Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2013

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 2013

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 Elevation *(16)*

(i) Projections from plan **1**

(ii) Projections from end view..... **1**

(iii) Identification of points in elevation **2**

(iv) Completion of elevation **9**

(v) Hidden detail **3**

(b) Circumscribing Sphere *(4)*

(vi) Identification of (or construction to determine) true length of body diagonal **2**

(vii) Draw required sphere in end view **2**

Total = ***20***

QUESTION A-2

MARKS

(a) Plan of sphere *(13)*

(i) Location of centre of sphere in elevation when tangential to pin **2**

(ii) Projection to correct point in plan..... **3**

(iii) Rotation about centre of pin in plan **3**

(iv) Location of required centre in plan …(1,1)..... **2**

(v) Draw required plan of sphere ….(Any = 1) **3**

(b) Plan of cylinder *(7)*

(vi) Draw line from centre of pin through P in plan **1**

(vii) Draw 2 sets of corresponding arcs/lines ….(2,1)..... **3**

(viii) Draw locus to determine required centre **2**

(ix) Draw required plan of cylinder **1**

Total = ***20***

QUESTION A-3

MARKS

(a) Interpenetration *(14)*

(i) Location of penetration points on RHS in plan **3**

(ii) Joining of points on RHS in plan, incl. hidden detail …(3x1) **3**

(iii) Location of penetration points on LHS and top in plan **3**

(iv) Draw required section in elevation **1**

(v) Draw corresponding section in plan to locate "crossover points" on edge 'de' **1**

(vi) Joining of points on LHS and top in plan, incl. hidden detail …(3x1) **3**

(b) True shape of triangle abc *(6)*

(vii) Rabattment of triangle in elevation or line in plan (or correct use of X_1Y_1) **1**

(viii) Correct use of projection lines **1**

(ix) Determination of required true shape **4**

Total = ***20***

QUESTION A-4

MARKS

(a) Determine relationship between lines AB and CD *(12)*

(i) Extend projections of AB and CD to intersect in elevation **5**

(ii) Extend projections of AB and CD to intersect in plan **5**

(iii) Use of tick to indicate answer **2**

(b) Determine true length of AC *(8)*

(iv) Join A to C in plan and elevation **2**

(v) Rotation of AC in plan (or elevation) **3**

(vi) Construction in elevation (or plan) to determine true length **3**

Total = ***20***

QUESTION B-1

MARKS

(a) Plan and elevation of structure *(10)*

(i) Draw given plan orientated as shown **5**

(ii) Project given elevation from plan **5**

(b) Dihedral angle between planes A and B *(21)*

(iii) X_1Y_1 parallel to line of intersection in plan (or elevation) **4**

(iv) Projection of planes onto auxiliary view **4**

(v) X_2Y_2 perp. to true length of line of intersection **4**

(vi) Projection of planes onto 2nd auxiliary view **3**

(vii) Indication of dihedral angle **6**

(c) True shape of surface A *(8)*

(viii) Rabattment of surface A in plan and projection to elevation ….(2,2) **4**

(ix) Determination of required true shape (T.S.) in elevation **4**

(d) Projections of movement path *(6)*

(x) Location of line from S, perp. to line of intersection on T.S. of surface A **2**

(xi) Location of above line in elevation **1**

(xii) Completion of path in elevation **2**

(xiii) Completion of path in plan **1**

Total = ***45***

QUESTION B-2

MARKS

(a) Axonometric axes and isosceles triangle *(7)*

(i) Draw Y, X and Z axes at correct angles .....(1,1,1)..... **3**

(ii) Establish 7m base and complete isosceles triangle .....(2,1,1) **4**

(b) End view and Elevation orientated as shown *(14)*

(iii) Draw line b_1c_1 and draw semicircle **2**

(iv) Establish orientation of Y and Z axes **2**

(v) Draw end view on established axes **4**

(vi) Draw line a_1c_1 and draw semicircle..... **2**

(vii) Establish orientation of X and Y axes **2**

(viii) Draw elevation on established axes **2**

Complete axonometric projection *(18)*

(ix) Projections from elevation and end view (as shown) **2**

(x) Draw given portion of axonometric projection..... **2**

(xi) Determine rectangular top in axonometric **2**

(xii) Determine points on curves in axonometric **9**

(xiii) Draw correct curves **2**

(xiv) Complete axonometric projection **1**

(c) Parabolic Kick *(6)*

(xv) Establish point F and vertex for parabola in end view ….(1,1) **2**

(xvi) Draw required portion of parabola to determine solution..... **4**

Total = ***45***

QUESTION B-3

MARKS

(a) Perspective *(34)*

(i) Draw the given elevation .....(5 x 1)..... **5**

(ii) Draw the outline plan including diagonals **5**

(iii) Completion of plan **4**

(iv) Position spectator and plan of picture plane (1, 2)..... **3**

(v) Plan of vanishing points..... **2**

(vi) Ground line, horizon line, vanishing points in elevation (1, 1, 1) **3**

(vii) Projection lines from plan to spectator **2**

(viii) Perspective of base lines of structure ....(4x1) **4**

(ix) Measure and apply height H^1 and complete main pyramid body **3**

(x) Determine auxiliary vanishing point and complete triangular entrance **3**

(b) Skew Lines *(11)*

(xi) Interpretation of coordinates and drawing of skew lines **2**

(xii) Creating a plane containing AB (or CD) and parallel to CD (or AB) **2**

(xiii) Elevation and plan of horizontal line on parallel plane **2**

(xiv) X_1Y_1 perpendicular to plan of horizontal line **2**

(xv) Projections of lines in 1^{st} auxiliary elevation … (parallel) **2**

(xvi) Indication of shortest distance **1**

Total = 45

QUESTION C-1

MARKS

(a) Earthworks for roadway ***(28)***

Earthworks between A and B (Level) - Cutting

(i) Draw parallel lines at 5mm intervals **2**

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

Earthworks between A and B (Level) - Embankment

(iii) Draw parallel lines at 7.5mm intervals **2**

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

Earthworks between B and C (Falling) - Cutting

(v) Draw required arc **4**

(vi) Draw parallel lines at 5mm intervals **4**

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

Intersection between level and rising earthworks

(viii) Establishment of additional points .....(3,1) **4**

(ix) Completion of intersection **1**

(b) Profile on DE ***(7)***

(x) Measure and draw height lines at 5mm intervals..... **2**

(xi) Projections from intersections between line DE and contours **2**

(xii) Draw outline of profile..... **2**

(xiii) Completion of profile to include edge view of cut surfaces **1**

(c) Strike and Dip ***(10)***

(xiv) Draw triangle PQR in plan and elevation .....(1,2)..... **3**

(xv) Determine strike line **3**

(xvi) Draw X_1Y_1 perp. to strike line **2**

(xvii) Determine dip **2**

Total = 45

QUESTION C-2

MARKS

(a) Plan of uplighter *(17)*

(i) Draw rectangular outline in plan …(1,1) **2**

(ii) Construction to determine points on parabola ABC **5**

(iii) Draw curve ABC .....(any = 1) **3**

(iv) Construction to determine points on inner curve (translation) **4**

(v) Complete plan including inner curve ..... (any curve = 1) **3**

(b) Projected End View *(7)*

(vi) Draw outline End View (excluding curve) **3**

(vii) Construction to determine points on parabola BD **2**

(viii) Draw curve BD .....(any = 1) **2**

(c) Elevation of uplighter *(15)*

(ix) Project and draw edge view of top and bottom curves **4**

(x) Construction to determine points on hyperbolic curves in elevation **8**

(xi) Draw hyperbolic curves .....(any = 1)..... ..... **3**

(d) Determination of asymptotes *(6)*

(xii) Identification of centre point as the point of intersection of asymptotes **2**

