



SUBJECT:	Engineering Drawing and Graphical Communication
DATE:	8 th June 2023
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 any **FOUR** questions from this section.

Question 1

A pictorial illustration of an exclusive cake box design is shown in Figure 1a. Two views of a similar cake box are shown in Figure 1b.

- a) Copy, full size, the two given views. (2)
- b) Study and select the lengths required so as to draw the pattern required. Annotate by letters and numbers the sides and find by using an appropriate neat method how the true lengths are obtained. (4)
- c) Construct a half surface development of the pattern using the triangulation method. (7)

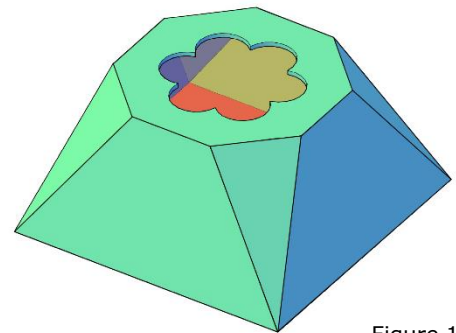


Figure 1a

(Total: 13 marks)

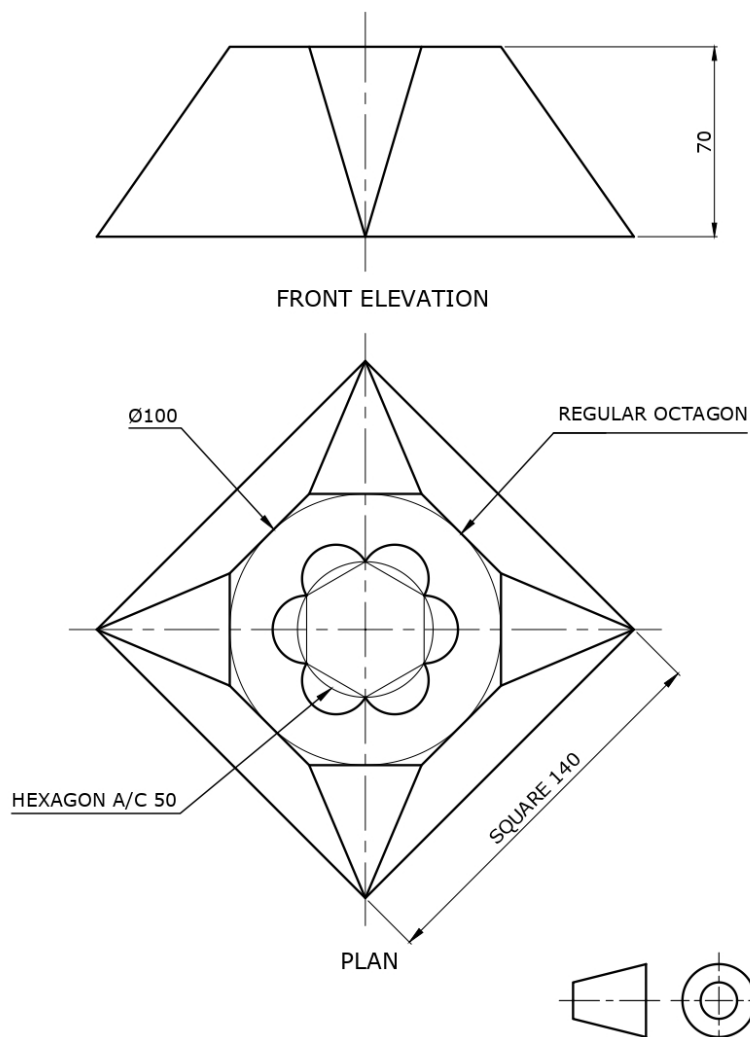


Figure 1b

Question 2

The illustration shown in Figure 2a demonstrates a heat sink to be mounted on the processor of the video card. The profile of one of the heat sink fins is composed of two curves, a hyperbolic curve and an elliptical curve shown in Figure 2b. Both curves are conics treated as a locus of a point.

- a) Plot the upper branch of the hyperbola, using an eccentricity of 5:2, and the vertex 20 mm from the directrix. (5)
- b) Plot the upper branch of the ellipse, placing the vertex 60 mm from the directrix and the focus 35 mm from the vertex. (5)
- c) Indicate on each curve a point P showing the ratio used and print the technical terms for the conics. (3)

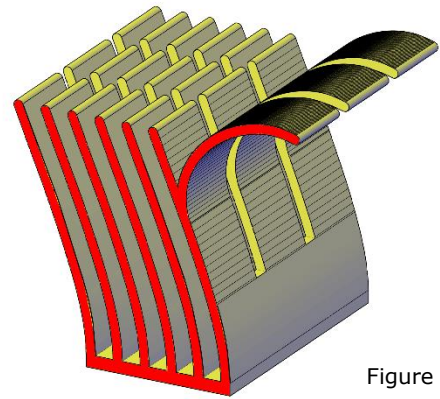


Figure 2a

(Total: 13 marks)

The solution may be presented as shown in Figure 2c.

