

**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Leaving Certificate 2011**

**Marking Scheme**

**Design and Communication Graphics**

**Higher Level**





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*State Examinations Commission*

*Leaving Certificate Examination 2011*

***Design and Communication  
Graphics  
Higher Level***



***Marking Scheme  
and Sample Solutions***

**(Other valid solutions are acceptable and ct g'marked accordingly+)**

**QUESTION A-1**

**MARKS**

- (a) Auxiliary Plan (16)**
- (i) Projections from elevation perp. to  $X_1Y_1$  .....(3,3,3) ..... 9
  - (ii) Transfer of distances from plan to auxiliary plan ..... 3
  - (iii) Location of points in auxiliary plan ..... 3
  - (iv) Determine correct dihedral angle..... 1
- (b) Projections of the largest possible sphere (4)**
- (v) Vertical downwards from **a** in elevation ..... 1
  - (vi) Bisect angle **acb** in elevation ...(or alternative correct method) ..... 1
  - (vii) Identify centre and draw sphere in elevation ..... 1
  - (viii) Identify centre and draw sphere in plan ..... 1

Total = 20

**QUESTION A-2**

**MARKS**

- (a) Vertex, Focus and Curve (15)**
- (i) Locate 2<sup>nd</sup> vertex .....(2,2)..... 4
  - (ii) Locate 2<sup>nd</sup> focus ....(2,1)..... 3
  - (iii) Determine points on curve ...(min. 5, to include end of minor axis “a”) ..... 5
  - (iv) Draw curve (Any = 1) ..... 3
- (b) Tangent (5)**
- (v) Identify point 70mm from F ..... 1
  - (vi) Required construction and draw tangent ... (3,1) ..... 4

Total = 20

**QUESTION A-3**

**MARKS**

**Projections of shortest horizontal distance**

- (i) Creating a plane containing AB (or CD) and parallel to CD (or AB) .....4
- (ii) Elevation and plan of horizontal line on parallel plane ...(1,2).....3
- (iii)  $X_1Y_1$  perpendicular to plan of horizontal line .....2
- (iv) Projections of lines in 1<sup>st</sup> auxiliary elevation ... (parallel) ..... (1,1,1).....3
- (v)  $X_2Y_2$  perpendicular to  $X_1Y_1$ .....2
- (vi) Identification of shortest horizontal distance in 2<sup>nd</sup> auxiliary ... (1,1) .....2
- (vii) Draw req. projections (projecting or measuring to plan and elevation)...(1,1,1,1).....4

*Total =* 20

**QUESTION A-4**

**MARKS**

**(a) Completion of Plan (10)**

- (i) Vertical line to contain centre of Sphere A in plan .....2
- (ii) Construction to determine centre of sphere in plan ..(2,1,2).....5
- (iii) Draw plan of Sphere A using correct radius ....(2,1).....3

**(b) Plan of Sphere C (10)**

- (iv) Construction to determine 1<sup>st</sup> arc through plan of sphere centre .....4
- (v) Construction to determine 2<sup>nd</sup> arc through plan of sphere centre .....2
- (vi) Draw plan of Sphere C incl. hidden detail ...(2,2) .....4

*Total =* 20

**QUESTION B-1**

**MARKS**

<b>(a)</b>	<b>Plan and elevation of pyramid (6)</b>	
	(i) Draw outline plan of pyramid .....	3
	(ii) Draw outline elevation of pyramid .....	3
<b>(b)</b>	<b>Plan and elevation of inclined prism (14)</b>	
	(iii) Position and draw cross-section view .....	5
	(iv) Draw outline elevation of inclined prism .....	4
	(v) Draw outline plan of prism, incl. triangular ends .....	5
<b>(c)</b>	<b>Interpenetration on left hand side (5)</b>	
	(vi) Projections from elevation .....	2
	(vii) Draw “intersection triangle” .....	3
	<b>Interpenetration on right hand side (15)</b>	
	(viii) Use of relevant solution method .....	5
	(ix) Determine points <b>a</b> & <b>b</b> in elevation and plan .....	4
	(x) Determine points <b>c</b> & <b>d</b> in elevation and plan .....	4
	(xi) Determine points <b>e</b> & <b>f</b> in plan.....	2
	<b>Completion of drawing (5)</b>	
	(xii) Joining up of interpenetration and crossover points .....	3
	(xiii) Hidden detail .....	2

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**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 14m base and complete isosceles triangle .....(2,1,1).....4
- (b) **Elevation and End view orientated as shown (14)**
- (iii) Draw line  $b_1c_1$  (or  $a_1c_1$ ) and draw semicircle .....3
- (iv) Establish orientation of X and Y (or Z and Y) axes .....2
- (v) Draw elevation (or end view) on established axes.....4
- (vi) Draw line  $a_1c_1$  (or  $b_1c_1$ ) and draw semicircle .....2
- (vii) Establish orientation of Z and Y (or X and Y) axes .....1
- (viii) Draw end view (or elevation) on established axes.....2
- (c) **Complete axonometric projection (18)**
- (ix) Projections from elevation and end view (as shown) .....4
- (x) Draw given portion of axonometric projection.....4
- (xi) Determine front curve .....4
- (xii) Determine rear curve .....4
- (xiii) Complete axonometric projection .....2
- (d) **Identify traces (6)**
- (xiv) Indicate vertical and horizontal traces .....6

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**Total = 45**

**QUESTION B-3**

**MARKS**

<b>(a) Plan, elevation and end view (36)</b>	
(i) Draw outline plan .....	3
(ii) Draw elevation .....	7
(iii) Complete plan .....	2
(iv) Projections to end view .....	4
(v) Draw outline end view .... (3x3) .....	9
(vi) Establish points on front curve (min 5, incl. lowest point) .....	5
(vii) Establish points on rear curve (min 3, incl. lowest point) .....	3
(viii) Complete end view, incl. hidden detail .....	3
 <b>(b) True shape of cut surface (6)</b>	
(ix) Establish correct lengths and widths ... (2,2) .....	4
(x) Draw true shape ... (any = 1) .....	2
 <b>(c) Establish focal point and directrix (3)</b>	
(xi) Elevation of focal sphere .....	1
(xii) Indicate focus and directrix on true shape of cut surface ... (1,1) .....	2

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**Total = 45**



**QUESTION C-1**

**MARKS**

**(a) Earthworks for roadway (35)**

*Earthworks between A and B (Level) - Embankment*

- (i) Draw parallel lines at 10m intervals .....3
- (ii) Identify intersections with contours and draw curve .....6

*Earthworks between A and B (Level) - Cutting*

- (iii) Draw parallel lines at 7.5m intervals .....3
- (iv) Identify intersections with contours and draw curve .....4

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

- (v) Draw arc(s) at 10m intervals.....2
- (vi) Identify intersections with contours and draw curve .....4

