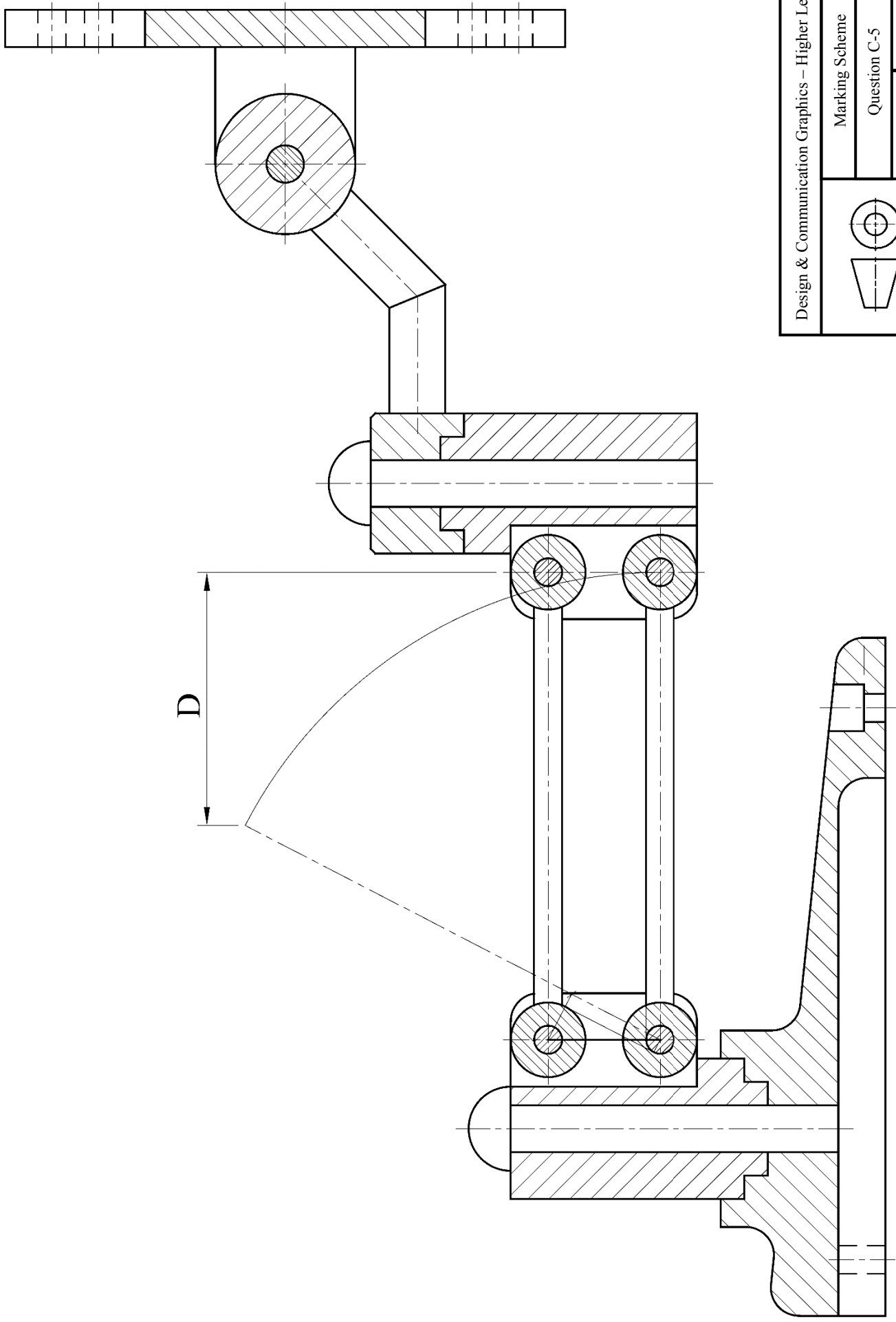


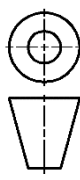




Design & Communication Graphics – Higher Level		
	Marking Scheme	
	Question C-3	
Scale: n/a	June 2017	





Design & Communication Graphics – Higher Level		
	Marking Scheme	
	Question C-5	
	Scale: n/a	June 2017



Design and Communication Graphics Student Assignment—Higher Level Assessment Sheet 2017

Candidate Exam No.