(xiii) Construction to determine additional point on first asymptote **3**

(xiv) Draw second asymptote **1**

Total = 45

QUESTION C-3

MARKS

(a) Plan of diamond and elevation of top surfaces *(16)*

(i) Draw square outline in plan **2**

(ii) Determine and draw outer octagon **4**

(iii) Determine and draw inner octagon **5**

(iv) Project to elevation and draw top surfaces ....(1,2,2) **5**

(b) Dihedral angle between surfaces A and B *(10)*

(v) X_1Y_1 parallel to line of intersection **2**

(vi) View of surfaces showing true length of line of intersection **4**

(vii) X_2Y_2 perpendicular to line of intersection **2**

(viii) Determination of dihedral angle **2**

(c) Elevation of underside of diamond *(9)*

(ix) Construction to allow application of 95mm T.L. (auxiliary or rabattment)..... **4**

(x) Correct determination of lower apex of diamond ...(2,2)..... **4**

(xi) Completion of elevation **1**

(d) Dihedral angle between surfaces D and F *(10)*

(xii) X_1Y_1 parallel to line of intersection **2**

(xiii) View of surfaces showing true length of line of intersection **3**

(xiv) X_2Y_2 perpendicular to line of intersection **2**

(xv) Determination of dihedral angle..... **3**

Total = 45

QUESTION C-4

MARKS

(a) Link Mechanism *(23)*

(i) Draw links and circular paths as given....(5x1) **5**

(ii) Divide circle into equal parts (min 12) **2**

(iii) Locate positions for point B **6**

(iv) Locate point C in all positions… **6**

(v) Draw arm CD in all positions **2**

(vi) Draw required locus **2**

(b) Cam and Displacement Diagram *(22)*

(vii) Draw camshaft and inner minimum diameter circle **2**

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

(ix) Construction to determine points on involute **3**

(x) Draw involute .... (any = 1) **2**

(xi) Completion of cam profile (circles and common tangent) **3**

(xii) Horizontal divisions on displacement diagram **2**

(xiii) Transfer of heights to displacement diagram **3**

(xiv) Complete displacement diagram **2**

(xv) Determination and indication of maximum displacement distance **2**

Total = 45

QUESTION C-5

MARKS

(a) Sectional elevation ***(41)***

Assembly (6)

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

Base Mount (12)

(ii) Outline of section **6**

(iii) Inner detail (holes x 3, slot, hinge support and back line) …..(6x1) **6**

Glass Body (2)

(iv) Rectangles x 2 .....**2**

Lid (4)

(v) Outline **2**

(vi) Inner detail (incl. chamfers and fillets) **2**

Platform Guide Rod (3)

(vii) Outline **2**

(viii) Detail (incl. chamfers and threaded end) **1**

Height Adjustment Lever (4)

(ix) Drawing of horizontal and inclined axes **2**

(x) Offsetting to determine edges of bar **1**

(xi) Completion of Height Adjustment Lever **1**

Roller (1)

(xii) Drawing of roller outline **1**

Candle Platform (3)

(xiii) Outline **1**

(xiv) Inner detail (incl. fillets) **2**

Drawing Completion (6)

(xv) Presentation, Hatching and Centrelines …(4,1,1) **6**

(b) Maximum height travel of platform ***(4)***

(xvi) Locate centre of roller in rotated position **2**

(xvii) Draw roller and indicate required height **2**

Total = 45

SECTION A - Core - Answer **Any Three** of the questions on this A3 sheet

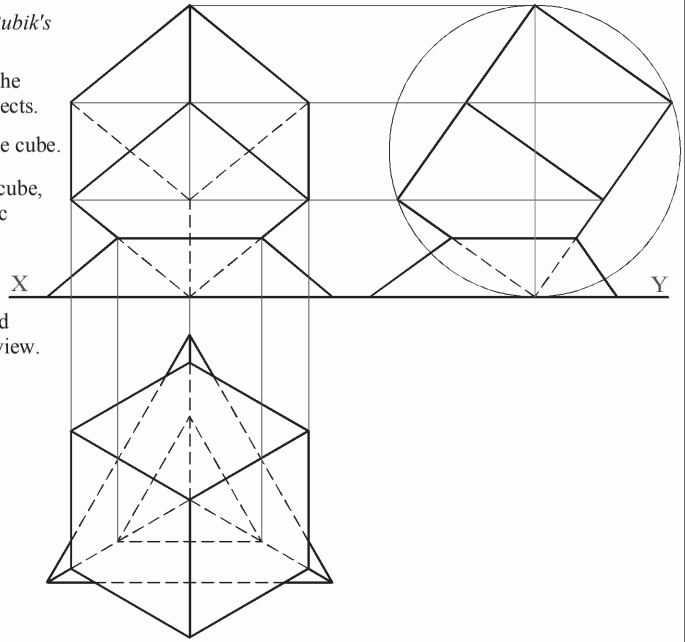
A-1. The 3D graphic below shows a *Rubik's Cube* and a display stand.

The drawing on the right shows the incomplete projections of the objects.

(a) Complete the elevation of the cube.

(b) It is planned to package the cube, without the stand, in a plastic sphere.

Determine the diameter of the smallest possible sphere that will contain the cube and draw that sphere in the end view.

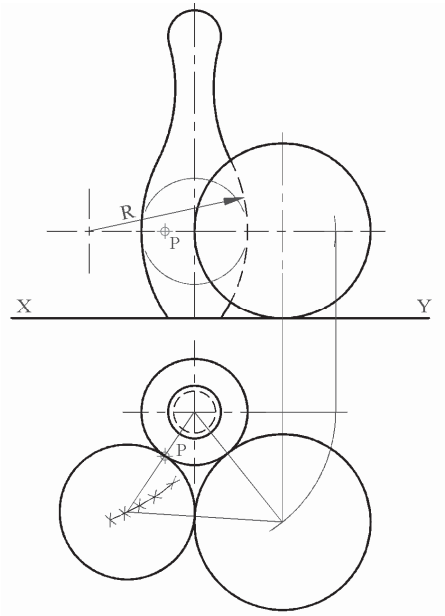


A-2. The graphic below shows a bowling ball and pins.

