



Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate Examination, 2020

Design & Communication Graphics

Higher Level

Section A (60 marks)

3 Hours

Centre No.

This examination is divided into three sections:

- SECTION A (Core - Short Questions)
SECTION B (Core - Long Questions)
SECTION C (Applied Graphics - Long Questions)

SECTION A

- Four questions are presented.
- Answer **any three** on the A3 sheet overleaf.
- All questions in Section A carry **20 marks** each.

SECTION B

- Three questions are presented.
- Answer **any two** on drawing paper.
- All questions in Section B carry **45 marks** each.

SECTION C

- Five questions are presented.
- Answer **any two** (i.e. the options you have studied) on drawing paper.
- All questions in Section C carry **45 marks** each.

General Instructions:

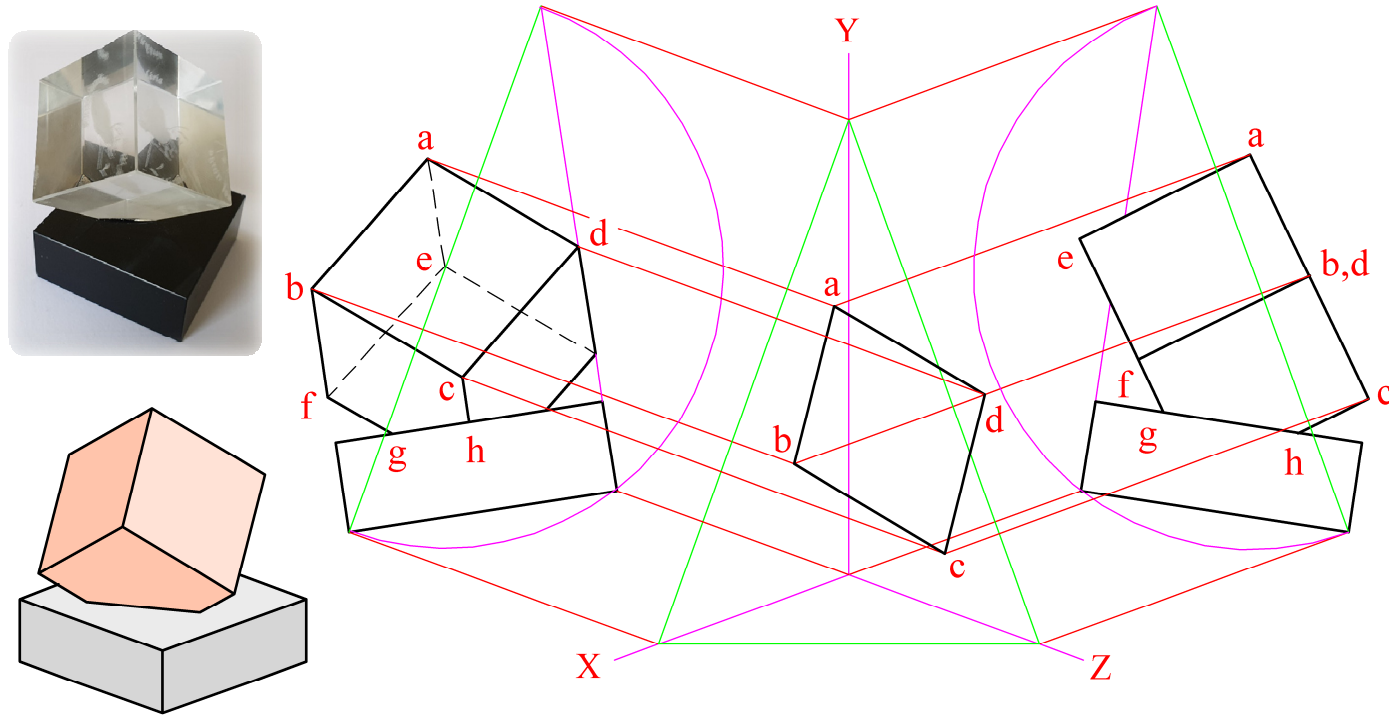
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box below and on all other sheets used.*

Examination Number

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

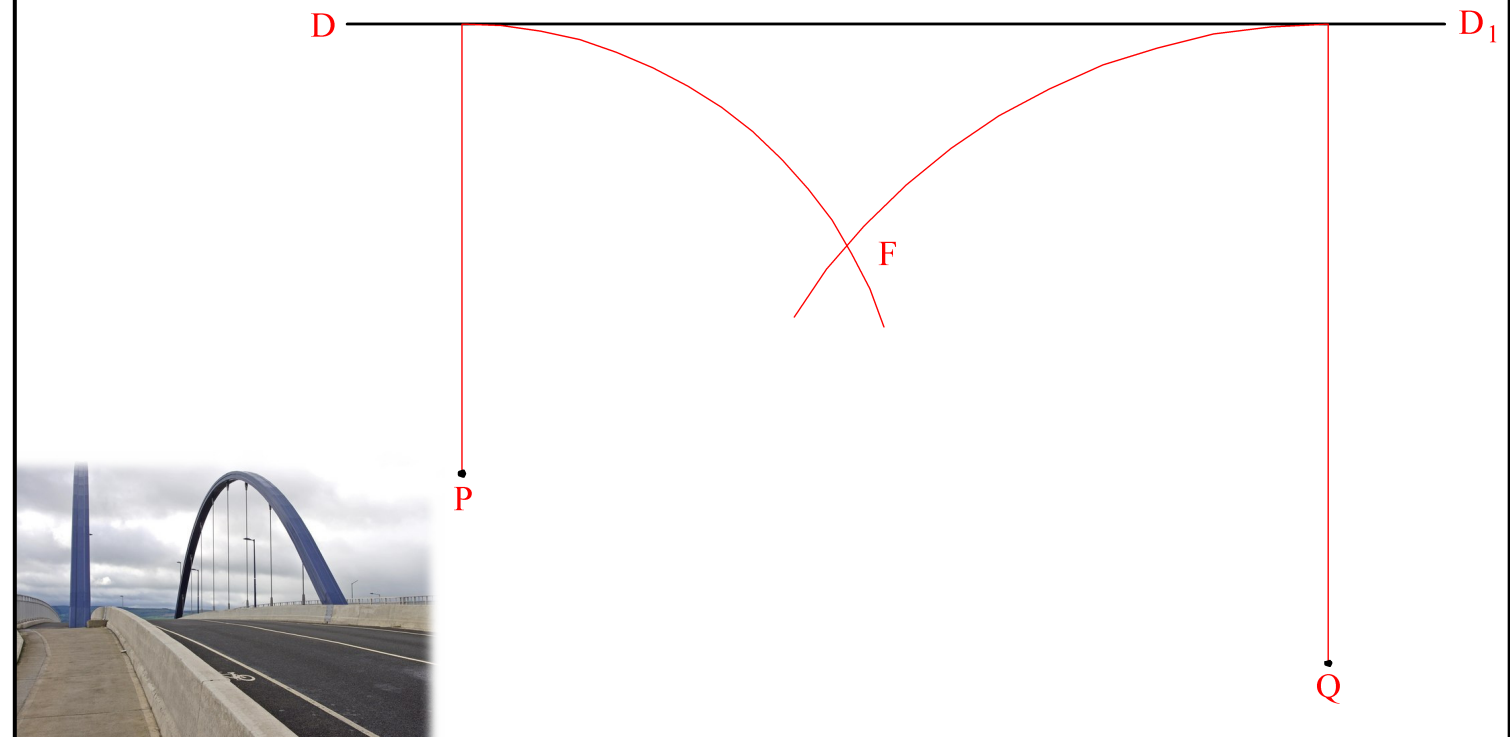
A-1. The image below shows a paperweight. It consists of a cube and a square prism which intersect each other. The drawing shows an incomplete dimetric projection of the paperweight. A pictorial view is also shown.

