Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2016

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 2016

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 surface development *(16)*

(i) Projection of point **m** from elevation to development view.....**1**

(ii) Location of points $\mathbf{m_1}$ and $\mathbf{m_2}$ on development view **1**

(iii) Projection of "turning point" from elevation to development view.....**2**

(iv) Location of "turning points" on development view **2**

(v) Projection of given points on underside of cylindrical surface to elevation **1**

(vi) Projection of these points to development view **1**

(vii) Vertical sub-division to establish intermediate points on development view **2**

(viii) Location of remaining points on development view **3**

(ix) Completion of surface development ……. (1,1,1).....**3**

(b) Location of Point P on surface development *(4)*

(x) Projection of P to end view and surface development view .....(1,1).....**2**

(xi) Location of point P on surface development view **2**

Total = 20

QUESTION A-2

MARKS

(a) Completion of elevation of flip chart and bar graph *(12)*

(i) Projection of points to elevation **2**

(ii) Location of points on diagonal AB in elevation **3**

(iii) Location of top left hand points of "bars" in elevation **3**

(iv) Location of top point on vertical axis in elevation **1**

(v) Completion of elevation **3**

(b) Inclination of diagonal AB to horizontal plane *(8)*

(vi) Rotation of AB in plan (or use of appropriate auxiliary view) **4**

(vii) Correct determination of required true inclination **4**

Total = 20

QUESTION A-3

MARKS

(a) Vertex and Curve *(15)*

(i) Locate vertex **3**

(ii) Locate points on and outside latus rectum (2,4) **6**

(iii) Locate point inside latus rectum **3**

(iv) Draw curve (Any = 1) **3**

(b) Tangent *(5)*

(v) Identify point 60mm from focus **1**

(vi) Required correct construction and draw tangent ... (3,1) **4**

Total = ***20***

QUESTION A-4

MARKS

(a) Completion of elevation of cube *(11)*

(i) Projection of vertices from plan to elevation **2**

(ii) Transfer of heights from auxiliary view to establish vertices in elevation **2**

(iii) Draw outer edges of cube in elevation **5**

(iv) Draw inner detail of cube in elevation to include correct hidden detail **2**

(b) Plan and elevation of circumscribing sphere *(9)*

(v) Establish centre of required sphere in elevation **2**

(vi) Establish half of a true length of a "body diagonal" to determine radius **1**

(vii) Draw required sphere in elevation and plan ….. (3,3) **6**

Total = ***20***

QUESTION B-1

MARKS

(a) Plan and Outline Elevation *(8)*

(i) Use given coordinates to draw required plan (connecting 6 correct points) **4**

(ii) Establish points A, B, C, D & E in elevation **4**

(b) Dihedral Angle *(12)*

(iii) New X_1Y_1 parallel to line of intersection AB **3**

(iv) Projection of planes and line of intersection on new X_1Y_1 .....**3**

(v) Additional X_2Y_2 perpendicular to line of intersection AB **3**

(vi) Projection of ABC and ABD as lines and indicating dihedral angle.....**3**

(c) Inclination of DEB to horizontal plane *(14)*

(vii) Projections of required horizontal line on DEB … (2,1,2).....**5**

(viii) X_1Y_1 perpendicular to plan of correct horizontal line **5**

(ix) Projection of plane DEB to auxiliary view and indication of true inclination **4**

(d) Elevation of point F and completion of projections *(11)*

(x) New X_1Y_1 parallel to line of intersection DE **2**

(xi) Projection of plane DEB on new X_1Y_1 .....**1**

(xii) Additional X_2Y_2 perpendicular to line of intersection DE **3**

(xiii) Projection of DEB as edge view and drawing of dihedral angle at 170° **2**

(xiv) Completion of elevation by projection of point F back to elevation incl. correct transfer of distances, etc. **3**

Total* = *45

QUESTION B-2

MARKS

(a) Plan and Elevation of structure *(18)*

(i) Construction to draw ellipse in plan **3**

(ii) Draw elliptical curve …..(Any = 1) **3**

(iii) Draw vertical surface (line) in plan **1**

(iv) Draw 2 vertical extreme edges in elevation **2**

(v) Construction to draw parabola in elevation **6**

(vi) Draw required parabolic curve …..(Any = 1) **3**

(b) End View *(12)*

(vii) Transfer of heights to end view **1**

(viii) Transfer of widths to end view **1**

(ix) Draw outline of end view **2**

(x) Hidden detail in end view **4**

(xi) Establish points on "curve" in end view **2**

(xii) Draw required curve in end view ……(Any =1) **2**

(c) True shape of section *(15)*

(xiii) Draw HT and VT in plan and elevation, as given **2**

(xiv) Establish edge view of inclined plane **2**

(xv) Establish points on true shape of required intersection **3**

(xvi) Draw true shape of circular portion of required intersection **6**

(xvii) Draw straight line on true shape of required intersection **2**

Total = ***45***

QUESTION B-3

MARKS

(a) Outline Elevation (11)

(i) Draw main (R 75mm) circle .....(1, 2, 2) **5**

(ii) Locate points E & G and draw required 'scalloped' arc **4**

(iii) Draw outline of legs L_1 & L_2 ..... **2**

(b) Required Plan (11)

(iv) Draw centreline BD in plan …….(1,1,1)..... **3**

(v) Establish centres and draw arcs BCD and BAD in plan ….(2,2,2×2) **8**

(c) Inner curve in Plan (16)

(vi) Project 'extremity' points E & G to plan **2**

(vii) Use of vertical sections (or other correct method) to establish additional points on one quadrant of curve in plan (min. 3) …..(2, 2, 1) **5**

(viii) Establish 'turning points' J & K **2**

(ix) Mirroring of points to other quadrants **2**

(x) Draw correct curve …..(Any = 1) ... (Ellipse = 2)..... **3**

(xi) Complete plan (hidden and other inner detail) **2**

(d) Supporting Legs (7)