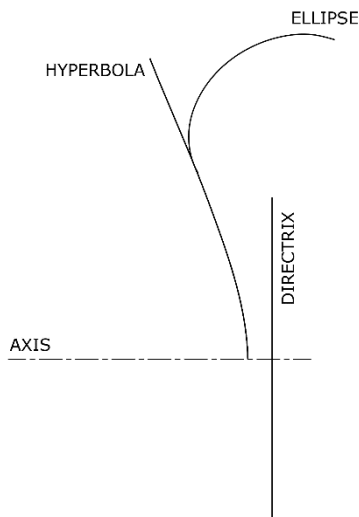


Figure 2b

<p>HYPERBOLA</p> <p>The Eccentricity of the HYPERBOLA is:</p> <p>Eccentricity = $\frac{\text{Distance } \dots\dots\dots}{\text{Distance } \dots\dots\dots}$</p>	<p>ELLIPSE</p> <p>The Eccentricity of the ELLIPSE is:</p> <p>Eccentricity = $\frac{\text{Distance } \dots\dots\dots}{\text{Distance } \dots\dots\dots}$</p>
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Figure 2c

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Question 3

A pictorial sketch of a gear wheel is shown in Figure 3a.

The spur gear wheel teeth profiles are of involute form with a pressure angle of 20° and a module of 10. The number of teeth on the gear wheel is 16.

a) Write down the given gear data and substituting the given gear data, calculate the dimensions required to draw, twice full size, the spur gear teeth. (3)

b) Copy, the conventional representation of the gear shown in Figure 3b and draw the pressure angle and the base circle passing through the pitch point P. Set up the construction of the involute to one side of one flank face profile of the gear, showing the construction of the flank face profile of the true involute form. (5)

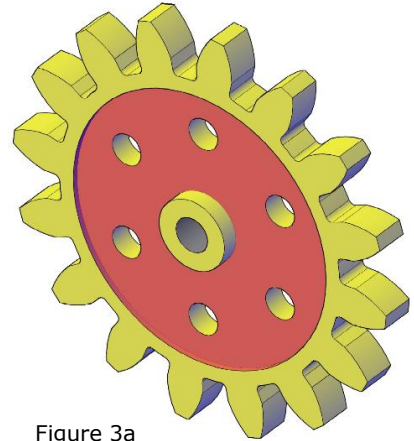


Figure 3a

c) Transfer the flank face of the involute into position, and draw, **TWO** teeth. The flank faces of the two teeth may be constructed, by using a geometrical approximate construction. (5)

(Total: 13 marks)

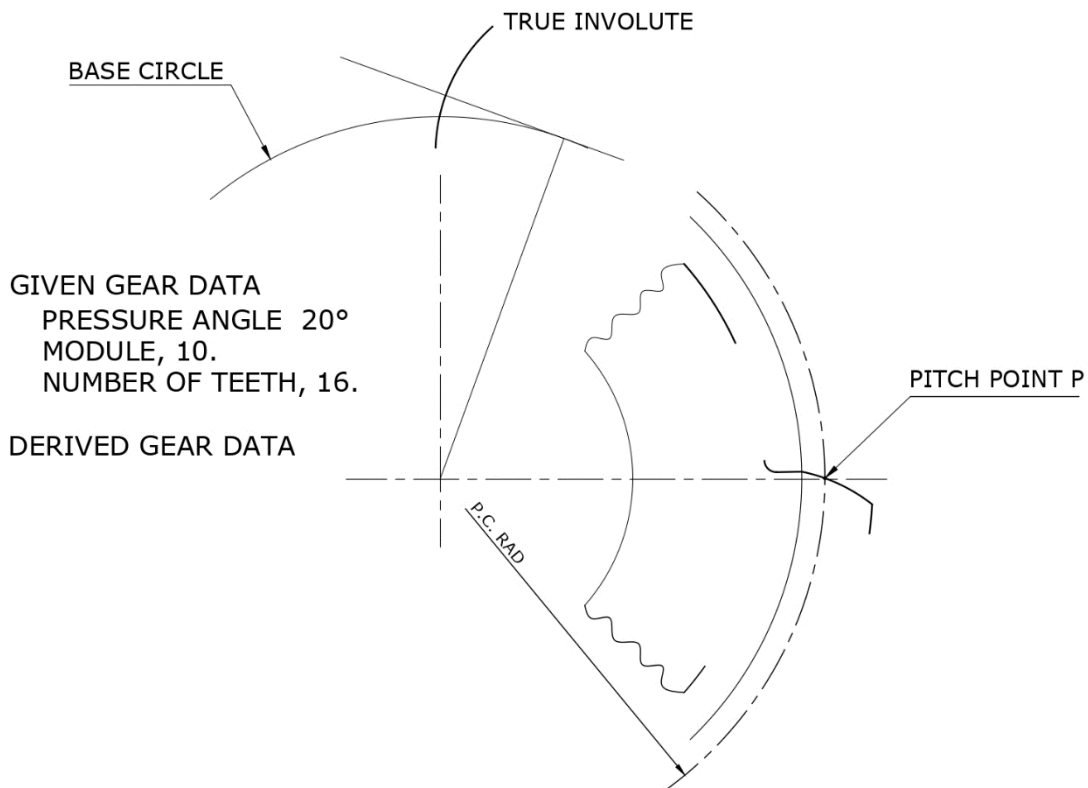


Figure 3b

Question 4

A triangular prismatic hole shown in Figure 4a was machined (cut) through a right cylinder perpendicular to the longitudinal axis. The axis of the cylinder is parallel to the vertical plane and horizontal plane in the Front Elevation.

