



*Leaving Certificate Examination, 2014*

***Design & Communication Graphics***  
***Higher Level***

***Sections B and C (180 marks)***

**Wednesday, 18 June**  
**Afternoon, 2:00 - 5:00**

**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:**

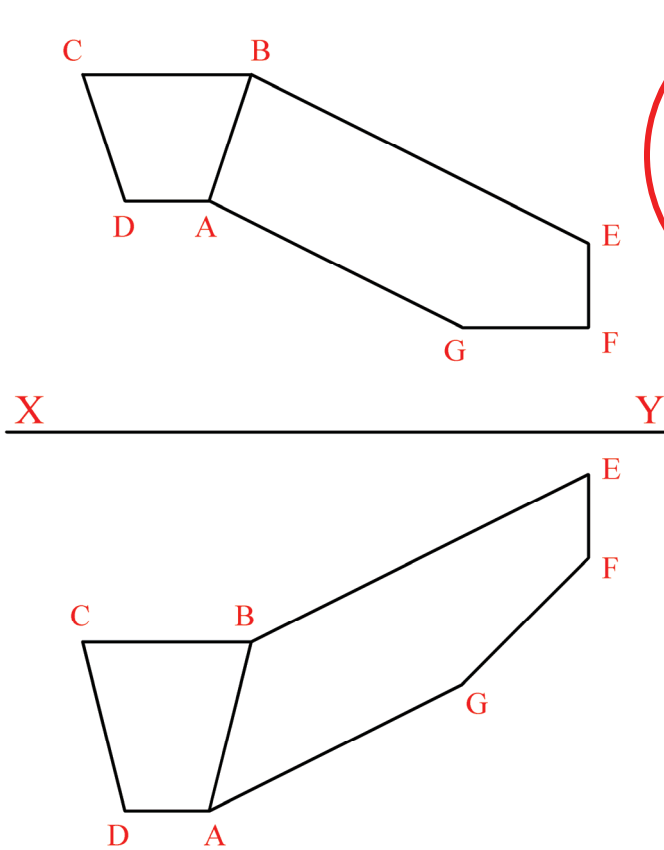
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your Examination number in the box provided on section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

## SECTION B - Core

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

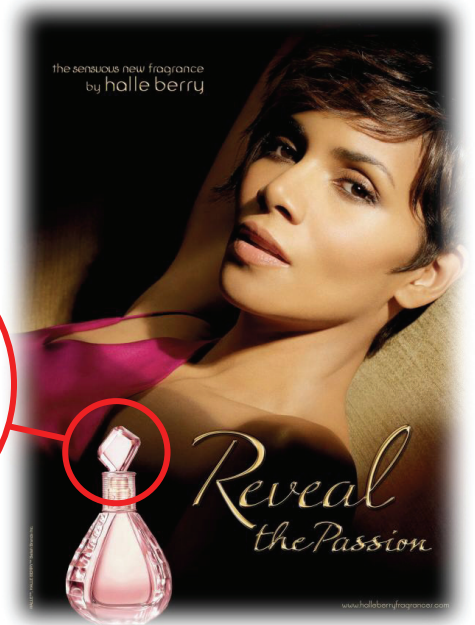
**B-1.** The image across shows the Halle Berry “Reveal” perfume bottle. The cap of the bottle includes intersecting planar faces.

Fig. B-1 below shows the plan and elevation of two such intersecting planes, **ABCD** and **ABEFG**. The horizontal and vertical coordinates of the two planes are also given.



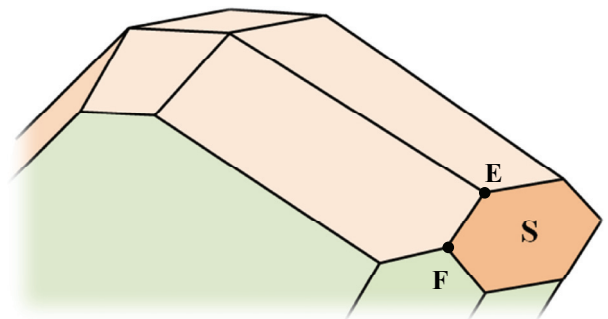
**Fig. B-1**

A	=	130	---	55	---	90
B	=	140	---	85	---	50
C	=	100	---	85	---	50
D	=	110	---	55	---	90
E	=	220	---	45	---	10
F	=	220	---	25	---	30
G	=	190	---	25	---	60



- (a) Draw the given elevation and plan of the two intersecting planes.
- (b) Determine the dihedral angle between the planes.
- (c) Determine the true shape of the surface **ABCD**.
- (d) Another surface, **S**, on the bottle cap is a regular hexagon.