The drawing on the right shows the elevation and incomplete plan of one of the pins and the bowling ball in contact with each other.

(a) Complete the plan of the solids in contact.

(b) Draw the **plan** of a right cylinder which stands upright on the horizontal plane. The top of the cylinder touches the pin at the point **P** and also touches the ball.

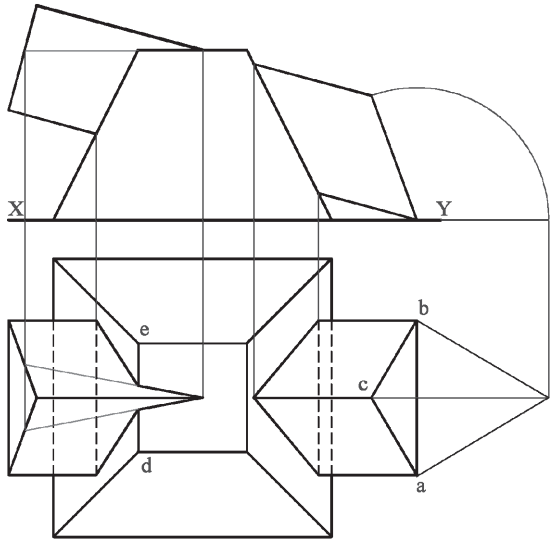


A-3. The image below shows a sign outside the offices of a company called '*Key Technologies'*. In the sign, a truncated copper pyramid is intersected by a triangular steel prism.

The drawing on the right below shows the elevation and incomplete plan of the solids which penetrate each other.

(a) Complete the plan, showing all lines of interpenetration. Use a **section plane** to find the "crossover points" on edge **'de'**.
(The image below shows a keyhole logo, which should be omitted on your drawing.)

(b) Determine the true shape of the triangle **abc**.

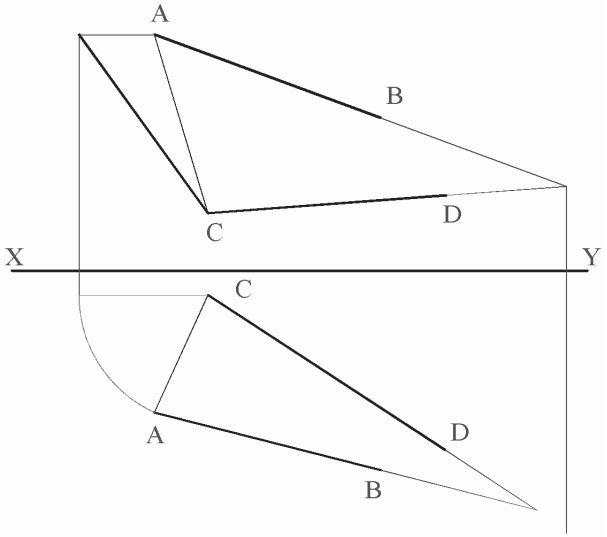


A-4. Lasers are often used in *Crime Scene Investigation* to determine the trajectory (flight path) of bullets. In the drawing on the right, two bullet paths are represented by the lines **AB** and **CD**.

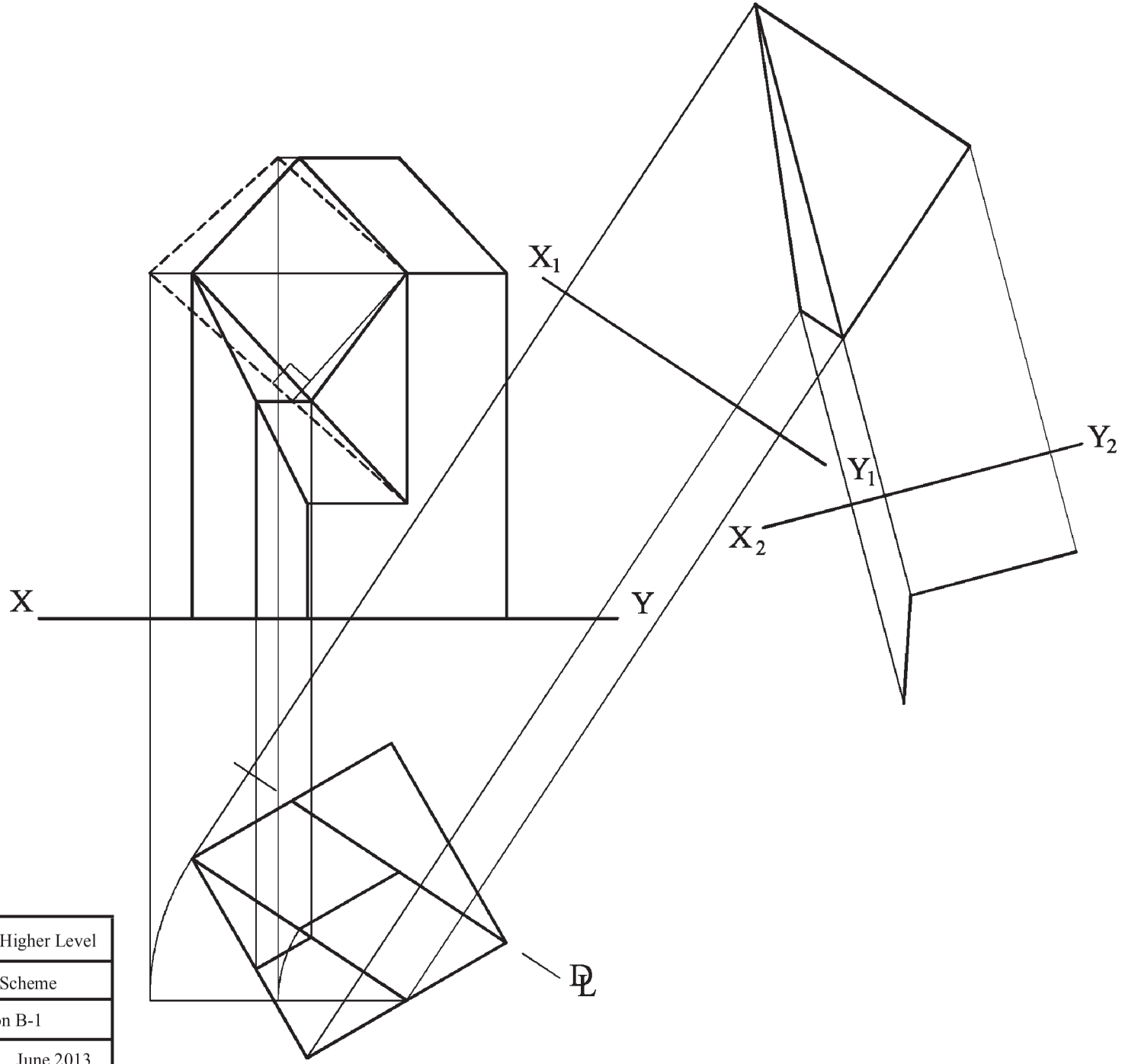
(a) Using geometric constructions, determine if the bullets were fired from the same location, by establishing if the lines are:

☑ **Skew lines**
or
☐ **Intersecting lines**
(Indicate using a tick '✓').