*Earthworks between C and D (Falling) - Cutting*

- (vii) Draw required arc .....4
- (viii) Draw parallel lines at 7.5m intervals .....3
- (ix) Identify intersections with contours and draw curve .....6

**(b) (i) Strike Line (4)**

- (x) Determine the strike line...(4 or 1,1,1,1).....4

**(ii) Dip of stratum (6)**

- (xi) Draw  $X_1Y_1$  perp. to strike line .....3
- (xii) Determine dip .....3

**Total = 45**

**QUESTION C-2**

**MARKS**

<b>(a)</b>	<b>Draw given elevation (16)</b>	
	(i) Establish major and minor axes ... (1,1) .....	2
	(ii) Determine points on ellipse - min. 4 additional points... (2,2,1,1) .....	6
	(iii) Draw ellipse ... (Any ellipse = 1) .....	3
	(iv) Draw horizontal line through A .....	1
	(v) Elevation of quadrilateral ABCD .....	4
<b>(b)</b>	<b>Elements and End view (27)</b>	
	(vi) Two sets of elements in elevation ..... (2x2) .....	4
	(vii) Extend elements to outline of elevation ..... (2,2,1) .....	5
	(viii) Draw quadrilateral ABCD in end view .....	2
	(ix) Show elements in end view to establish curve AC ... (4,1) .....	5
	(x) Establish 5 points (incl. bottom point) on left hand curve in end view .....	5
	(xi) Construction to determine point P in end view .....	2
	(xii) Construction to determine intermediate point Q in end view .....	1
	(xiii) Draw left hand curve in end view ... (Any = 1) .....	3
<b>(c)</b>	<b>Curvature along S-S (2)</b>	
	(xiv) Determine required curvature .....	2

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**Total = 45**

**QUESTION C-3**

**MARKS**

<b>(a)</b>	<b>Plan and elevation of surfaces A and B incl. dihedral angle (25)</b>	
	(i) Draw outline plan of surfaces A and B ....(5x1) .....	5
	(ii) Edge view of surface A in elevation (incl XY line).....	3
	(iii) Construction to determine point on line of intersection in plan .....	4
	(iv) Completion of plan and elevation of surfaces A and B ....(4x1).....	4
	(v) View showing true length of line of intersection between A and B .....	4
	(vi) Construction to determine dihedral angle.....	3
	(vii) Indicating dihedral angle.....	2
<b>(b)</b>	<b>Plan and elevation of surfaces C and D (12)</b>	
	(viii) Plan of surface C. incl hidden detail ....(4x1).....	4
	(ix) Elevation of surface C ....(3x1) .....	3
	(x) Plan of surface D ....(3x1) .....	3
	(xi) Elevation of surface D ....(2x1) .....	2
<b>(c)</b>	<b>Surface E (8)</b>	
	(xii) View showing true length of line of intersection 'rs'.....	2
	(xiii) Construction to determine point on HT of surface E in plan .....	2
	(xiv) Completion of plan of surface E .....	2
	(xv) Completion of elevation of surface E (including determination of height) .....	2

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**Total = 45**

**QUESTION C-4**

**MARKS**

**(a) Cam and roller follower (27)**

**Displacement Diagram**

- (i) Horizontal divisions .....(<math>12=1</math>).....3
- (ii) Use of 55mm rise .....3
- (iii) Uniform velocity from  $0^\circ$  to  $90^\circ$  .....3
- (iv) Dwell from  $90^\circ$  to  $180^\circ$  .....2
- (v) S.H.M. construction and curve from  $180^\circ$  to  $360^\circ$  ... (2,2) .....4

**Cam Profile**

- (vi) Correct use of nearest approach .....1
- (vii) Angular divisions for cam profile (corresponding with (i) above) .....3
- (viii) Correct rotation direction .....1
- (ix) Identification of centres and draw roller in each position ..... (2,2) .....4
- (x) Draw cam profile tangential to rollers ... (Any = 1) .....3

**(b) Rolling Log (18)**

**(i) Draw Block and Roller**

- (xi) Block B and Roller L positioned as shown .....4

**(ii) Locus of P**

- (xii) Location of Point P on circumference .....1
- (xiii) Division of circle .....2
- (xiv) Corresponding divisions stepped horizontally .....2
- (xv) Location of points on locus, incl. end point .... (2,1,1).....4
- (xvi) Draw Locus....(any = 1).....3

**(iii) Final position of Block B**

- (xvii) Construction to locate Block B in final position .....2

Total = 45

**QUESTION C-5****MARKS****(a) Sectional elevation (42)*****Assembly (6)***

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

***Base (10)***

(ii) Outline...(4,2,1) .....7

(iii) Inner detail (recesses and hole) .....(3x1) .....3

***Seed Holder and Hinge Pin (6)***

(iv) Outline .....3

(v) Hinge Mount .....2

(vi) Inner detail .....1

***Perches (9)***

(vii) Outline .....5

(viii) Holes .....2

(ix) Pins .....2

***Lid (3)***

(x) Arc incl. centre location .....2

(xi) Top of lid .....1

***Drawing Completion (8)***

(xii) Fillets and Chamfers .....2

(xiii) Presentation, Hatching and Centrelines ... (3,2,1) .....6

**(b) Maximum rotation of lid (3)**

(xiv) Determine open position .....1

(xv) Lines from centre and indication of angle .....2

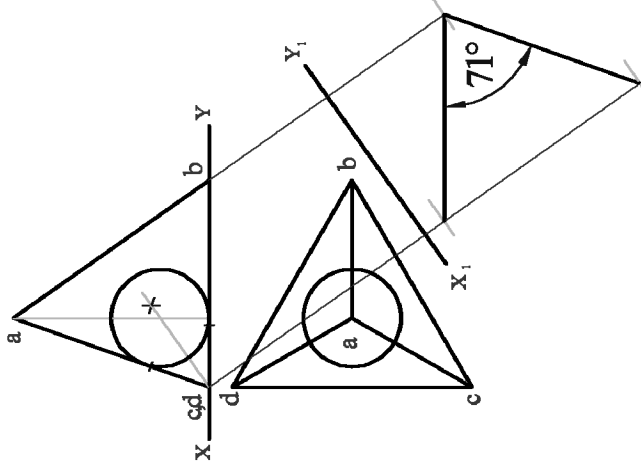
***Total = 45***

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

**A-1.** The 3D graphic below shows a molecule of methane. The four outer atoms, shown in red, are located at the vertices of a tetrahedron.