**EF** is one of the sides of this hexagon.  
On a separate diagram draw, full size, the true shape of hexagon **S**.



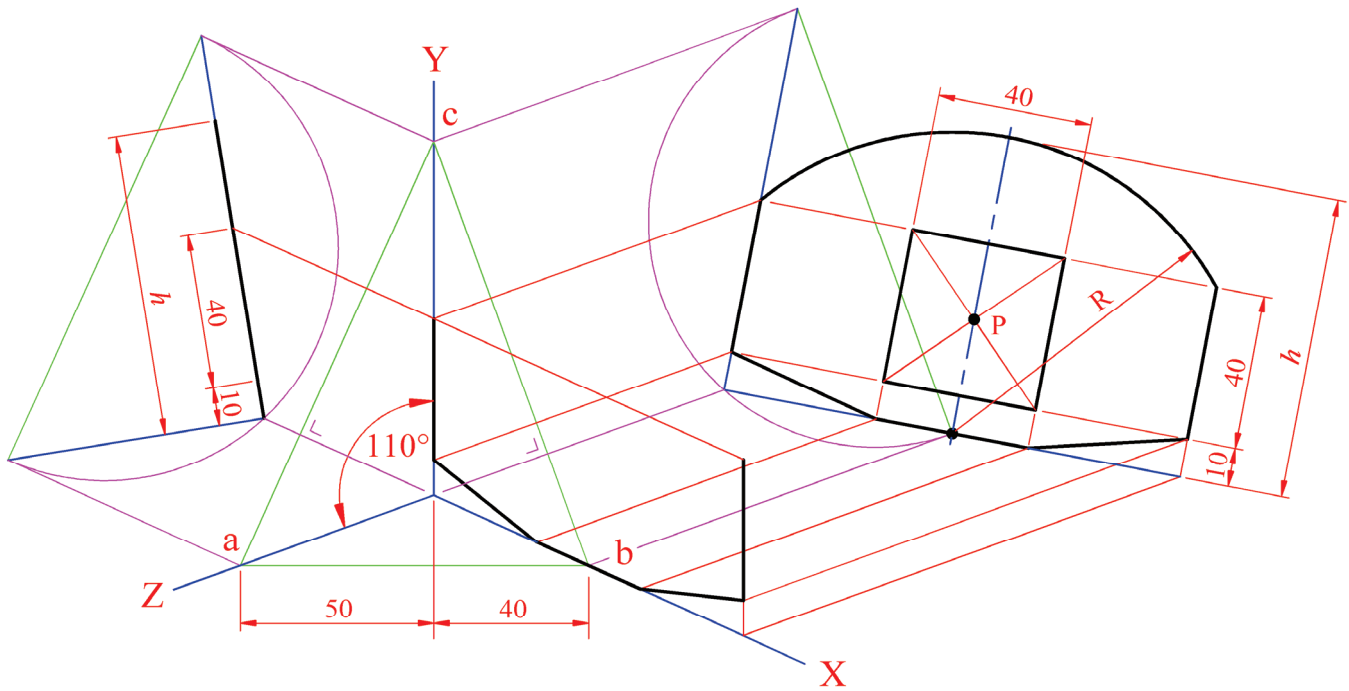
**Scale 1:1**

**B-2.** Fig. B-2 shows an incomplete trimetric projection, using the axonometric axes method, of a model of a basketball backboard, based on the 3D graphic on the right. The elevation and end view are shown in their required positions.



