

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA
MATRICULATION EXAMINATION
INTERMEDIATE LEVEL
MAY 2016

| | |
|-----------------|---|
| SUBJECT: | ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION |
| DATE: | 25 th April 2016 |
| TIME: | 4:00 p.m. to 7:05 p.m. |

Directions to Candidates

Write your **index number** where indicated **at the top** of **all** Drawing Sheets.

Only scientific calculators may be used. Programmable calculators are **NOT** allowed.

Unless otherwise stated:

- B.S. or equivalent (ISO) recommendations should be adopted throughout your answers;
- all dimensions are in millimetres, unless otherwise stated;
- all answers are to be accurately drawn with instruments;
- all construction lines must be left in each solution;
- drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

Colour/shading may be used where appropriate.

Section A: Attempt any **FOUR** questions from five.

Section B: Attempt any **ONE** question from two.

Section C: Attempt any **ONE** question from two.

SECTION A

Attempt only **FOUR** questions from this section.

Question 1

The illustration in Figure 1a shows an exploded view of a ceiling lighting fixture. The front reflector is formed from a parabola and the rear reflector shade is formed from its evolute.

- a) Copy the directrix, axis and vertex shown in Figure 1b and draw the upper part of the parabola.
- b) Show by neat construction, the centres of curvature of the points P₁, P₂, and P₃. Draw by a smooth curve the evolute of the parabola.



(13 marks)

FIG. 1a

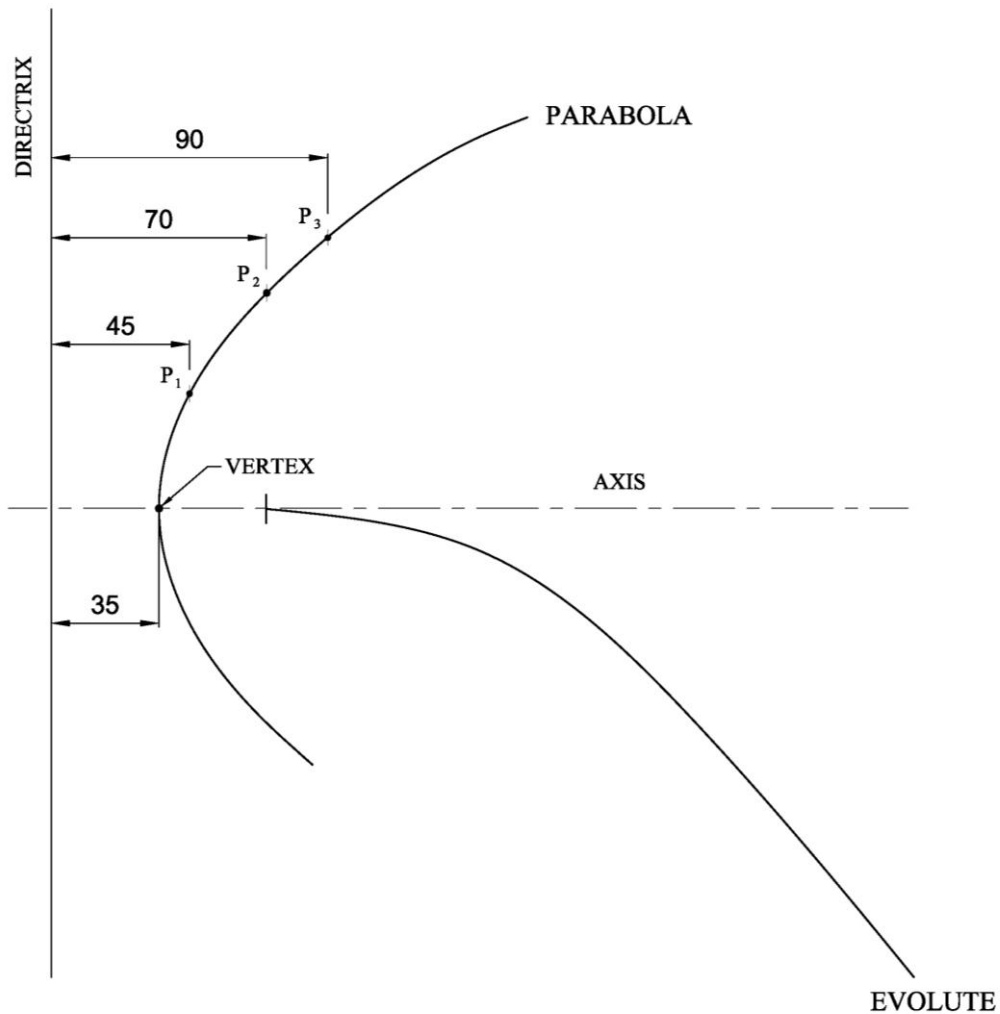


FIG.1b

Question 2

A uniform beam is hinged to a wall and supported by a steel wire as shown in Figure 2. Four weights are attached to the beam and act as downward forces.

- a) Copy the space diagram using a scale of 80 mm representing 1 metre.
- b) Find the position of the resultant of the four downward forces and state the distance of the resultant from the wall. Use a scale of 20 mm representing 150 N.
- c) Determine graphically the magnitude and direction of the:
 - (i) tension in the steel wire;
 - (ii) reaction at the hinge.