(xii) Draw outline of legs L_1 & L_2 in plan **2**

(xiii) Use of any correct method to establish intersection points **2**

(xiv) Location of intersection points in plan and elevation **1**

(xv) Completion of plan and elevation, incl. hidden detail **2**

Total = 45

QUESTION C-1

MARKS

(a) Earthworks for Eastern Pool Edge *(20)*

(i) Measure required 10mm distances perp. to pool edge **4**

Earthworks between B and C (Level) - Embankment

(ii) Draw parallel arcs (centre O) at 10mm intervals **3**

(iii) Identify intersections with contours and draw curve **4**

Earthworks between C and D (Level) - Cutting

(iv) Draw parallel lines at 10mm intervals **4**

(v) Identify intersections with contours and draw curve **5**

(b) Earthworks for Sloping Pathway *(10)*

Earthworks for edge DE of sloping pathway (Falling) – Cutting

(vi) Draw required 10mm arc at E **3**

(vii) Draw parallel lines at 10mm intervals **4**

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

(c) Dip and the Thickness of floor slab *(8)*

(ix) X_1Y_1 (or datum) perpendicular to "Strike Line" **2**

(x) Draw R & S in Auxiliary view ...(2×1) **2**

(xi) Join R & S (in auxiliary view) to determine Dip **2**

(xii) Establish point on bottom of slab and determine required thickness **2**

(d) Vertical Section through steps and floor slab *(7)*

(xiii) Projection of steps to profile view **1**

(xiv) Drawing of steps in profile view ……(4×1) **4**

(xv) Drawing of top and bottom surfaces of floor slab.....(1,1) **2**

Total = 45

QUESTION C-2

MARKS

(a) Plan and Elevation ***(27)***

(i) Draw both circles in plan …(1,1) **2**

(ii) Draw plan of triangular entrance (incl. point of tangency)…(2,2,1) **5**

(iii) Location of base and 'throat' in elevation ….(2,2) **4**

(iv) Draw cylindrical top in elevation …(1,1) **2**

(v) Construction to determine points on one branch of hyperbola in elevation **5**

(vi) Determination of points on second branch in elevation **2**

(vii) Draw hyperbolic curves ….(Any = 1) **3**

(viii) Draw elevation of triangular entrance **2**

(ix) Draw horizontal bands in elevation and plan **2**

(b) End View ***(14)***

(x) Projection (or transfer) of widths and heights to End View **2**

(xi) Draw required hyperbolic curves in end view ….(Any = 1) **3**

(xii) Locate and draw end view of triangular entrance **3**

(xiii) Construction to determine points on ellipse **3**

(xiv) Draw elliptical curve ……(Any = 1) **3**

(c) Focal point and Directrix ***(4)***

(xv) Construction to determine required focal point **2**

(xvi) Construction to determine required directrix **2**

Total = 45

QUESTION C-3

MARKS

(a) Plan and Elevation *(18)*

(i) Draw plan and elevation of package to include square base and circular top **8**

(ii) Angular division of circle in plan into 12 equal parts **2**

(iii) Draw straight line elements in plan as given **4**

(iv) Draw straight line elements in elevation as given **4**

(b) True shape of ACE and true length of AF *(6)*

(v) Draw AC as a true length in required view **1**

(vi) Draw true shape of ACE (construction to locate point E) **2**

(vii) Construction to locate true length of AF **3**

(c) Partial surface development of the transition piece *(6)*

(viii) Use of true lengths to establish points F, G & H in development view **3**

(ix) Draw required development of transition piece **3**

(d) Dihedral angle between surfaces ABC and ABD *(15)*

(x) Establish true length of line of intersection (AB) in auxiliary view ..(2,2,2).....**6**

(xi) Establish plane perp. to AB (triangular lamina or X_2Y_2) **3**

(xii) Construction to determine required dihedral angle **6**

Total = 45

QUESTION C-4

MARKS

(a) Spiral Sculpture ***(24)***

(i) Draw concentric circles (R100 & R40) as given **4**

(ii) Divide circles into 12 equal parts as shown **3**

(iii) Establish start point A and end point B for spiral **2**

(iv) Establish intermediate radii on angular division lines **5**

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

(vi) Establish parallel lines 8mm from either side of angular division lines **4**

(vii) Completion of drawing **3**

(b) Combined Movement Locus ***(21)***

(viii) Draw tipped truck body, tailgate and wheel in required relative positions **6**

(ix) Division of 60° angle into equal parts (min. 6) **2**

(x) Use of angular divisions to establish intermediate for bottom of Tailgate **2**

(xi) Divide wheel into corresponding number of equal parts **2**

(xii) Use of points established at (x) & (xi) above to determine points on locus **6**

(xiii) Draw required locus …(any = 1) **3**

Total = ***45***

QUESTION C-5

MARKS

(a) Sectional Elevation ***(41)***

Assembly (7)

(i) Relative positioning of components.....**7**

Base (9)

(ii) Outline of section **3**

(iii) Cylindrical Boss for Vertical Slide Rod **2**

(iv) Inner detail (relief, fillets × 2 sets and hole) …..(4×1) **4**

Vertical Slide Rods (2)

(v) Rod.....**2**

Link Plate (2)

(vi) Two vertical lines in required positions and top centre … (1, 1) **2**

Hinge Plate (7)

(vii) Outline of Hinge Plate **5**

(viii) Inner detail **2**

Moving Jaw (6)

(ix) Outline of moving jaw **5**

(x) Inner detail **1**

Handle (4)

(xi) Establish correct height (or use of broken section).....**1**

(xii) Establish correct width(s) **2**

(xiii) Circular top **1**

Drawing Completion (4)

(xiv) Representation of tension springs, presentation, hatching and centrelines **4**

(b) Maximum angle of rotation of part 5 ***(4)***

(xv) Use of distance 'QR' in a horizontal orientation **2**

(xvi) Correct use of 50mm arc to determine and indicate maximum rotation angle.....**2**

Total = 45

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

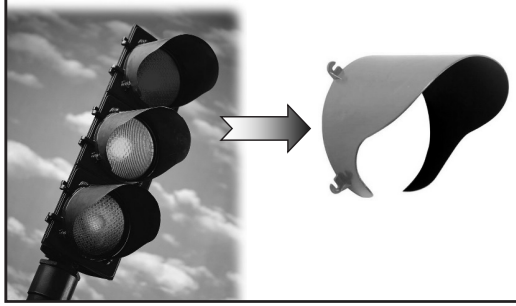
A-1. The images below show details of a curved metal shade from a set of traffic lights.