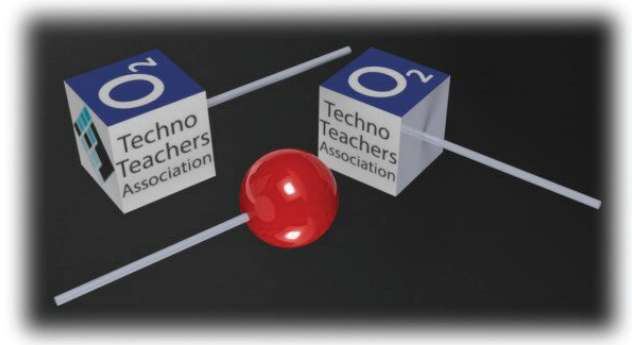
- (a) Draw the axonometric axes **X**, **Y** and **Z** and the scalene triangle **abc**.
- (b) Draw the elevation and end view orientated as shown and complete the trimetric projection.
- (c) Draw the axonometric projection of a basketball in contact with the backboard at the point **P**. The radius of the ball is 12mm.

**Scale 1:1**



**Fig. B-2**

**B-3.** The 3-D graphic on the right shows lollipops which are to be distributed as promotional gifts at a trade show. Each lollipop is packaged in a cube as shown. The cube is as small as possible and the stick emerges centrally from one of its faces.

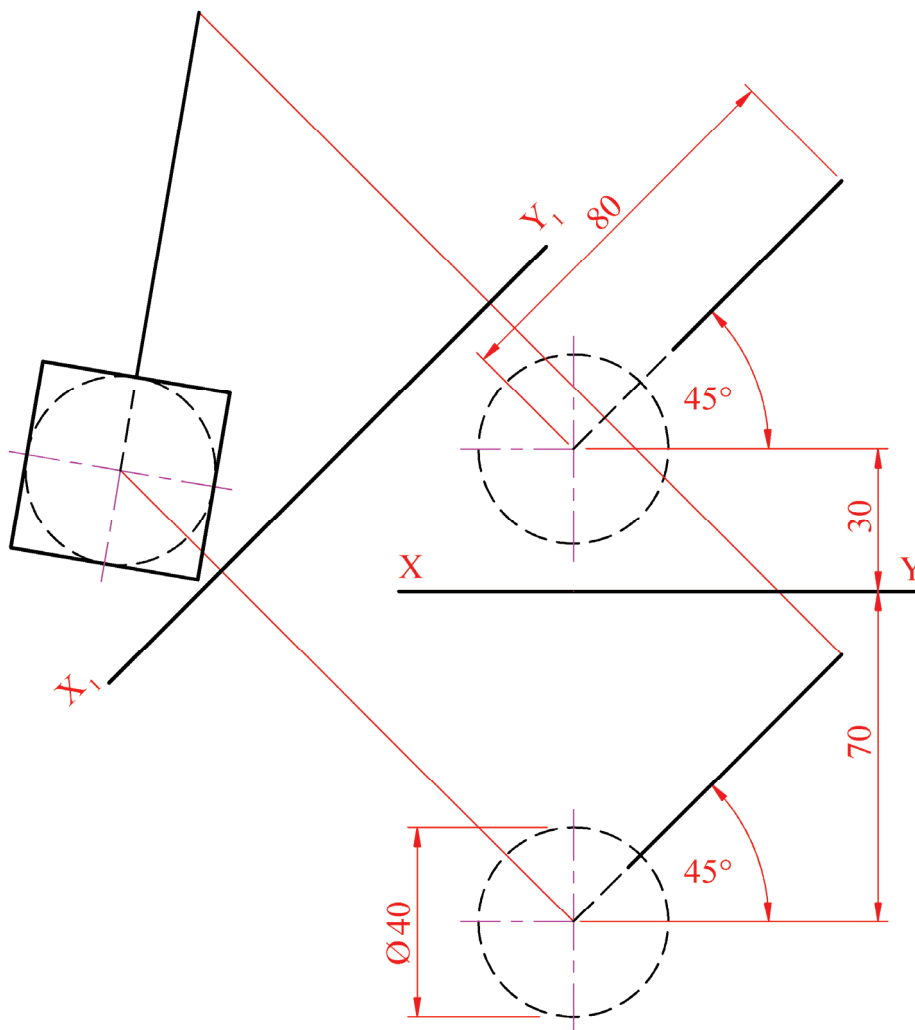


The plan and elevation of one of the lollipops is shown in Fig. B-3 below.