- (a) Complete the dimetric projection of the paper weight.
- (b) Determine, and indicate in degrees, the true angle between the surface **abcd** and the horizontal plane.



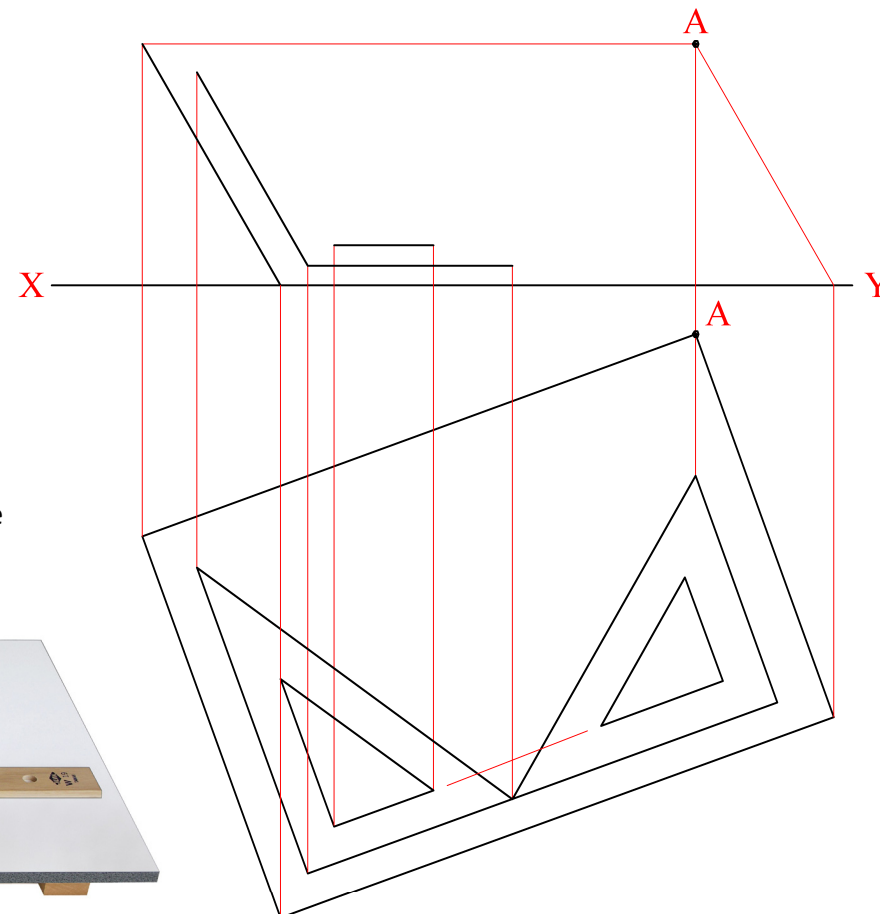
A-3. The image below shows a parabolic bridge at the M50 interchange in Dublin. The drawing shows the directrix **DD₁** the focus **F** and two points **P** and **Q** on a similar parabola.

- (a) Locate the axis and the vertex and draw a portion of the parabolic curve which shall pass through **P** and **Q**.
- (b) Construct a normal to the curve at the point **P**.



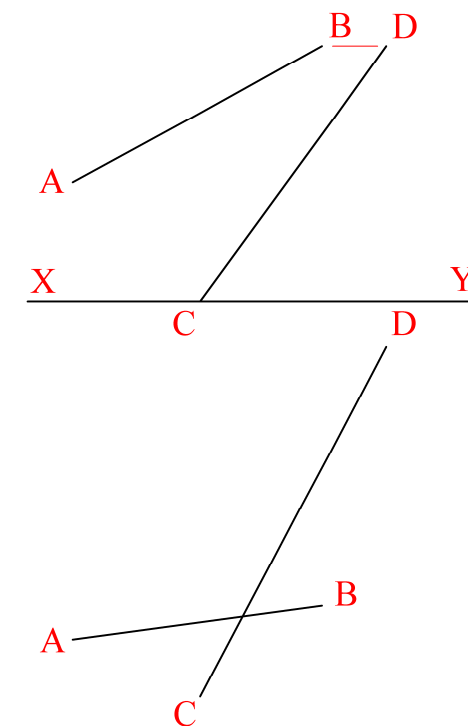
A-2. The image below shows a drawing board and two set squares. The drawing on the right shows the plan and incomplete elevation of a similar drawing board with a 30°/60° set square and also a 45° set square.