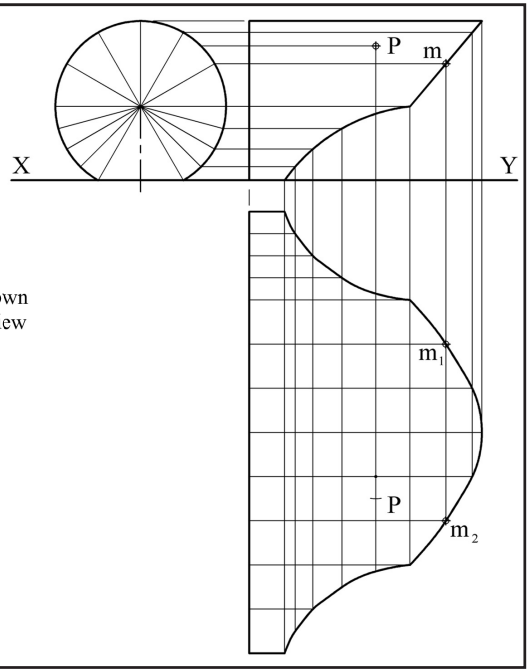
The shade is based on a cylinder which is truncated and shaped as shown.

The drawing on the right shows the circular end view and the elevation of the shade.
The incomplete surface development of the shade has been projected beneath the elevation.

(a) Complete the surface development.

(b) A point **P**, on the surface of the cylinder, is shown in the elevation. Locate this point in the end view and on the surface development.

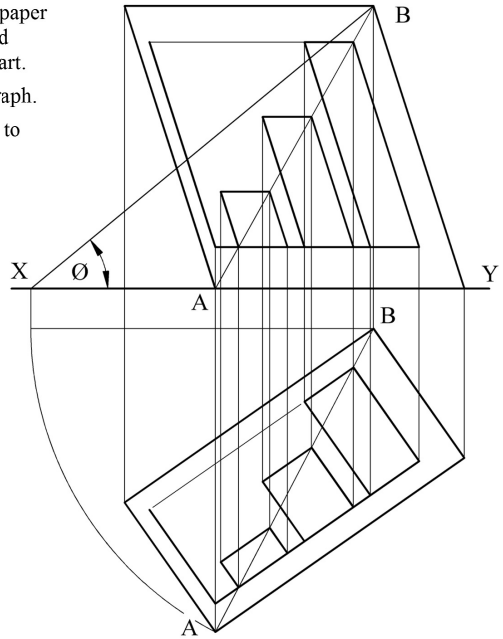




A-2. The image below shows a bar graph presentation on a paper flip chart. The drawing on the right shows the plan and incomplete elevation of a similar bar graph and flip chart.

(a) Complete the elevation of the flip chart and bar graph.

(b) Determine the true inclination of the diagonal **AB** to the horizontal plane.

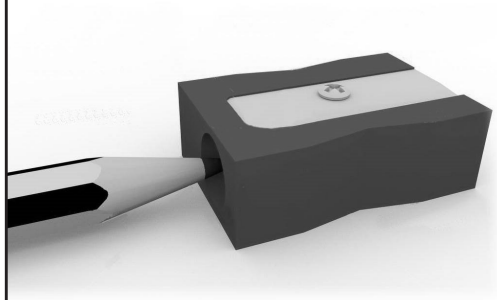


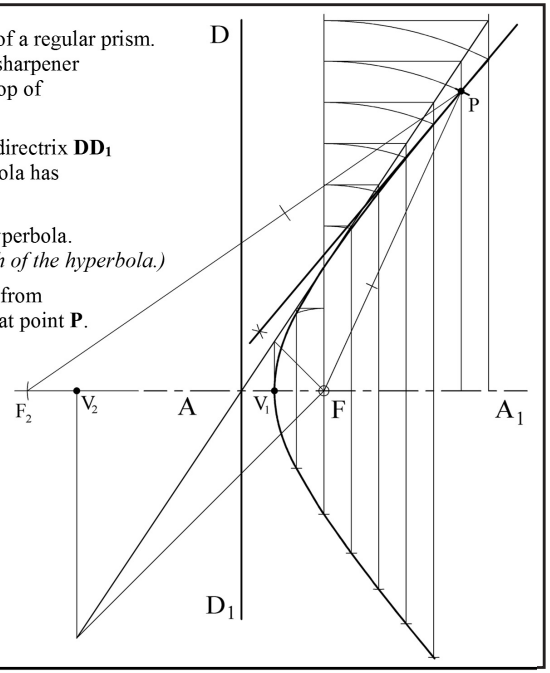
A-3. The 3D graphic below shows a pencil in the form of a regular prism. When a conical top is applied to the pencil by the sharpener it results in a series of hyperbolic curves near the top of the pencil as shown.

The drawing on the right shows the axis $\mathbf{AA_1}$, the directrix $\mathbf{DD_1}$ and a focus **F** for one such hyperbola. The hyperbola has an eccentricity of 3:2.

(a) Locate the vertex and draw a portion of the hyperbola.
*(**Note**: It is only necessary to draw one branch of the hyperbola.)*

(b) Locate a point **P** on the curve which is 60mm from the focus and construct a tangent to the curve at point **P**.



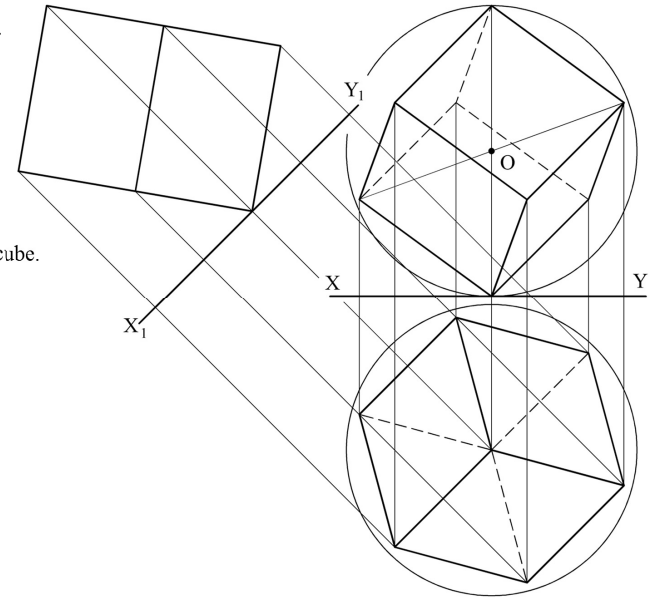


A-4. The image below shows the *Atomium* structure in Brussels which is based on an inclined cube.