(b) Draw a line, joining points **A** and **C**, and determine the true length of that line.



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



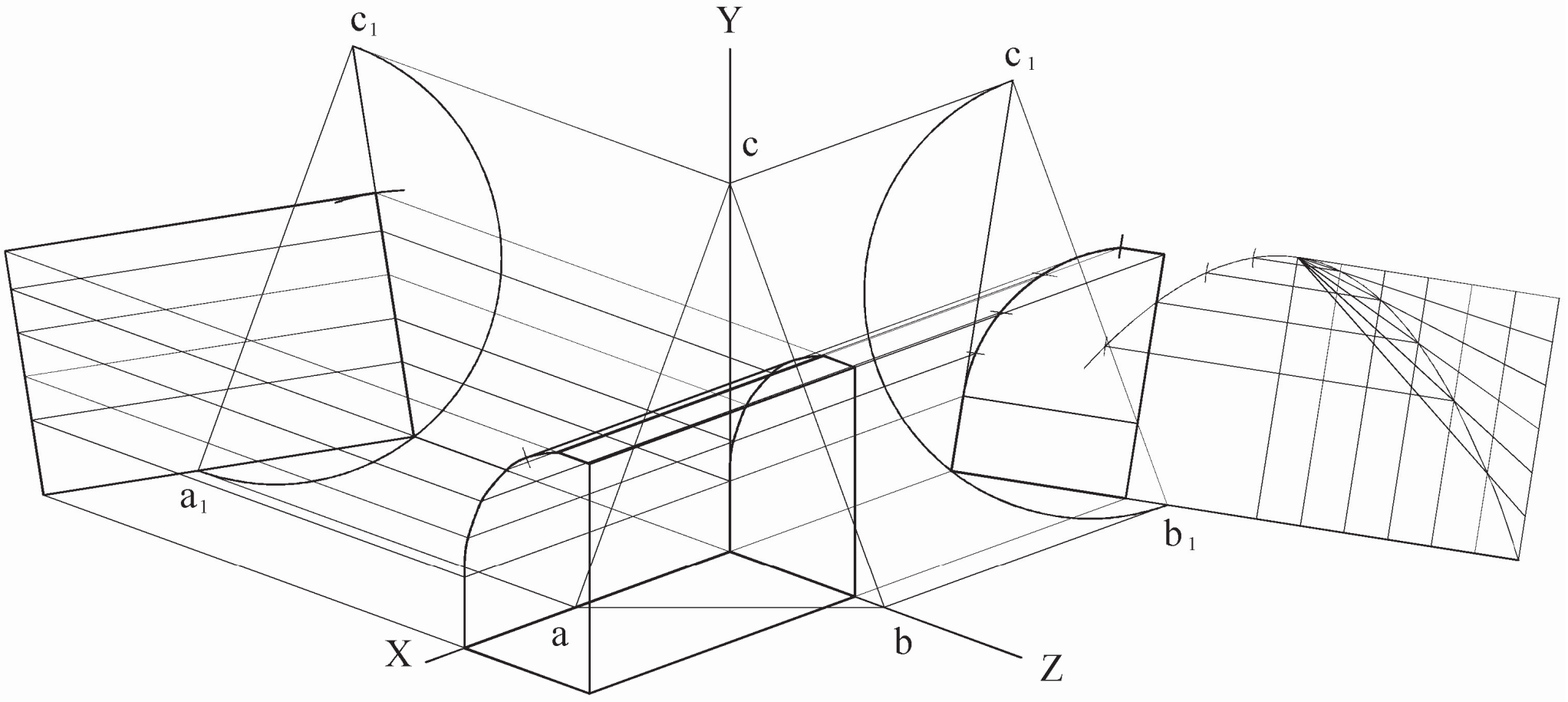
Design & Communication Graphics – Higher Level		
	Marking Scheme	
	Question B-1	
	Scale: n/a	June 2013

Design & Communication Graphics – Higher Level

Marking Scheme

Question B-2

Scale: n/a | June 2013



Design & Communication Graphics – Higher Level

Marking Scheme

Question B-3(a)