- (a) Complete the elevation of the drawing board and the two set squares.
- (b) A line from point **A** is drawn on the surface of the board. The line has a true length of 50mm and makes a true angle of 45° with the bottom edge of the board. Draw the projections of this line.



A-4. The image below shows a fragrance bottle and diffuser reeds. The given elevation and plan show two similar reeds represented by the skew lines **AB** and **CD**.

- (a) Determine the projections of the shortest horizontal line between the skew lines.
- (b) Determine the true length of a line joining **A** to **C**.



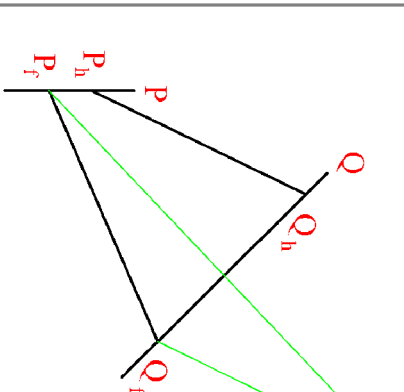
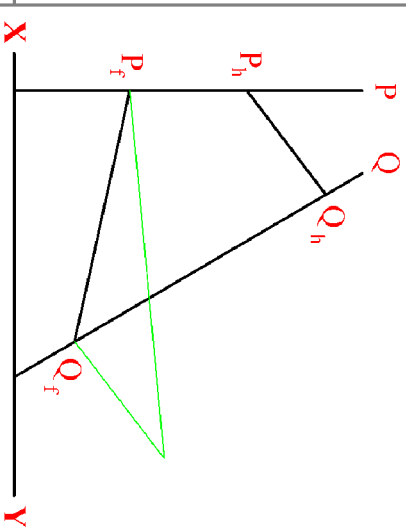
This Contour Map is part of Section C
and should only be used for the
answering of the Geologic Geometry
Option (Question C-1).

(Scale 1:1000)

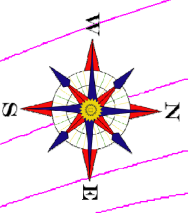
70 65 60 55 50

50 45 45 50 50

D 65



45 45 50 50 45 40 35 35 40 45



C →

O

A

B

D

55 50 45 45 50 55 60 65 70 75 80 80 75 70 65 60 55 50 50 45 40 35



Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate Examination, 2020

Design & Communication Graphics

Higher Level

Sections B and C (180 marks)

3 Hours

This examination is divided into three sections:

SECTION A	(Core - Short Questions)
SECTION B	(Core - Long Questions)
SECTION C	(Applied Graphics - Long Questions)

SECTION A

- Four questions are presented.
- Answer **any three** on the accompanying A3 examination paper.
- All questions in Section A carry **20 marks** each.

SECTION B

- Three questions are presented.
- Answer **any two** on drawing paper.
- All questions in Section B carry **45 marks** each.

SECTION C

- Five questions are presented.
- Answer **any two** (i.e. the options you have studied) on drawing paper.
- All questions in Section C carry **45 marks** each.

General Instructions:

- *Construction lines must be shown on all solutions.*
- *The graphics presented are not necessarily drawn to scale and must not be used for scaling purposes.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box provided on section A and on all other sheets used.*

SECTION B - Core

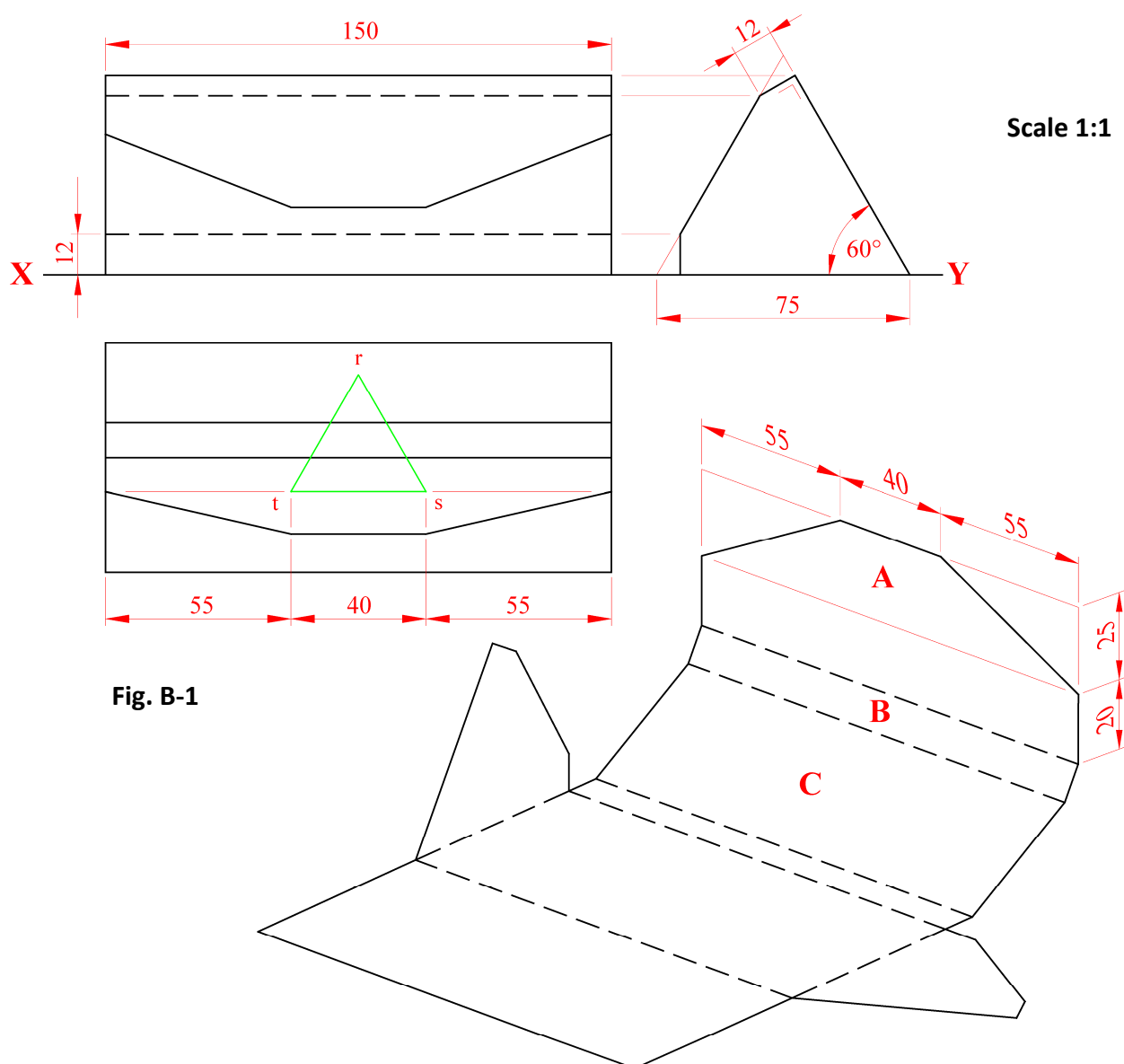
Answer **any two** questions from this section on drawing paper.