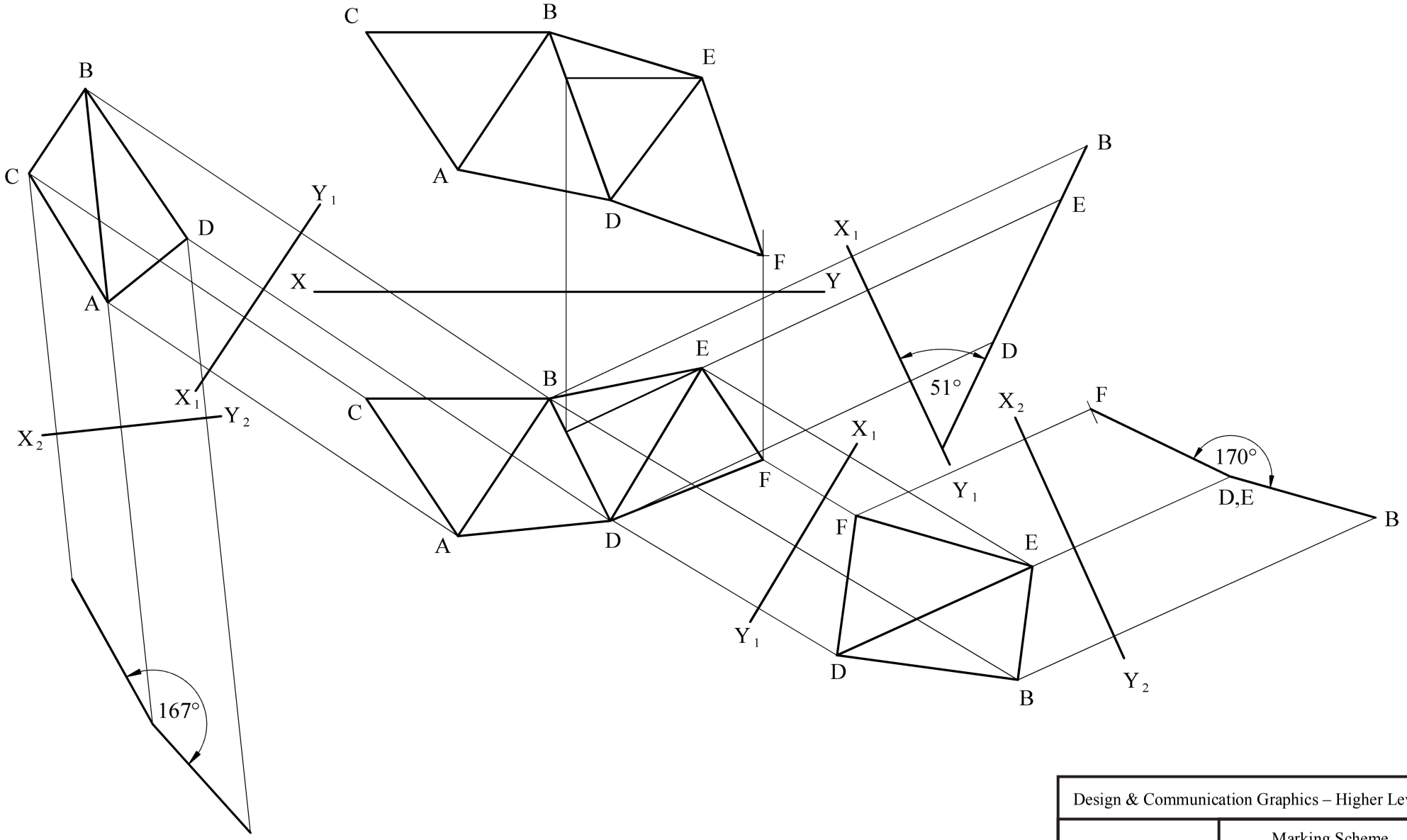
The drawing on the right shows the incomplete projections of a similar inclined cube.

(a) Complete the elevation of the cube.

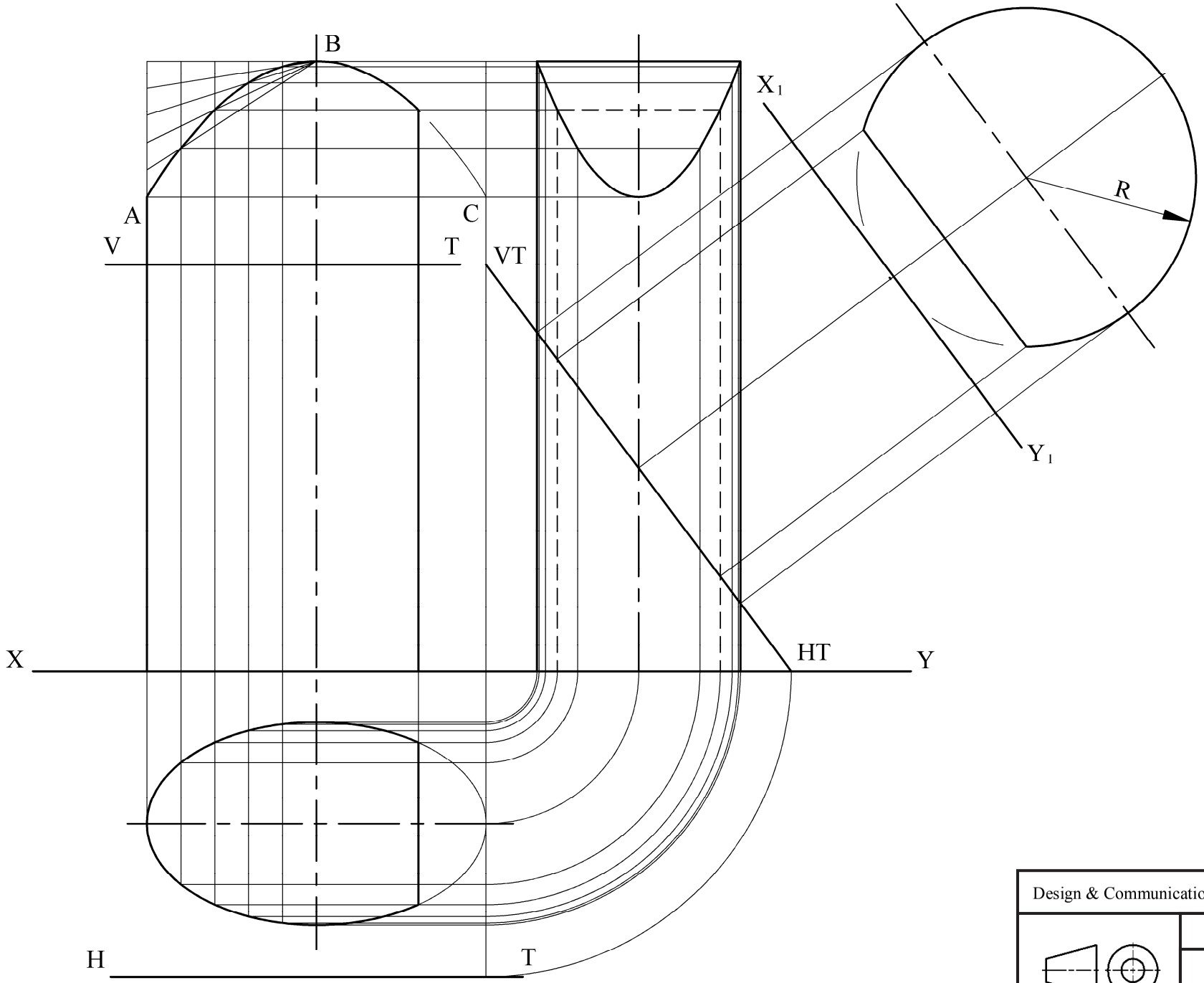
(b) Draw the plan and elevation of the smallest circumscribing sphere that would contain the cube.