Draw full size:

- a) the **THREE** given views shown in Figure 4b; (3)
- b) a complete Front Elevation of the cylinder showing:
 - i. the curve of intersection; (7)
 - ii. hidden details. (3)

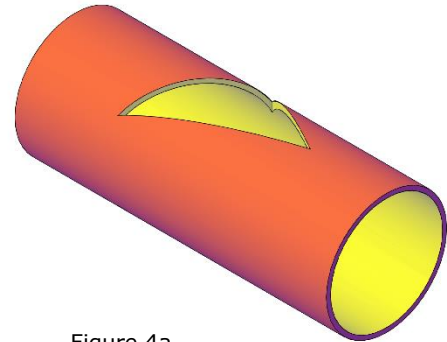


Figure 4a

(Total: 13 marks)

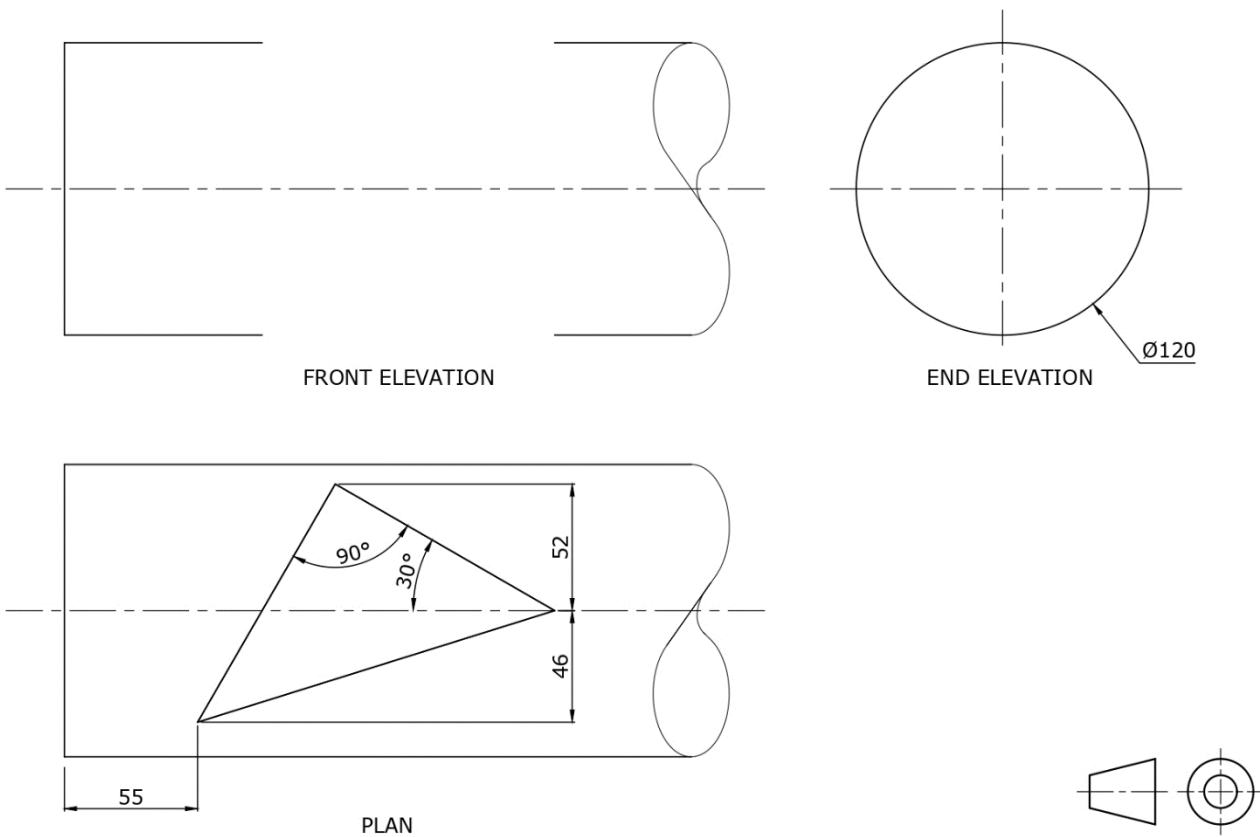


Figure 4b

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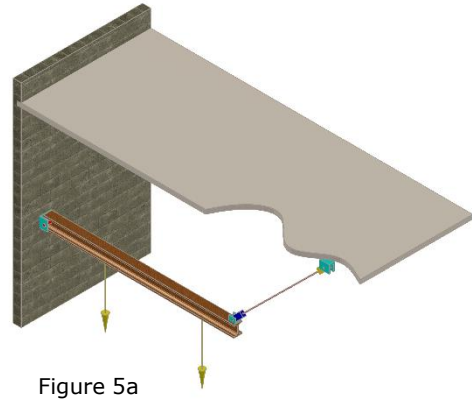
Question 5

A light 12 m beam shown in Figure 5a and Figure 5b is hinged at the left end and carries two parallel loads. The beam is kept in a horizontal position by a cable from the right end.

a) Copy, the space diagram shown in Figure 5b, using a scale of 20 mm representing 1 m. (2)

b) Using a scale of 10 mm representing 10 N, determine graphically the magnitude and direction of the:

- i. tension in the cable; (5)
- ii. reaction at the hinge. (6)



(Total: 13 marks)

