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SUBJECT:	<b>Engineering Drawing/Graphical Communication</b>
PAPER NUMBER:	I
DATE:	26 <sup>th</sup> May 2020
TIME:	9:00 a.m. to 12:05 p.m.

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### **Directions to Candidates**

Write your index number where indicated at the top of all drawing sheets.

Attempt any **FIVE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- 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.

1. An igloo-shaped doghouse is illustrated in Figure 1a. It consists of a hemisphere with an offset pentagonal doorway.

Use the dimensions given in Figure 1b to:

- a. copy the given views; (3)
- b. complete the plan showing clearly the resulting curves of intersection; (10)
- c. project an end elevation as seen from arrow A. (7)

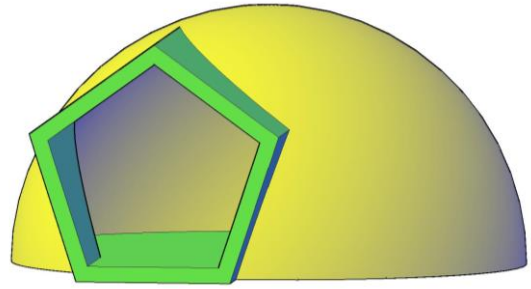


Figure 1a

**(Total: 20 marks)**

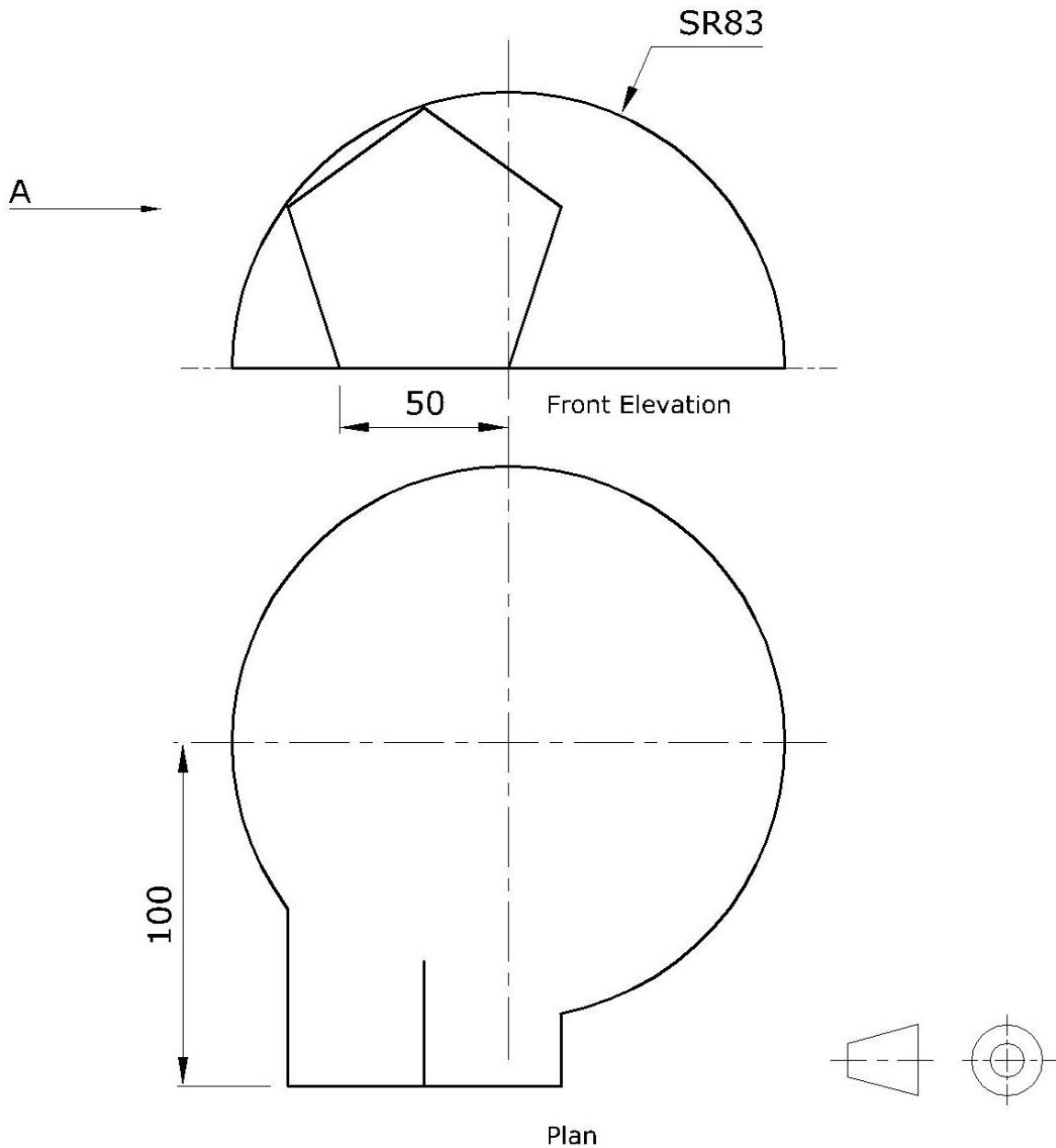


Figure 1b

2. An illustration of an ornamental candle holder is given in Figure 2a. The ornament consists of four items shown in Figure 2b.

- Item 1 is the top of the candle holder.
- Item 2 consists of two  $\text{Ø}20$  metal tubes twisted to form two left-hand helices.
- Item 3 is a spacer on which the tubes are fitted.
- Item 4 is the base which has its curved profile consisting of a semi superior trochoid. The locus is generated by point P on the generating circle  $\text{Ø}54$  as the  $\text{Ø}44$  concentric circle (centre O) rotates, in an anticlockwise direction, without slipping along line A B for half a revolution.

You are requested to use the given dimensions to draw / construct the assembled candle holder as shown in Figure 2a. Note that you are requested to construct the right-hand side semi-superior trochoid and reflect the left-hand side.

