

**MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD**  
**UNIVERSITY OF MALTA, MSIDA**  
**MATRICULATION EXAMINATION**  
**INTERMEDIATE LEVEL**  
**SEPTEMBER 2014**

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<b>SUBJECT:</b>	ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION
<b>DATE:</b>	6th September 2014
<b>TIME:</b>	4.00 p.m. to 7.00 p.m.

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**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:

- a. B.S. or equivalent (ISO) recommendations should be adopted throughout your answers;
- b. all dimensions are in millimetres;
- c. all answers are to be accurately drawn with instruments;
- d. all construction lines must be left in each solution;
- e. 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.

Mark allocations are shown in brackets.

Colour/shading may be used where appropriate.

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

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

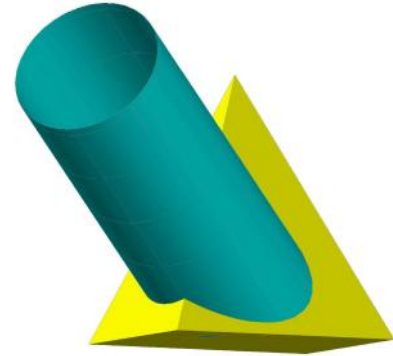
**Section C:** Attempt any **ONE** question from two.

**SECTION A**

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

**Question 1**

An inclined cylinder is shown penetrating a rectangular pyramid.



Copy, full size;

- a) The incomplete diagram shown in Figure 1.
  - b) Determine the curve profile of the interpenetration of the given rectangular pyramid and cylinder, the axis of which are inclined to each other. The axis of the inclined cylinder starts from point T.
- Use care in indicating the visible and invisible parts of the curve of intersection.*

**(13 marks)**

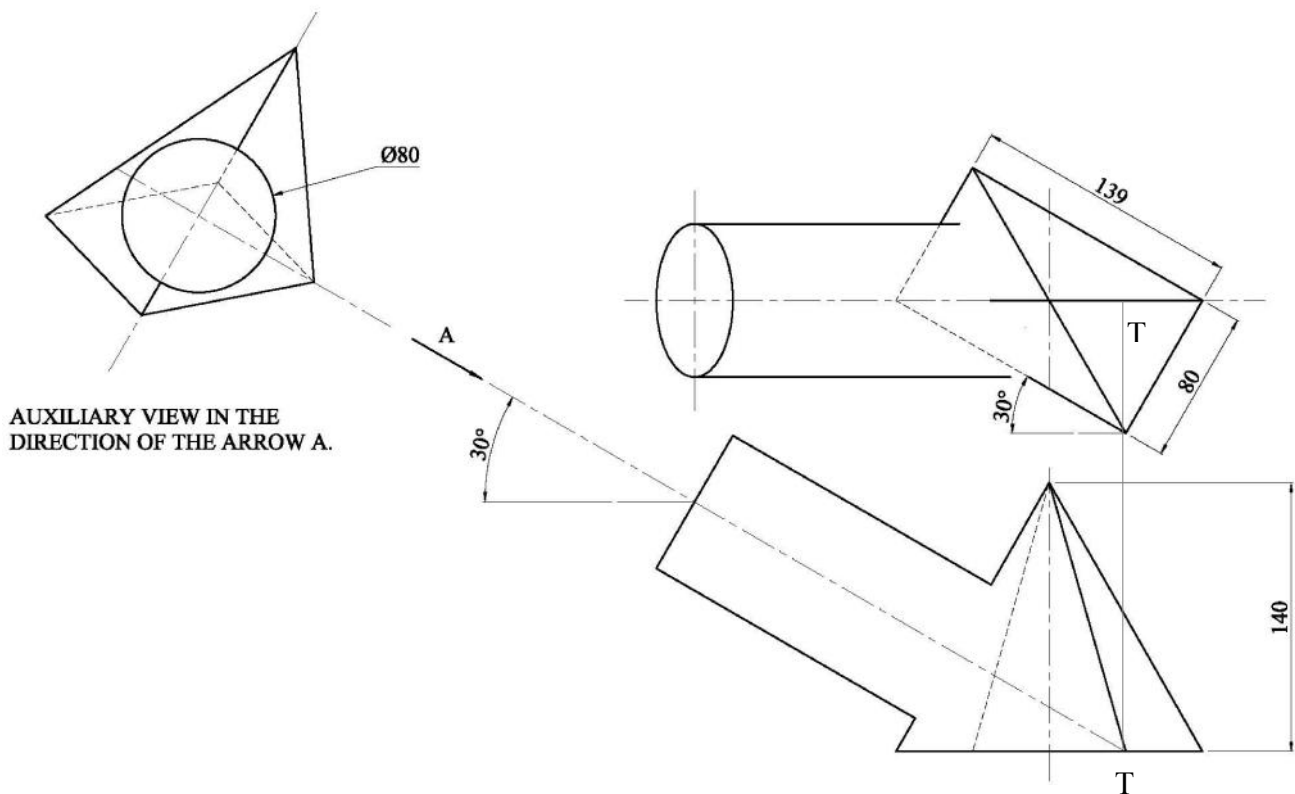
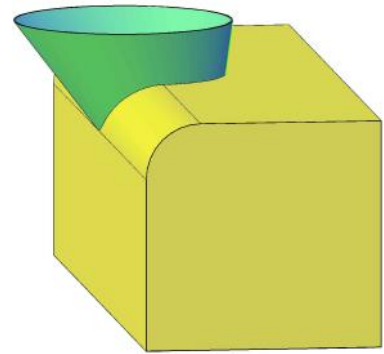


FIG. 1

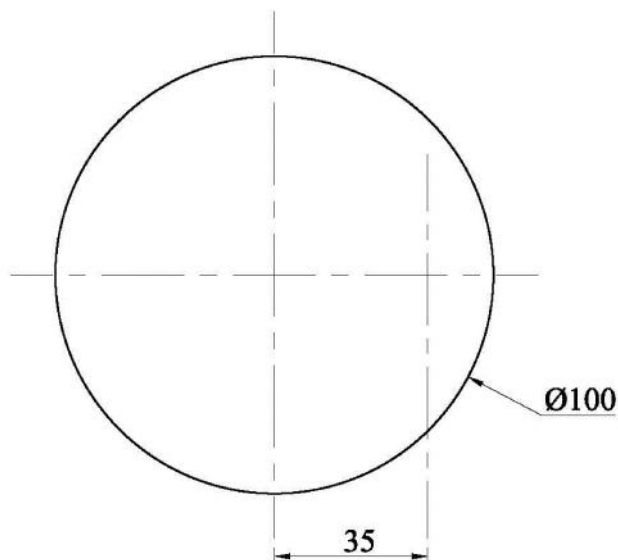
**Question 2**

The illustration on the right shows a conical feed hopper fitted on a cylindrical screw casing. The feed hopper consists of an inverted oblique cone having its apex falling inside the base of the cone.