B-1. The image on the right shows a case for holding reading glasses. The shape is based on an equilateral triangular prism of side 75mm.

Fig. B-1 shows the elevation, plan and end view of the case. A pictorial view showing the surfaces of the case unfolding on to the horizontal plane is also given.



- (a) Draw the given end view, plan and elevation.
- (b) A sticker **rst**, which appears as an equilateral triangle in plan is shown. It is applied across the three surfaces **A**, **B** and **C** of the case.
Draw the plan and elevation of the sticker **rst**.
- (c) On a separate diagram, draw a one-piece surface development of the case. Include the outline location of the sticker **rst**.



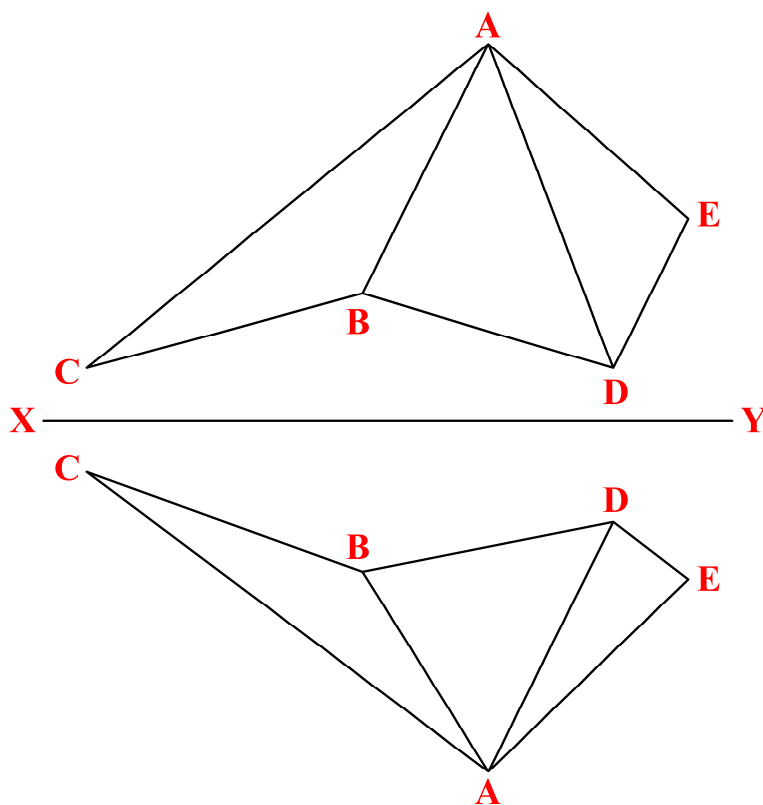
B-2. The image on the right shows the *Crystal Building* in London which is one of the world's most sustainable buildings. The geometry of the crystal-shaped design includes a series of planar glass surfaces.

Fig. B-2 shows the plan and elevation of three intersecting planar surfaces.

The horizontal and vertical coordinates for points **A**, **B**, **C** and **D** are given. Partial coordinates for point **E** are also given.



Scale 1:1



A:	180	---	75	---	70
B:	155	---	25	---	30
C:	100	---	10	---	10
D:	205	---	10	---	20
E:	220	---	40	---	?

Fig. B-2

- Draw the given elevation and plan of the intersecting planes **ABC** and **ABD**.
- Determine the dihedral angle between the planes **ABC** and **ABD**.
- Draw the elevation and plan of a horizontal line on the plane **ABC** which shall pass through point **B**. Hence:
 - Determine the angle of inclination of the plane **ABC** to the horizontal plane.
 - Determine the true shape of the plane **ABC**.
- The dihedral angle between the planes **ABD** and **ADE** is 165° . Complete the projections of the plane **ADE**.

B-3 The image on the right shows a monument to deceased members of the Irish Defence Forces.

Fig. B-3 shows the plan and elevation of a pyramid, based on the image on the right.

A pictorial view of the structure is also shown.



- (a) Draw the given plan and make a perspective drawing of the structure given the following:
- The spectator point **S**, is 3.3m from corner **A**
 - The picture plane is touching corner **A**
 - The horizon line is 3.0m above the ground line.
- 
- (b) The true shape of a flag located at position **C** is shown in elevation. The flag is in the shape of an equilateral triangle. Draw the flag in the perspective view. Use auxiliary vanishing point(s) to determine the sloping lines on the flag.