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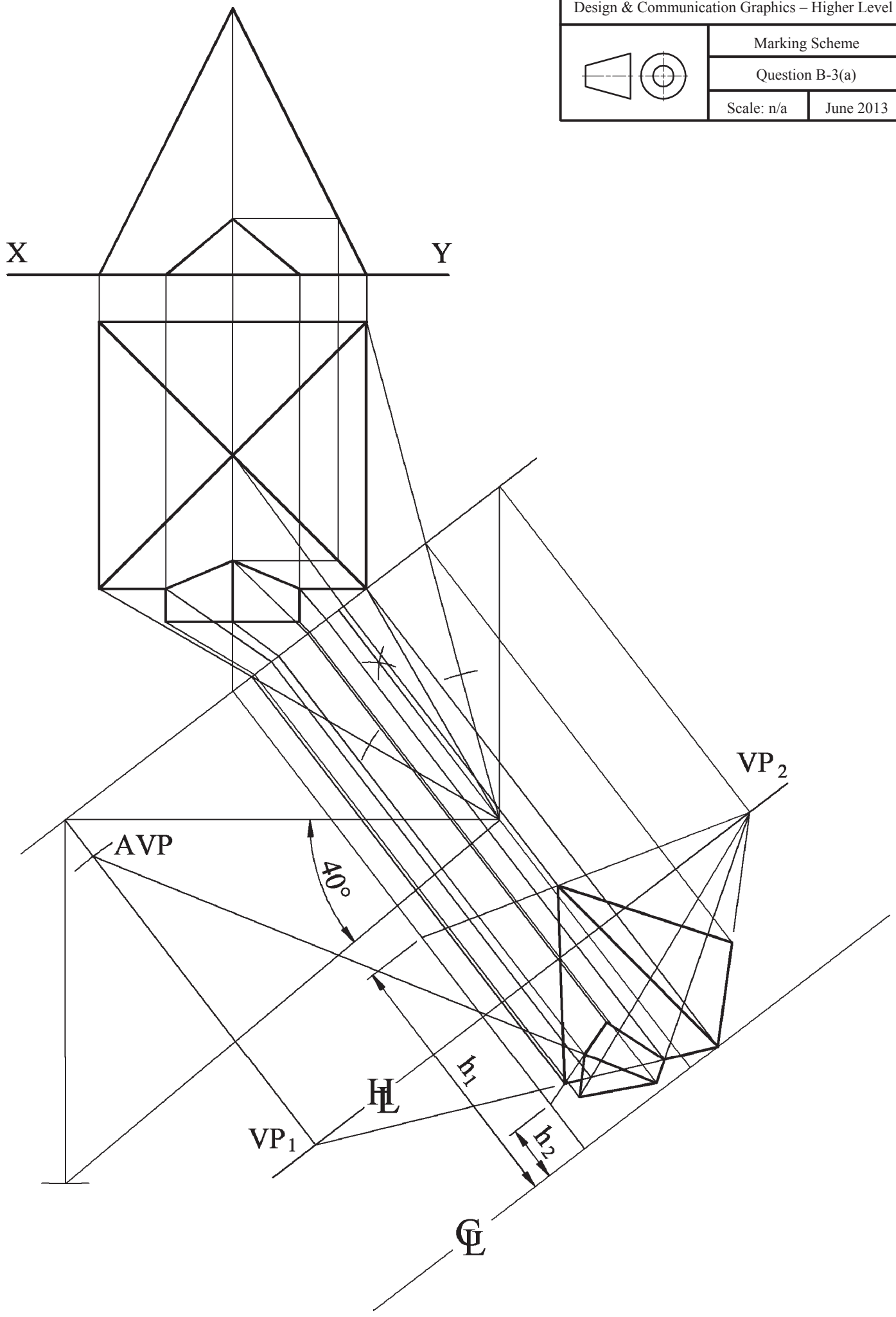
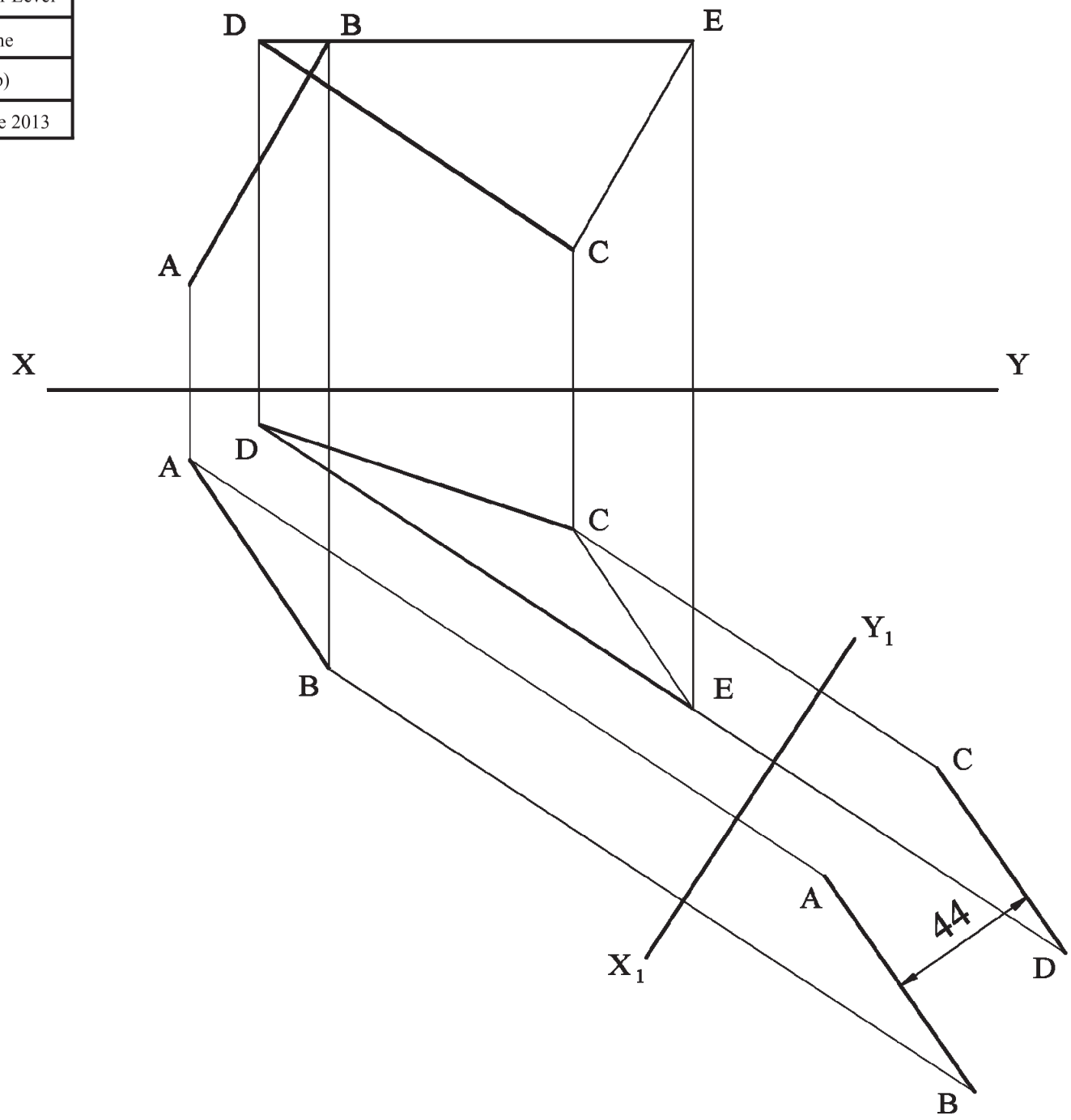
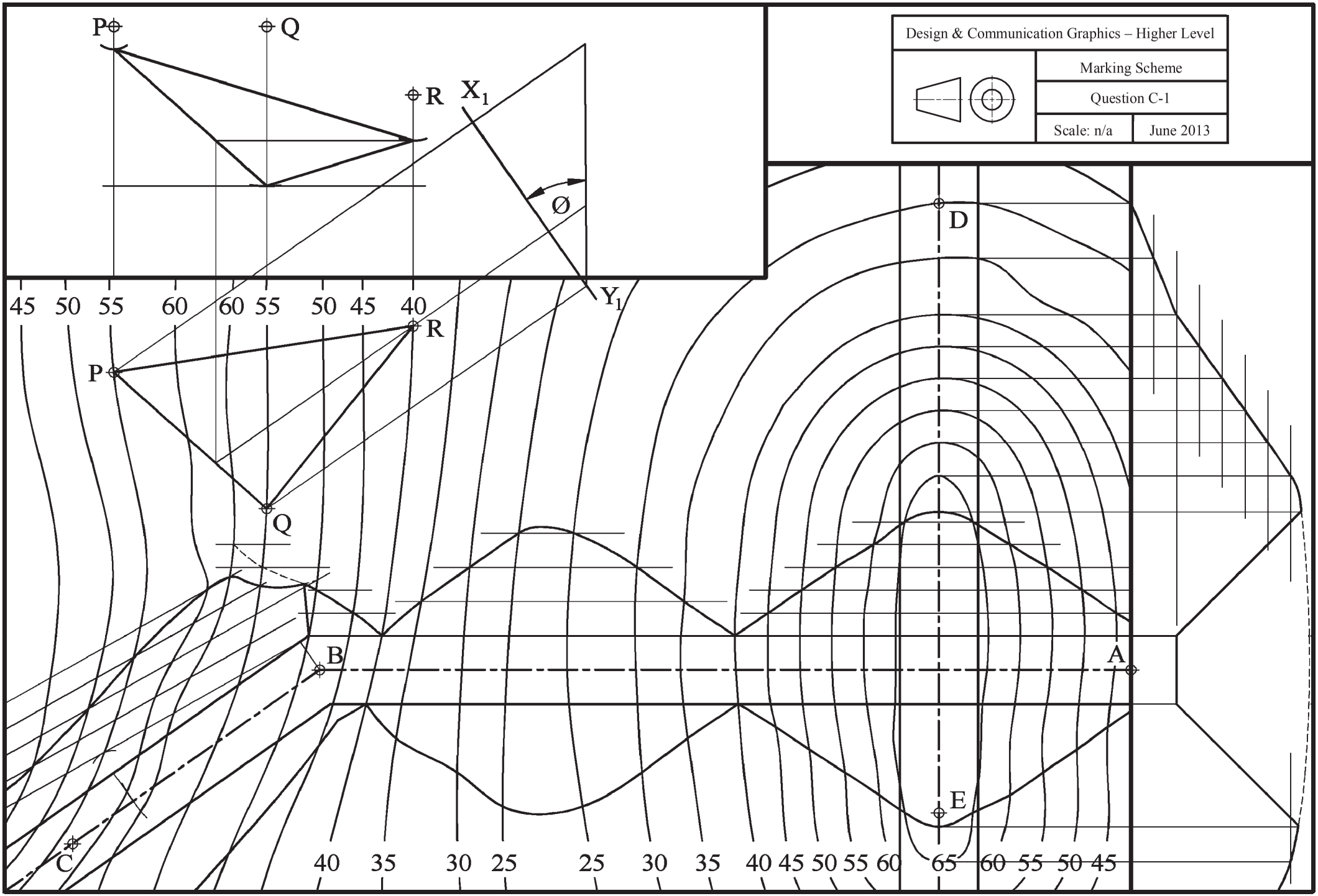


Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question B-3(b)
Scale: n/a	June 2013




Design & Communication Graphics – Higher Level
Marking Scheme
Question C-1
Scale: n/a
June 2013
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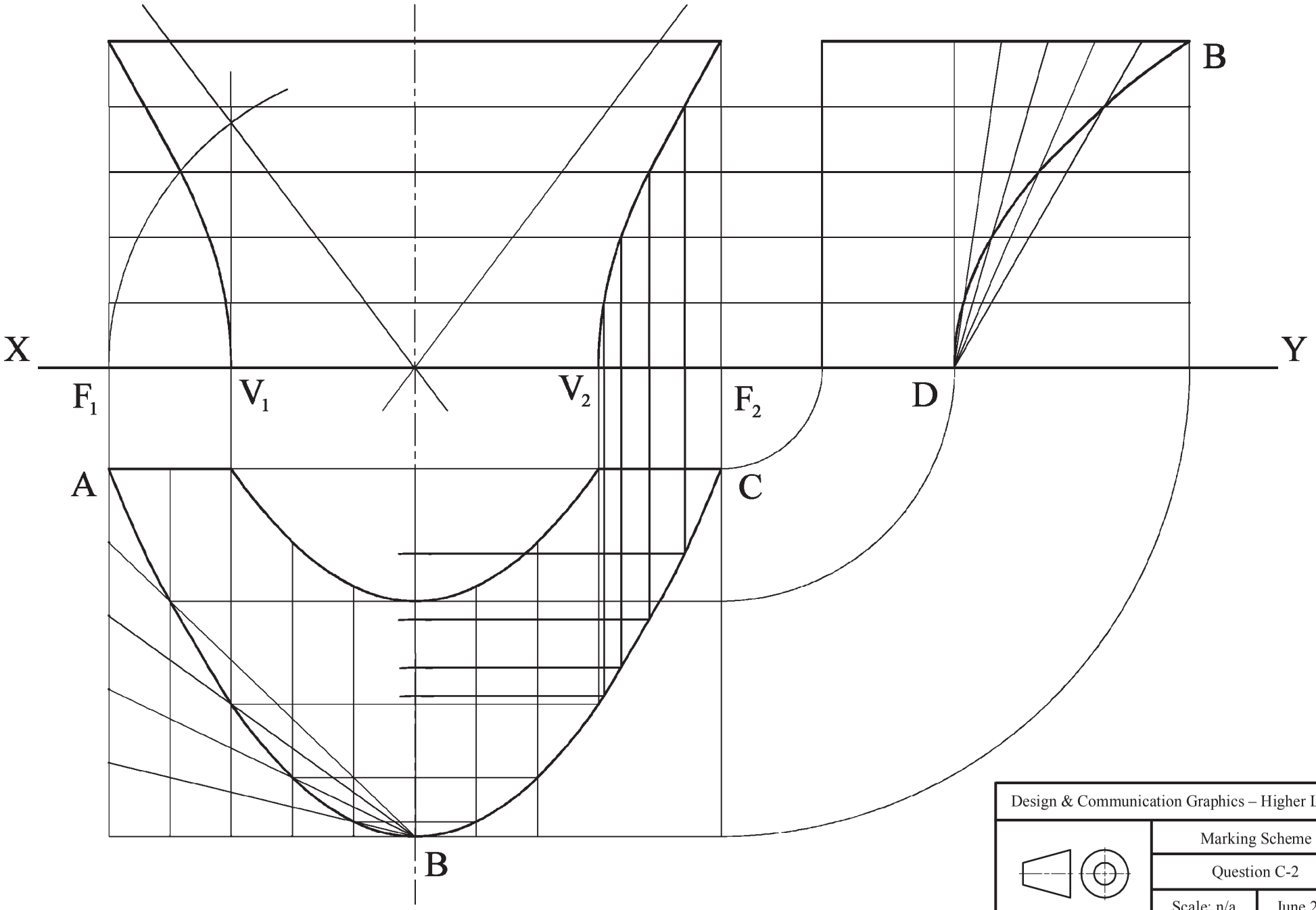