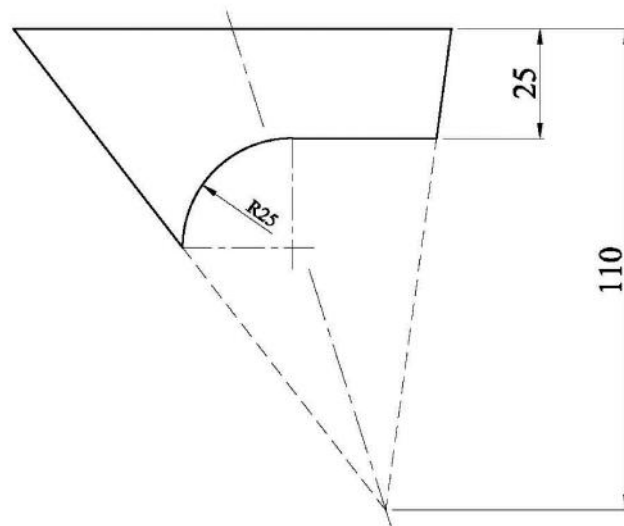


- Copy in full size Figure 2.
- Complete the plan by including the curved edge formed by the interpenetration.
- Obtain the required true lengths.
- Develop half of the pattern of the feed hopper.

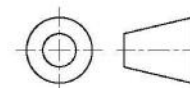
**(13 marks)**



**INCOMPLETE PLAN**



**FRONT ELEVATION**



**FIG. 2**

**Question 3**

Part of a mechanism is shown in Figure 3. The circular disc can roll clockwise without slipping on the straight line or anticlockwise without slipping on the circumference of a larger circle.

Draw, full size;

- a) the given view;
- b) the locus of the point P when the disc rolls;
  - i) clockwise for one revolution from the given position towards point S,
  - ii) in an anticlockwise direction for one revolution from the given position towards point T.
- c) Name the curves drawn.

(13 marks)

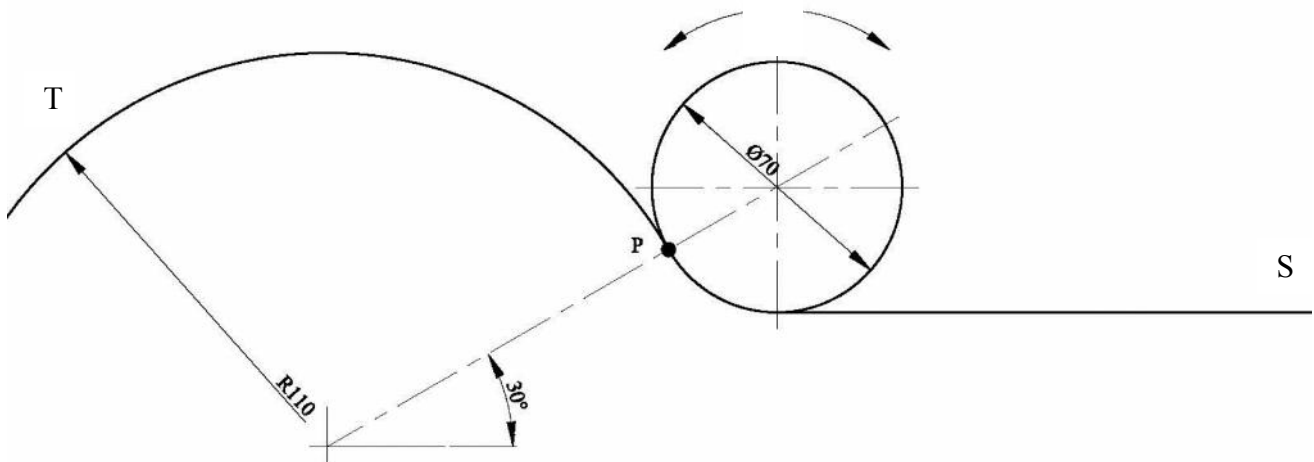
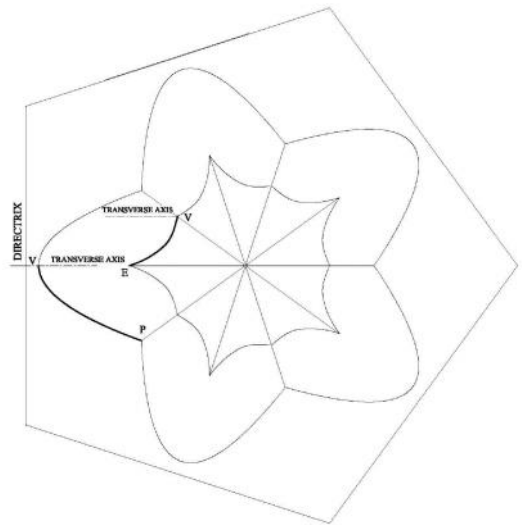


FIG. 3

**Question 4**

The pattern illustrated is formed from an outer and inner curve inside a regular pentagon. The outer and inner curves are parts of a parabola and of an ellipse. The side of the pentagon is the directrix of the parabola.



Construct, full size, by plotting the points of the;

- a) lower part of the parabola V-P, shown in Figure 4, using the transverse axis V-A, directrix, vertex, and focus,
- b) lower part of the ellipse V-E, using the transverse axis V-B, directrix, vertex and focus. The eccentricity of the ellipse is 4:5.