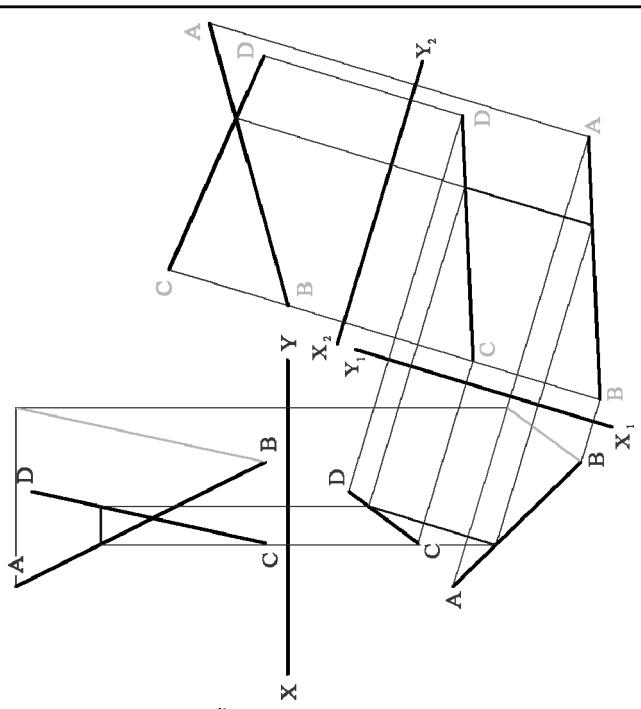
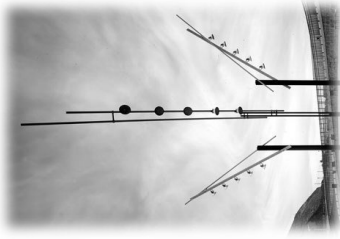
The drawing on the right shows the projections of a regular tetrahedron (*without the spheres*).

- (a) Draw an auxiliary plan, on the given  $X_1Y_1$  line, to show the dihedral angle between the planes  $abc$  and  $abd$ .
- (b) Draw the projections of the largest possible sphere that can be contained inside the tetrahedron.



**A-3.** The graphic below shows a number of sloping arms which support lights in a modern sculpture.

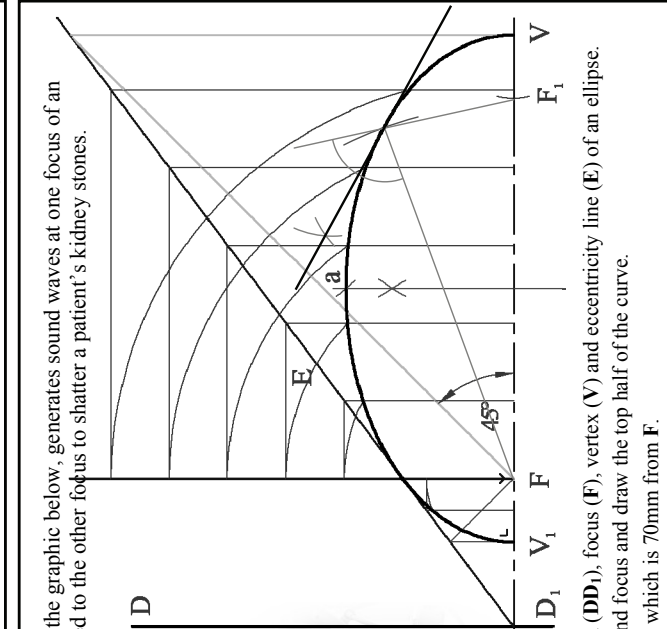
Two such arms are represented by the skew lines  $AB$  and  $CD$  on the right. Determine the projections of the shortest horizontal distance between the two lines.



**A-2.** A bio-medical device, as shown in the graphic below, generates sound waves at one focus of an ellipse. The waves are then reflected to the other focus to shatter a patient's kidney stones.

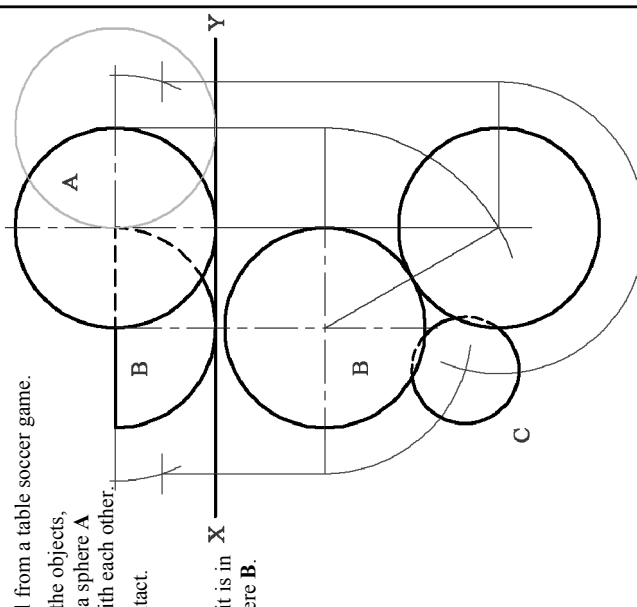
The drawing on the right shows the directrix ( $DD_1$ ), focus ( $F$ ), vertex ( $V$ ) and eccentricity line ( $E$ ) of an ellipse.