Scale 1:30

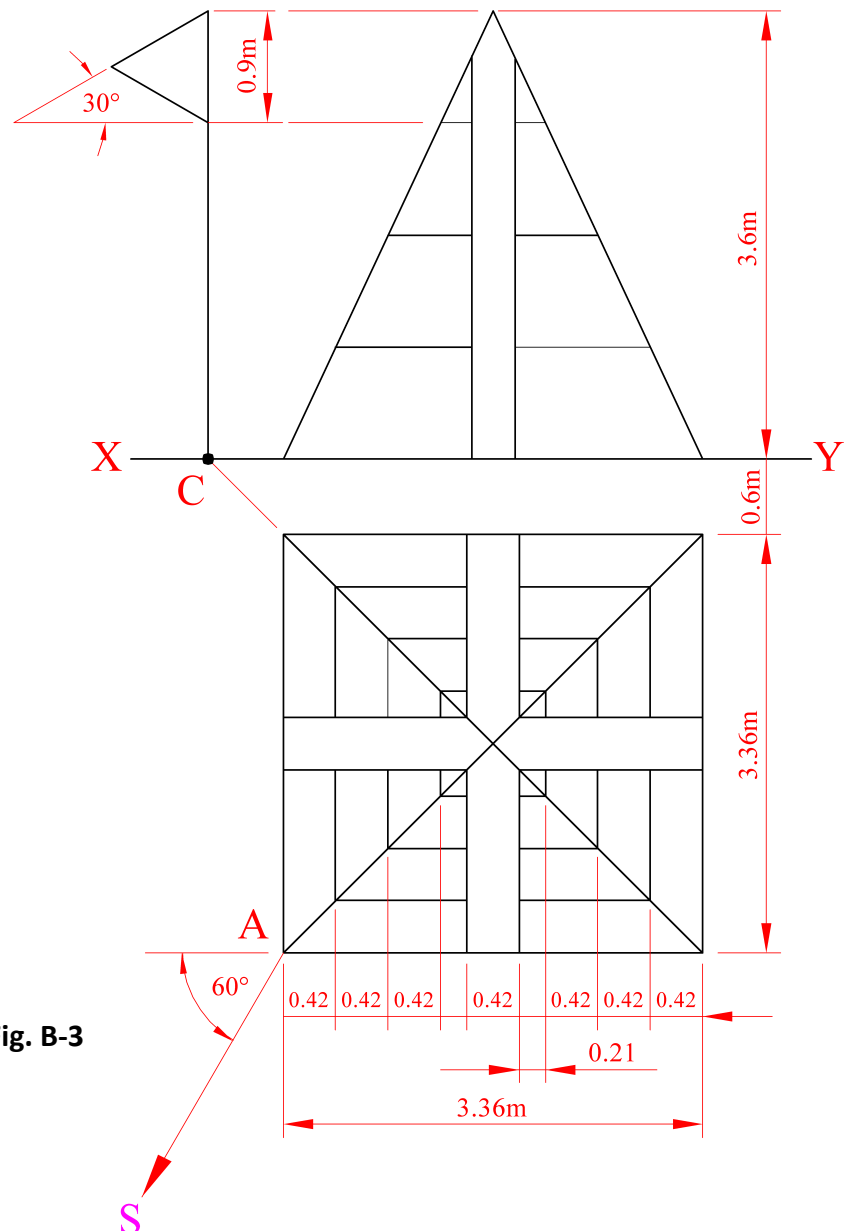
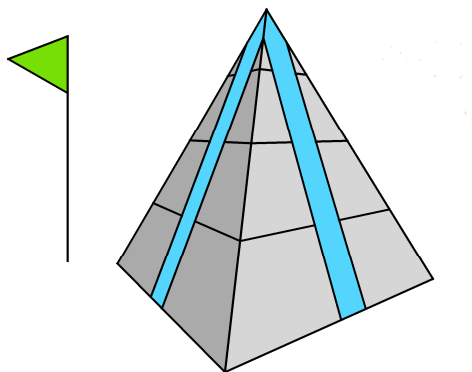


Fig. B-3

SECTION C - Applied Graphics

Answer **any two** questions (i.e. the options you have studied) from this section on drawing paper.

Geologic Geometry

- C-1. (a)** The accompanying map, located on the back page of Section A, shows ground contours at five metre vertical intervals on a footgolf course.

ABC is the edge of a proposed fairway and point **O** is the centre of the semi-circular curve which forms part of the putting green.

The fairway **ABC** and the putting green have the following specifications:

- the semi-circular putting green is level at an altitude of 60m
- the section of the fairway between **A** and **B** is level at an altitude of 60m
- the section of the fairway from **B** to **C** has a gradient of 1 in 15 rising.

Using side slopes of 1 in 1 for the cuttings and 1 in 1.5 for the embankments complete the earthworks necessary to accommodate the putting green and fairway on the northern side.



- (b)** A football, positioned at point **D**, is kicked in a westerly direction. The path of the ball is parabolic. The vertex of this parabola is located at an altitude of 95m and is 60m horizontally west of point **D**.

In the space provided at the top of the map, draw the parabolic path and determine the position of the point on the green where the ball initially lands.



- (c)** On a separate diagram on the map, the elevation and plan of two skew boreholes from points **P** and **Q** are shown. The borehole at **P** reveals the top and bottom surfaces of a stratum of ore at **P_h** and **P_f**, respectively. The borehole at **Q** reveals the top and bottom surfaces of the stratum at **Q_h** and **Q_f**, respectively.

The elevation and plan of a portion of the bottom surface of the stratum is also given.

Determine the strike, dip and thickness of the stratum.

Scale 1:1000

Structural Forms

C-2. The image on the right shows the air traffic control tower at Newcastle airport. It includes a hyperboloid of revolution and three truncated cones.

The projections of a model of the tower are shown in Fig. C-2 below. The curves **LMN** and **L₁M₁N₁** are branches of a double hyperbola with vertices **M** and **M₁**. The asymptotes **AB** and **CD** to the double hyperbola are shown in the elevation.

- (a) Draw the given plan and elevation.
- (b) Determine the positions of the directrices and focal points of the double hyperbola in elevation.
- (c) The line **PQ** represents the flight path of an aircraft. Draw the projections of the line **PQ** and determine the length of the shortest perpendicular distance from the point **S** to the line **PQ**.