An auxiliary view which includes the cube-shaped packaging is also given.

- (a) Draw the given plan and elevation of the lollipop.
- (b) Draw the given auxiliary elevation.
- (c) Complete the plan and elevation to include the cube-shaped packaging.

**Scale 1:1**



**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 5 metre vertical intervals on a proposed golf course.

**ABC** is the centreline of a proposed fairway and **O** is the centre of the circular curve which forms the putting green.

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

- the section of the fairway between **A** and **B** is level at an altitude of 75m;
- the putting green is also level at an altitude of 75m;
- the section of the fairway from **B** to **C** has a gradient of 1 in 20 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 the fairway on the northern side.

*Note: The earthworks on the southern side have already been completed.*

**(b)** In the space provided at the top of the map, draw a vertical section (profile) on the line **DE** *after* the earthworks for the fairway **ABC** have been completed.

**(c)** A golf ball, positioned at the point **E**, is struck in a westerly direction. The path of the ball is a parabola which rises to a maximum altitude of 115m having travelled a horizontal distance of 100m (in plan).

In the profile view, draw the parabola and determine the position of the point on the green where the ball initially lands.

**Scale 1:1000**



# Structural Forms

**C-2.** The graphic on the right shows the club house of the *Dubai Creek golf and yacht club*. The design of the building was inspired by the sails of a ship.



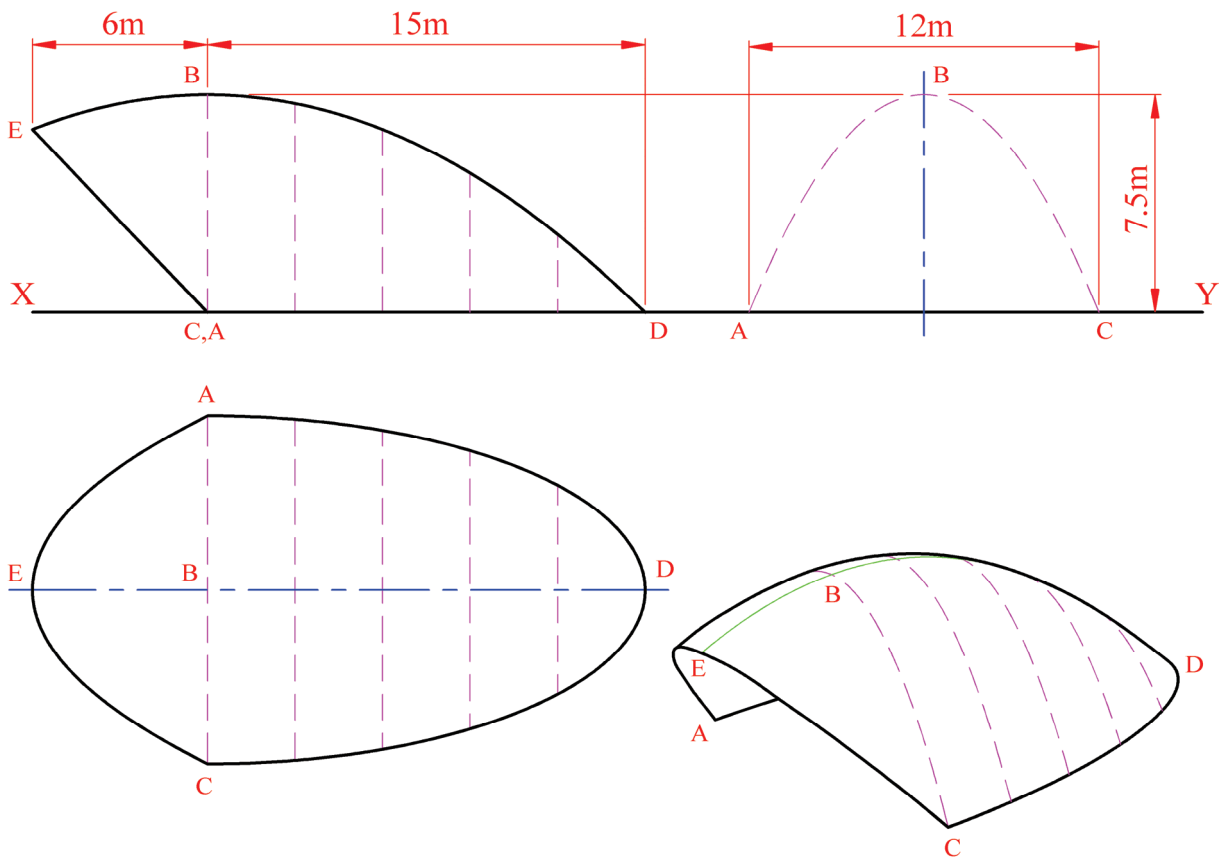
The projections of part of the structure are shown in Fig. C-2 below. An isometric view is also given. The curved surface is produced by translating the generating parabola **ABC**, in a vertical position, along the parabola **EBD**.