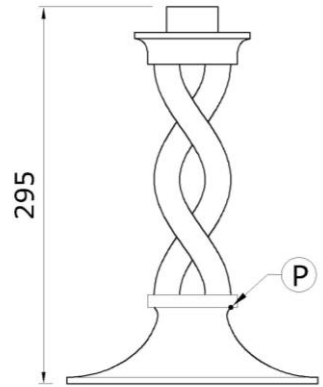


Figure 2a

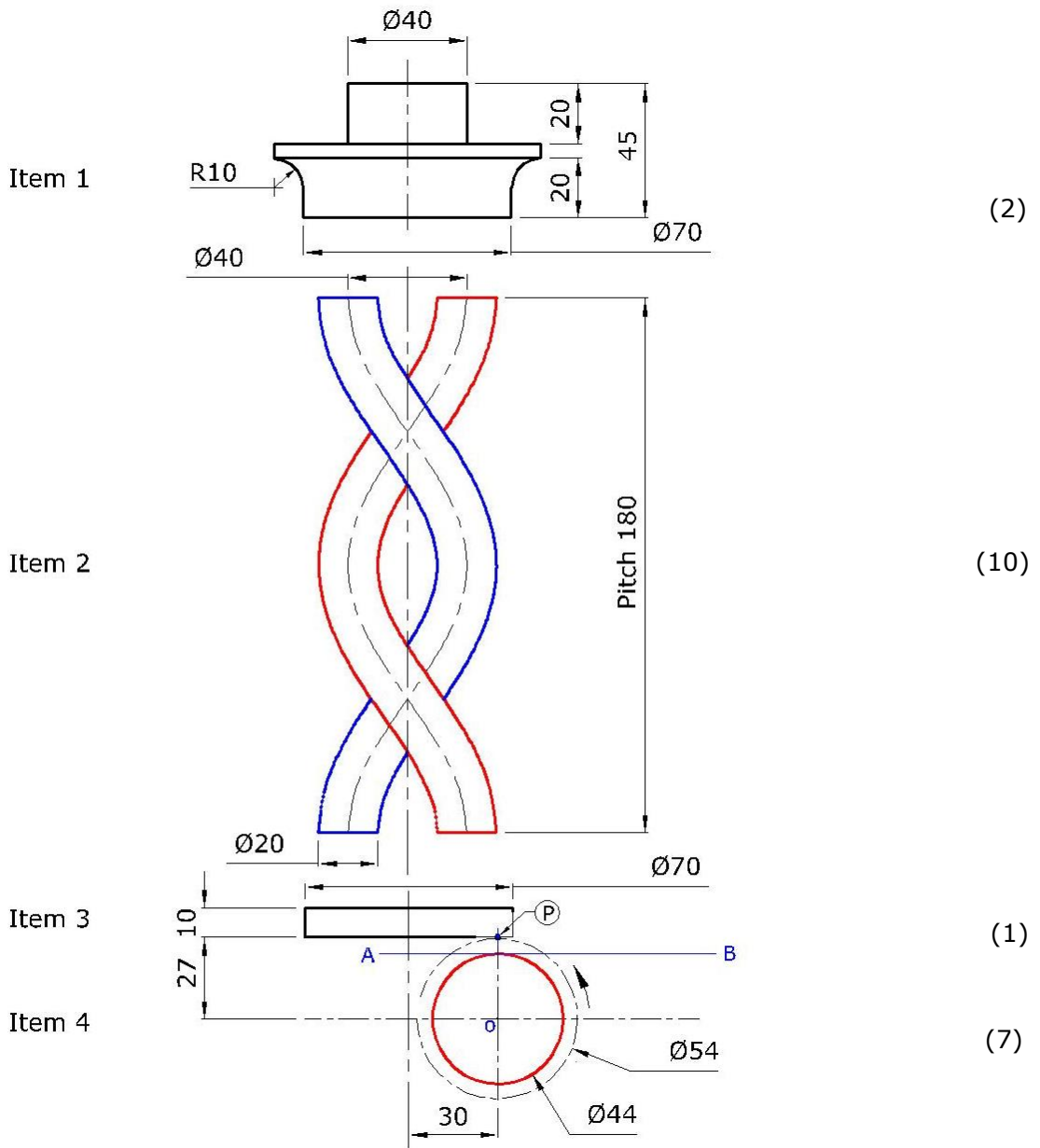


Figure 2b

**(Total: 20 marks)**

3. An illustration of a bird feeder is shown on the right. The upper part of the feeder consists of two sheet metal hexagonal pyramids. Six identical sheet metal ridge caps are used to join lower pyramid (as indicated in Figure 3a). Two orthographic views of one ridge cap are given in Figure 3b. You are required to:
- copy the given views; (2)
  - determine the dihedral angle of the bent sheet metal ridge cap; (12)
  - determine the true shape of the ridge cap before bending. (6)