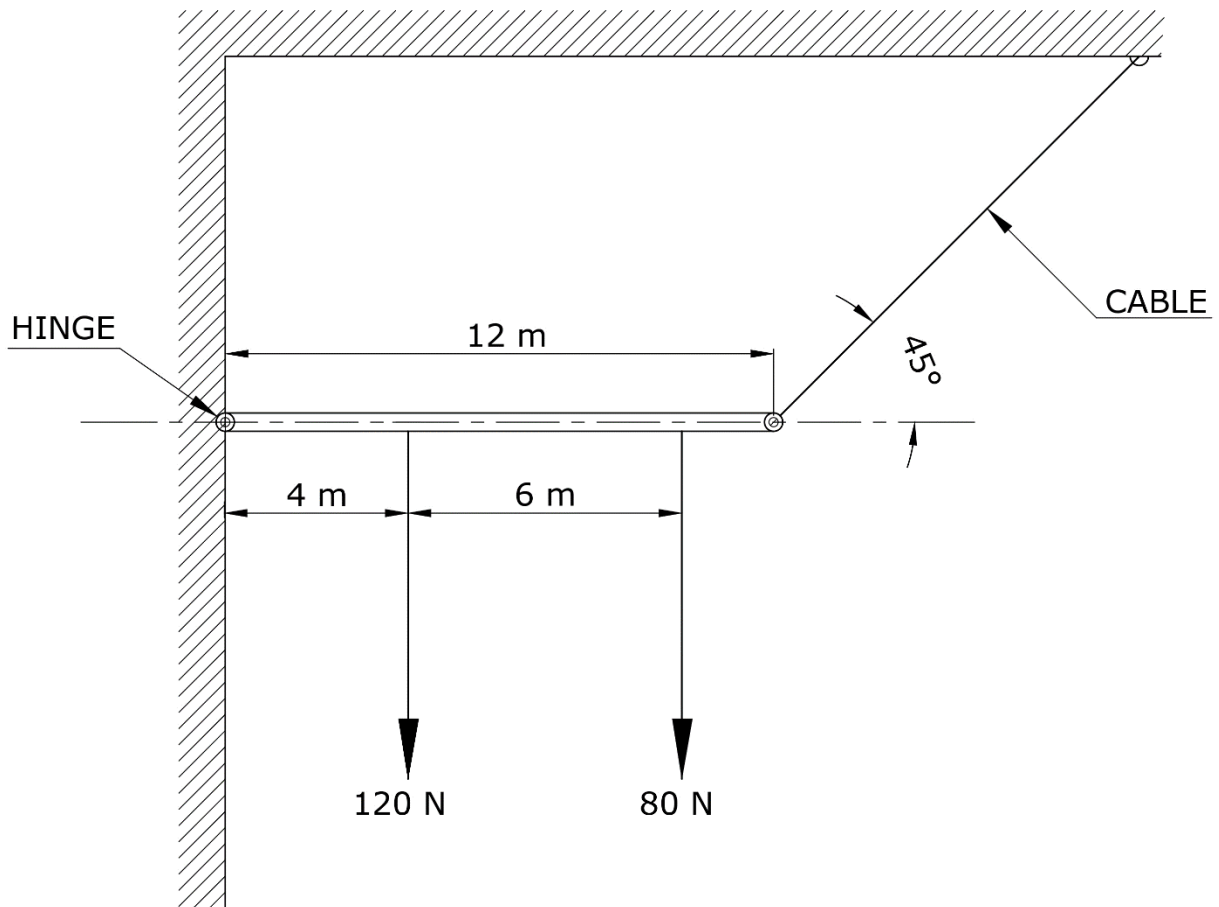


Figure 5b

SECTION B

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

Question 6

A three-dimensional view of a pipe vice is shown in Figure 6a. The parts of the pipe vice are displayed disconnected from each other, ready to be assembled together.

Detailed dimensions of the parts of the pipe vice, are shown in Figure 6b, on the A3 paper attached. The parts are assembled as follows.

The rectangular block 90 x 60 x 30, referred to as the sliding vee piece (Item 1), is inserted through the hollow base of the main body (Item 2), with the 15 mm diameter hole, first. The block is located in the upper section of the rectangular cavity in the main body. The clamping spindle (Item 3), is screwed into the M20 thread in the main body. The 15 mm diameter by 23 mm length waisted end of the spindle is inserted into the top of the sliding vee piece. The spindle securing the M8 screw (Item 4), is introduced through the 10 mm hole of the main body and located in the 6 x 10 mm diameter undercut in the clamping spindle, securing the spindle to the sliding vee block. The 15 mm diameter rod end of the clamping handle (Item 5), is inserted through the 15 mm hole in the clamping spindle. The end piece is shown assembled with the clamping handle. This end piece is fitted to the handle to prevent it becoming loose.