The generating parabola **ABC** is represented by a dotted line in the outline end view.

**B** is the vertex of both the parabola **ABC** and the parabola **EBD**, as shown.

- (a) Draw the given elevation of the structure.
- (b) Draw the end view of the generating parabola **ABC**.
- (c) Project the plan of the structure.
- (d) Determine the true shape of surface **AEC**.

Scale 1:100



**Fig. C-2**

# Surface Geometry

C-3. The concept design for the proposed *U.S. Marshals Museum* in America is shown in the graphic below. The plan of the building was inspired by the pentagonal star shape on a marshal's badge.

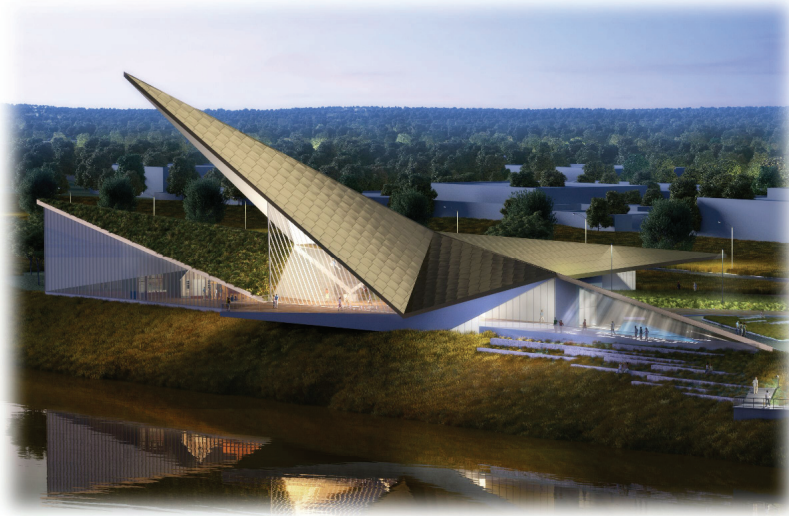


Fig. C-3 shows the plan and elevation of three intersecting triangular surfaces A, B and C, which form part of the structure. The outline plan is based on a regular pentagon.

- (a) Draw the regular pentagon and complete the given plan and elevation of surfaces A and B.
- (b) Determine the dihedral angle between the surfaces A and B.
- (c) Determine the vertical trace and the horizontal trace of the plane that contains surface B.
- (d) The dihedral angle between surfaces B and C is  $160^\circ$ . Complete the projections of surface C.