(13 marks)

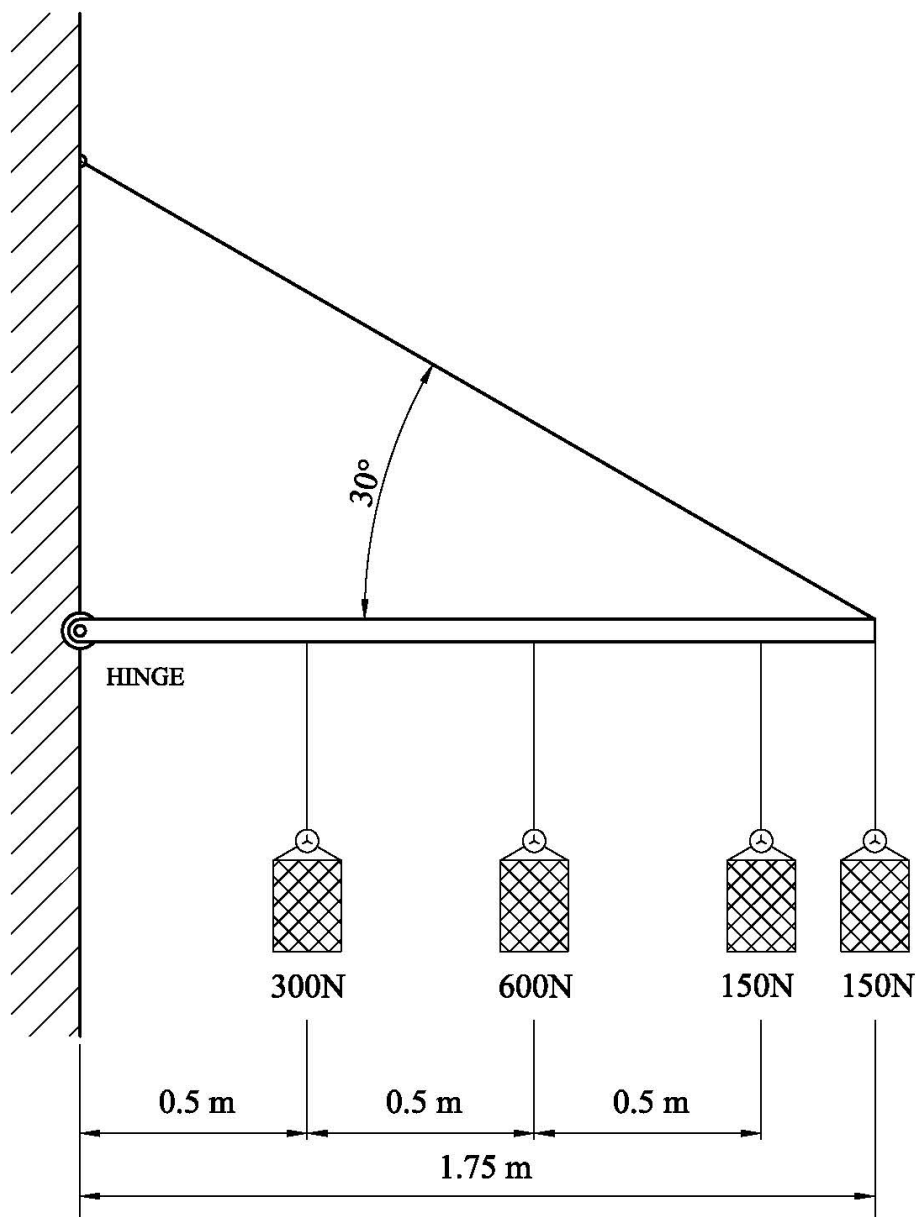


FIG. 2

Question 3

The illustration in Figure 3a represents a sheet metal duct of a regular hexagonal cross-section connected to an open duct. The open duct consists of a rectangular octagonal prism with the upper three sides removed.

The elevation of the assembly is shown in Figure 3b. The open duct is 80 mm long and is equally spaced about the hexagonal duct axis.

Construct full size:

- a) the given elevation;
- b) an elevation in the direction of arrow A;
- c) an auxiliary view in the direction of arrow B.

Represent all hidden details.

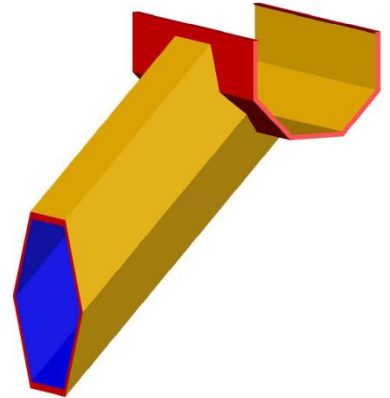


FIG. 3a

(13 marks)

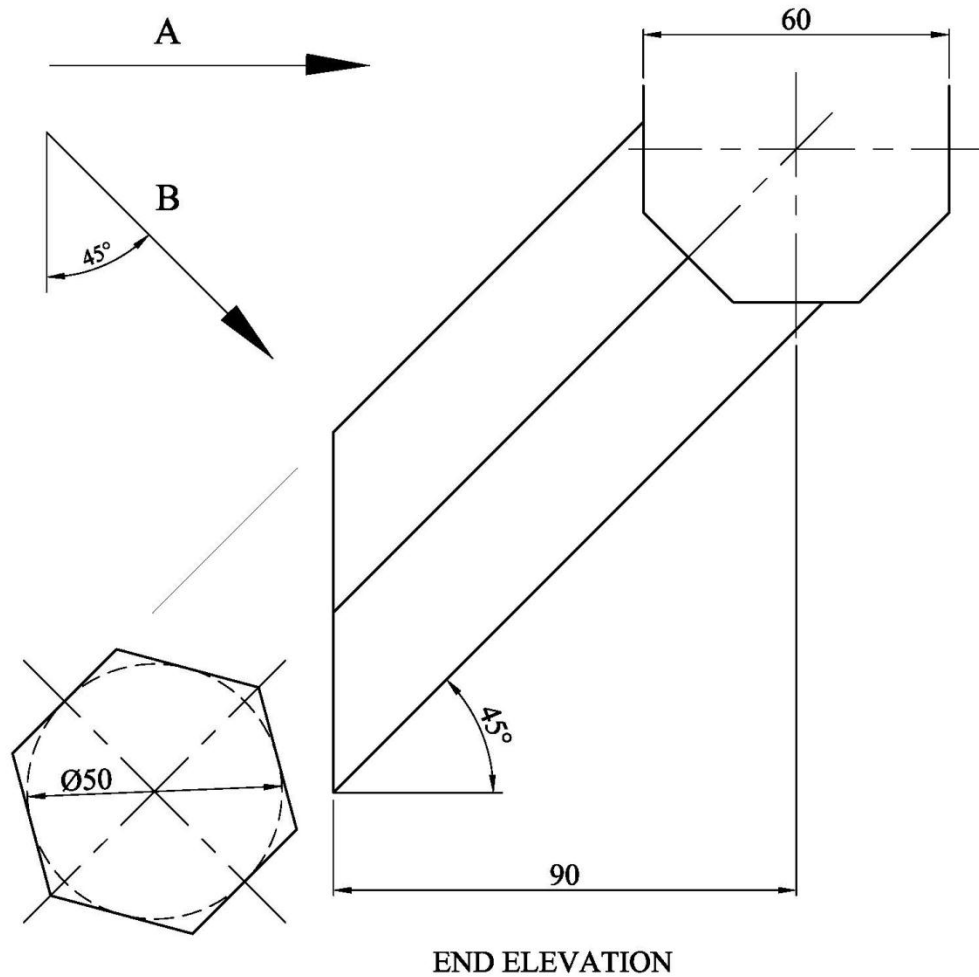
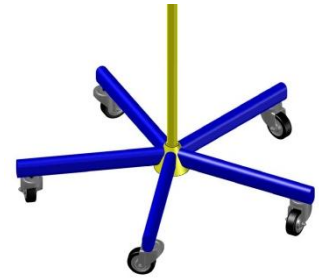