Draw, full size, the following views of the assembled pipe vice:

- a) a sectional elevation on the section X-X; (19)
- Show the clamping handle positioned centrally in the clamping spindle.
 - Show the sliding vee piece with the securing screw end hole aligned on the centre line of the 10 mm hole of the main body.
- b) an end elevation, as seen from the left-hand side. (5)

(Total: 24 marks)

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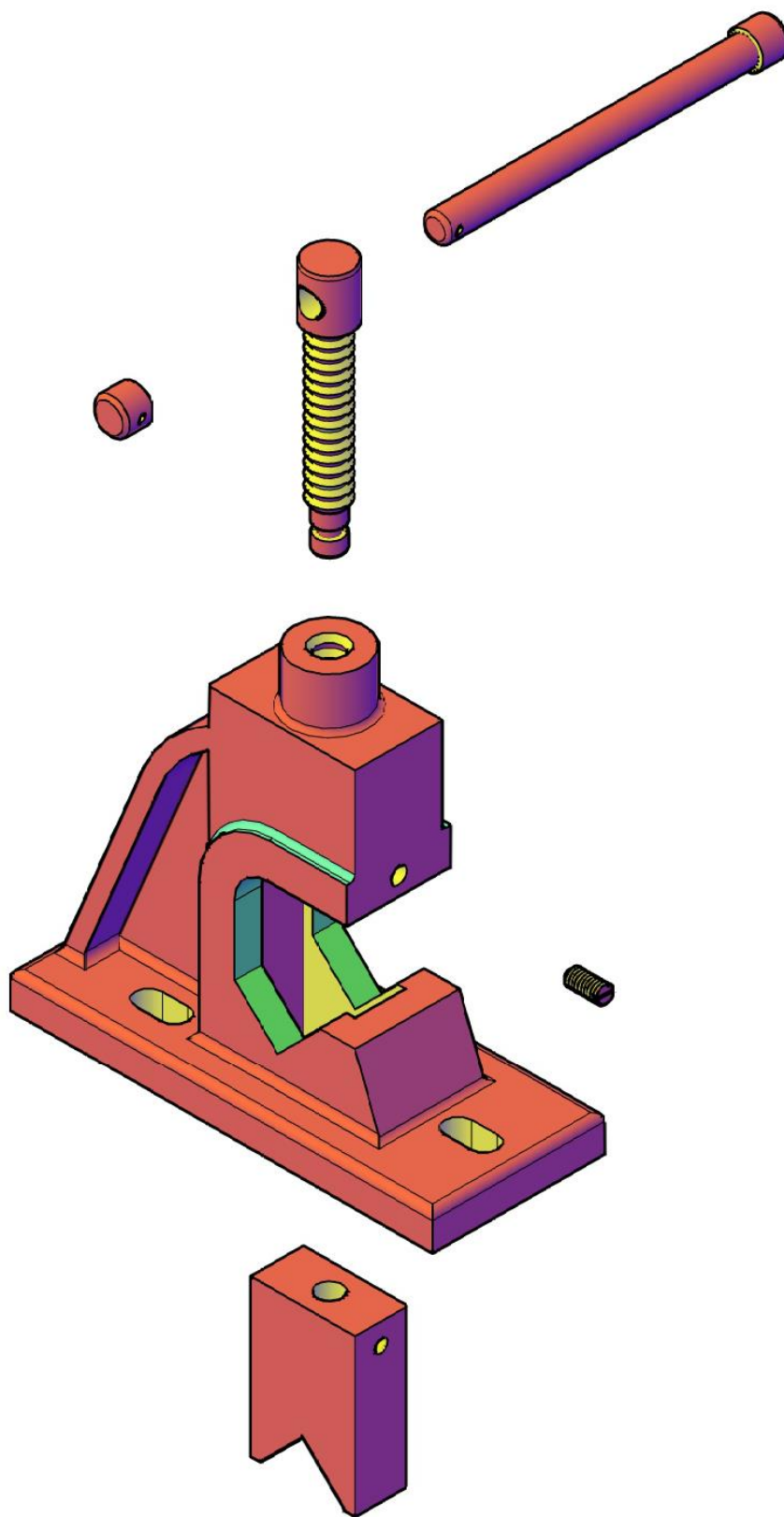


Figure 6a

Question 7

Detailed dimensions of a mechanism operating a roller ended follower on a cam profile are shown in Figure 7a on the A3 paper attached. A pictorial illustration of the exploded mechanism is also shown in Figure 7b on the A3 paper attached.

The roller follower (Item 1) 40 mm diameter face marked A, is mounted onto 30 mm diameter face marked B, of the follower rod (Item 2). These two parts are retained by an M10 screw (Item 3). The M10 threaded part of the screw is tightened into the M10 internal thread of the follower rod. The shank of 20 mm diameter x 14 mm portion of the screw fits into the 20 mm diameter x 14 mm hole of the roller and the roller is free to rotate. The 16 mm diameter follower rod with the roller and screw assembly are fitted into the 16 mm holes of the base bracket (Item 4).

Draw, full size:

- a) A plan of the base bracket, with the 16 mm diameter follower rod fitted into the two 16 mm diameter holes of the base bracket. Point N of the follower rod on point M of the base bracket. The 70 mm diameter circle of the cam is tangential to the 40 mm diameter of the roller and on the same centre line. The follower moves back and forth in a straight line, while the cam rotates. (4)
- b) Construct a displacement diagram, the motion of the follower is to:
- move outward 54 mm through 180° of cam rotation with uniform acceleration and retardation; (4)
 - move inwards 54 mm with uniform acceleration and retardation during the remainder of the revolution of the cam; (2)
 - draw the cam profile. (6)
- c) Project a view underneath the plan drawn, showing part of the roller rod end attached to the roller and secured by means of the M10 screw. Show the partial rod end and roller assembly in section. Do **not** include the base in the projected view. (8)

(Total: 24 marks)

Please turn the page.