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

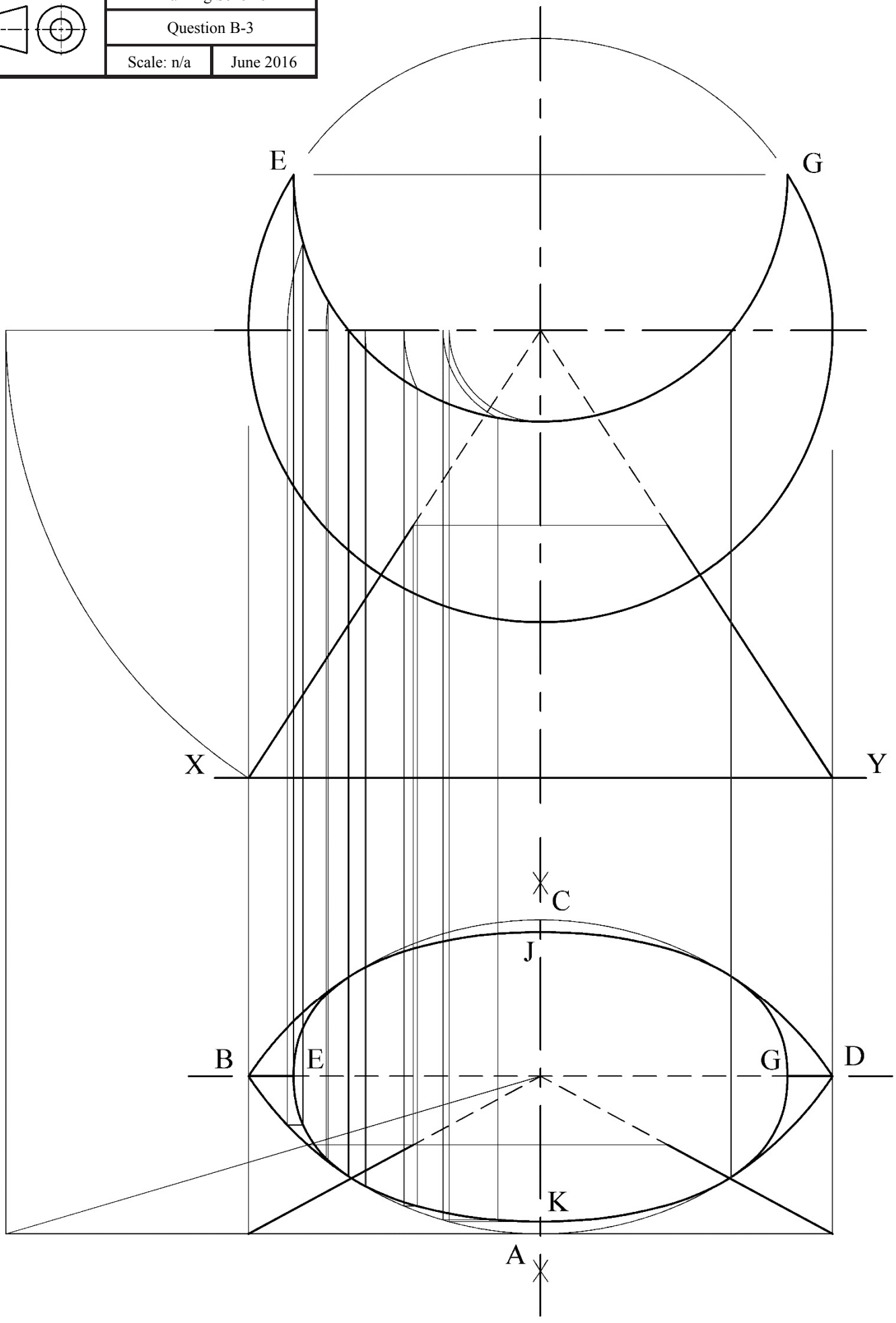


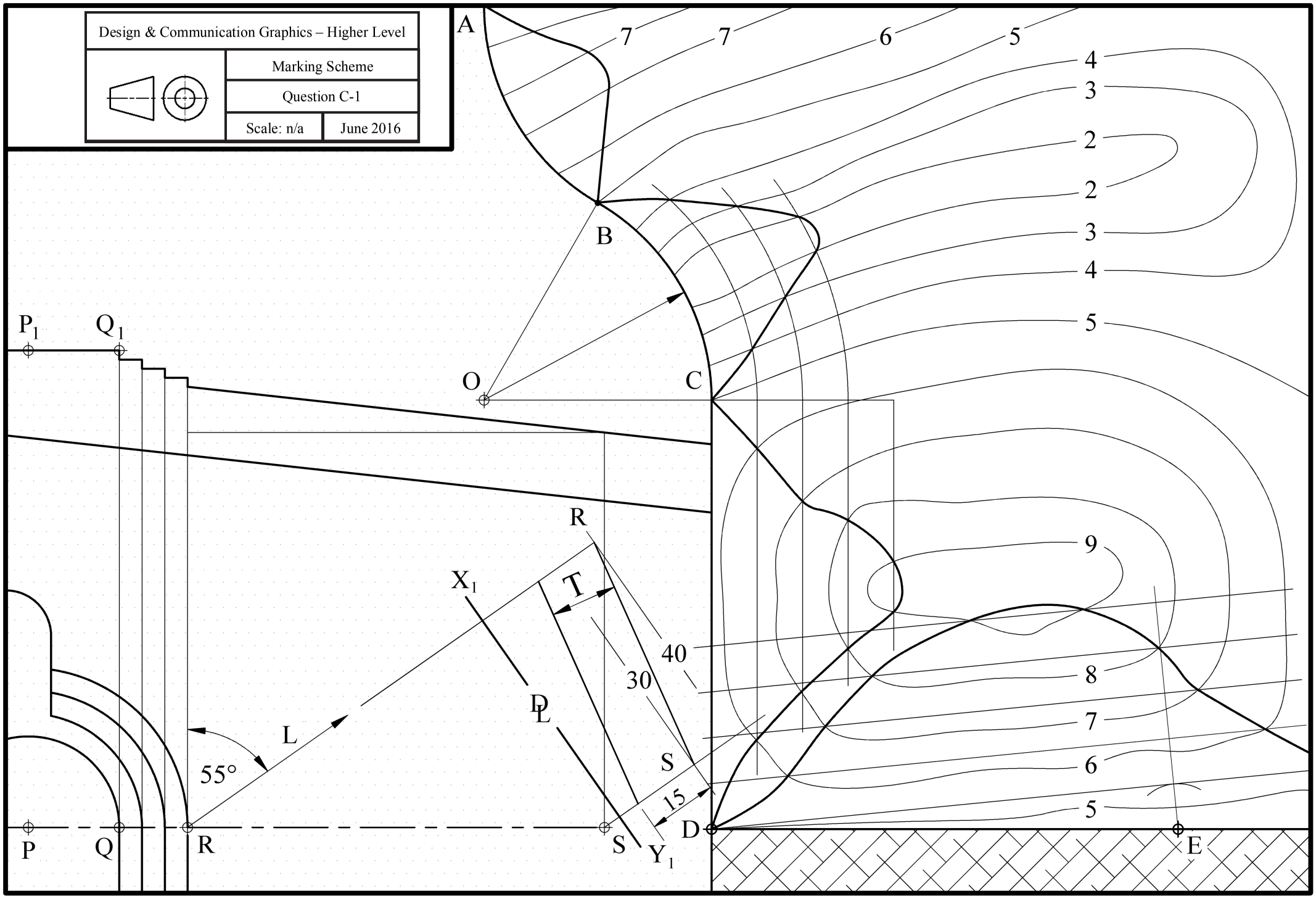
Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question B-1
	Scale: n/a — June 2016



Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question B-2
Scale: n/a	June 2016

Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question B-3
	Scale: n/a — June 2016