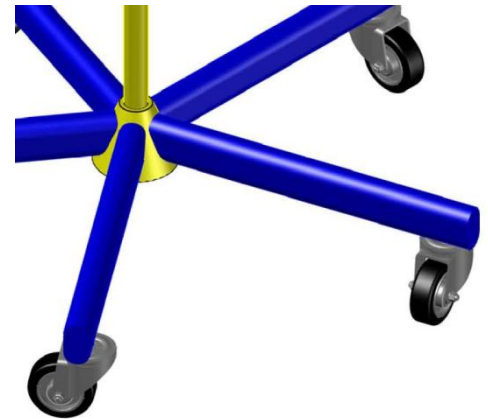
FIG. 3b

Question 4

The base of a hospital stand is illustrated in Figure 4a. The vertical stainless steel pole is rigidly fixed to the centre hub of the base. Five castors swivelling wheels are fixed at the end of the five radial support arms to ease the mobility of the stand by the nurses and patients. The five radial support arms are equally spaced and joined to the conical hub at the centre.



- Copy, full size, the incomplete elevation and plan of the lower part of the stand shown in Figure 4b.
- Show by construction, the curve of intersection between the semi-cylindrical arms and the conical hub in the plan.
- Project and complete, by using neat projection lines, the front elevation of the stand, showing the curve of intersection on the two arms.



(13 marks)

Note: Include hidden details.

FIG. 4a

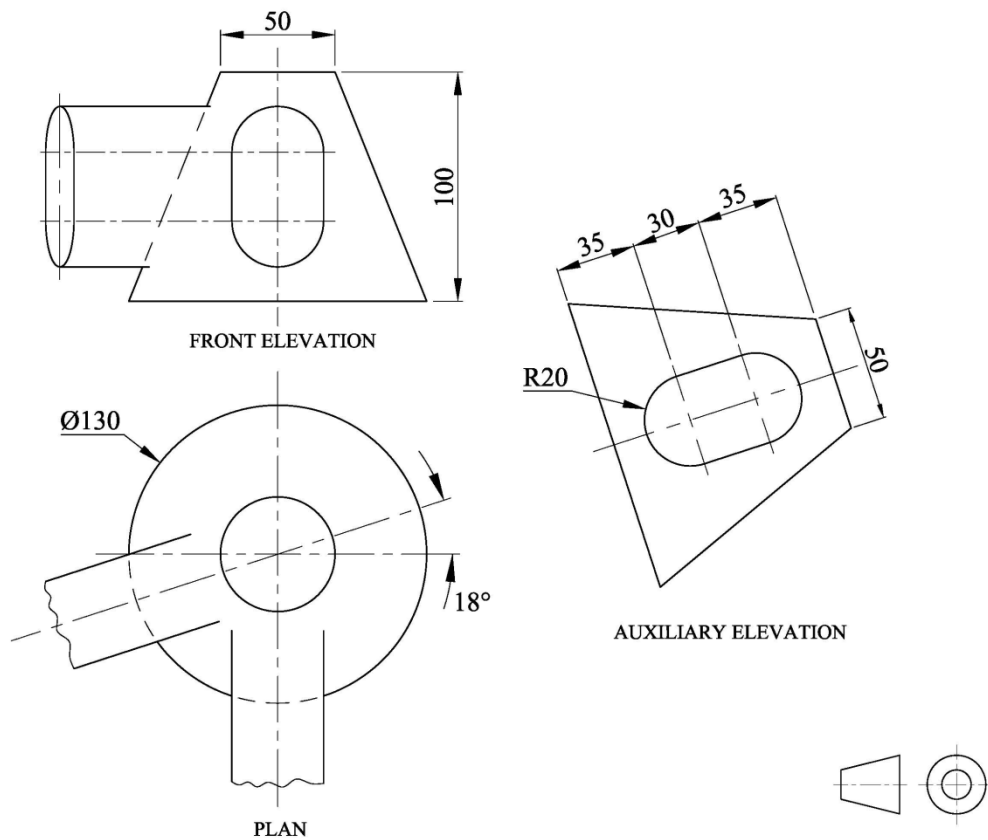


FIG. 4b

Question 5

A rectangular duct is positioned in a corner and two of its sides lie flat against the adjacent walls. The rectangular duct has a transition piece to shift the rectangular section by 90° about the corner; the broad side attached to one wall shifts to the other wall.

- Copy, full size, the plan and elevation shown in Figure 5b;
- Include construction lines on the given views to form triangles and find the necessary true lengths to answer (c);
- Construct a surface development of the rectangular duct.

Notes: Place the joint line along the edge 's', 't' on the surface development.