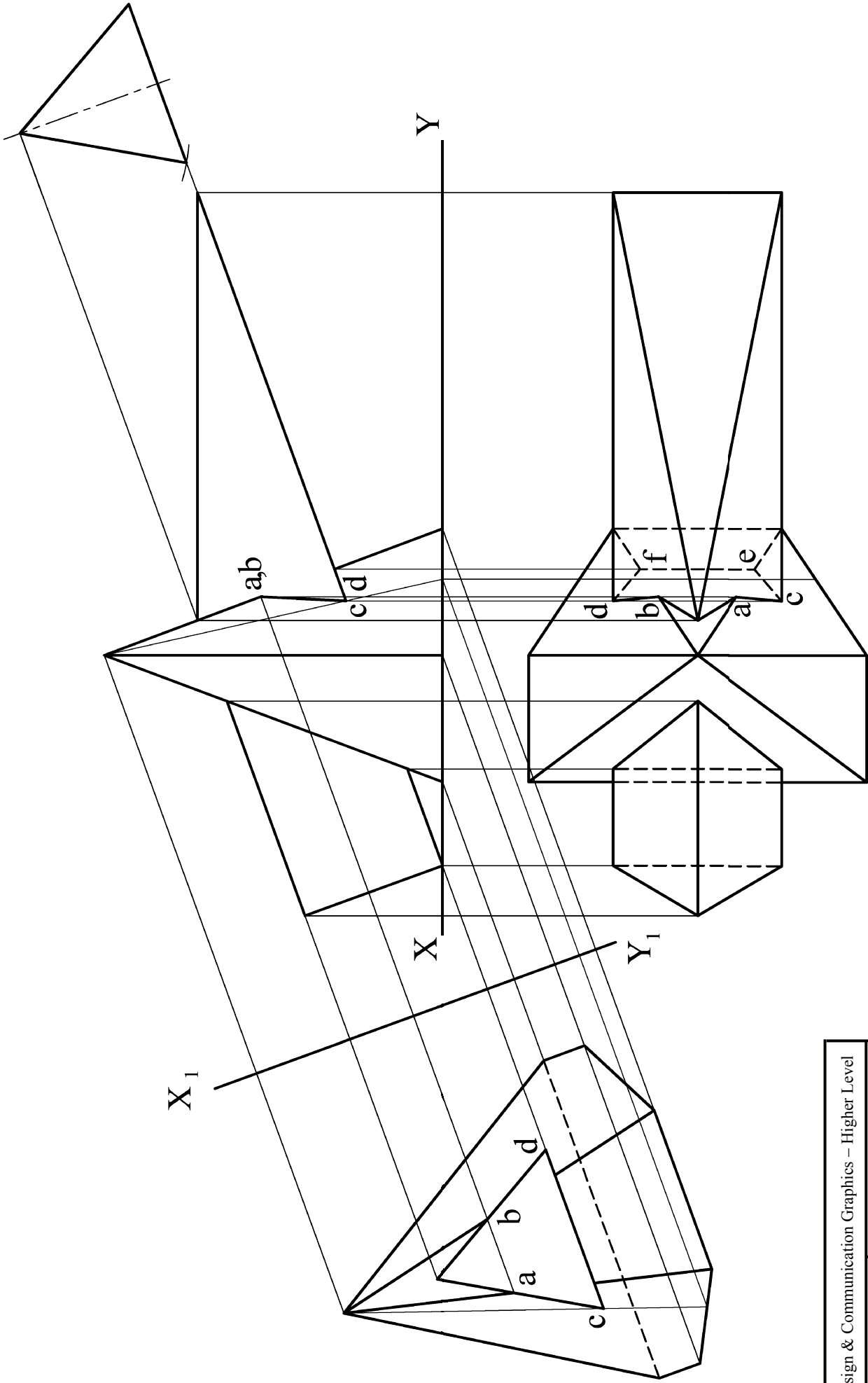
- (a) Locate the second vertex and the second focus and draw the top half of the curve.
- (b) Draw a tangent at a point on the curve which is 70mm from  $F$ .



**A-4.** The graphic below shows a figure and a ball from a table soccer game. The drawing on the right, which represents the objects, shows the elevation and incomplete plan of a sphere  $A$  and a hemisphere  $B$ , which are in contact with each other.

- (a) Complete the plan of both solids in contact.
- (b) Draw the plan of another sphere, of diameter 20mm, which rests on the horizontal plane, in position  $C$ , so that it is in contact with the sphere  $A$  and hemisphere  $B$ .



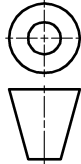


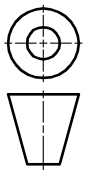
Design & Communication Graphics – Higher Level