Scale 1:500

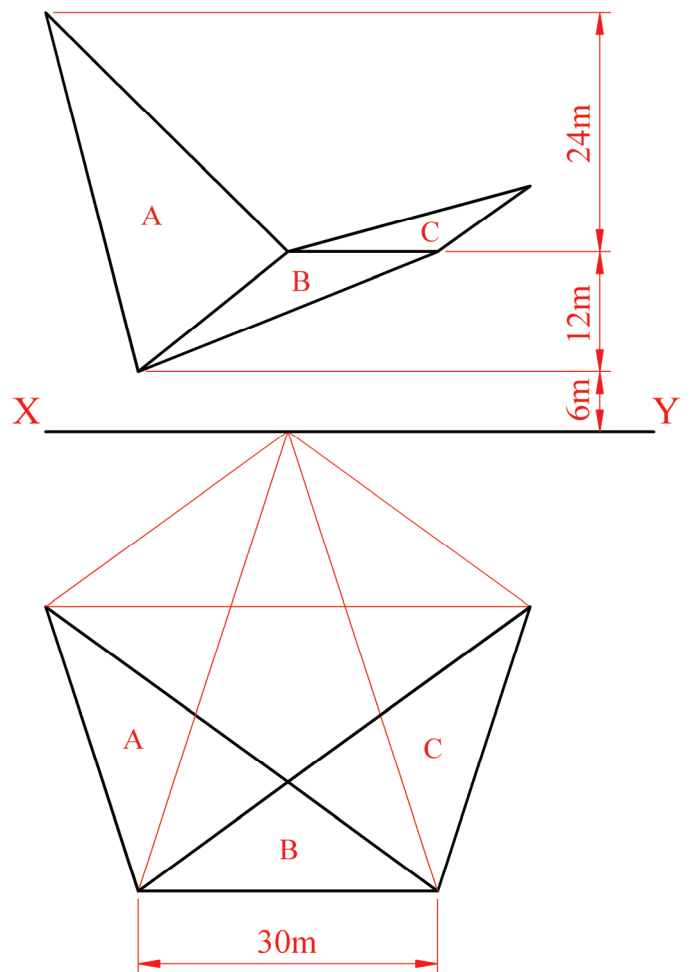


Fig. C-3

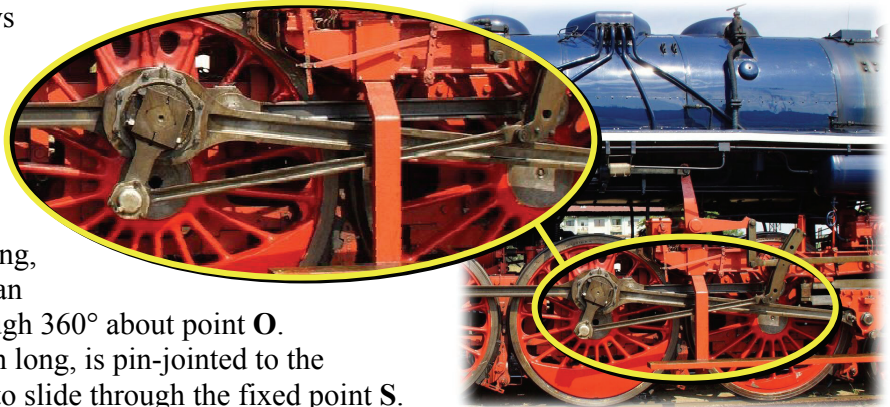
# Dynamic Mechanisms

- C-4. (a)** The graphic on the right shows a crank and slider mechanism in a steam engine.

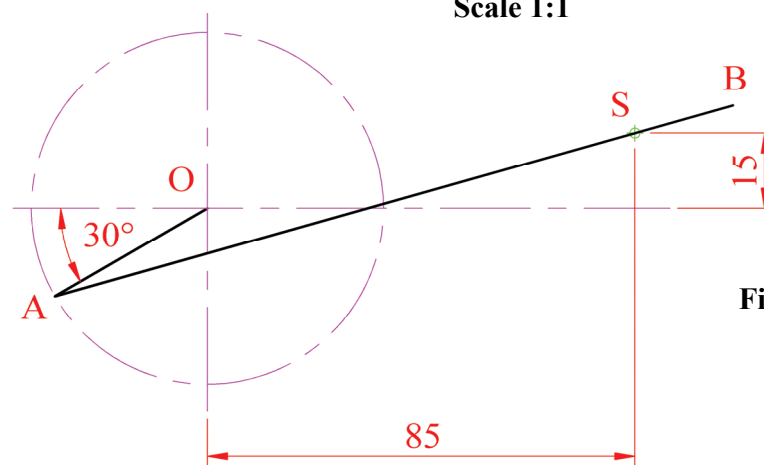
A similar link mechanism is shown, in line diagram format, in Fig. C-4(a) below.