Design & Communication Graphics – Higher Level
Marking Scheme
Question C-1
Scale: n/a
June 2016
A
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P_1
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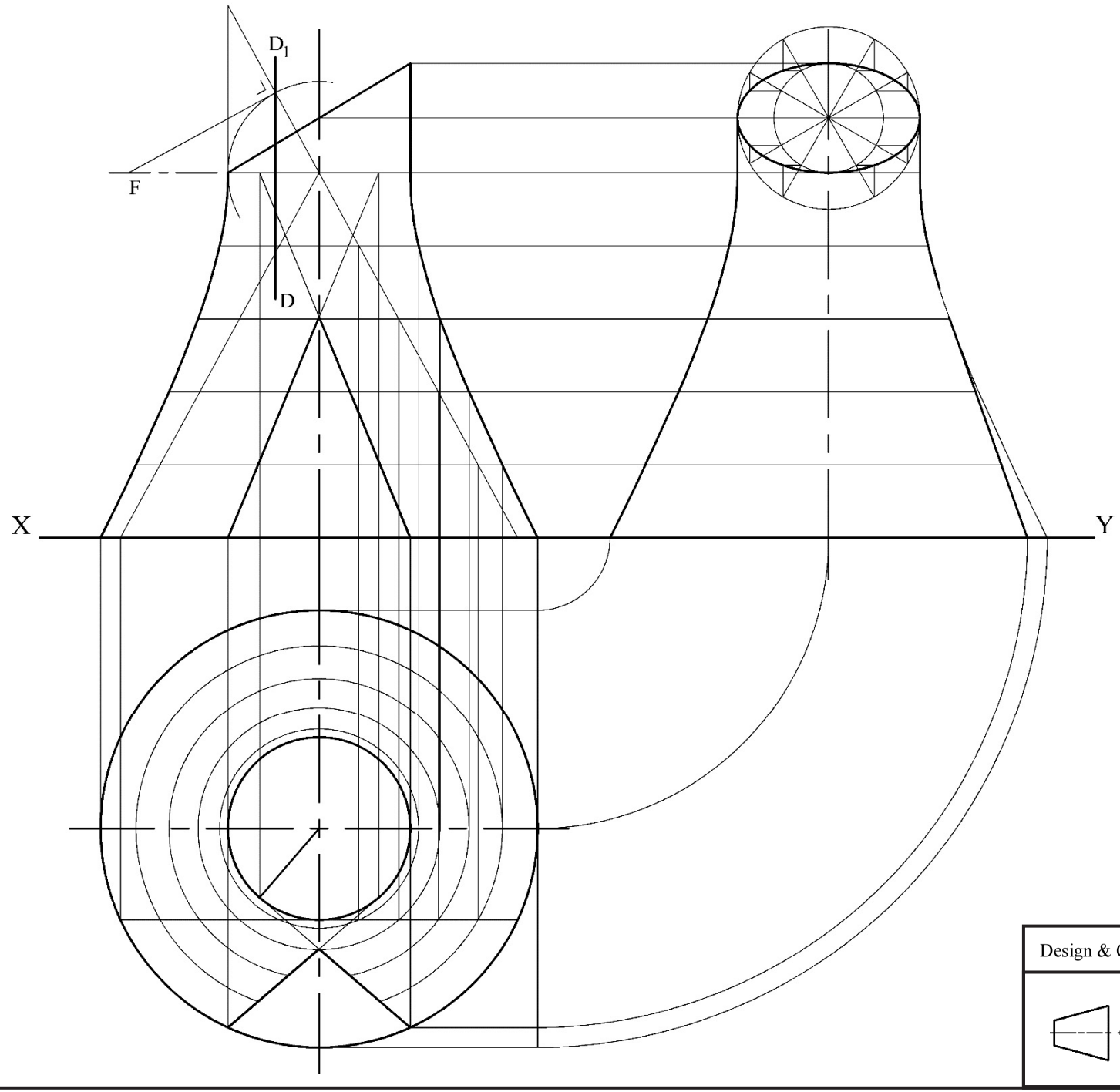
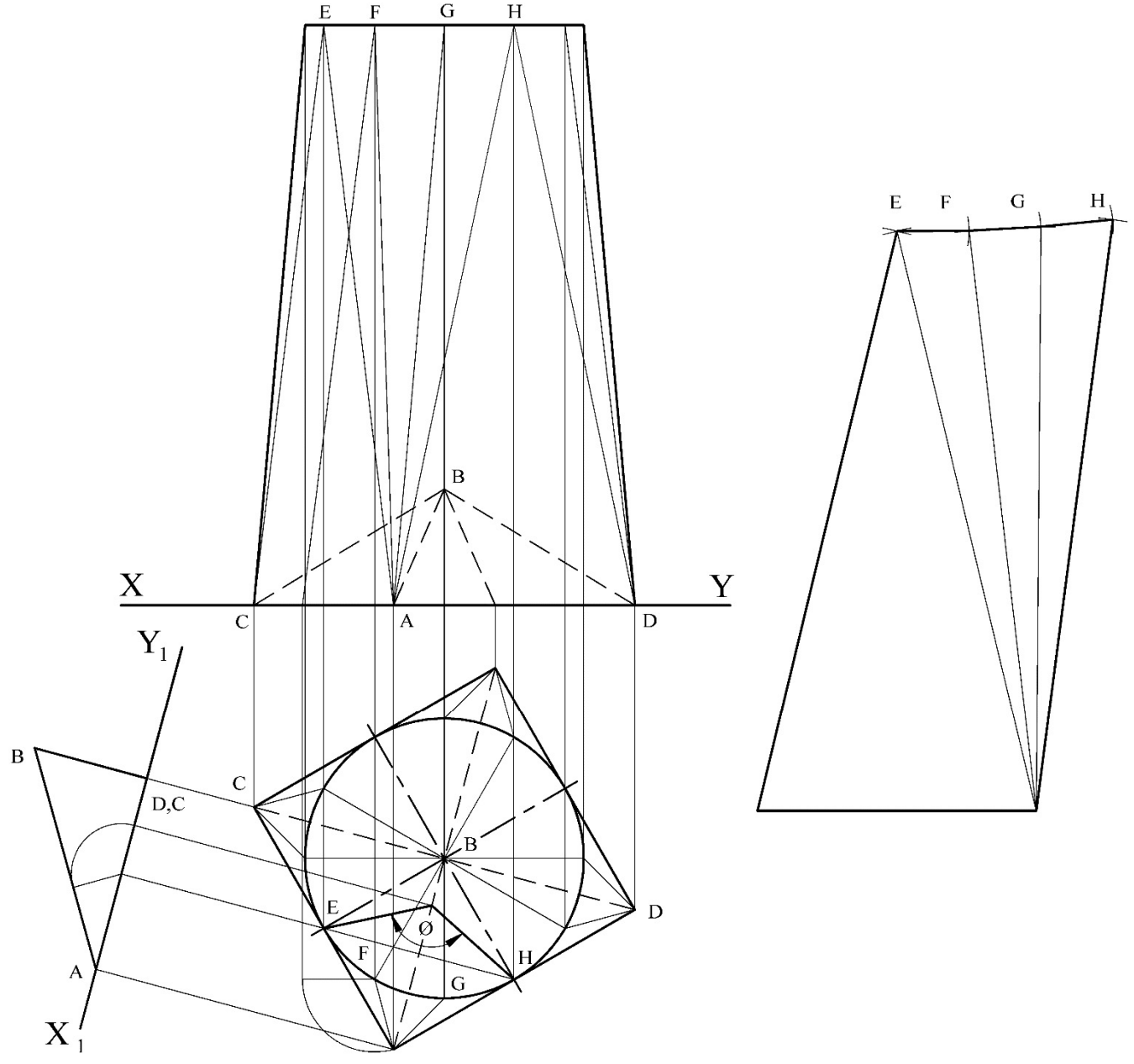
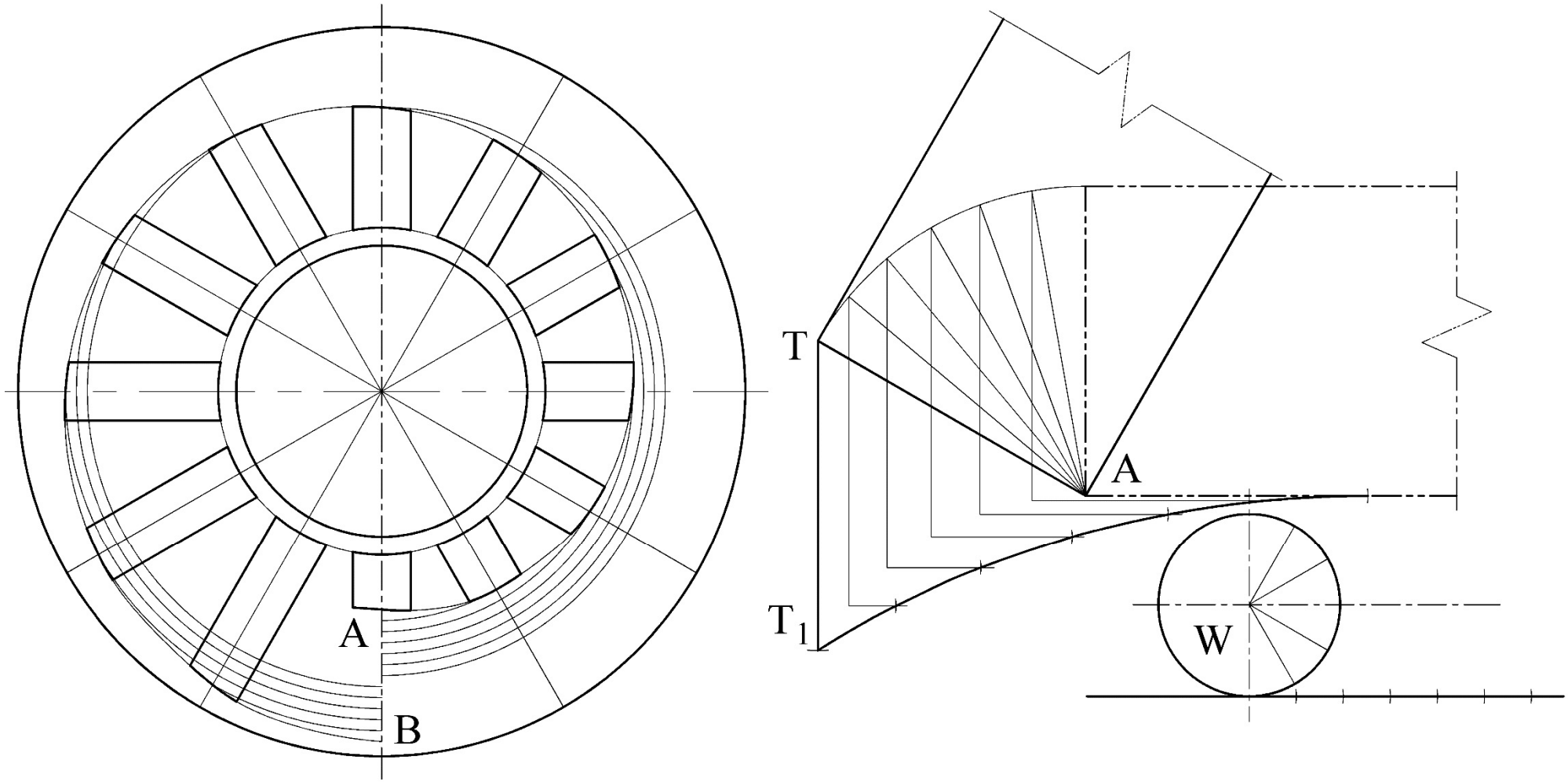


Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question C-2
Scale: n/a	June 2016

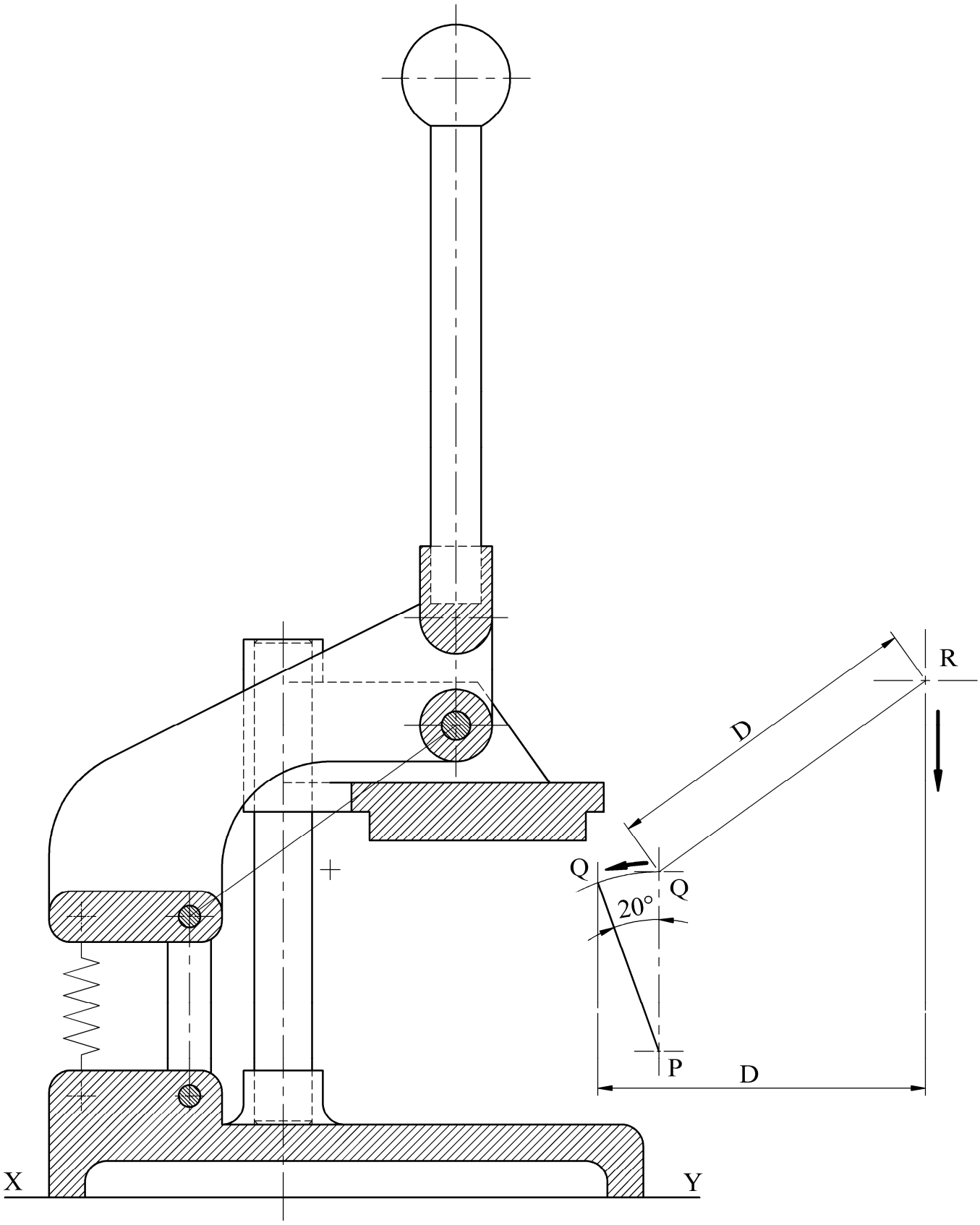
Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question C-3
Scale: n/a	June 2016





Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question C-4
	Scale: n/a | June 2016

Design & Communication Graphics – Higher Level		
	Marking Scheme	
	Question C-5	
	Scale: n/a	June 2016



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Design and Communication Graphics
Student Assignment—Higher Level
Assessment Sheet 2016

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**		
	• **eDrawing of CAD model**	**2**		
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**	