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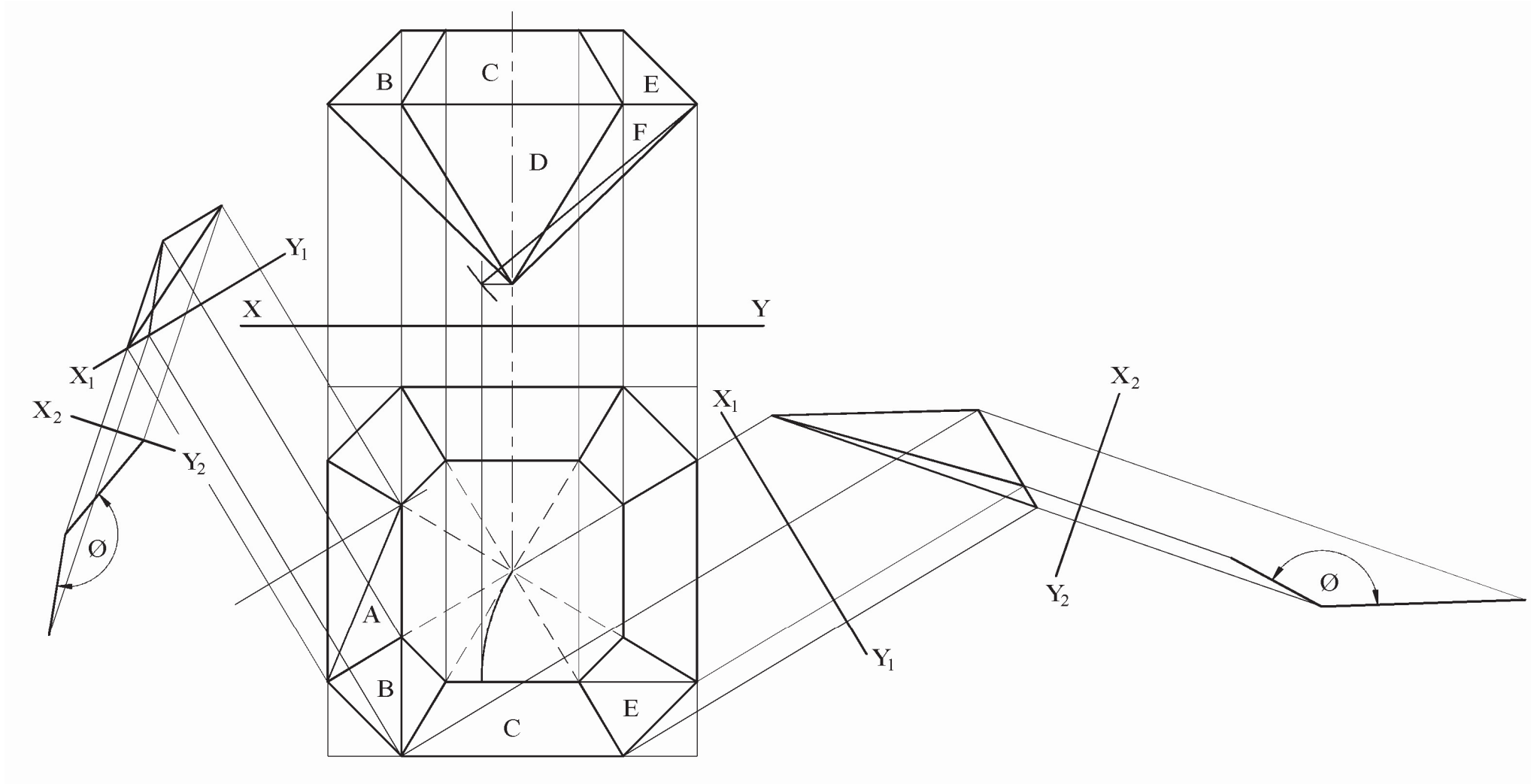
	Marking Scheme
	Question C-2
	Scale: n/a June 2013

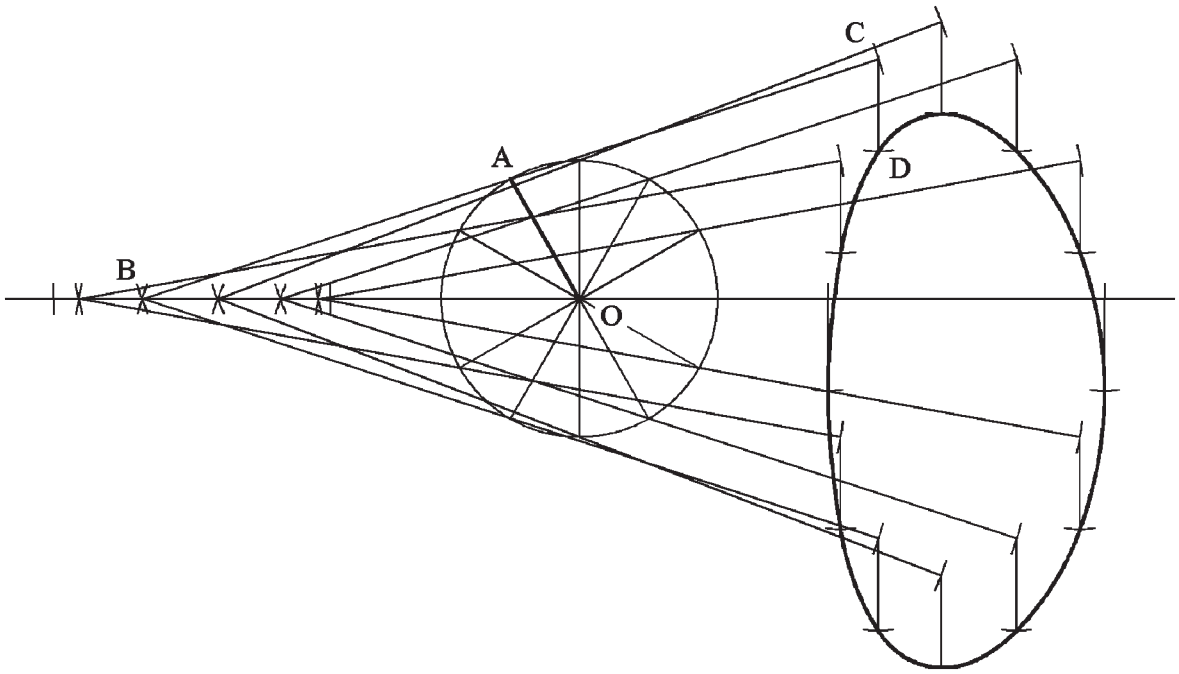
Design & Communication Graphics – Higher Level