SECTION C

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

Question 8

If not properly managed, hazardous waste can pose a threat to both people and the environment. A private green company named HWM (Hazardous Waste Malta) is planning to begin a business collecting and disposing hazardous material in Malta safely and efficiently. HWM promises an expert and professional solution for transporting and managing toxic waste to protect the environment. In advance of their investment, they analysed some data from the Malta National Statistics Office on waste generation by year and category.

Table 8.1: Waste generation
[NSO Transport Statistics reference year 2020]

Waste Generation category	Waste Generation by year in tonnes					
	2016	2017	2018	2019	2020	Total
Batteries and accumulators waste	1,000	1,800	1,800	1,800	1,300	7,700
Discarded equipment	2,300	3,500	3,500	2,900	2,900	15,100
Spent solvents	1,300	2,000	1,700	1,300	1,700	8,000

You are required to design a poster. Your presentation must follow the steps given below and organised as suggested in Figure 8.

- Label the poster with the heading "HWM". (2)
- Draw **THREE** graphic app icons to use as a mobile phone application, subsequently the company may choose the most suitable icon. This app icon should make it easier for customers to find this application on their mobile phone and use the company services. The icons should be simple and should reflect the company identity. Sketches to develop ideas can be drawn at the side of your A2 sheet. (8)
- Draw a bar chart on your poster showing batteries and accumulators waste, discarded equipment and spent solvents in tonnes for 2016 and 2017. (4)
- Draw a line graph showing batteries and accumulators waste, discarded equipment and spent solvents in tonnes for 2018, 2019 and 2020. (4)
- Draw a pie chart showing the total number of batteries and accumulators waste, discarded equipment and spent solvents in tonnes. (4)
- Finalise your designed poster. The poster is expected to have a visual impact and carry the intended message clearly. (2)

Special consideration is to be given to the following:

- the use of colour and shading to render the drawing;
- the use of typography (fonts);
- the formation of an attractive presentation, clearly conveying the information.

(Total: 24 marks)


a) HEADING		PROJECTION	
b) GRAPHIC APP ICON	b) GRAPHIC APP ICON	b) GRAPHIC APP ICON	b) SKETCHES TO DEVELOP IDEAS FOR THE GRAPHIC APP ICONS
e) PIE CHART			
c) BAR CHART		d) LINE GRAPH	
		e) WORKING FOR THE PIE CHART	
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	PAPER No:	DATE: 8 - 6 - 2023	SHEET OF

Figure 8

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Question 9

An isometric view of a teenage bedroom is shown in Figure 9a. An orthographic projection of the room is shown in Figure 9b. The room consists of bed with storage behind the headboard, an overhead shelf, a four-door wardrobe with drawers, a small desk and a window.

a) Use the dimensions given in the orthographic projection to construct an estimated one-point perspective of the room. The viewing direction required is indicated by the arrow in the plan. Use the vanishing point for the one-point perspective given in the Front view. (21)

b) Render in colour your drawing to enhance its presentation. (3)

(Total: 24 marks)