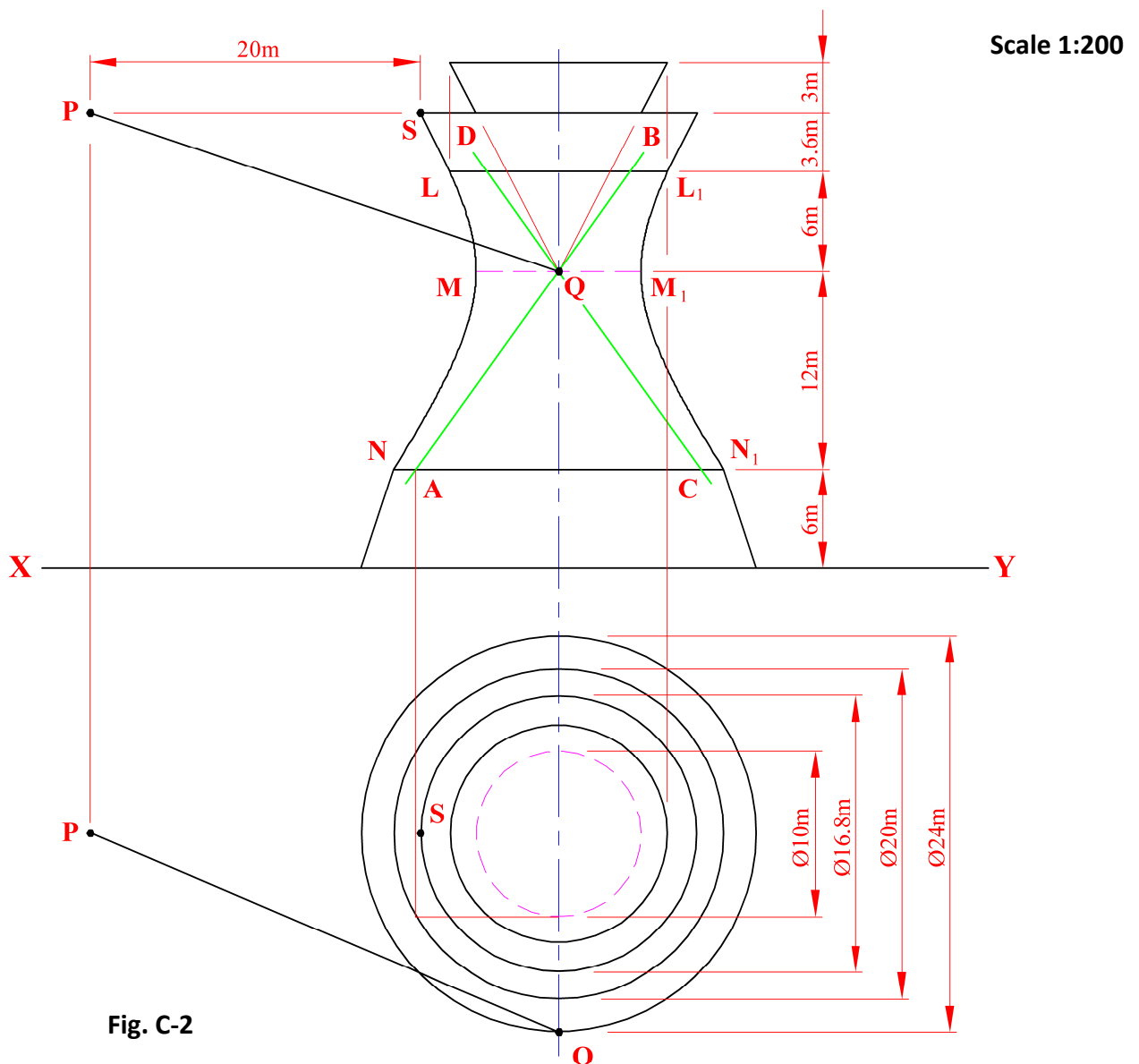


Fig. C-2

Surface Geometry

C-3. The image on the right shows a watch.
The design includes transition pieces connecting an octagonal base to a square watch face.

Fig. C-3 shows the elevation, plan and end view of a similar watch. A partial surface development of the watch face and two of the transition pieces is also shown.

- Draw the given end view and project the plan and elevation.
- Determine the dihedral angle between surfaces **A** and **B**.
- Determine the surface development of the surfaces **A**, **B** and **C**.
- The hour and minute hands are shown on the square watch face **C** in the development.

Draw the hands on surface **C** in the development view and also in elevation and plan.