Marking Scheme

Question B-1

Scale: n/a June 2011



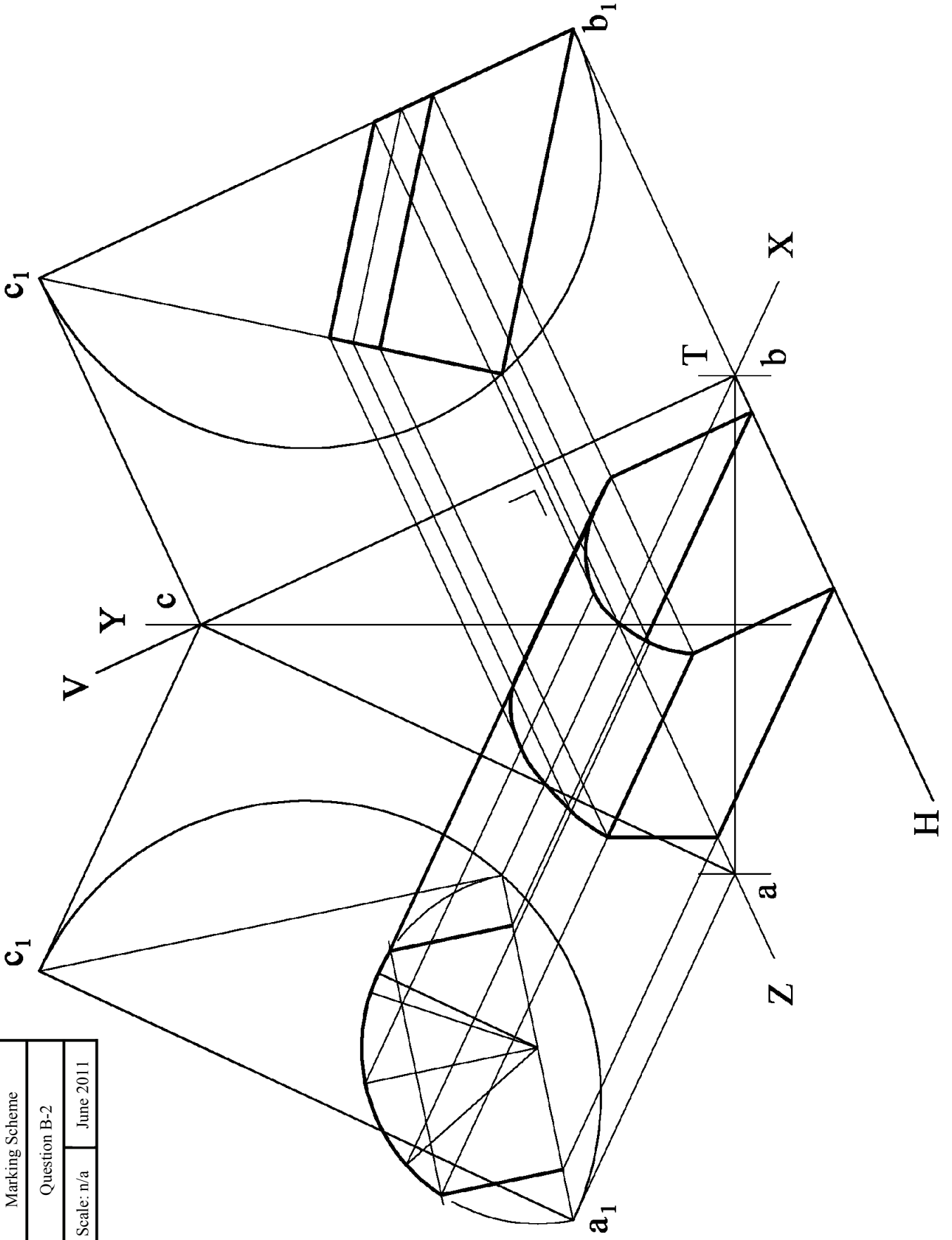


Marking Scheme

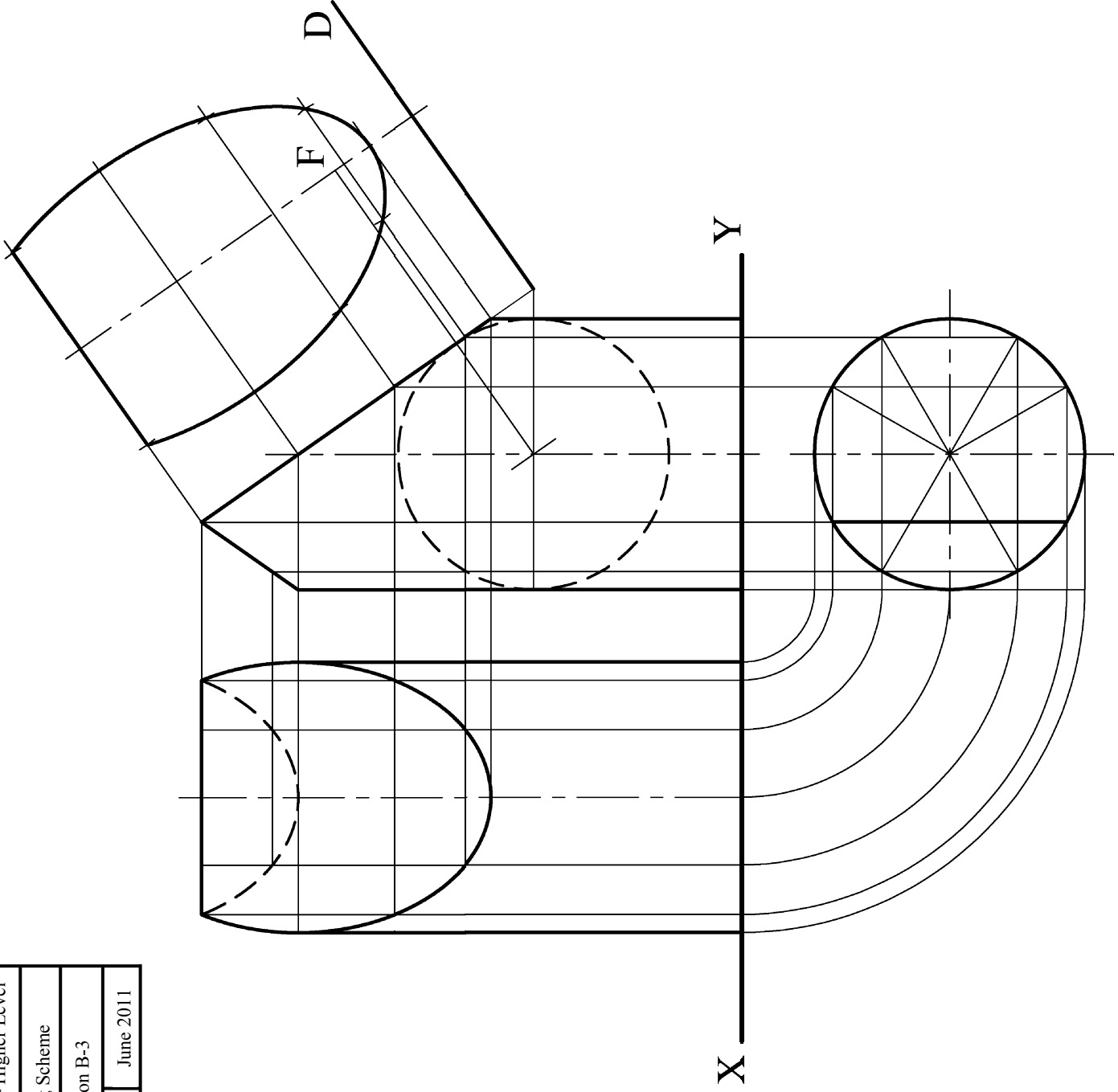
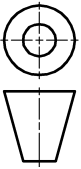
Question B-2



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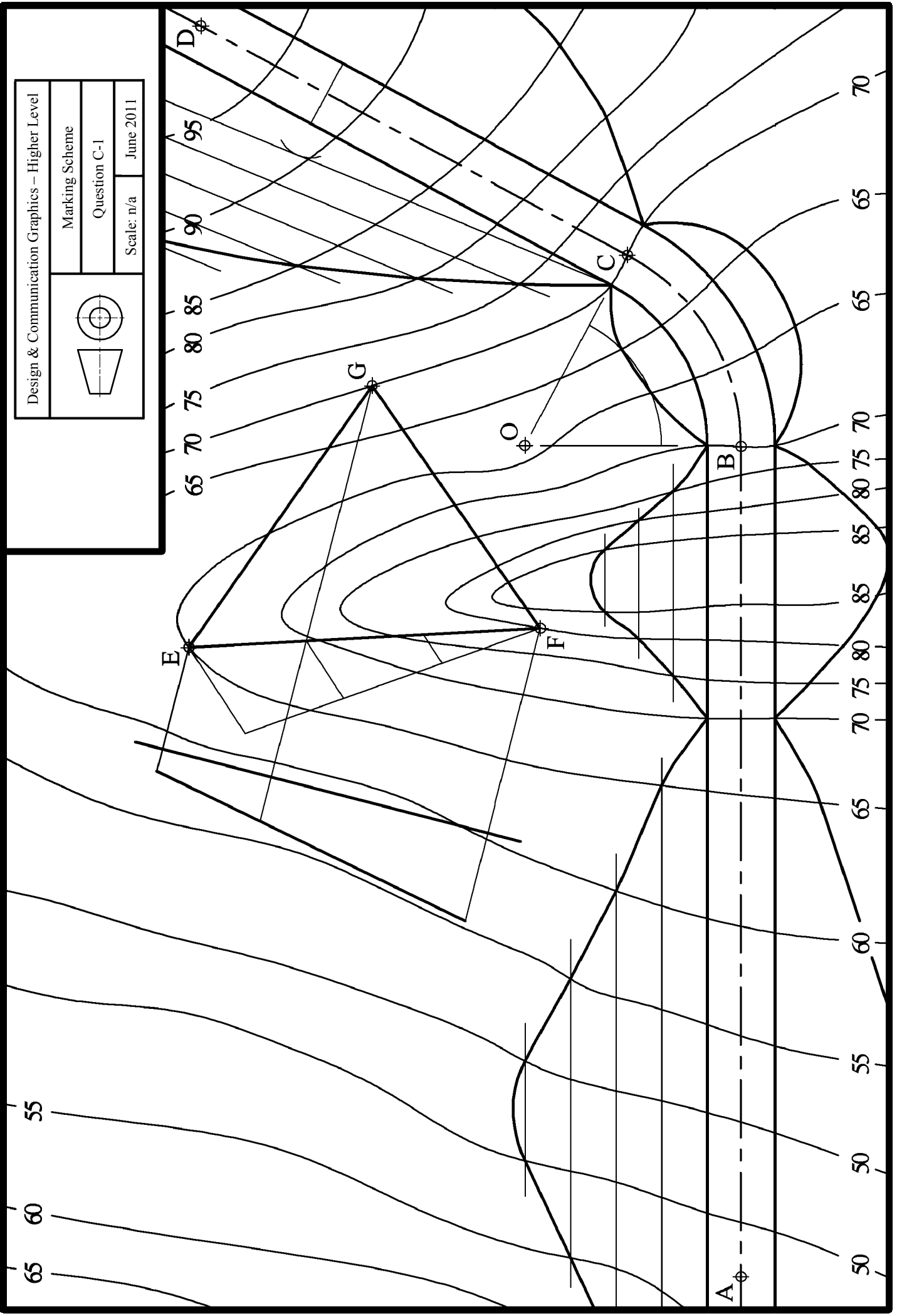
June 2011