**(13 marks)**

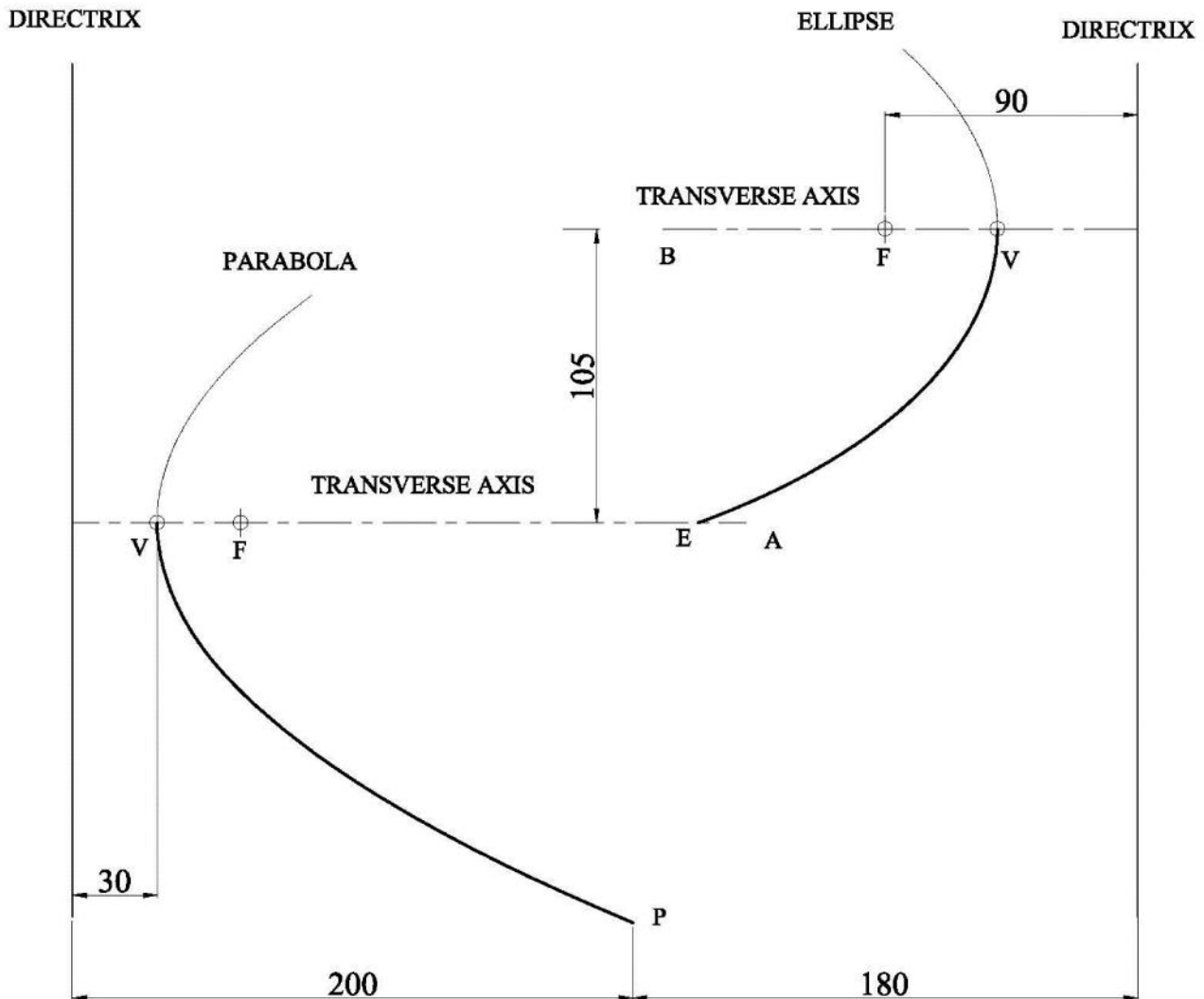


FIG. 4

**Question 5**

Figure 5 shows a loaded beam overhanging on the left support and with the right hand support at its right end.

- Copy the diagram shown in Figure 5. Use a scale of 10mm = 1 metre.
- Draw the vector diagram and use a scale of 10mm = 5kN. Include the polar diagram and make the polar distance 120mm.
- Construct the funicular polygon to determine graphically the values of the left and right supports.
- Draw the shear force diagram.
- State the position along the beam where the bending moment is zero.

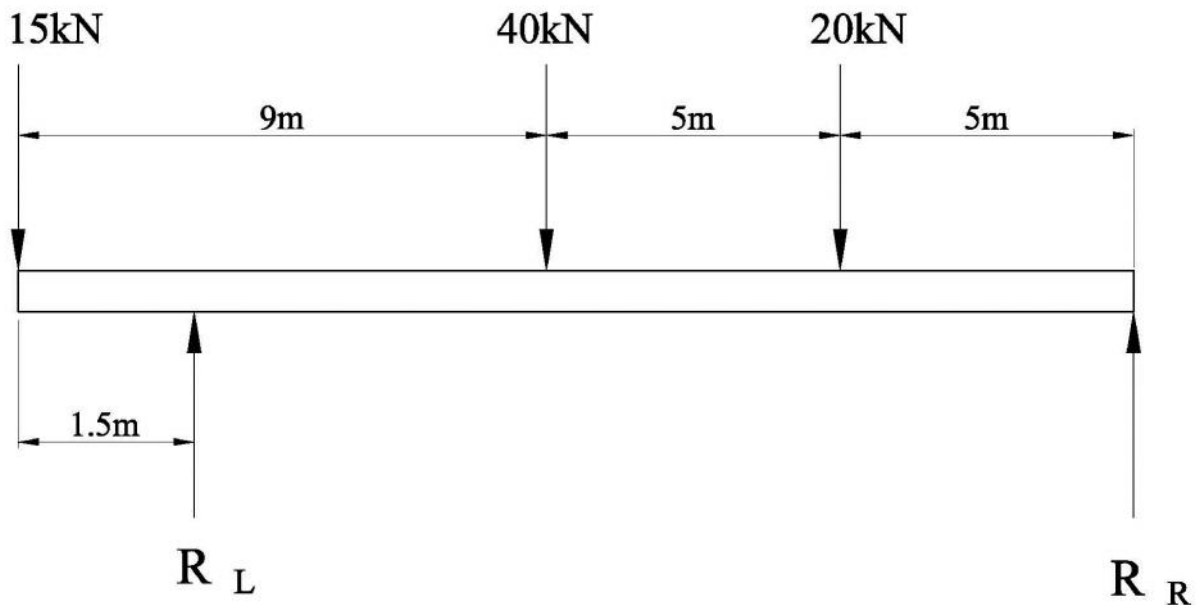
**13 marks**

FIG. 5

## SECTION B

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

### Question 6

An illustration of a crane hook assembly is given on the right.