**(Total: 20 marks)**

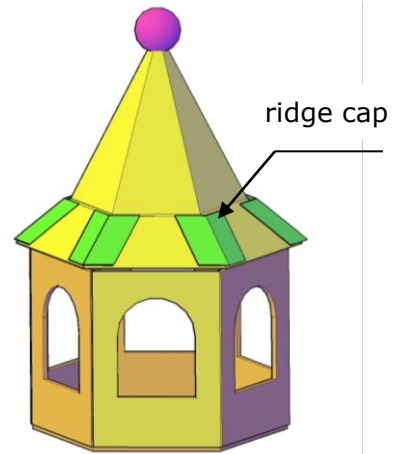


Figure 3a

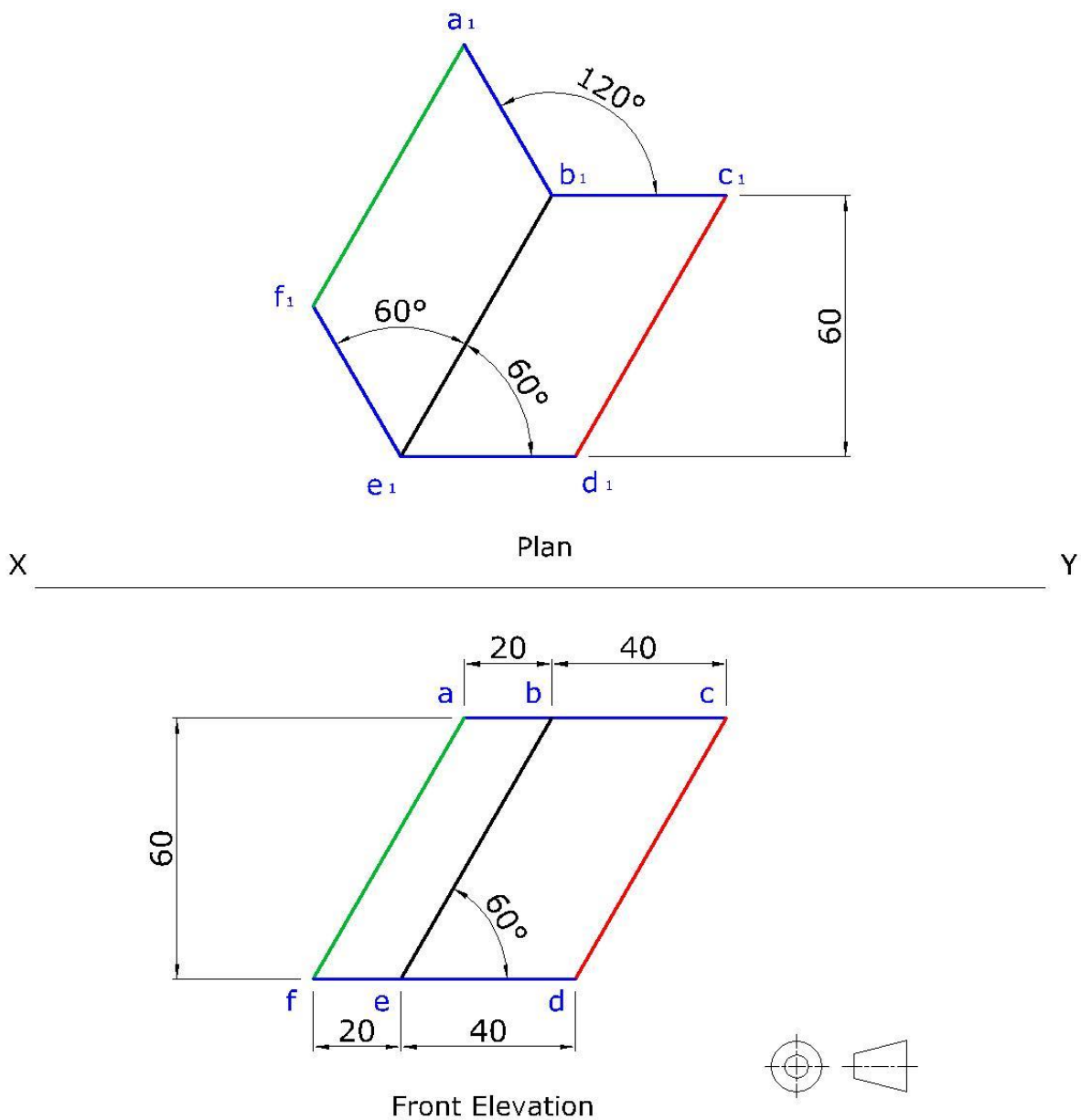


Figure 3b

4. The illustration in Figure 4a shows a transition piece designed to connect a rectangular duct to a cylindrical duct inclined at  $30^\circ$  to the horizontal plane.  
 Use the dimensions given in Figure 4b to:
- copy the given views; (4)
  - construct the necessary true lengths; (4)
  - construct the full surface development. (12)

Note: Take X-X as the seam line.

**(Total: 20 marks)**

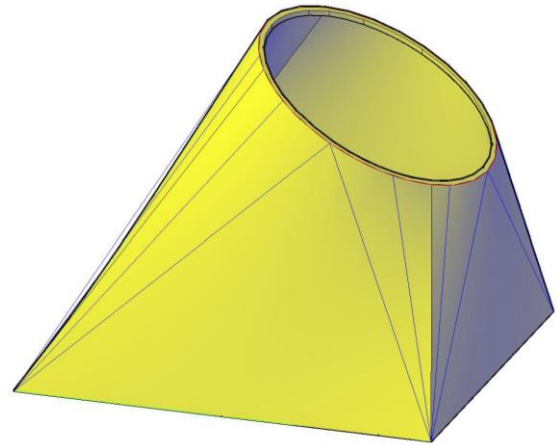
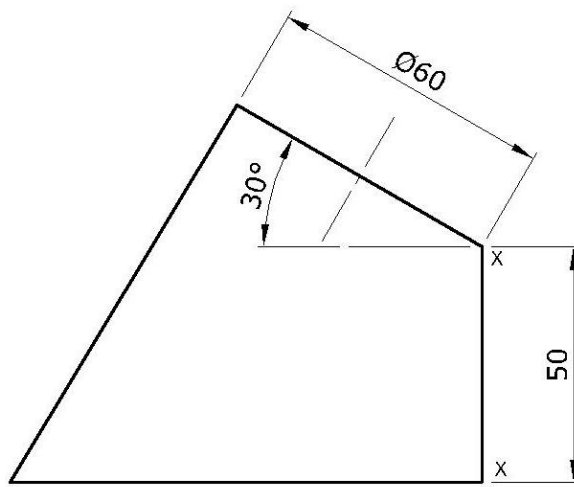


Figure 4a



Front Elevation

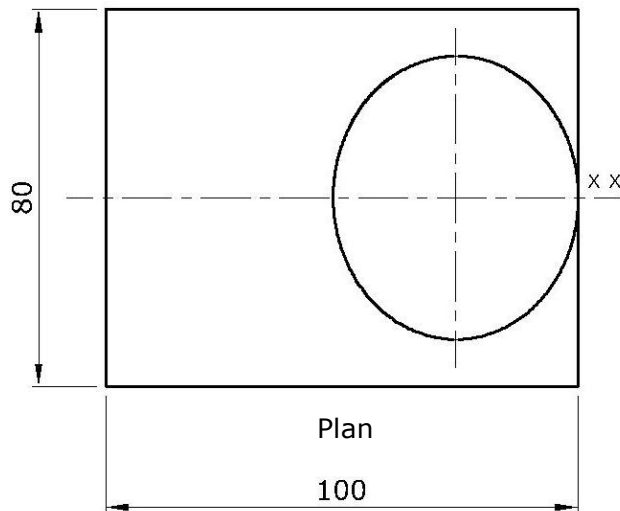


Figure 4b

5. A trophy consists of an inverted octagonal pyramid, partly inserted in a square, chamfered base. The trophy is cut by an oblique plane VTH to complete the final design, as shown in Figure 5a.