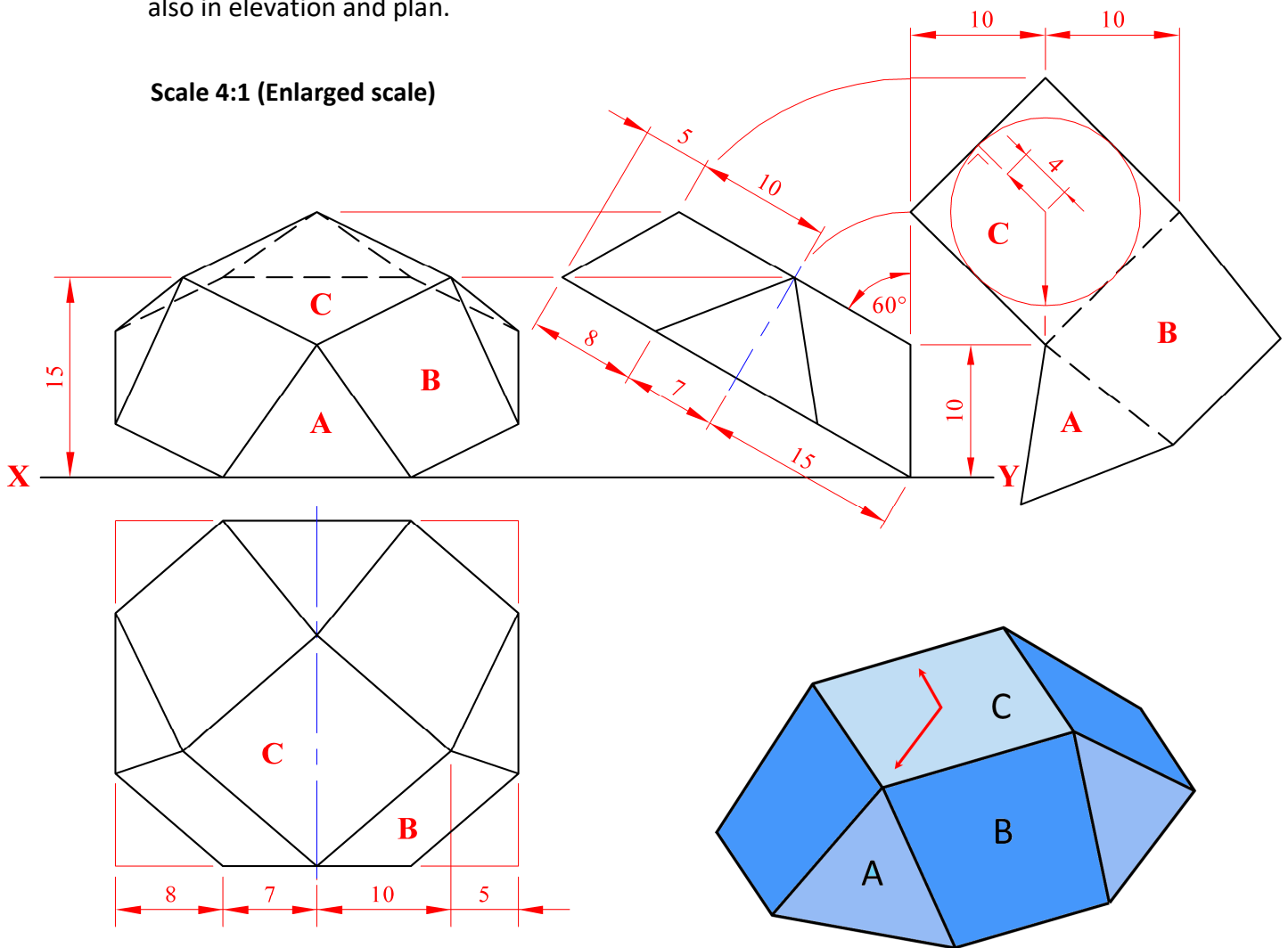


Fig. C-3

C-4. (a) The 3D graphic shows a radial plate cam.
Fig C-4(a) shows the details of a similar cam.

The cam rotates in a clockwise direction and has a Ø20mm camshaft.

Draw the cam profile and the displacement diagram given the following data:

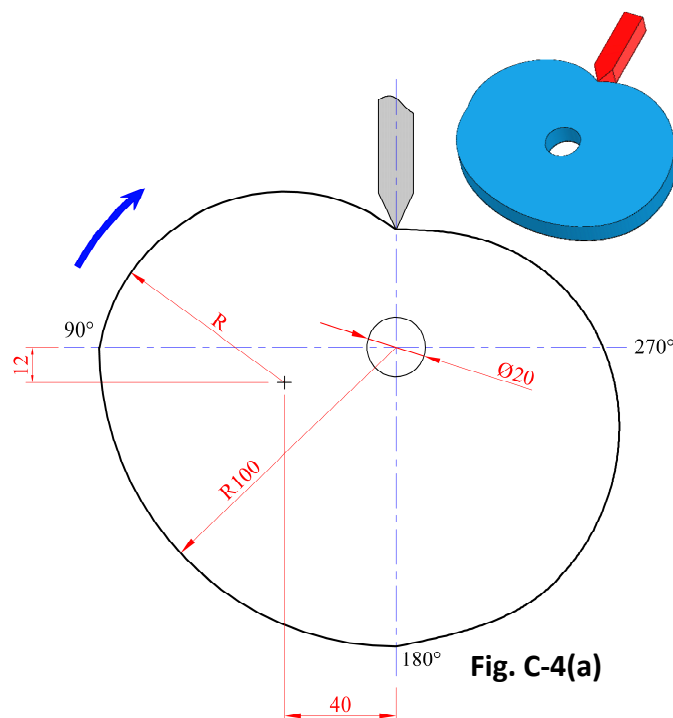
0° to 90° Rise as shown in the diagram

90° to 180° Dwell as shown in the diagram

180° to 360° Return to initial position with Simple Harmonic Motion.

In the displacement diagram, use a distance of 12mm to represent each 30° interval.