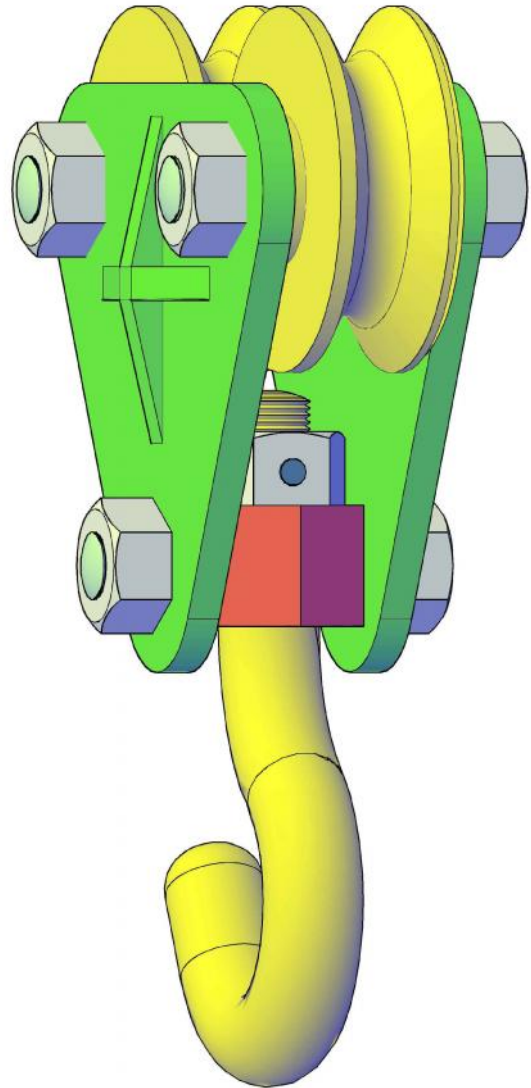
Make an assembly drawing of the crane hook from the details given in Figure 6(a) and (b) shown on the A3 papers attached. The components are assembled as follows.

The M24 end of the crane hook (item 5) is pushed through the 24mm hole of the hook support block (item 6) and an M24 hexagonal nut (item 8) screwed on until the 8mm diameter hole of the nut is in line with the 8mm diameter hole of the crane hook. A nut lock pin (item 4) is pressed right through into the 8mm diameter hole of the nut and the crane hook. The M20 threaded end of the support block is inserted into the 20mm lower hole of the side plate (item 1) and an M20 hexagonal nut (not shown) screwed on. The two pulley shafts (item 3) are inserted into the 20mm holes of the side plate and two M20 hexagonal nuts (not shown) are screwed on to the M20 threaded ends of the pulley shafts. The 24mm diameter holes of the pulleys (item 2) are fitted on to the 24mm diameter portion of the pulley shaft. The other side plate is placed onto the three M20 mm threaded ends and three hexagonal nuts screwed on to secure the side plate.

Draw, full size,

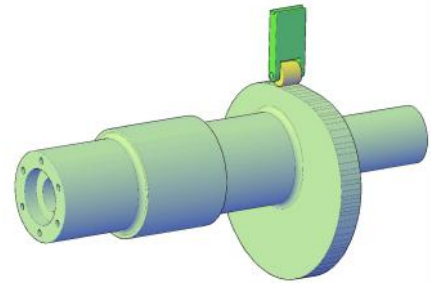
- a front elevation of the assembled crane hook, showing one M20 hexagonal nut fitted on the lower hole of the side plate.
- a sectional end elevation, on the plane X-X passing through the side plates, the support block, the M24 hexagonal nut and the hook. Show only one M20 hexagonal nut.

**(24 marks)**



**Question 7**

An illustration of a coupling with an integral cam is shown on the right.



A sectional view of the integral coupling and disc cam are shown in Figure 7(a).

- a) The motion to be given to the follower by the cam is to be;
  - 0° - 90° lift of 40 mm with simple harmonic motion
  - 90° - 180° dwell
  - 180° - 360° fall of 40 mm with uniform acceleration and retardation.
 Draw the displacement diagram of the follower.  
 The rotation of the cam is to be clockwise.
- b) Construct the cam profile.
- c) Draw an oblique view of the coupling as indicated in the layout shown in Figure 7 (b).
  - The view of the coupling is to be an outside view and the sloping lines are to be reduced by 0.75.
  - Do not draw the six holes for the M6 screws, but represent/indicate their position by centre-lines.
  - Omit hidden details.

(24 marks)

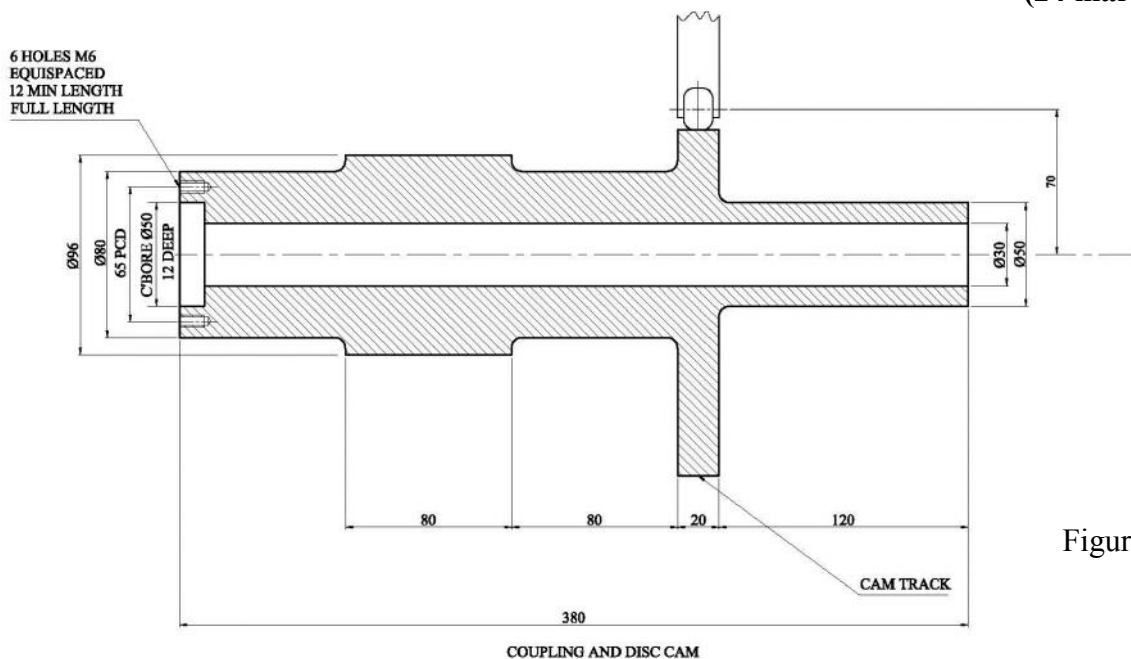


Figure 7(a)

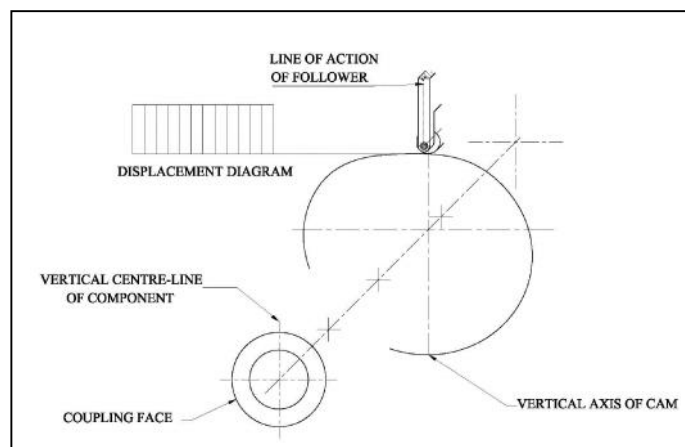


Figure 7(b)



## SECTION C

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

### Question 8

The front view and the plan of a small **confectionery shop** are shown in Figure 8b.