You are requested to:

- a. copy faintly the given views; (4)
- b. determine, by projecting an auxiliary view, how the trophy is truncated by the oblique plane; (4)
- c. complete the truncated plan; (4)
- d. complete the truncated front elevation; (4)
- e. project / construct the true shapes of cut of both base and octagonal pyramid. (4)

**(Total: 20 marks)**

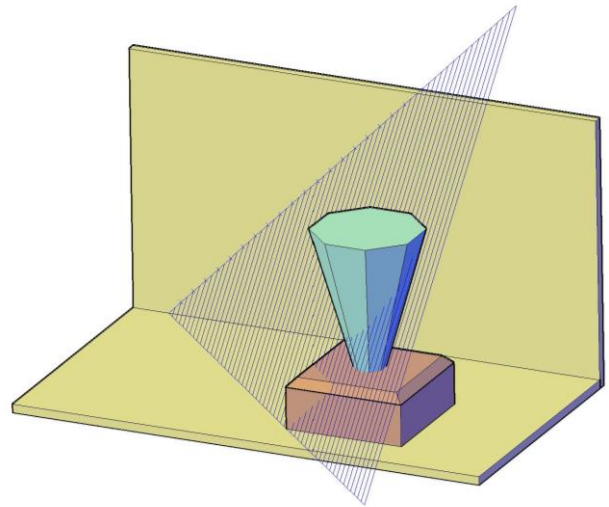


Figure 5a

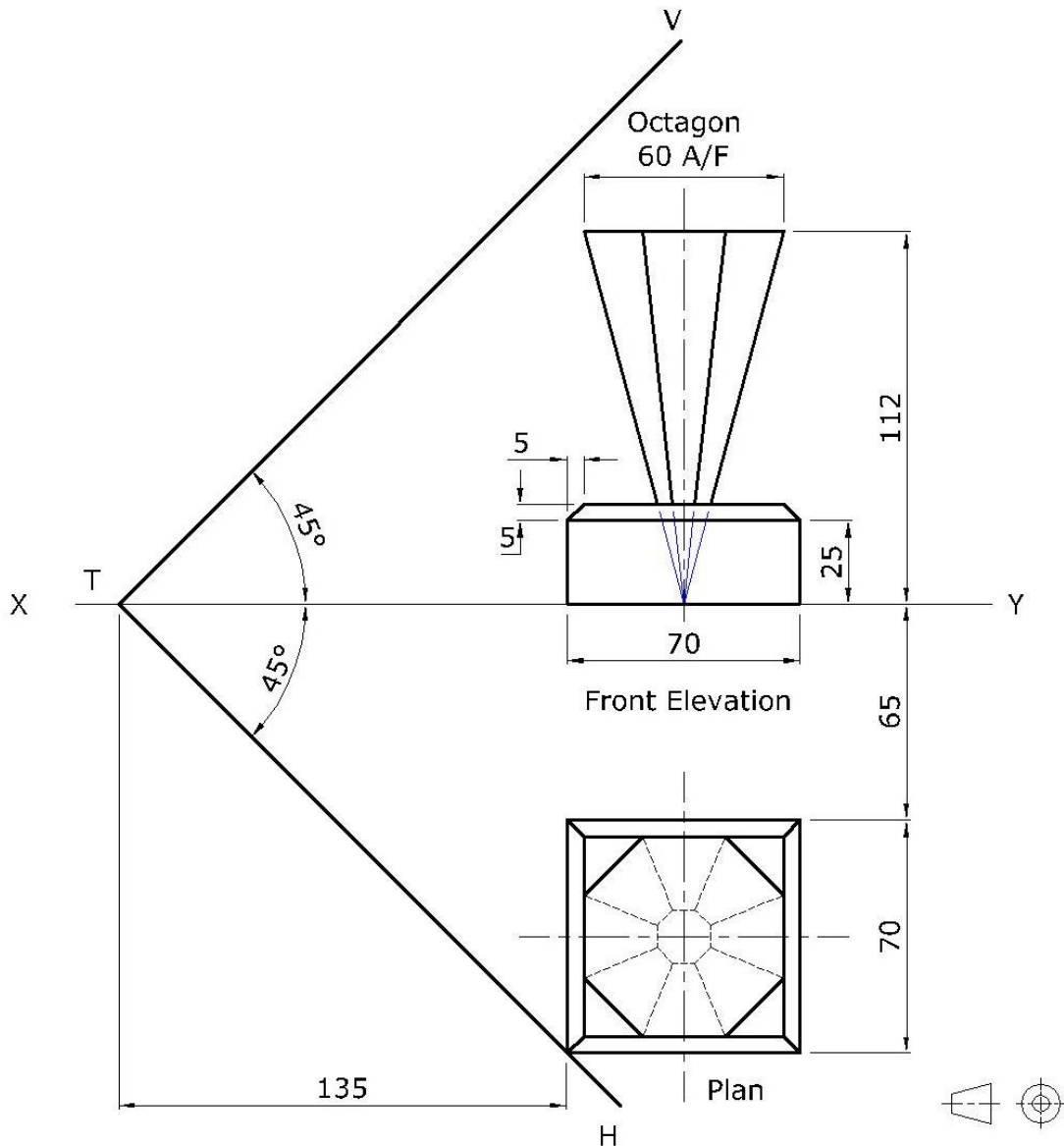


Figure 5b

6. Figure 6 represents the framework of a roof. The framework is supported at both ends, has a span of 3.2 m and is loaded as shown.
- You are required to construct:
    - the space diagram and complete the Bow's notation; (3)
    - the polar diagram, the link polygon and the force diagram; (6)
  - Determine and state the magnitude of the left and right reactions ( $R_L$  and  $R_R$ ). (4)
  - Find, by graphical means, the forces in each member and distinguish between struts and ties. (7)

Notes:

- Use a scale of 50 mm representing 1 m to draw the space diagram.
- Use a scale of 10 mm representing 1 kN to draw the force diagram.
- Neatly tabulate your results.