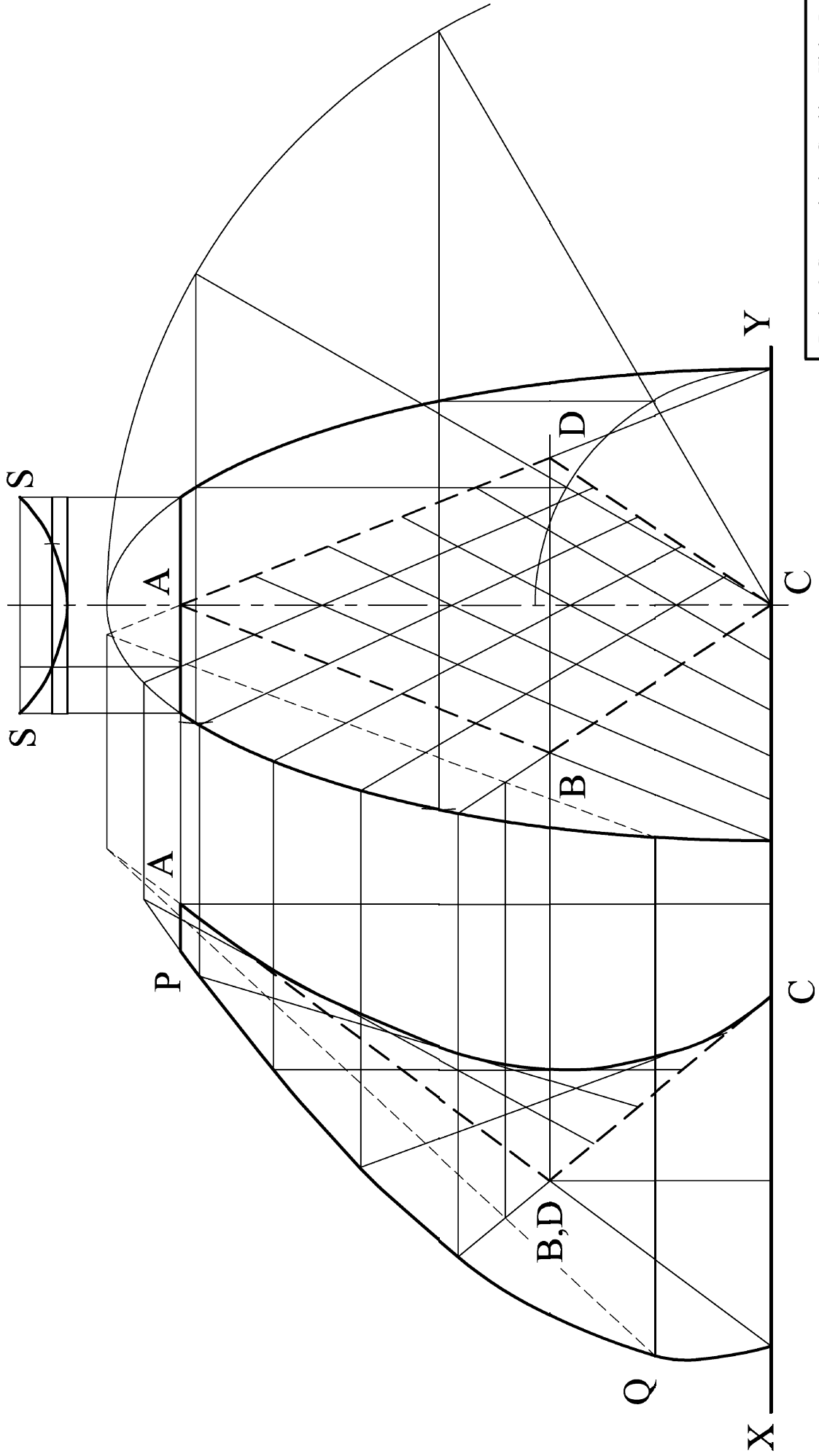






Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question C-1
Scale: n/a	June 2011