- The scaled down measurements of the shop, are 490mm wide x 560mm long x 280mm high (from floor to soffit ceiling).
- The floor tiles dimensions are 35mm x 35mm and the height of the courses is 35mm.
- The shop consists of two areas. The major shop area which is furnished with shelves and a point of sale counter. The minor area is consists of a small room which is used by the staff.
- Details of the furniture (labeled A, B and C) are given in Figure 8(a).
- The ceiling consists of mineral fiber suspended tiles 70mm X 70mm.
- Three light fixtures are installed in the soffit ceiling.
- A flat screen TV is fitted on the wall behind the counter C.

On an A2 drawing paper, produce an estimated single point perspective view of the confectionery.

The viewing position is indicated by arrows. It is suggested that the vanishing point is placed on the clock as shown in Figure 8b.

Render your drawing to enhance your solution.

**(24 marks)**

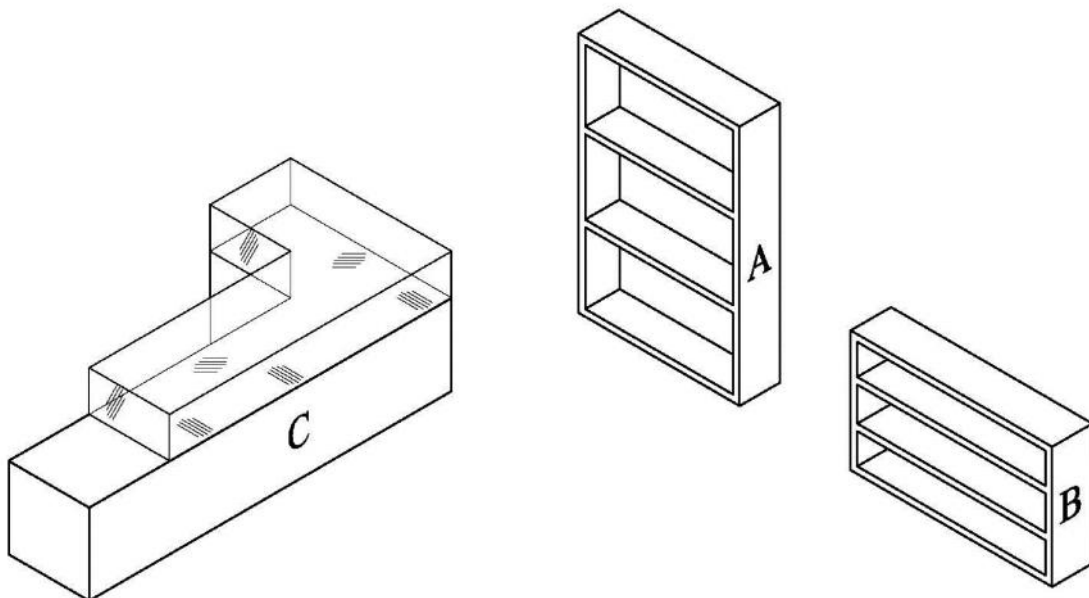


FIG.8(a)