**(Total: 20 marks)**

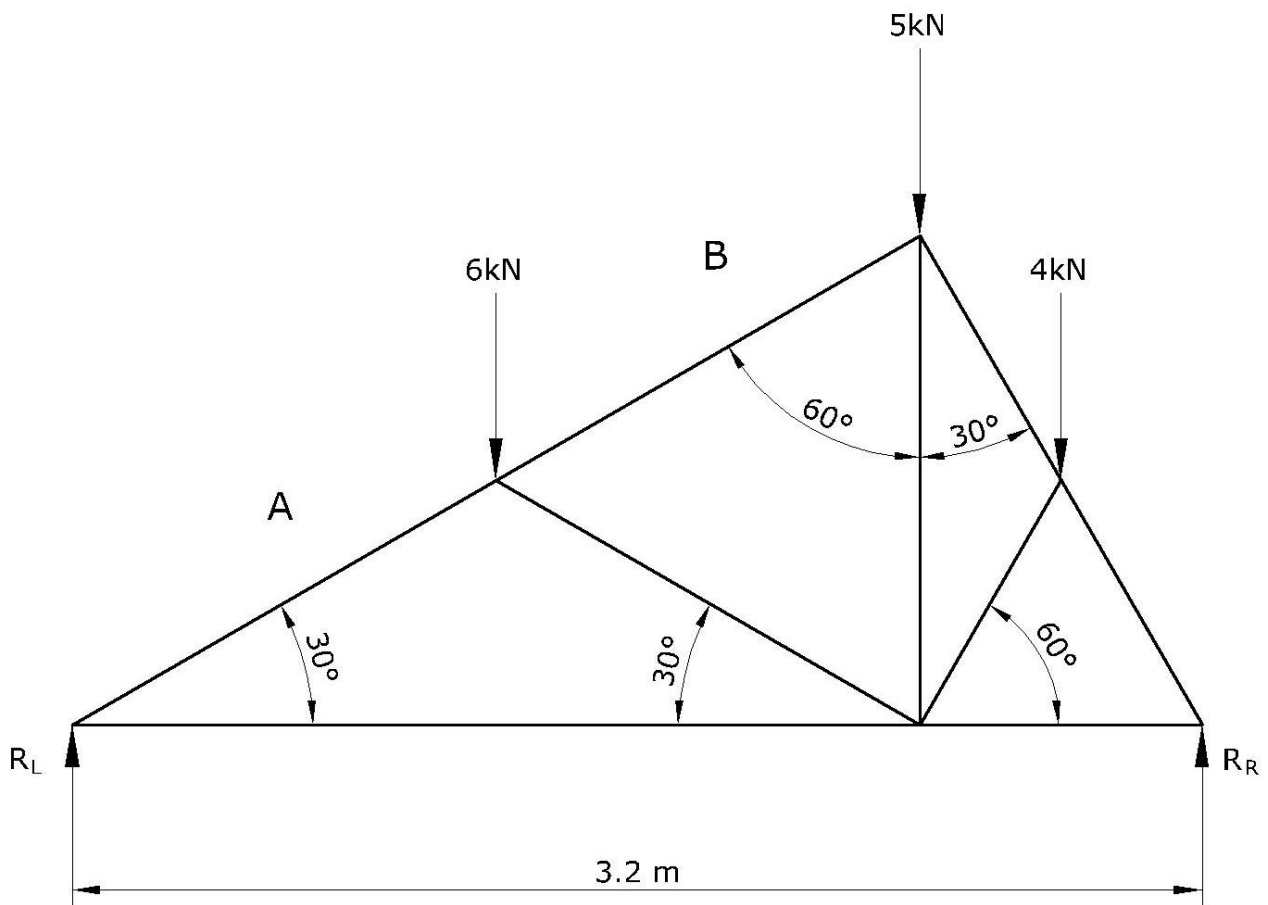


Figure 6



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SUBJECT:	<b>Engineering Drawing</b>
PAPER NUMBER:	II
DATE:	26 <sup>th</sup> May 2020
TIME:	4:00 p.m. to 7:05 p.m.

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### **Directions to Candidates**

Write your index number where indicated at the top of all drawing sheets.

Attempt **Question 1** and any other **TWO** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- all answers are to be accurately drawn with instruments;
- all construction lines must be left on each solution;
- drawing aids may be used.

Dimensions not given should be estimated using engineering judgement.

Careful layout and presentation are important.

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

Mark allocations are shown in brackets.

Question 1 carries 60 marks. Questions 2, 3 and 4 carry 20 marks each.



1. A machine Compound Vice, illustrated in Figures 1a and 1b, is used to hold a workpiece for machining on a grinding machine surface table. Figures 1c and 1d show details of the compound vice parts. The compound vice is assembled as follows.
  - The swivel body, (Item 1), is fastened to the base, (Item 2), by means of the pivot pin, (Item 6), and the flanged hexagonal nut, (Item 7). The head of the pivot pin seats in the swivel body counterbore recess  $\text{Ø}36 \text{ mm} \times 6 \text{ mm}$  deep.
  - One of the jaw plates, (Item 5), is attached to the swivel body at the face marked (P), and the other jaw plate is attached to the guide block, (Item 3), at the face marked (Q). Each jaw plate is secured by two cheese head screws, (not shown).
  - The guide block, (Item 3), slides in the  $131 \text{ mm} \times 50 \text{ mm}$  wide slot of the swivel body, (Item 1). The guide plate, (Item 4), is mounted to the guide block by two M8 Allen screws. (not shown).
  - The spindle, (Item 8), operates the movement of the guide block. The spindle is inserted in the  $\text{Ø}22 \text{ mm}$  hole of the swivel body. The  $\text{Sq}22 \times 5$  threaded collar, (Item 10), is screwed on to the spindle and locked by means of a taper pin (not shown). The shoulder (E) of the threaded collar rests against the surface (S) of the swivel body.
  - The collar, (Item 9), is inserted in the spindle, positioned with the taper pin holes aligned. The collar is secured in position by a 5 mm taper pin, (not shown), inserted in the aligned holes.
  - The spindle is turned by a handle in the 16 mm square-drive end. The handle is not required in your drawing.

Draw, full size:

- a) a sectional front elevation on the cutting plane A-A of the complete assembly.  
The swivel body is to be drawn tilted about the centre of the pivot pin and set at an angle of  $30^\circ$  to the horizontal. The jaw plates are to be shown displaced 40 mm apart. (50)
- b) a sectional end elevation on the cutting plane B-B. (10)

Note:

Hidden detail is not required.