Scale 1:1

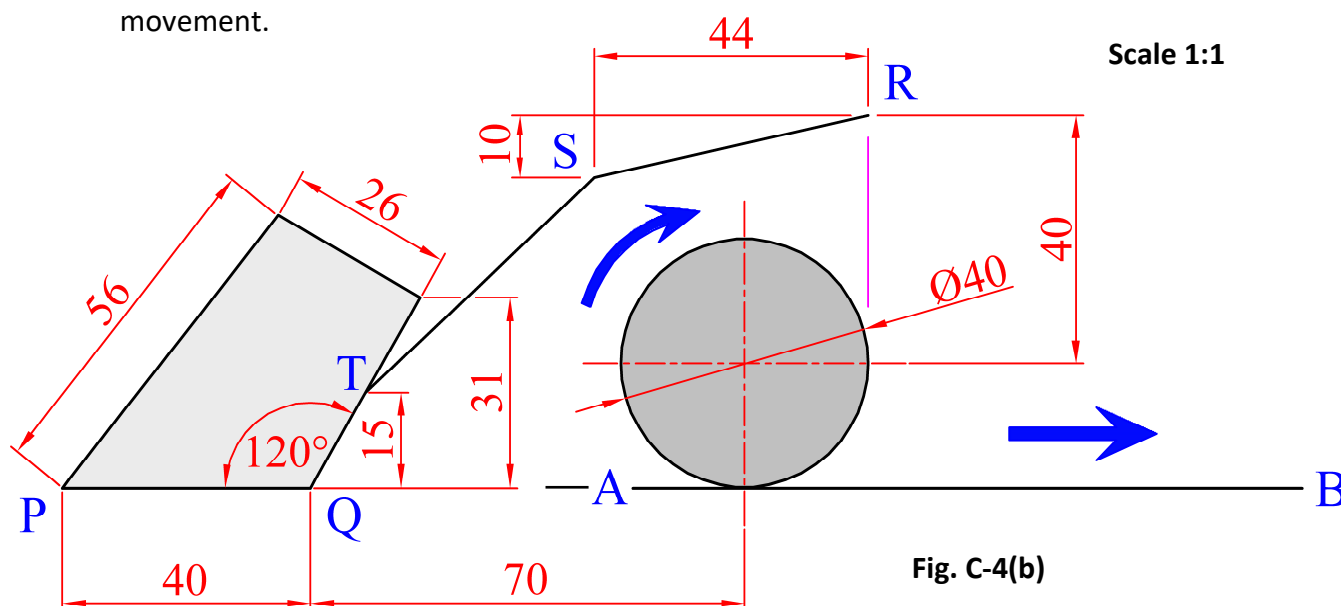


(b) The graphic on the right shows a toy digger. Line diagram details of portion of the digger showing the front wheel, the arm and the bucket are given in Fig C-4(b) below. The bucket rests on the ground as shown.

The wheel rotates in a clockwise direction through 180° moving the digger along line **AB**. During this movement the arm rotates clockwise through 60° about point **R** at a constant rate. The edge **PQ** of the bucket remains horizontal throughout the movement.

Draw the given outline of the digger and plot the locus of point **P** for the combined movement.

Scale 1:1



Assemblies

C-5. The 3D graphic on the right shows a phone holder for a bicycle.
 The details of the holder are given in Fig. C-5 below.
 The parts list is also given in a table. The swivel arm is inclined at 45°. The phone holder body is shown sectioned as required.
 Draw a sectional elevation on A-A, with the parts fully assembled.
 Screws and bolts need not be shown.
*(Unless otherwise stated, fillets are 6mm and chamfers 1×1mm.
 Some dimensions and inner parts have been removed for clarity.
 Any omitted dimensions may be estimated.)*



Scale 1:1

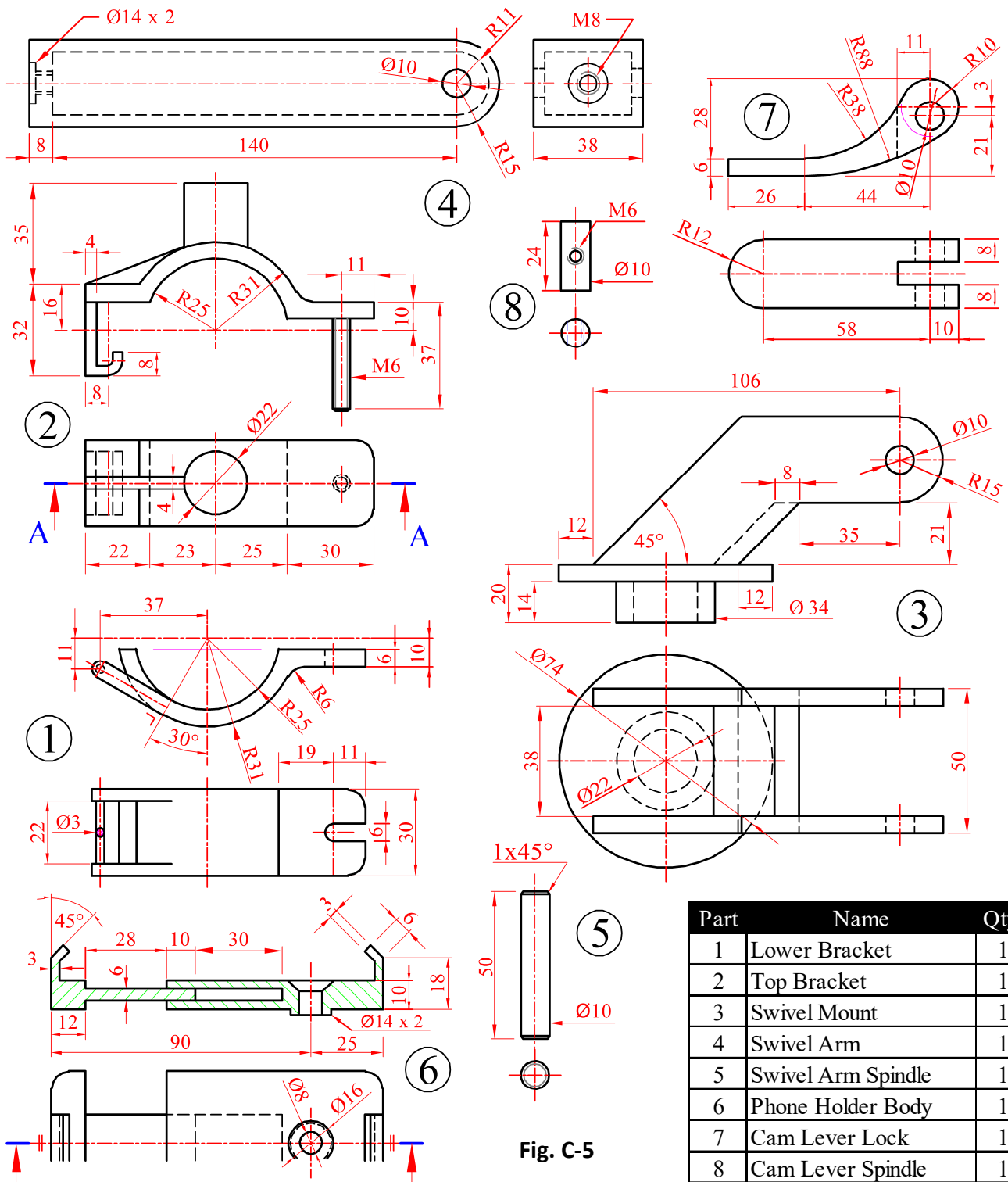


Fig. C-5

Part	Name	Qty.
1	Lower Bracket	1
2	Top Bracket	1
3	Swivel Mount	1
4	Swivel Arm	1
5	Swivel Arm Spindle	1
6	Phone Holder Body	1
7	Cam Lever Lock	1
8	Cam Lever Spindle	1

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