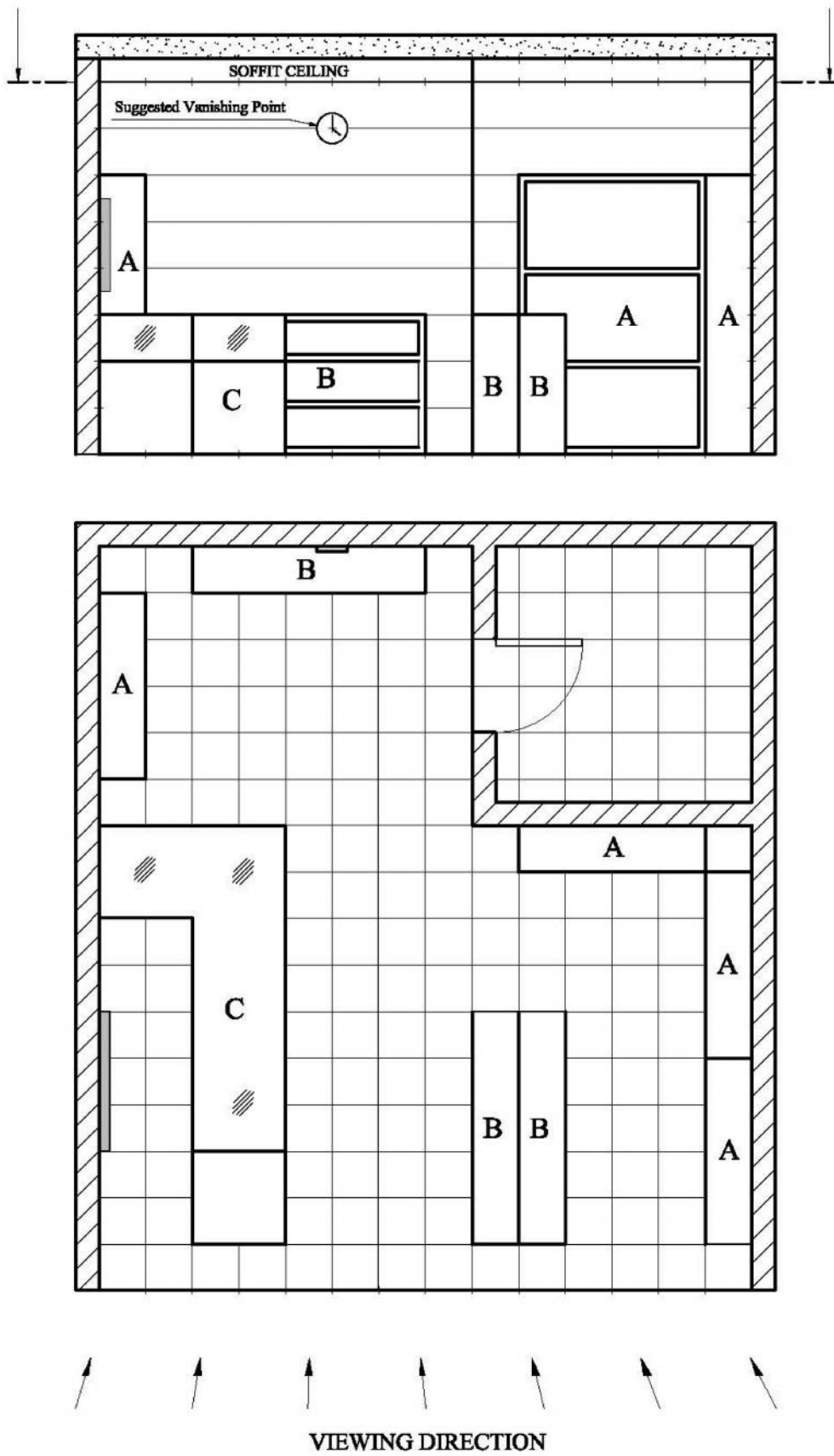


FIG. 8(b)

**Question 9**

A toy rocket is shown in Figure 9 (a).

A Graphical Communication teacher prepared the necessary surface developments, which are shown in Figure 9(b), to be used as templates (patterns) by the summer school students to produce a cardboard version.

The teacher gave the following written instructions:

1. Place the templates on a piece of cardboard and mark the outlines and the folding lines.
2. Cut around the marked outlines and fold along the folding lines.
3. Apply glue to the long glue flap 'A' and join to form the main body of the rocket (inverted octagonal truncated pyramid).
4. Apply glue to the glue flaps 'B' and join the octagonal base to the pyramid.
5. Apply glue to glue tab 'C' to form the top octagonal pyramid.
6. Apply glue to glue tabs 'D' and join the nose to the main body.
7. Apply glue to the fins glue tabs 'E' and join to the main body.

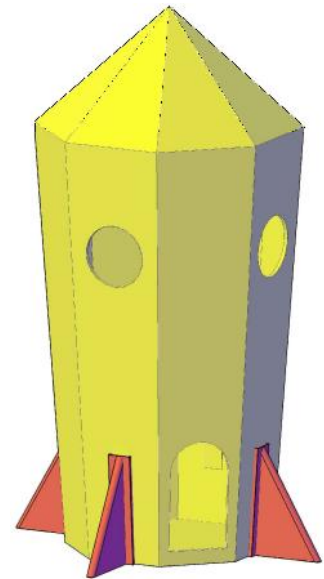


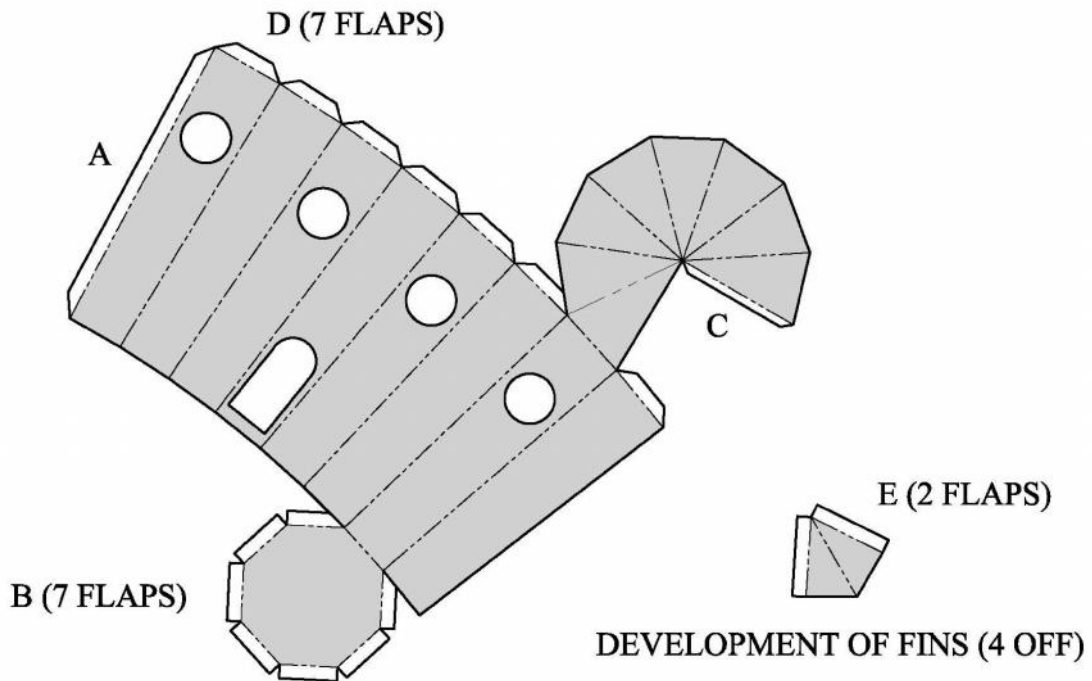
FIG 9 (a)

**The summer school students preferred visual instructions from written instructions and you have been asked to design a pictorial instruction chart to depict the above stages.**

You are required to:

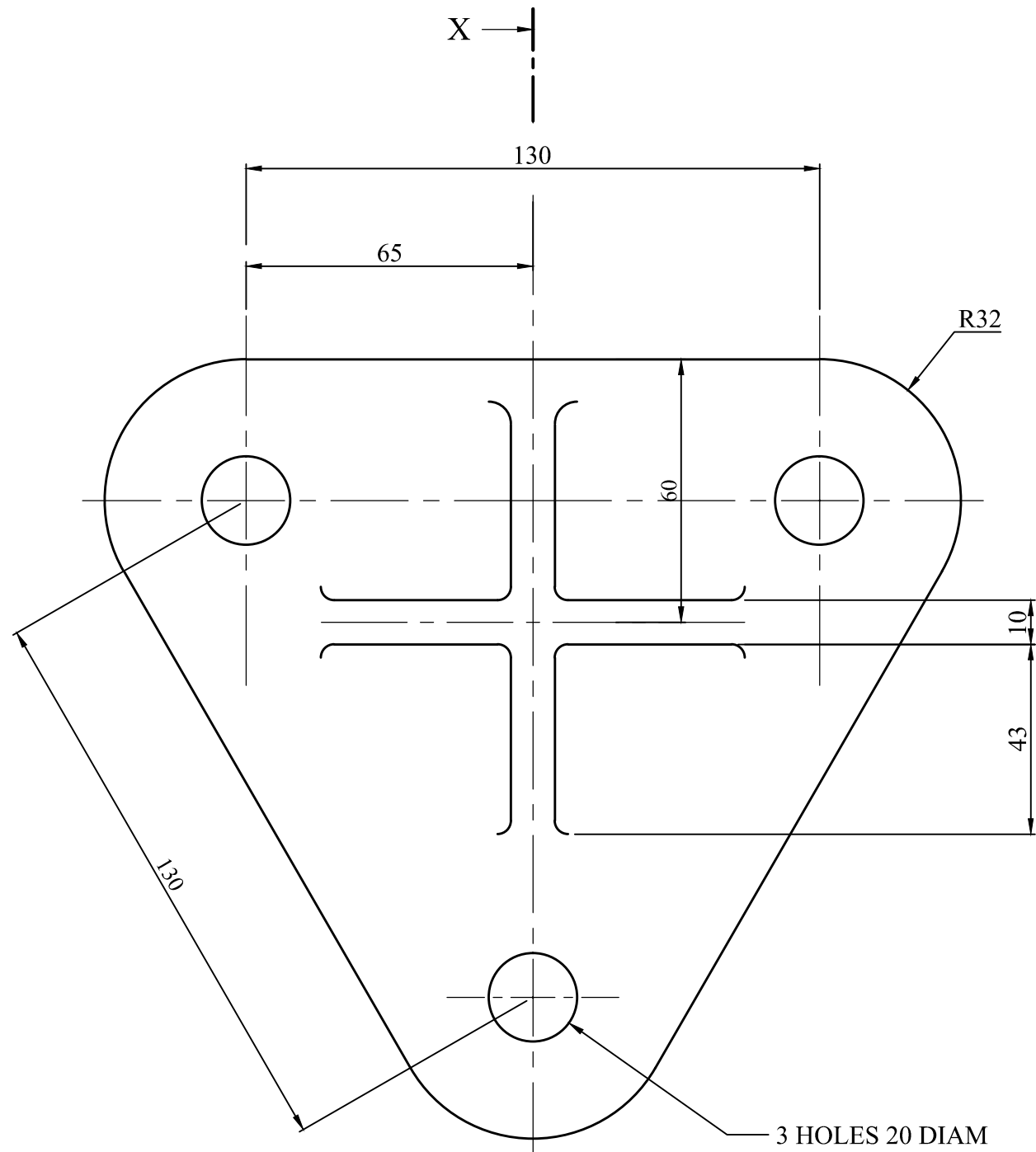
- i) Prepare three annotated preparatory sketches to illustrate your developing ideas regarding the layout and presentation of the chart.
- ii) Clearly identify the elements that you intend to use in your final chart.
- iii) Draw the final illustrated chart.
- iv) Apply colour neatly to enhance your visual aid.

**(24 marks)**

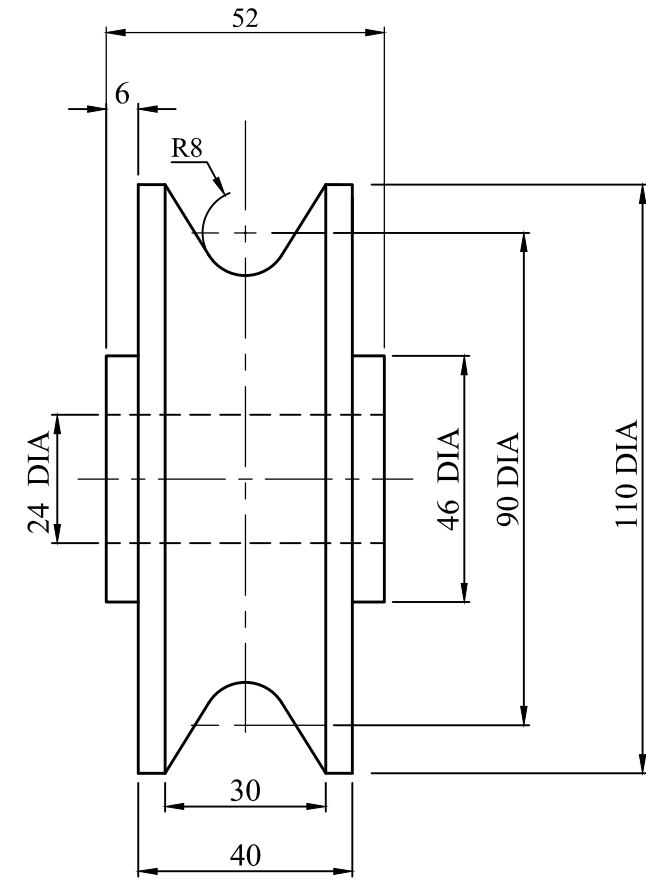
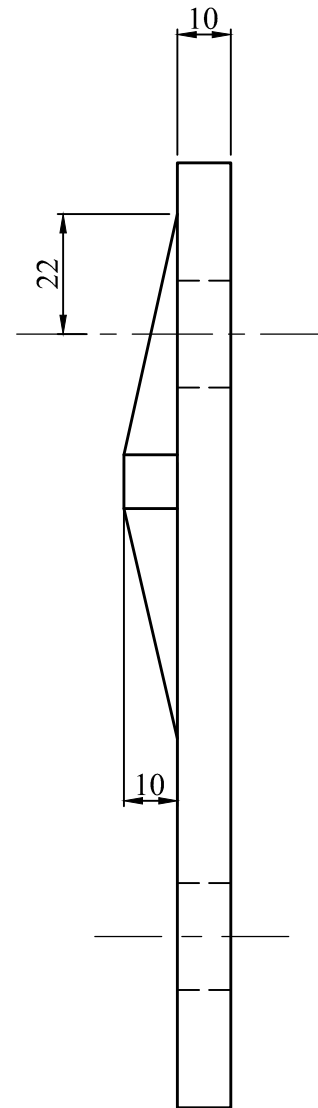


**ONE-PIECE DEVELOPMENT OF TOY ROCKET**

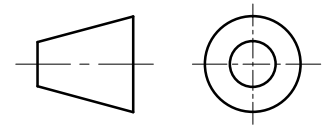
FIG. 9 (b)