(13 marks)

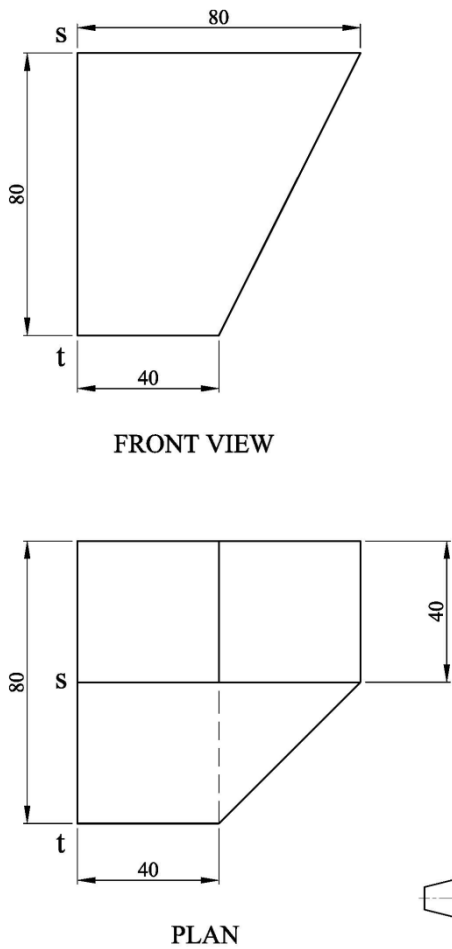


FIG. 5b

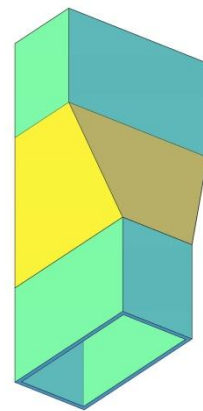
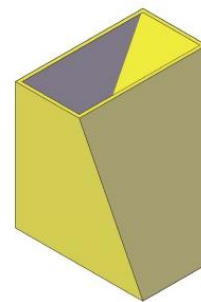
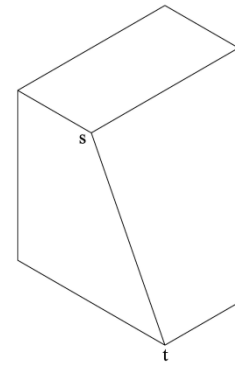


FIG. 5a

SECTION B

Attempt only **ONE** question from this section.

Question 6

An exploded view of a Clamp Bracket is shown in Figure 6a. Detailed working drawings of the separate parts are given in Figure 6b on the attached A3 sheet. Two identical bushes (item 2 & 3) fit in the 26 mm diameter hole of the bracket (item 1). The plain end face of the bush (item 2) is to be assembled 5 mm above the outside top side of the bracket. The 12 mm radius arc is to be aligned with the 40 mm diameter bore of the bracket. Face marked P on the bush has to match the inner curvature at the mark Q of the bracket. The other bush (item 3) is assembled similarly with the plain end on the lower side of the bracket.

An M16 mm diameter bolt (item 4) is pressed from the lower end into the 16 mm diameter bore of the two bushes. A segment is machined on the bolt head, the flat sides of the head rest against the flat machined recess of the bracket to prevent the bolt from rotating.

A clamping bar with a handle (item 5) secures the bolt to the body of the bracket

Draw, full size in first angle projection, the following views of the clamp bracket assembly.

- A sectional elevation on the main horizontal centre line of symmetry, as indicated by the arrows A-A;
- A sectional plan on the main horizontal centre line through the 40mm diameter bore as indicated by the arrows B-B.

The clamping bar handle is to be positioned along the centre line of symmetry. Do not include hidden detail.

(24 marks)

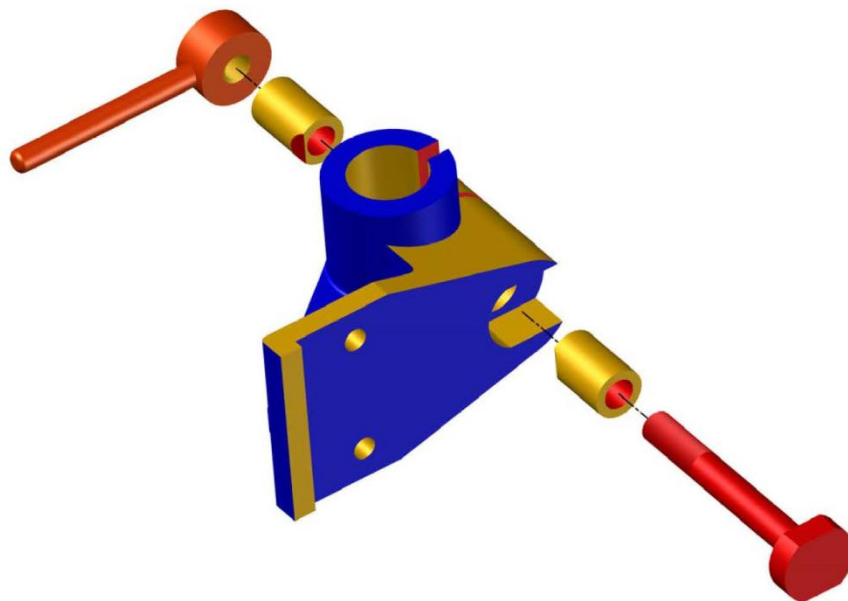


FIG. 6a

Question 7

A sketch of a roller ended follower on a disk cam is shown in Figure 7a. Two incomplete elevations of the cam and the in-line roller ended follower are shown in Figure 7b.

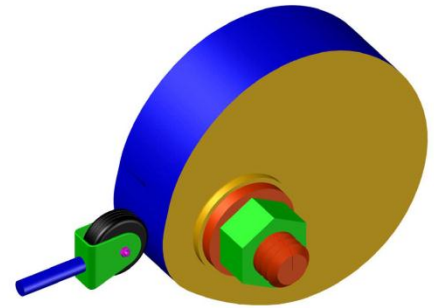


FIG. 7a

- a) Construct the cam to satisfy the following design specifications.
 - (i) A disc cam of a minimum radius of 60 mm mounted on a camshaft of 30 mm diameter to rotate in an anticlockwise direction.
 - (ii) an in-line roller ended follower of 20 mm diameter to have the following displacement and motion:
 - 0° to 90°, rise of 24 mm with uniform acceleration;
 - 90° to 180°, rise of 24 mm with uniform retardation;
 - 180° to 300°, fall of 48 mm with simple harmonic motion;
 - 300° to 360°, dwell.