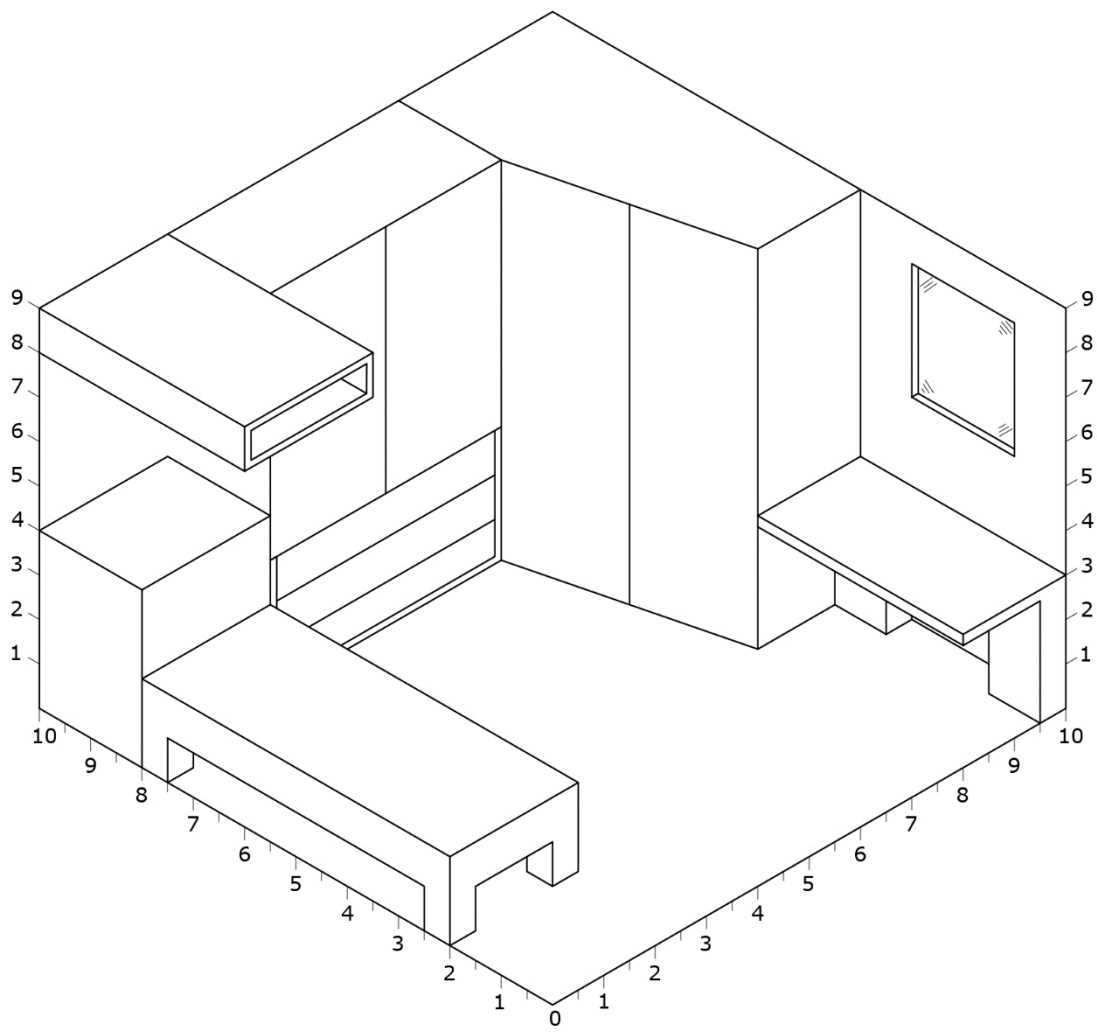


Figure 9a

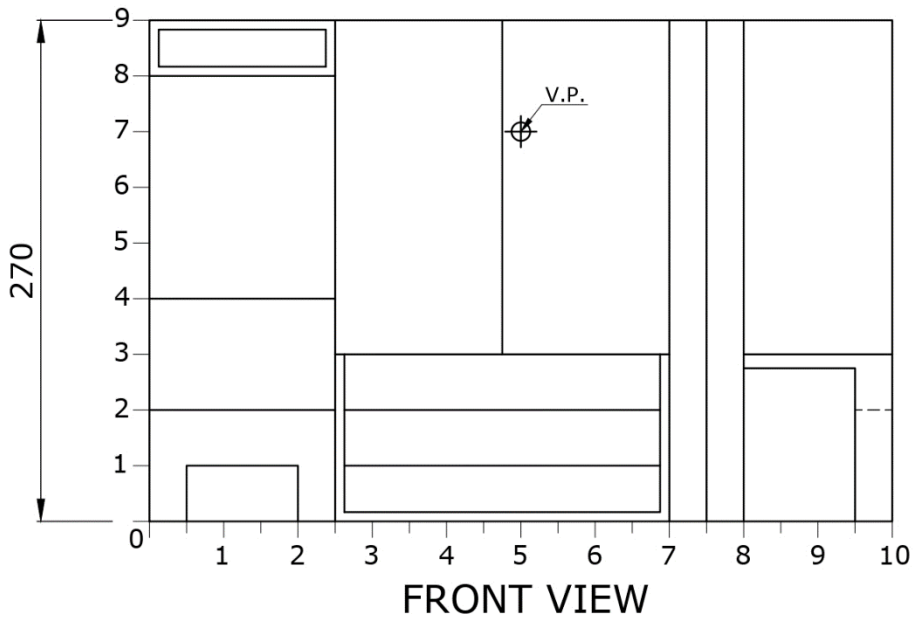