Crank **OA**, which is 35mm long, rotates at a constant speed in an anti-clockwise direction through  $360^\circ$  about point **O**. The link **AB**, which is 140mm long, is pin-jointed to the crank **OA** and is constrained to slide through the fixed point **S**.

Plot the locus of point **B** for this movement.



Scale 1:1



**Fig. C-4(a)**

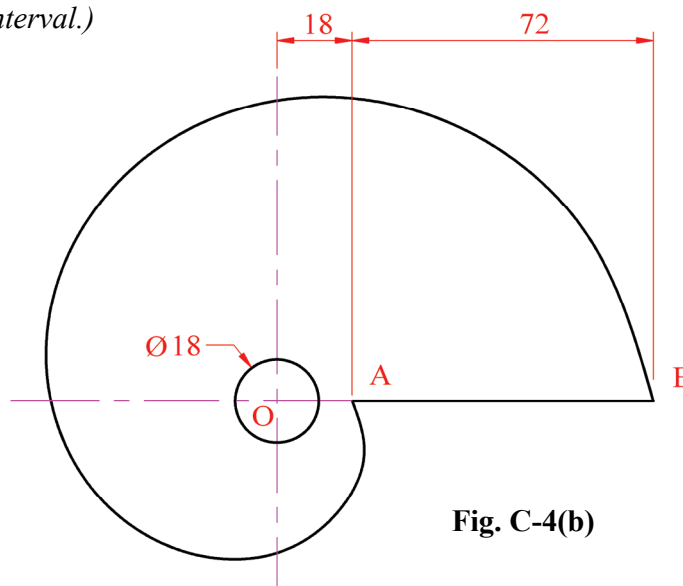
- (b)** The 3D graphic on the right shows a radial plate cam, which is used in the steam engine. A 2D drawing of the cam is shown in Fig. C-4(b) below.

The cam is based on an archimedean spiral which allows for a rapid fall of the in-line, knife-edge follower.

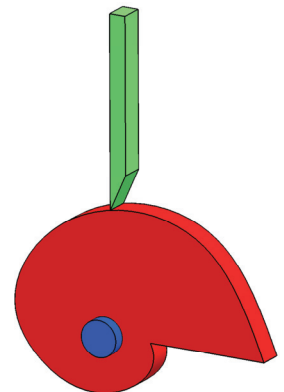
Draw the given cam profile and plot the follower displacement diagram for one anti-clockwise rotation of the cam.

*(In the displacement diagram, use a distance of 12mm to represent each  $30^\circ$  interval.)*

**Scale 1:1**



**Fig. C-4(b)**





# Assemblies

C-5. (a) Details of a miniature **Bench Vice** are shown in Fig. C-5. The vice is adjustable and can be tilted and rotated. A parts list and a 3D graphic of the parts are also given. Draw a full size sectional elevation, on A-A, of the vice in the horizontal position, showing the parts fully assembled and with the jaw faces 30mm apart. (All fillets are 6mm, all chamfers are 2×45°. Any omitted dimensions may be estimated.)

(b) Determine, on your drawing, the position of point P when the jaws are fully closed and the vice is tilted fully to the left.

Part	Name	Qty.
1	Moving Jaw	1
2	Base	1
3	Clamping Nut	1
4	Swivel Shaft	1
5	Retaining Screw	1
6	Adjusting Screw	1
7	Crossbar Nut	1
8	Fixed Jaw	1