- b) Complete the sectional end elevation shown in Figure 7b of the disc cam by drawing a washer and an M20 hexagonal nut on the 54 mm diameter spot face. Show a small portion of the M20 thread part.

- c) The camshaft fitted to the disc cam is tapered as shown in Figure 7c.
 - (i) Construct an isometric view of the tapered camshaft showing a key slot.
 - (ii) Draw an exploded isometric view of a suitable key which can fit between the tapered hole in the hub and the tapered part of the camshaft. Name the type of key used.

(24 marks)

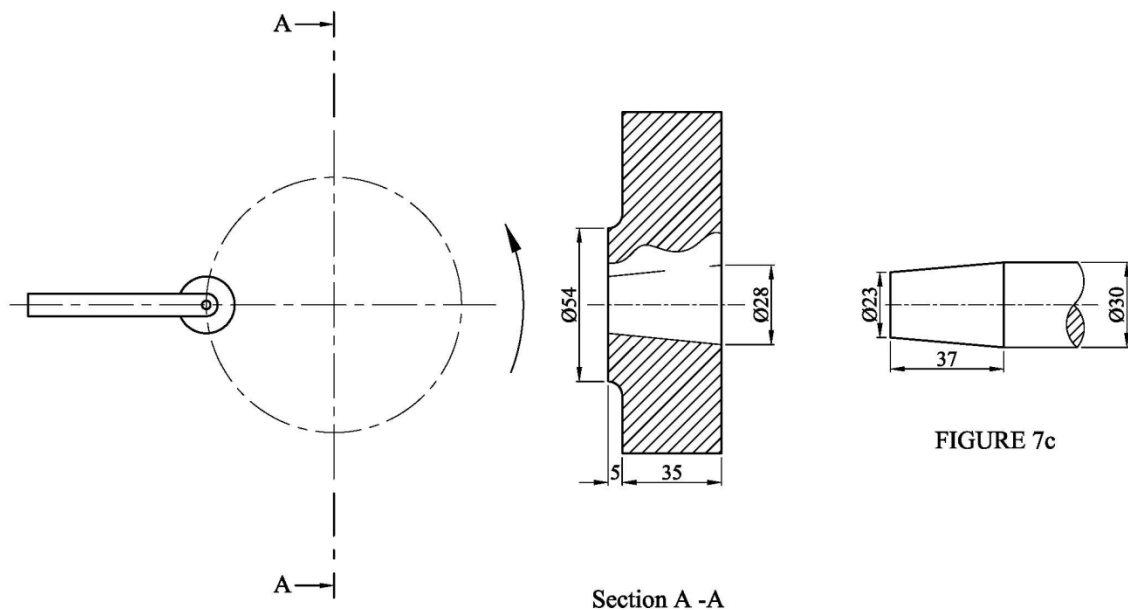


FIGURE 7b

FIGURE 7c

SECTION C

Attempt only **ONE** question from this section.

Question 8

A group of people want to fund a new NGO (non-governmental organisation) with the name of Garzes Foundation. The aim of this NGO is to help restore and keep in good condition the coastal watch towers built by the Knights of Malta during the 17th century. These towers were manned nightly to watch the seaward approach and to raise the alarm in the event of imminent threat.

Garzes Foundation requires a logo to give a visual representation of the NGO. You have decided to submit your design. Your work is to be broken down in four steps (a, b, c and d) with each part clearly identified as indicated in Figure 8.

- a) **Written analysis**
Write a list of words or short phrases to describe elements such as graphic symbols, colours and fonts, target marketing and feeling to convey.

- b) **Graphic analysis**
Based on your response to (a), produce a series of sketches to illustrate your developing ideas of the logo composition including the fonts.

- c) **Graphic synthesis**
Clearly identify those elements produced in your response to (b) that you intend to use in your final image.

- d) **Final realization**
Produce your final solution in a rectangle of 200mm x 200mm. Neatly, render the logo.

(24 marks)

| GARZES FOUNDATION LOGO | | |
|-------------------------------|--|-------------------|
| Written analysis: | | |
| | | |
| Graphical analysis: | | Final Realisation |
| | | |
| | | |
| Graphical synthesis: | | |
| | | |
| GRAPHICAL COMMUNICATION IM09 | | A2 |

FIG. 8

Question 9

An isometric sketch showing the layout of a bedroom is shown in Figure 9a.

The plan and front view of a children’s bedroom are shown in Figure 9b. The bedroom furniture is composed of a wardrobe having four doors and a corner compartment with two doors, a small desk with two drawers beneath a window and two identical single beds with mattresses. Soft furnishings and a window frame are yet to be added.

Using a scale of 60 mm representing one floor tile and a scale of 27 mm representing one course, construct an estimated **single-point perspective** view of the bedroom.

Notes:

- *The viewing direction is indicated by the large arrows at the bottom of Figure 9b.*
- *The suggested vanishing point is indicated in Figure 9b.*
- *Add a window frame and some soft furnishings such as duvets, cushions, curtains, etc.*
- *Render your drawing to enhance the solution.*

(24 marks)