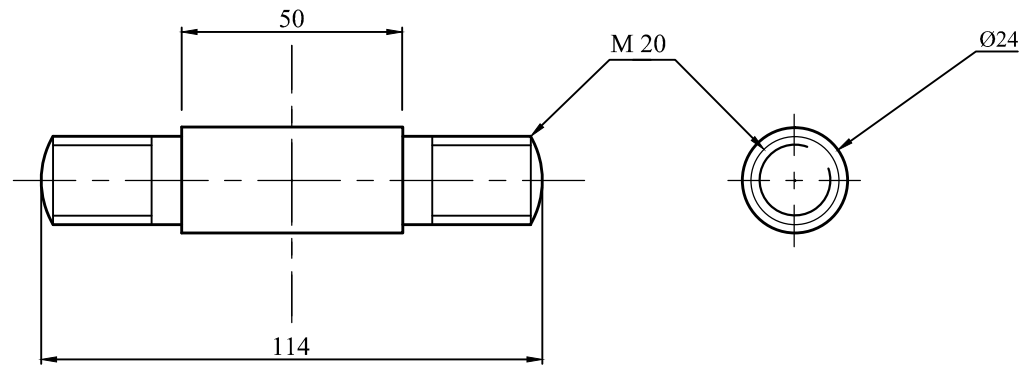


1. SIDE PLATE (2 OFF)

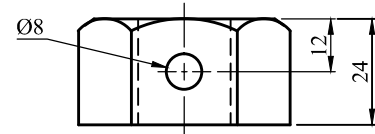


2. PULLEY (2 OFF)

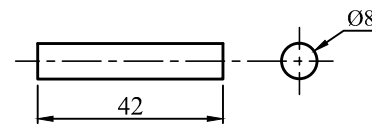




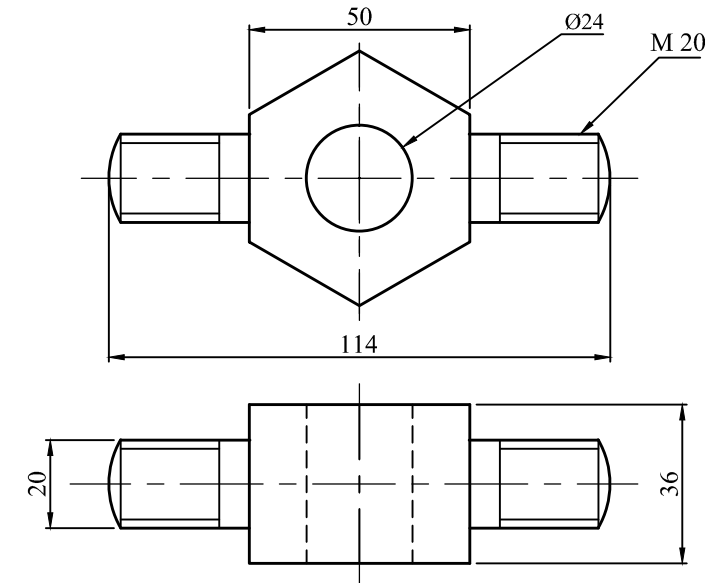
3. PULLEY SHAFT (2 OFF)



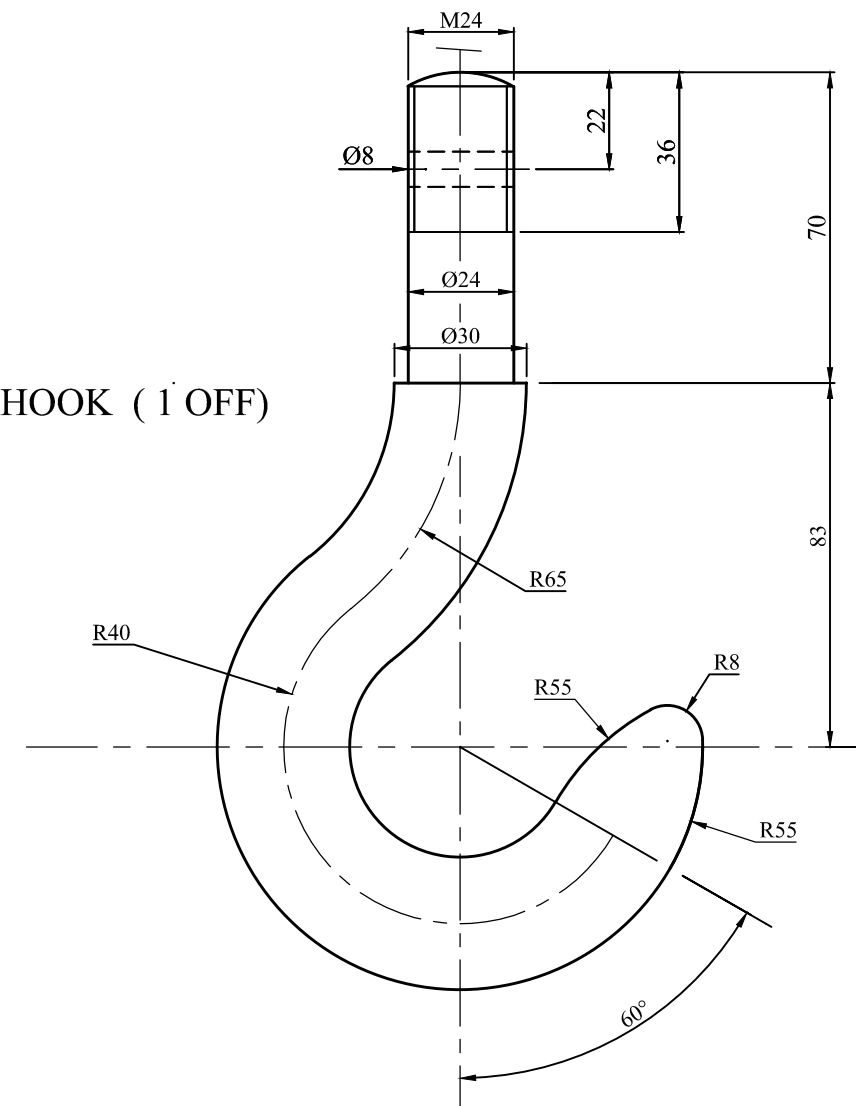
8. M 24 HEXAGONAL NUT (1 OFF)



4. NUT LOCK PIN (1 OFF)



6. HOOK SUPPORT BLOCK (1 OFF)



5. CRANE HOOK (1 OFF)

ITEM No.	DESCRIPTION	QUANTITY
1	SIDE PLATE	2
2	PULLEY	2
3	PULLEY SHAFT	2
4	NUT LOCK PIN	1
5	CRANE HOOK	1
6	HOOK SUPPORT BLOCK	1
7	M 20 HEX NUT (not shown)	6
8	M24 HEX NUT	1
9	WASHER	2