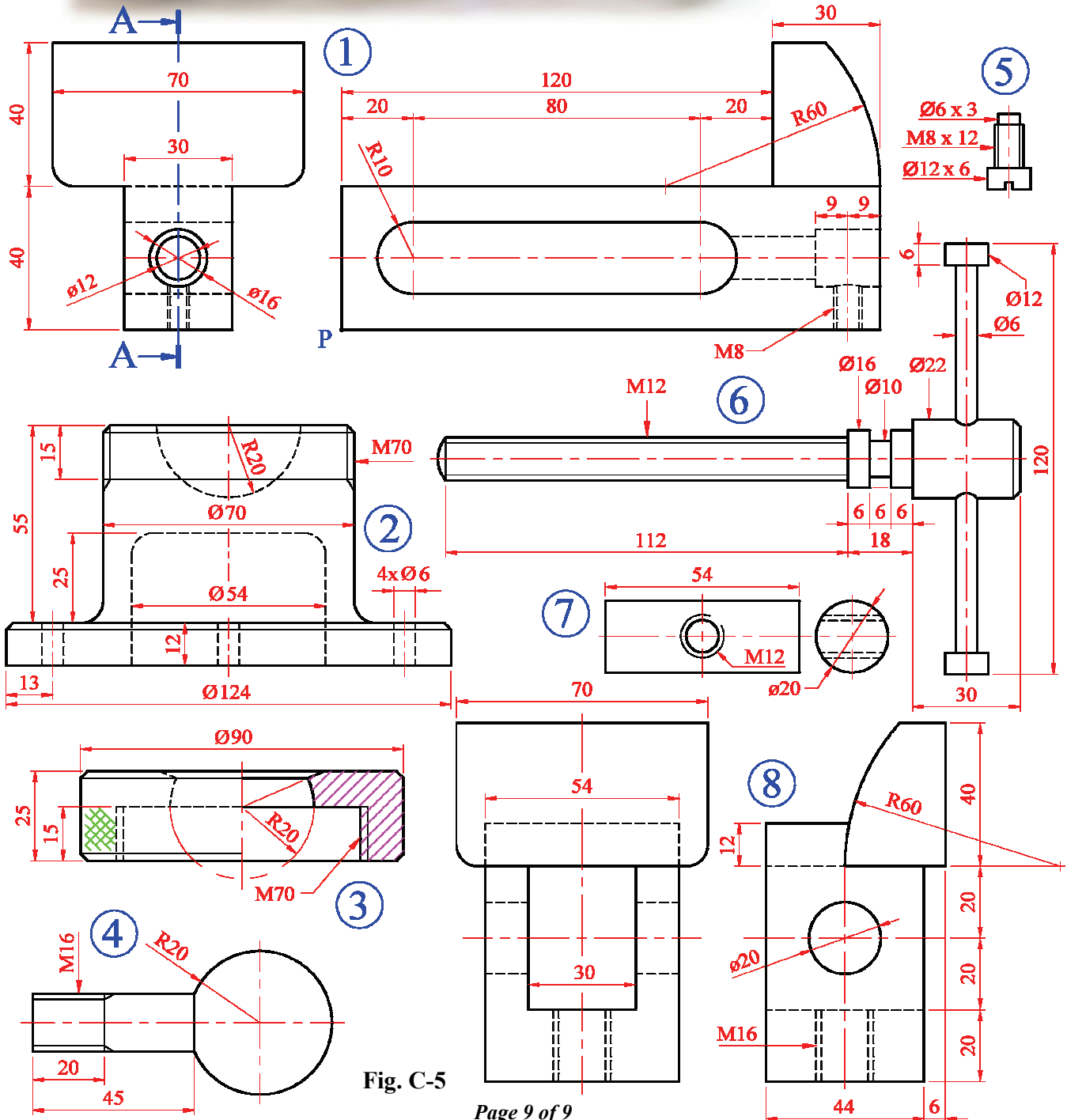
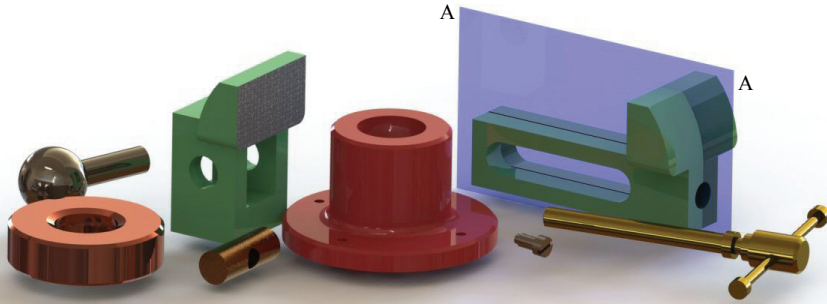


Fig. C-5

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