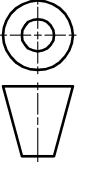


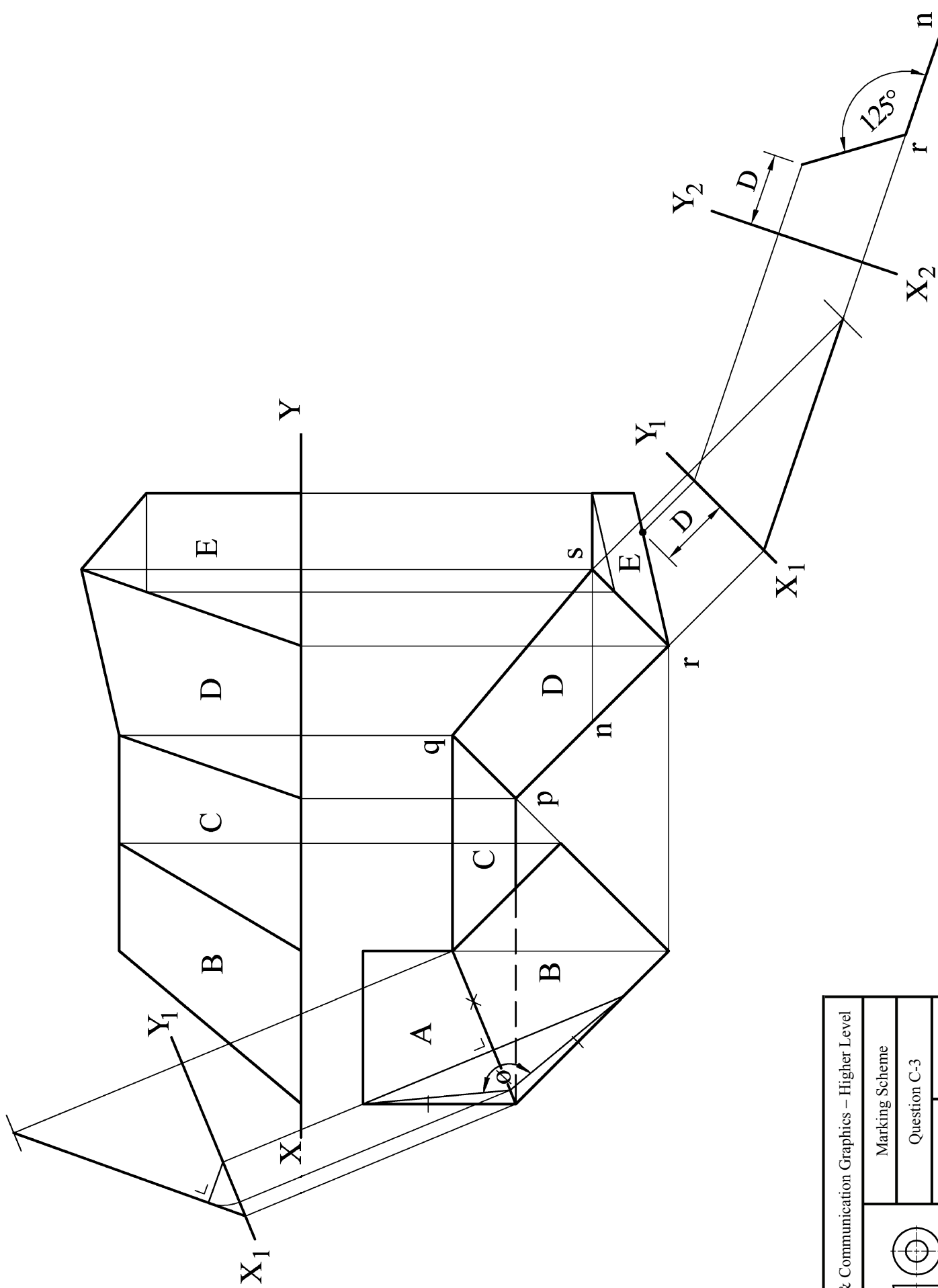
Design & Communication Graphics – Higher Level

Marking Scheme

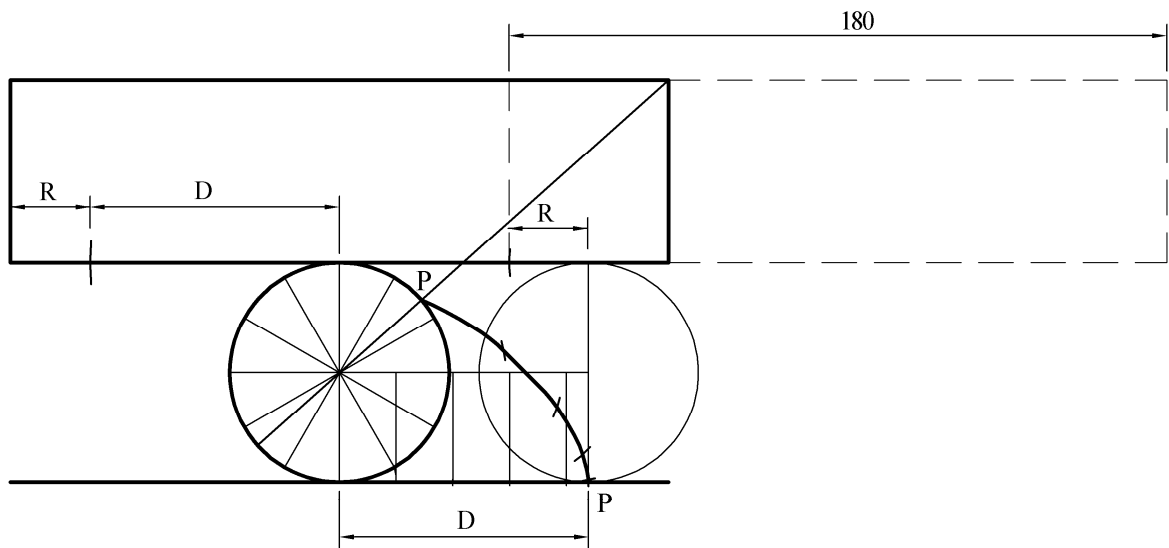
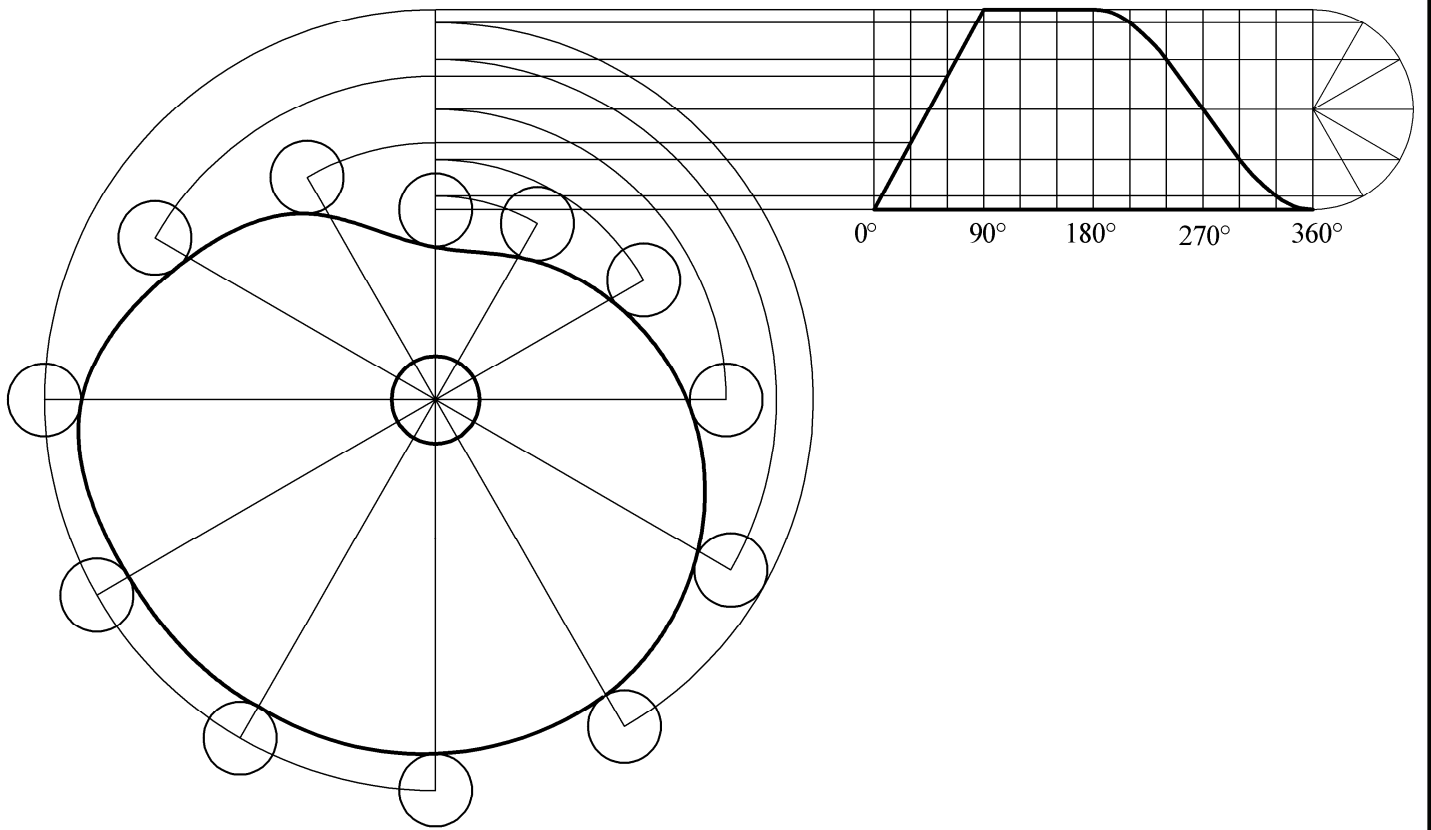
Question C-2