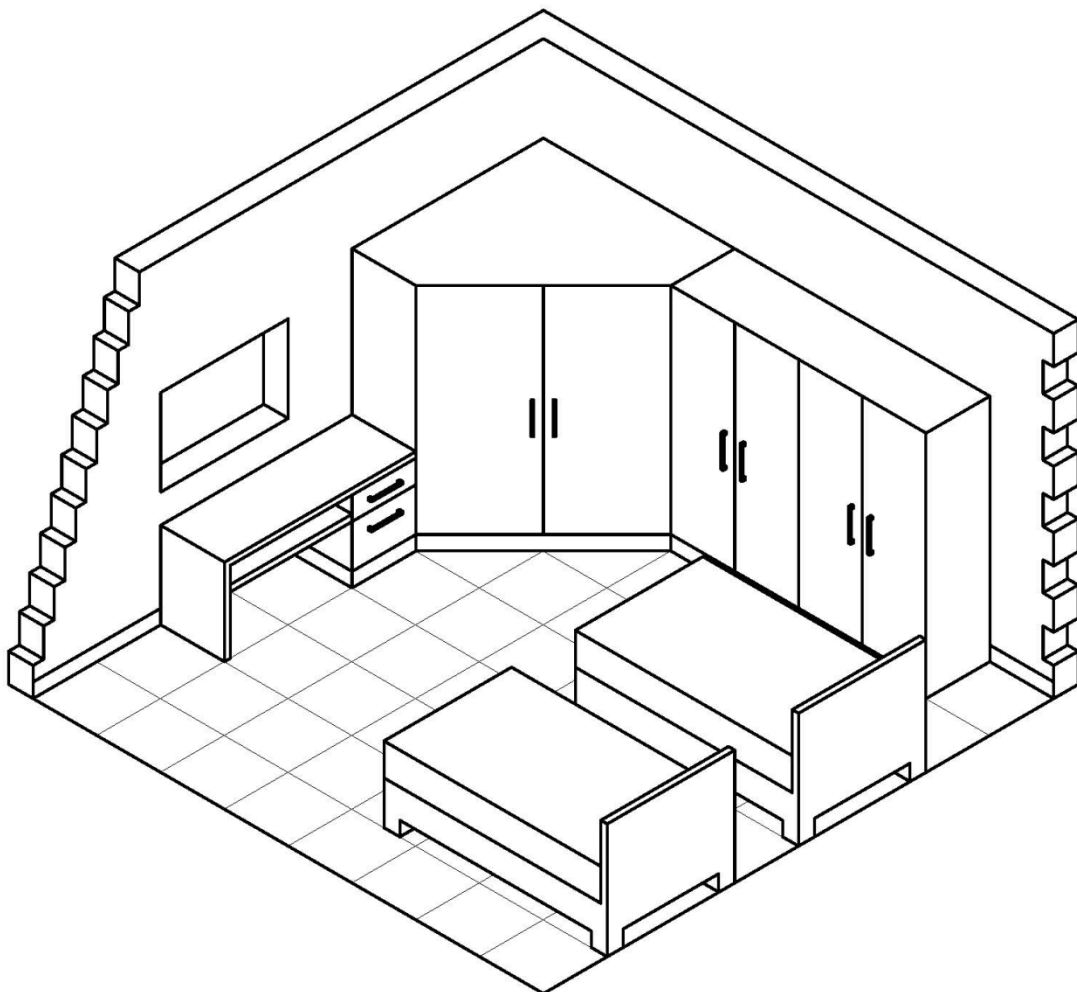
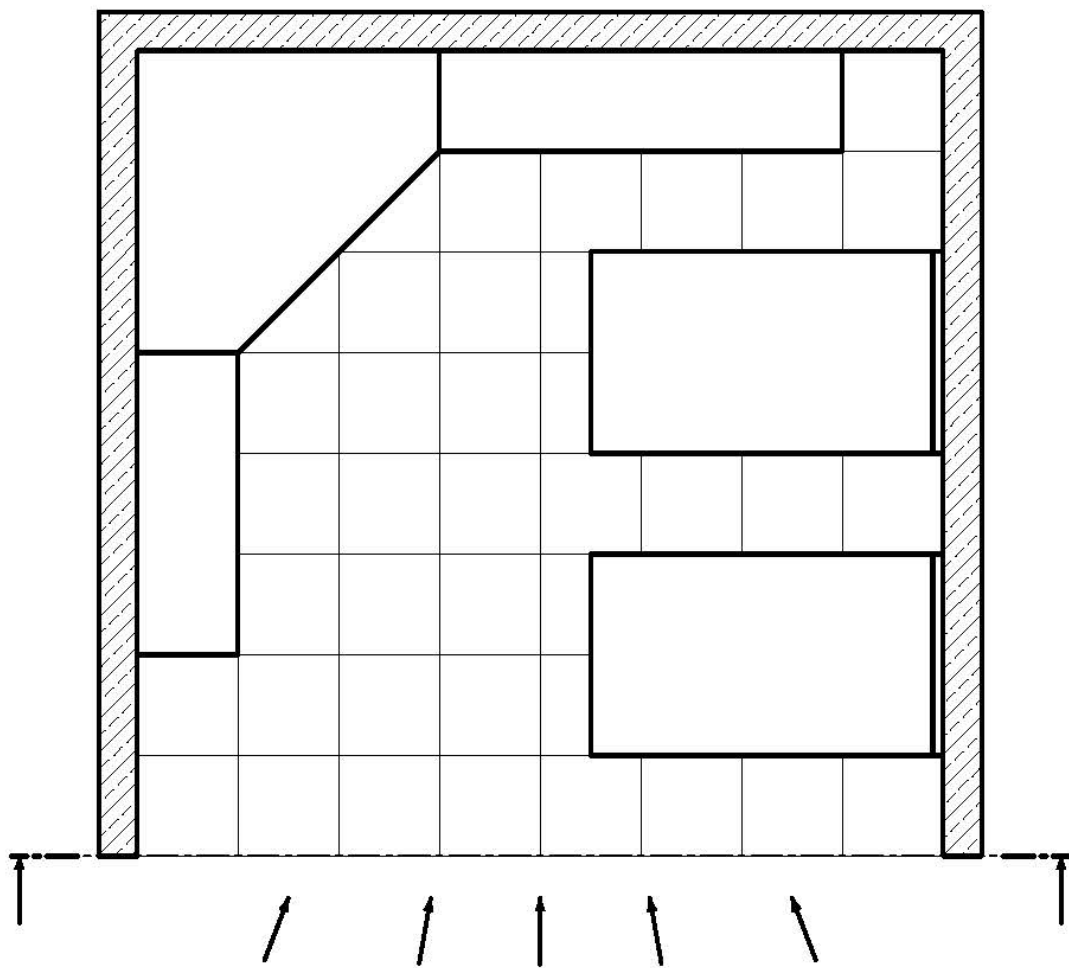
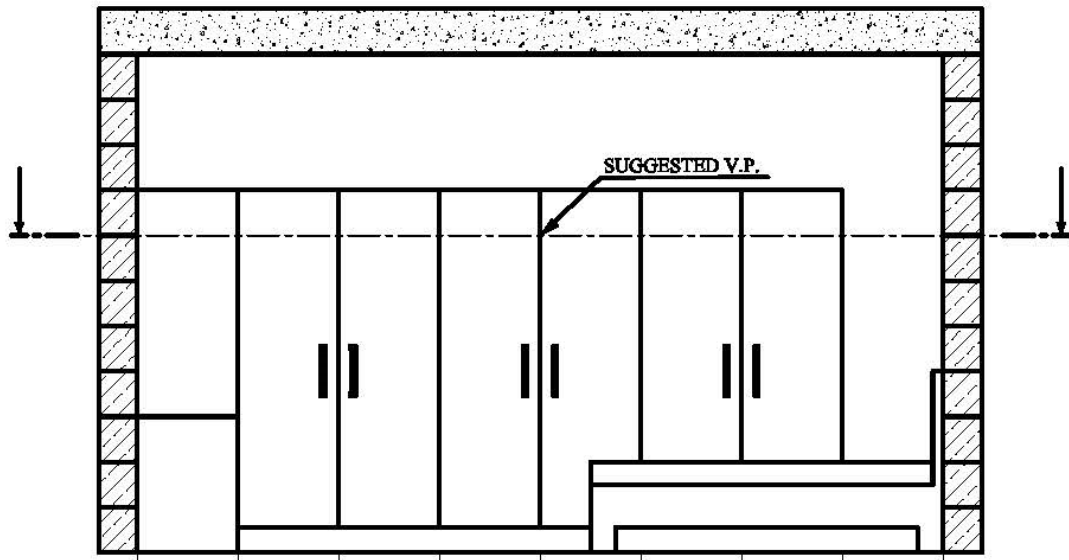