**(Total: 60 marks)**

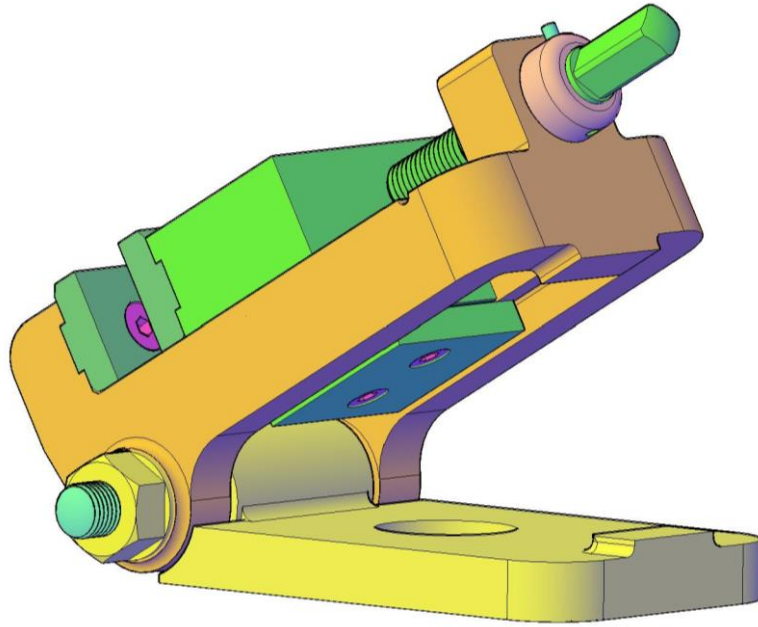


Figure 1a

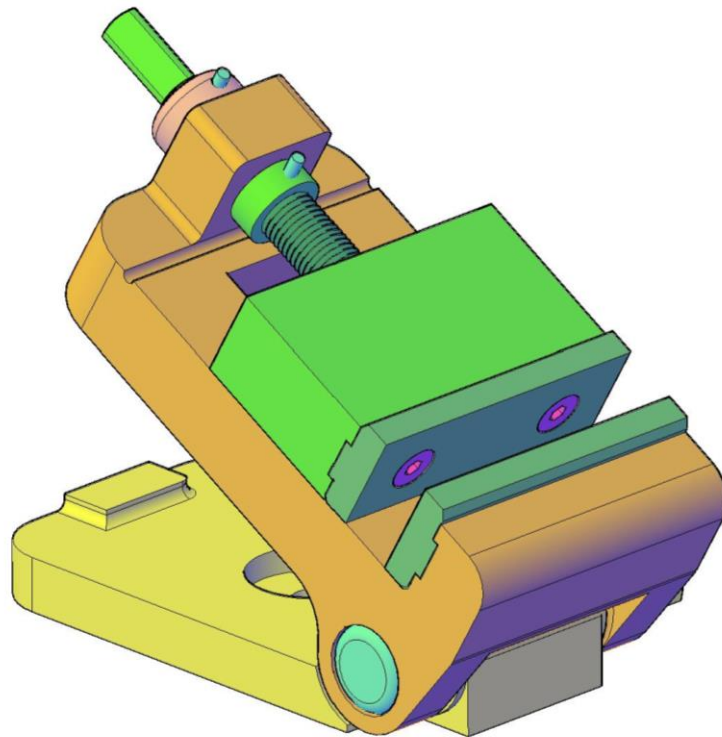


Figure 1b

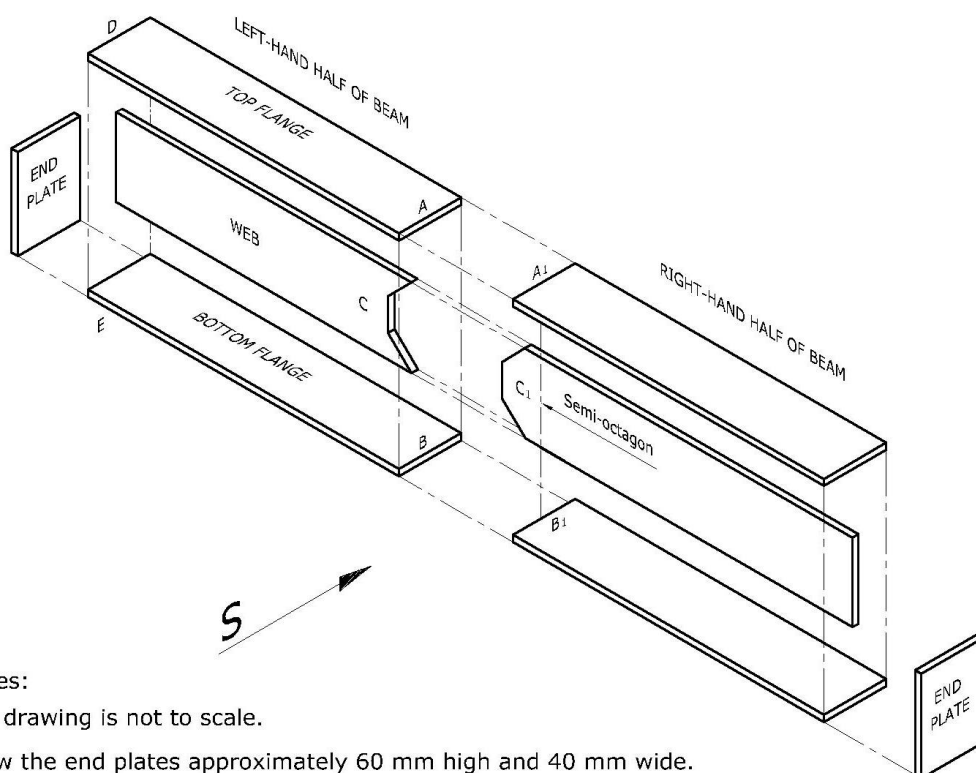
2. A long beam is required on a construction site. The beam is to be fabricated from steel plates which are to be manually arc welded together. For practical reasons, two separate halves of the beam are to be welded in the workshop. The two halves are to be transported to the construction site and welded together on location.

- A pictorial exploded drawing of the steel plates, which are being prepared for the welding of the beam, is given in Figure 2a.
- A front elevation, looking in the direction of arrow S, showing the assembled left-hand and right-hand halves of the beam is given in Figure 2b. Textual instructions of some of the welds are also given in Figure 2b.

You are required to:

- Sketch a pictorial drawing, like Figure 2a, of the assembled left-hand half of the beam. In the sketch you are to illustrate pictorially the fillet welding runs between the vertical steel plate (web) and the horizontal plates (flanges). Illustrate also the single-J butt welds joining the end plate to the top and bottom flanges. Use different colours to denote the steel plates and the welds. (6)
- Draw a well-proportioned copy of Figure 2b. (4)
- Replace the textual instructions, given in Figure 2b, by the appropriate welding symbols in accordance to BS EN 22553:1995. (10)