Output	Marking criteria		Marks
1	Design Research - Exploration of main design features using primary & secondary research; Selection of appropriate graphics; Effective layout and presentation of information combining images, sketches & annotations		
	a) Extensive range of relevant criteria considered - excellent presentation	13 - 15	
	b) Most relevant criteria considered - very good presentation	10 - 12	
	c) Some relevant criteria considered - good presentation	7 - 9	
	d) Limited criteria considered - fair presentation	4 - 6	
	e) At least one criterion considered - poor presentation	0 - 3	
2	Design Feature Comparison - 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		
	a) Extensive range of relevant criteria considered - excellent presentation	13 - 15	
	b) Most relevant criteria considered - very good presentation	10 - 12	
	c) Some relevant criteria considered - good presentation	7 - 9	
	d) Limited criteria considered - fair presentation	4 - 6	
	e) At least one criterion considered - poor presentation	0 - 3	
3	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		
	a) Extensive range of relevant criteria considered - excellent presentation	17 - 20	
	b) Most relevant criteria considered - very good presentation	13 - 16	
	c) Some relevant criteria considered - good presentation	9 - 12	
	d) Limited criteria considered - fair presentation	5 - 8	
	e) At least one criterion considered - poor presentation	0 - 4	
4	SolidWorks Parts, Assembly, Drawing and eDrawing files		
	• Adherence to required filing structure	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	10	
	• Assembly – Creation of Assembly environment; Accuracy of parts to facilitate correct assembly; Correct mating of parts; Application of appropriate appearances	5	
	• Factor of difficulty	5	
5	Hardcopy outputs from SolidWorks - Detailed orthographic views of the selected artefact; Section/Detail views where appropriate; Rendered 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		
	a) Extensive range of relevant criteria considered - excellent presentation	13 - 15	
	b) Most relevant criteria considered - very good presentation	10 - 12	
	c) Some relevant criteria considered - good presentation	7 - 9	
	d) Limited criteria considered - fair presentation	4 - 6	
	e) At least one criterion considered - poor presentation	0 - 3	
6	Photorealistic Representation		
	Produce photorealistic computer generated images of the artefact	7	
7	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		
	a) Extensive range of relevant criteria considered - excellent presentation	21 - 25	
	b) Most relevant criteria considered - very good presentation	16 - 20	
	c) Some relevant criteria considered - good presentation	11 - 15	
	d) Limited criteria considered - fair presentation	6 - 10	
	e) At least one criterion considered - poor presentation	0 - 5	
8	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		
	a) Extensive range of relevant criteria considered - excellent presentation	9 - 10	
	b) Most relevant criteria considered - very good presentation	7 - 8	
	c) Some relevant criteria considered - good presentation	5 - 6	
	d) Limited criteria considered - fair presentation	3 - 4	
	e) At least one criterion considered - poor presentation	0 - 2	
9	Hardcopy outputs from SolidWorks – CAD Model; Detailed orthographic views of the proposed solution; Section/Detail views where appropriate; Rendered pictorial view of the CAD model; Photorealistic image; Inclusion of main dimensions, notes and symbols; Appropriate scaling, layout and presentation to be considered		
	• Application of CAD skills	5	
	a) Extensive range of relevant criteria considered - excellent presentation	17 - 20	
	b) Most relevant criteria considered - very good presentation	13 - 16	
	c) Some relevant criteria considered - good presentation	9 - 12	
	d) Limited criteria considered - fair presentation	5 - 8	
	e) At least one criterion considered - poor presentation	0 - 4	
Sub-total			
Marks deducted for pages in excess of maximum			
Total			