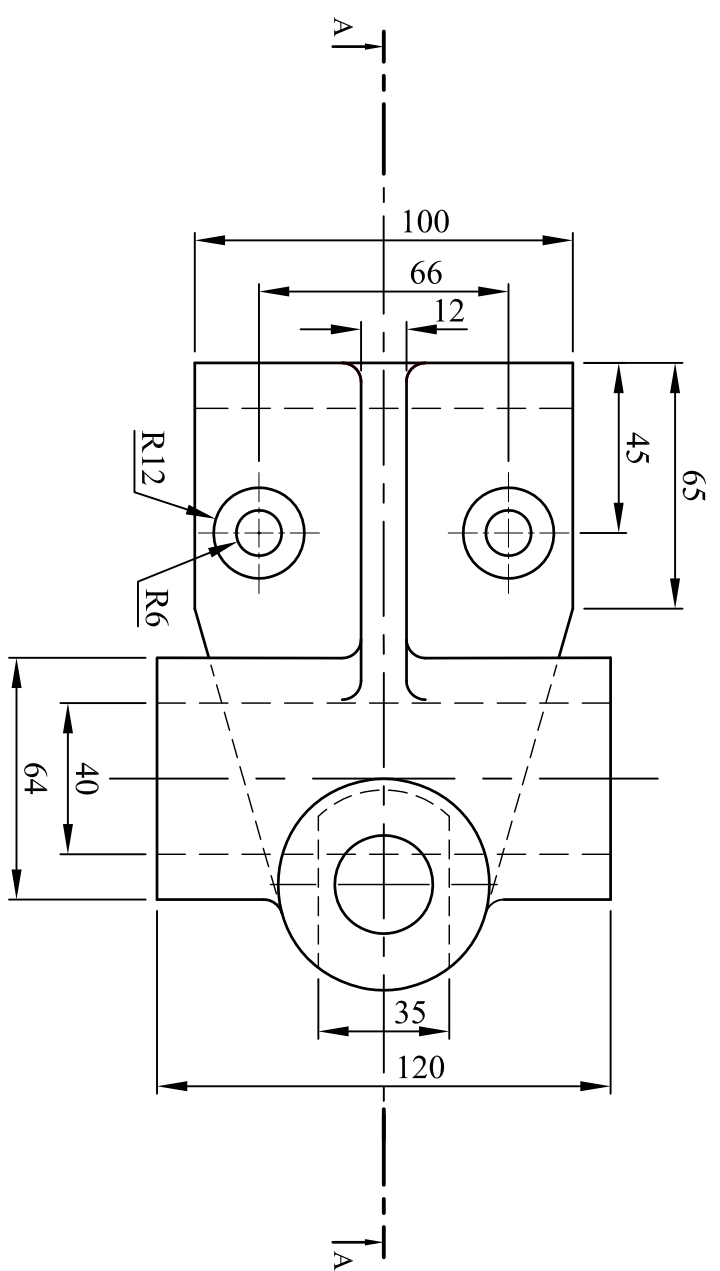
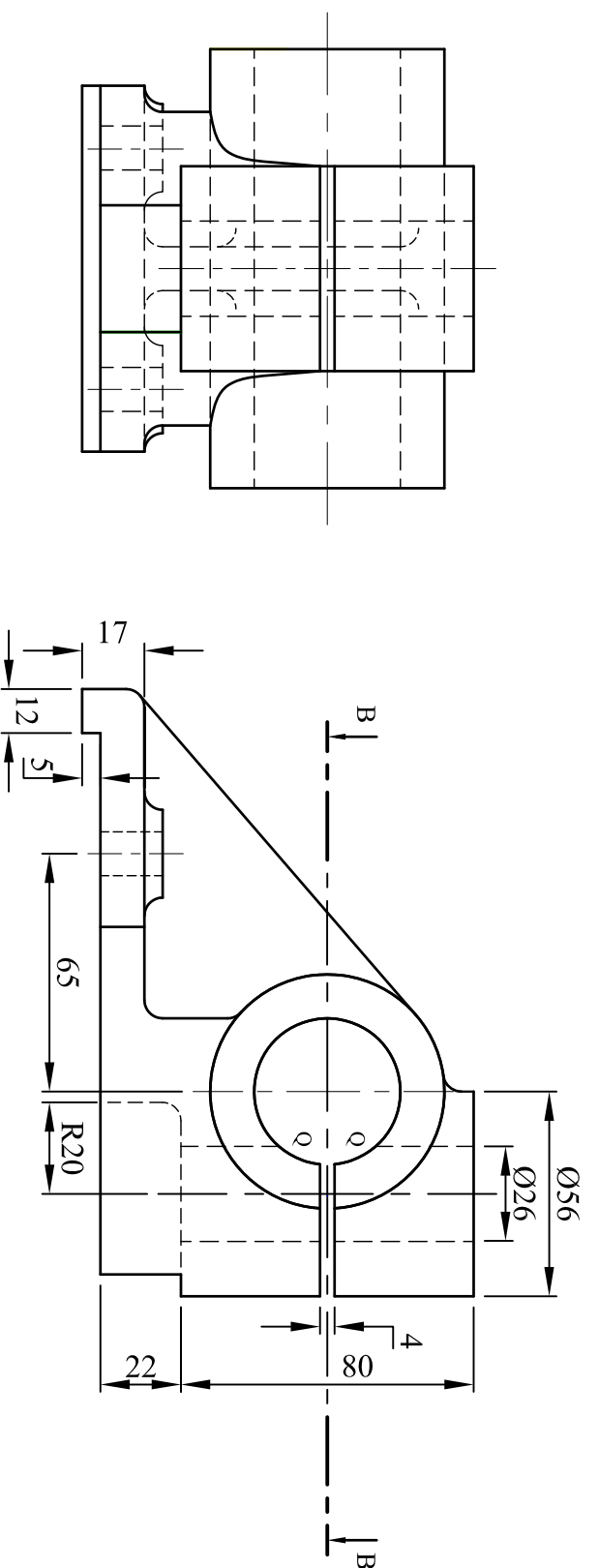