Scale: n/a June 2011

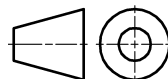




Design & Communication Graphics – Higher Level	
	Marking Scheme
	Question C-3
Scale: n/a	June 2011



Design & Communication Graphics – Higher Level

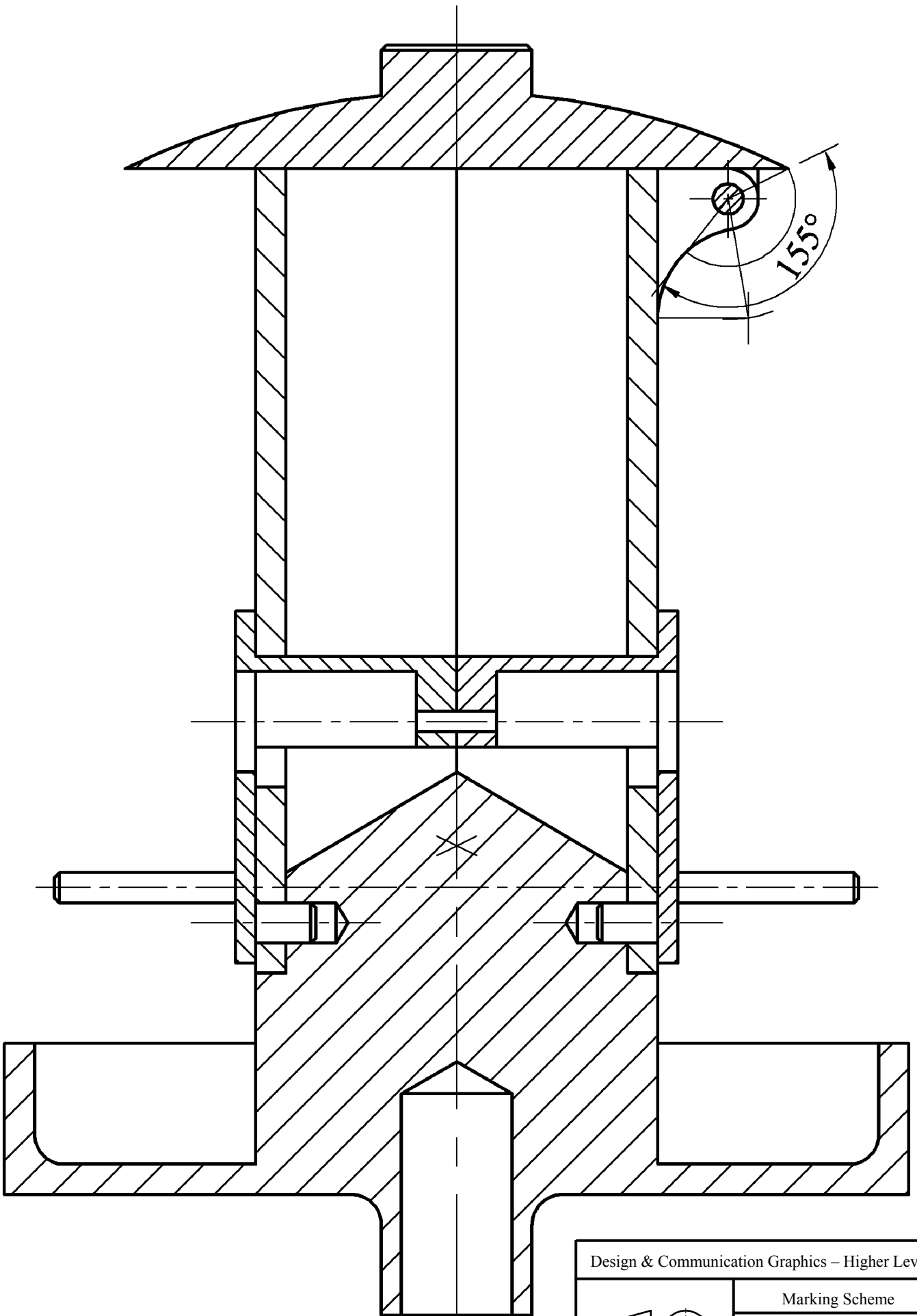


Marking Scheme

Question C-4

Scale: n/a

June 2011



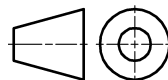
Design & Communication Graphics – Higher Level

Marking Scheme

Question C-5

Scale: n/a

June 2011





# Design and Communication Graphics

## Student Assignment—Higher Level

### Assessment Sheet

Candidate Exam No.

Output	Marking criteria	Marks
<b>1</b>	<b>Design Research</b> - 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
<b>2</b>	<b>Design Feature Comparison</b> - 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
<b>3</b>	<b>Freehand Graphical Representation</b> – 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
<b>4</b>	<b>SolidWorks Parts, Assembly, Drawing and eDrawing files</b>	
	• Adherence to required filing structure	3
	• Creation of a minimum of 5 Part files	3
	• 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
<b>5</b>	• eDrawing of CAD model	2
	<b>Hardcopy outputs from SolidWorks</b> - 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	
<b>6</b>	<b>Photorealistic Representation</b>	
	Produce photorealistic computer generated images of the artefact	7
<b>7</b>	<b>Graphical exploration of design solutions</b> - 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
<b>8</b>	<b>Presentation of Modification/Concept Design</b> – 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
<b>9</b>	<b>Hardcopy outputs from SolidWorks</b> – 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	
<b>Sub-total</b>	<b>Marks deducted for pages in excess of maximum</b>	<b>Total</b>