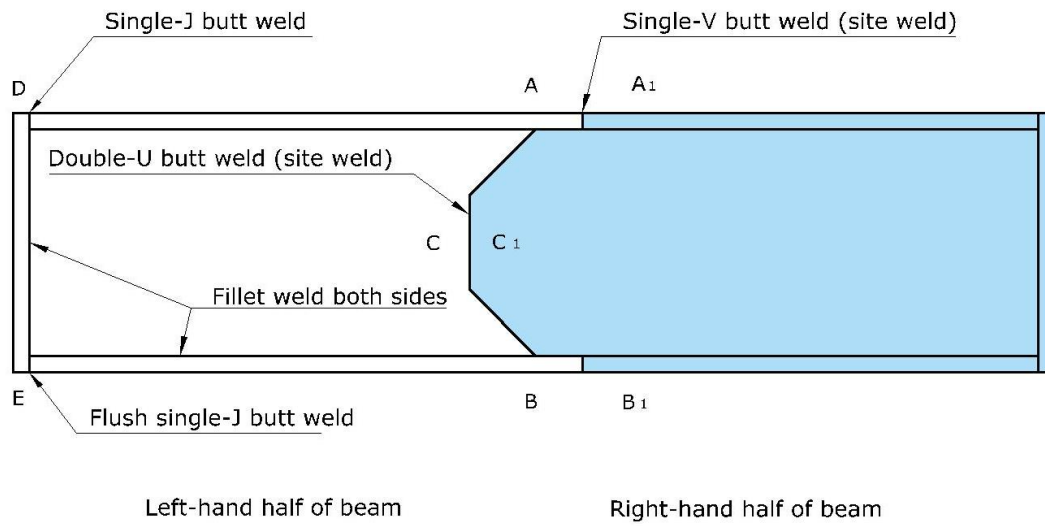
**(Total: 20 marks)**



Notes:

- The drawing is not to scale.
- Draw the end plates approximately 60 mm high and 40 mm wide.
- The left-hand half and the right-hand half of the beam are to be welded in the workshop.
- Edges A,B and C are to be welded to edges A1, B1 and C1 on the construction site.

Figure 2a



Note: Draw the plates approximately 5 mm thick.

Figure 2b

3. Figures 3a and 3b show illustrations of an exploded and an assembled screwdriver. The screwdriver has the following features:

- flat bladed bit;
- cylindrical shank;
- hexagonal bolster;
- ferrule cap;
- handle with octagonal gripping zone and having a hexagonal hole.

A detailed plan of the exploded screwdriver is shown in Figure 3c. You are requested to:

- a) copy the drawing given in Figure 3c; (8)
- b) draw the removed sections where indicated by cutting planes A-A, B-B and C-C. (6)
- c) draw revolved sections where indicated by vertical centerlines P, Q and R to indicate the  $\varnothing 12$ , the hexagon 14 A/C and the octagon 46 A/F sections, respectively. (6)

Notes:

- The interpenetration curves are to be drawn freehand;
- Do not insert dimensions;
- Estimate dimensions which are not given.