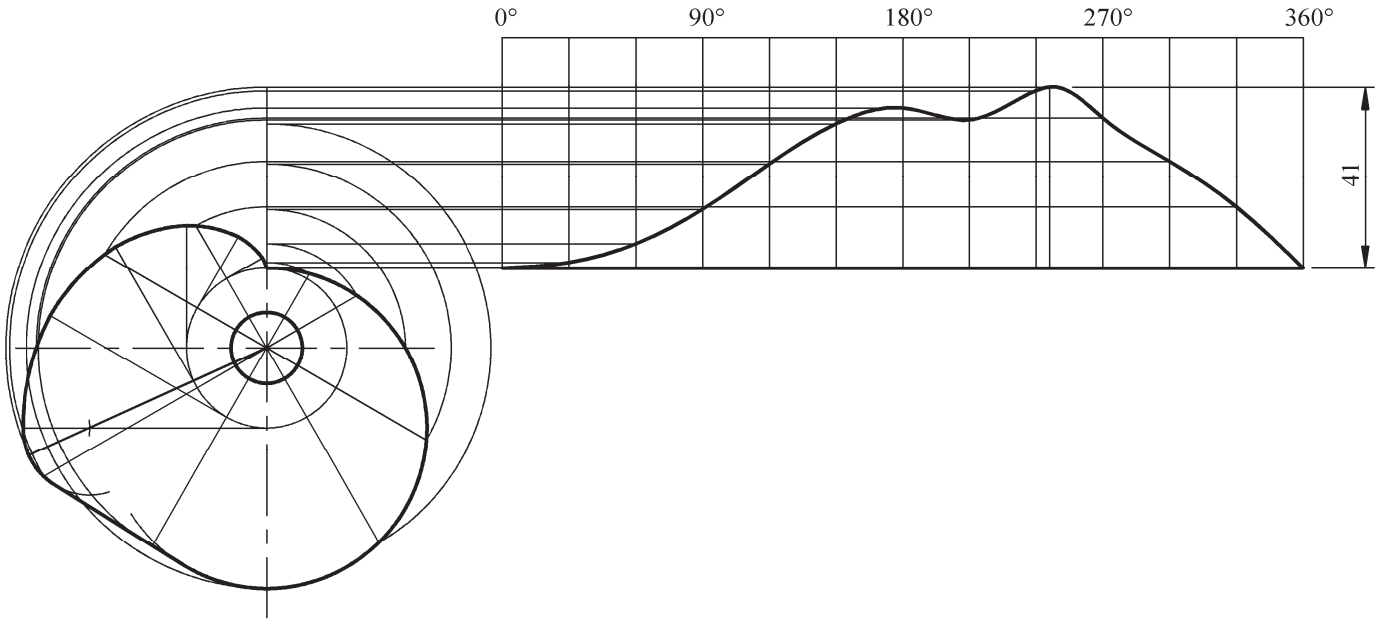
Marking Scheme

Question C-3

Scale: n/a | June 2013







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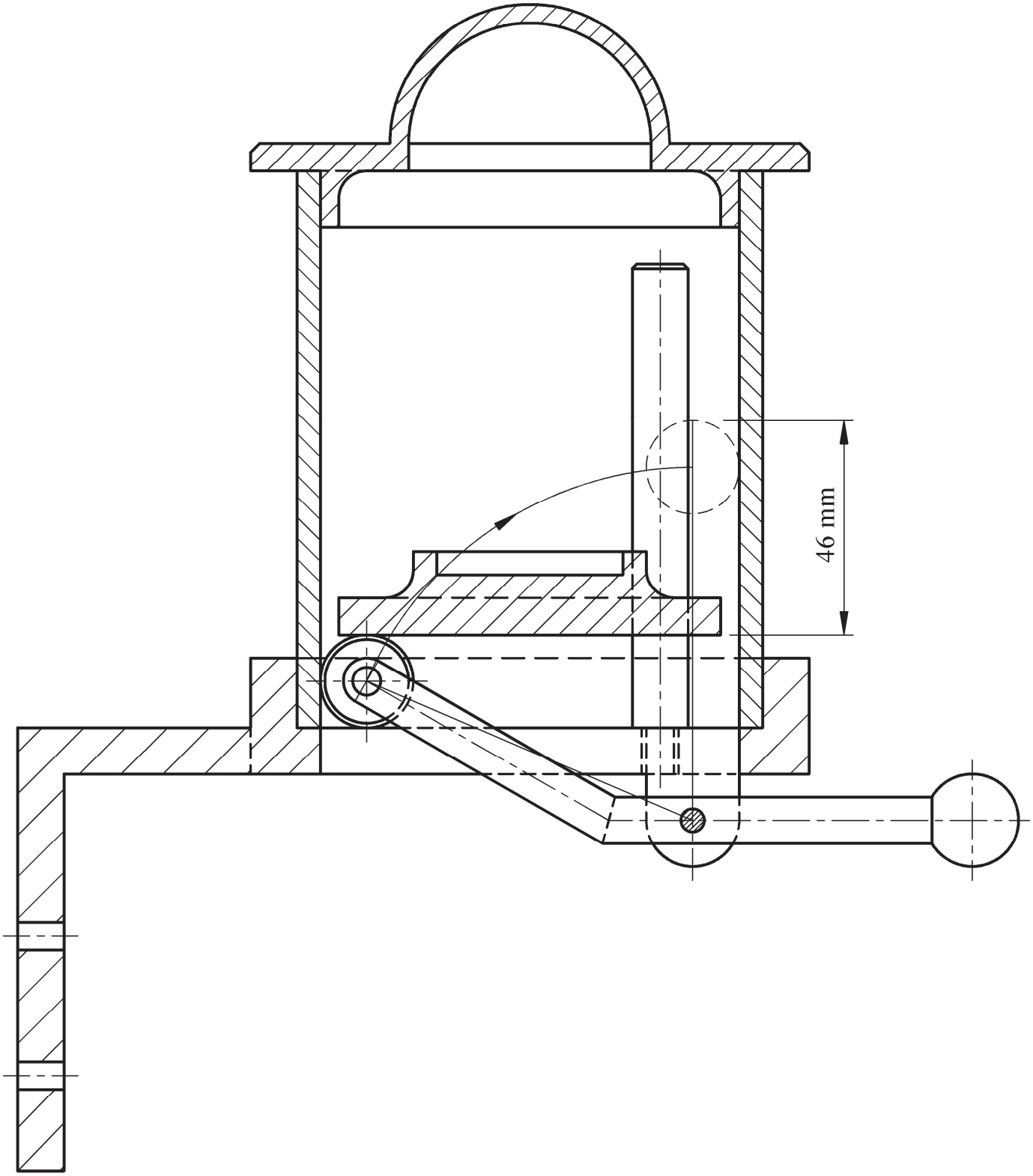
	Marking Scheme
	Question C-4
	Scale: n/a — June 2013



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	Marking Scheme
	Question C-5
	Scale: n/a — June 2013

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Design and Communication Graphics
Student Assignment - Higher Level
Assessment Sheet 2013

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	

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