FIG. 9a.



VIEWING POSITION

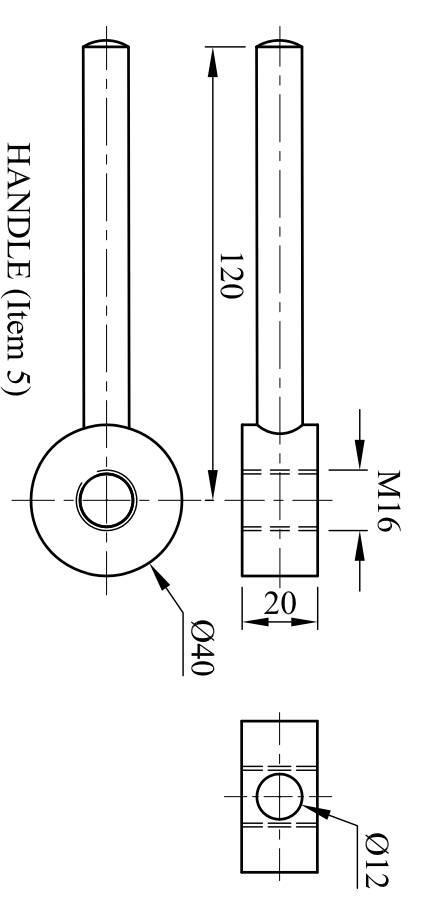
FIG. 9b



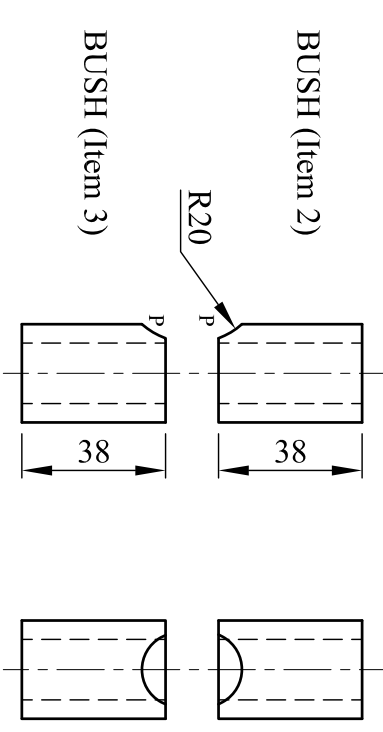
BRACKET (Item 1)

FILLET RADII 5mm unless otherwise stated

CLAMP BRACKET

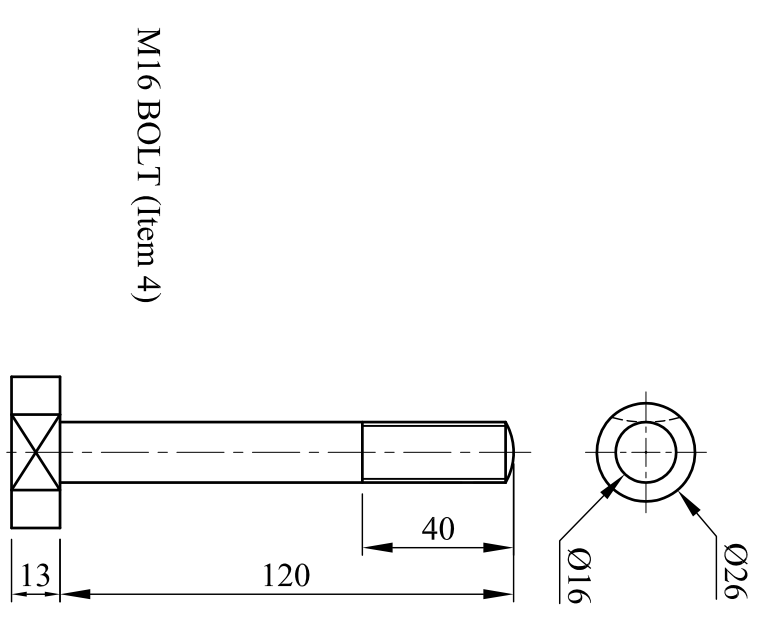


HANDLE (Item 5)



BUSH (Item 2)

BUSH (Item 3)



M16 BOLT (Item 4)