**(Total: 20 marks)**

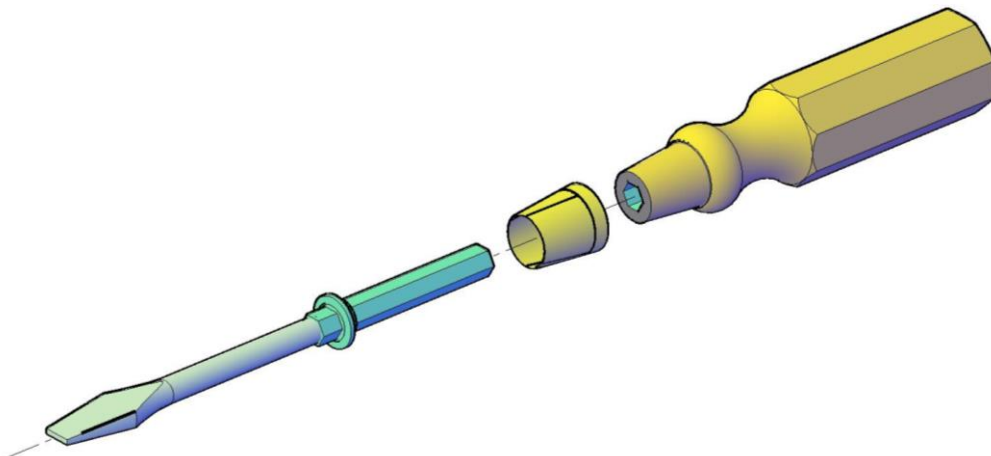


Figure 3a

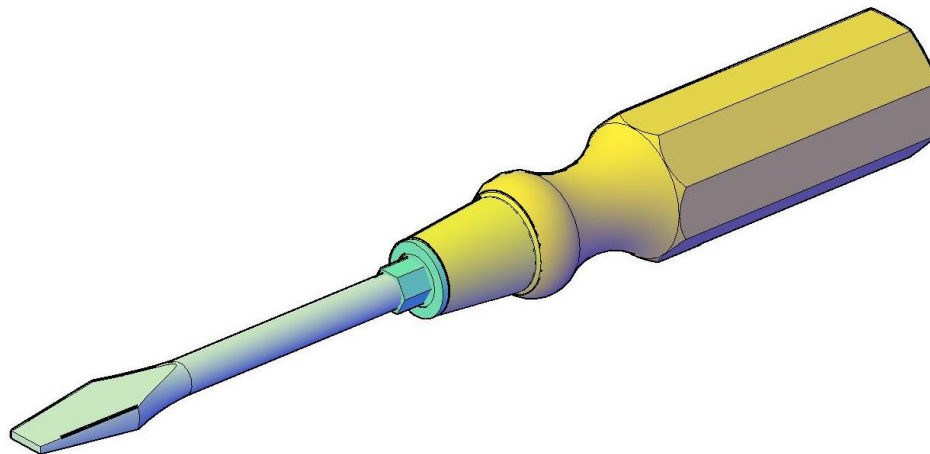


Figure 3b

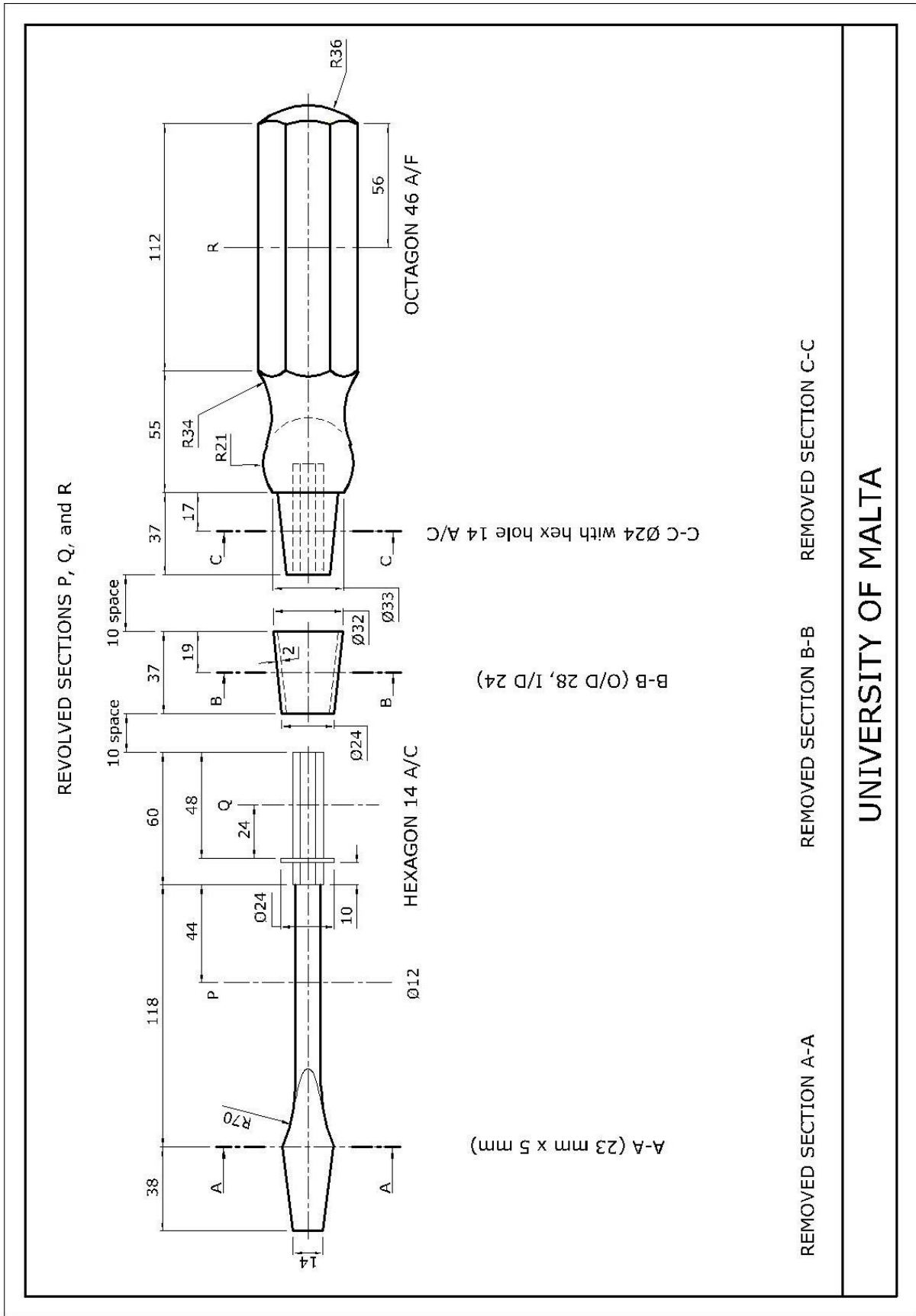


Figure 3c

4. A screw thread can be defined as a ridge of uniform section in the form of a helix on the external or internal surface of a cylinder or hole.

The three basic applications of screw threads are:

- to hold parts together;
- to transmit power;
- to provide adjustment between parts.

You are required to:

- a) draw **THREE** freehand sketches to illustrate an example of each function listed above. (18)
- b) neatly print the main title 'THE BASIC APPLICATIONS OF SCREW THREADS' and label each sketch as suggested in Figure 4. (2)

Notes:

- Use the appropriate thread type for each application.
- Draw sectional views where required.
- The three freehand sketches are to be well finished, shaded, and annotated, where applicable.

**(Total: 20 marks)**

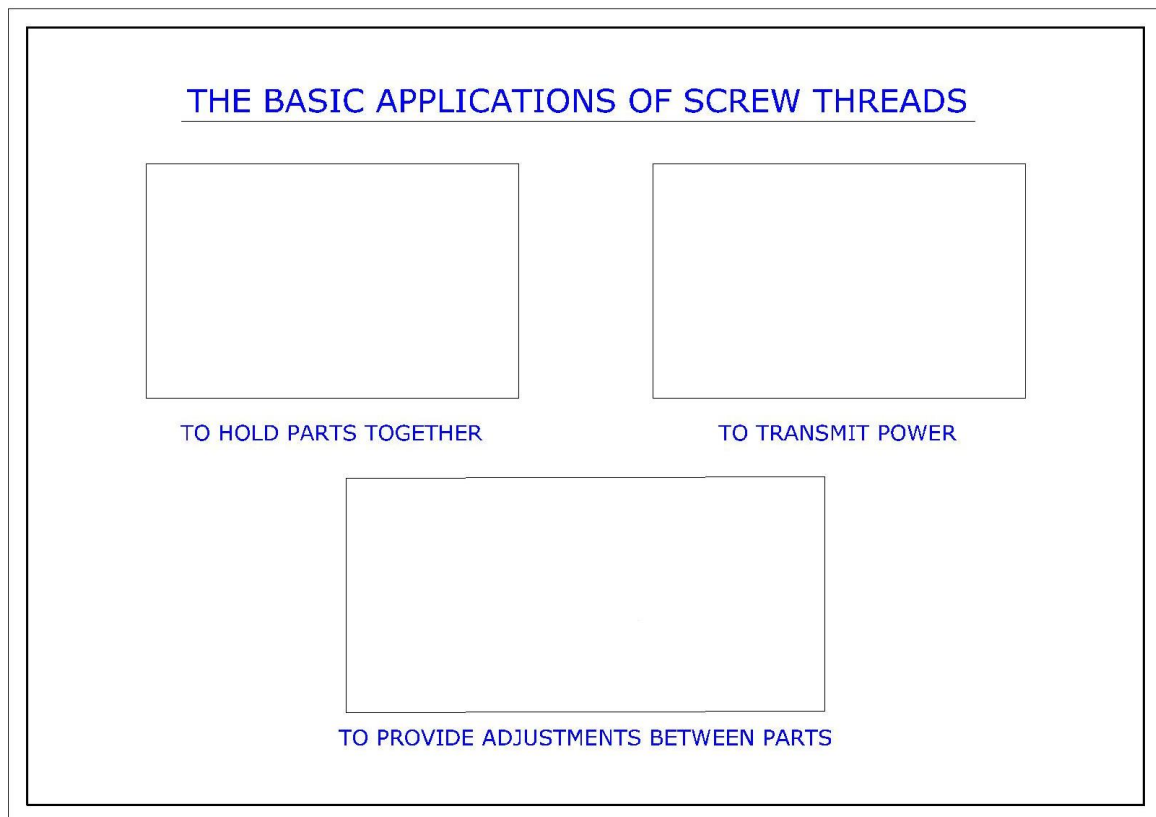


Figure 4