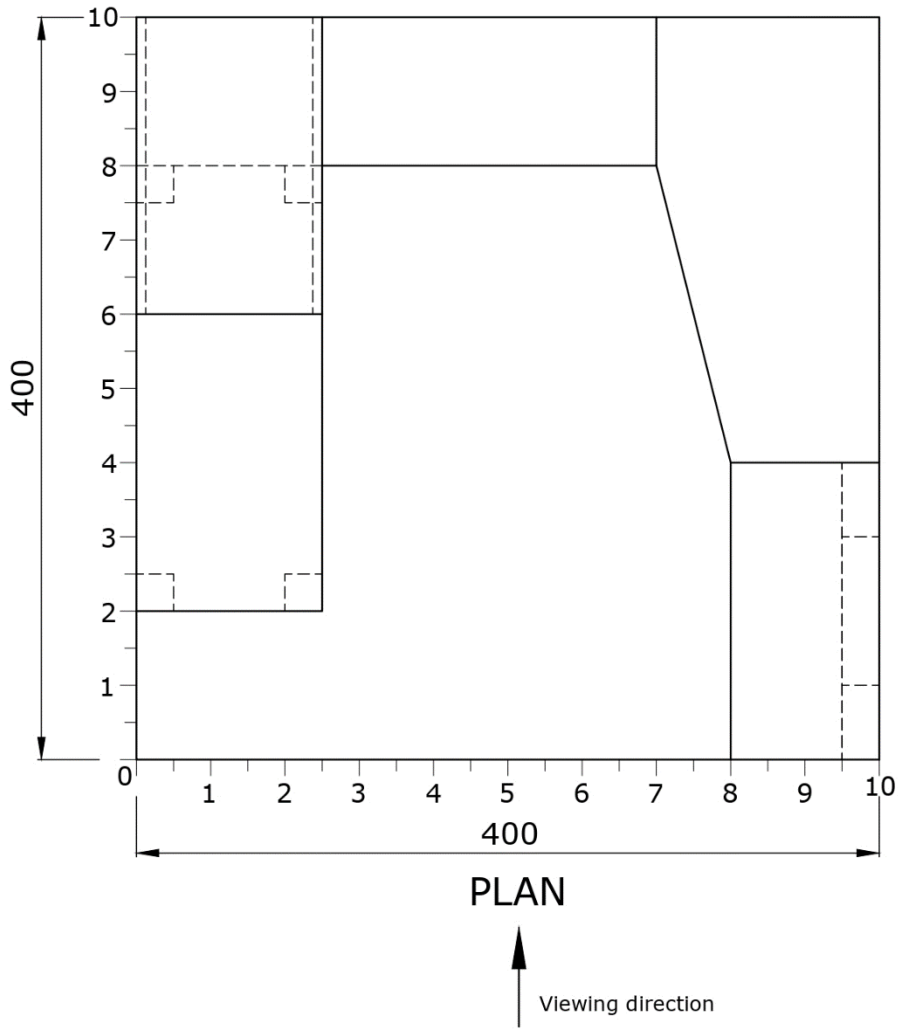
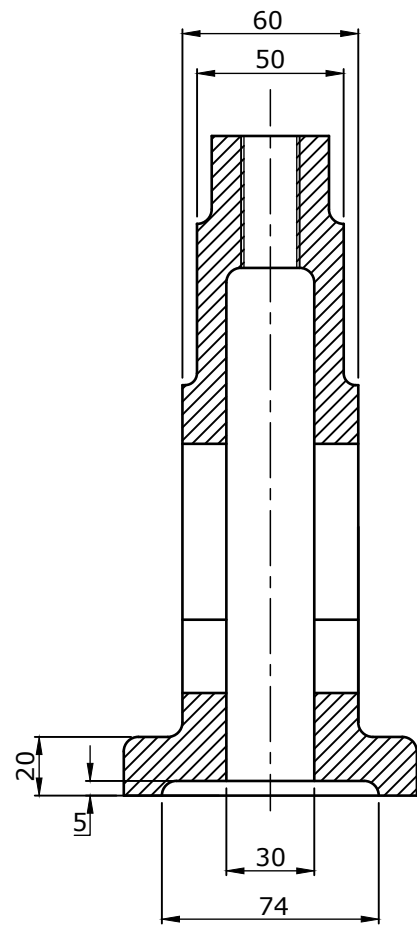
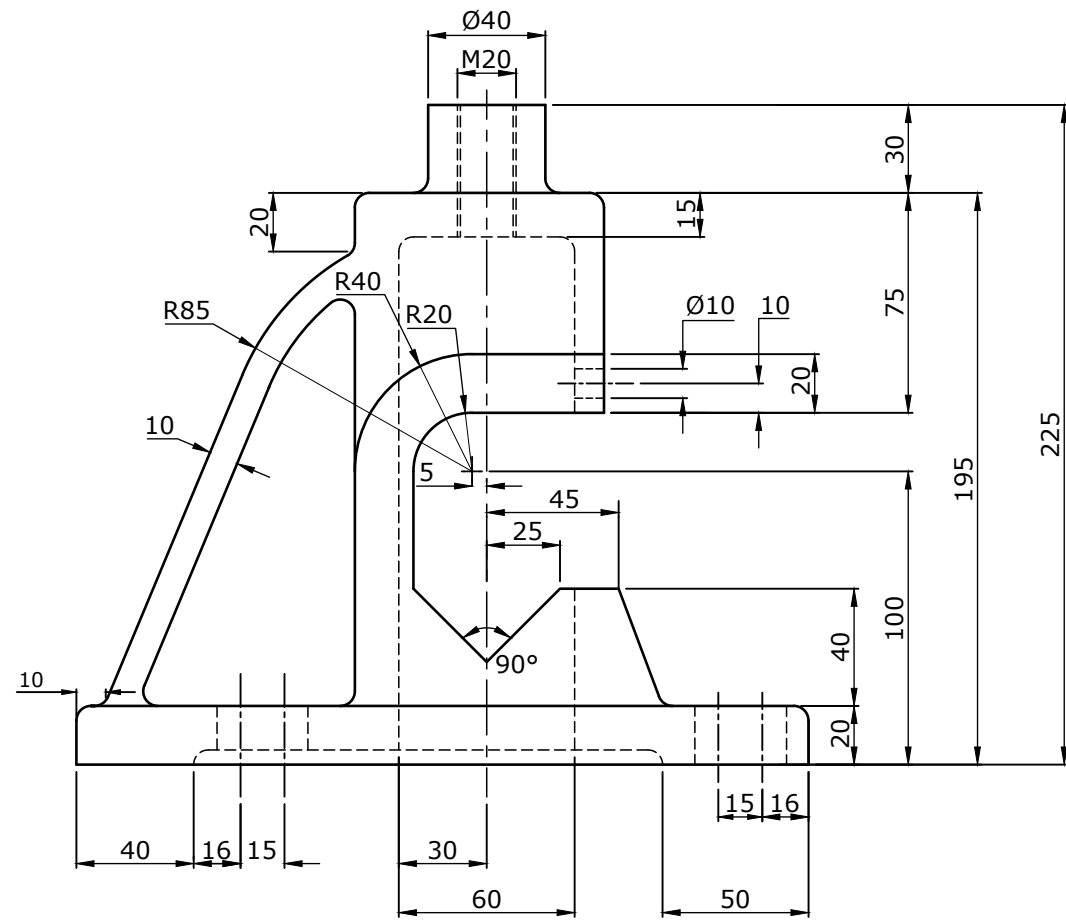


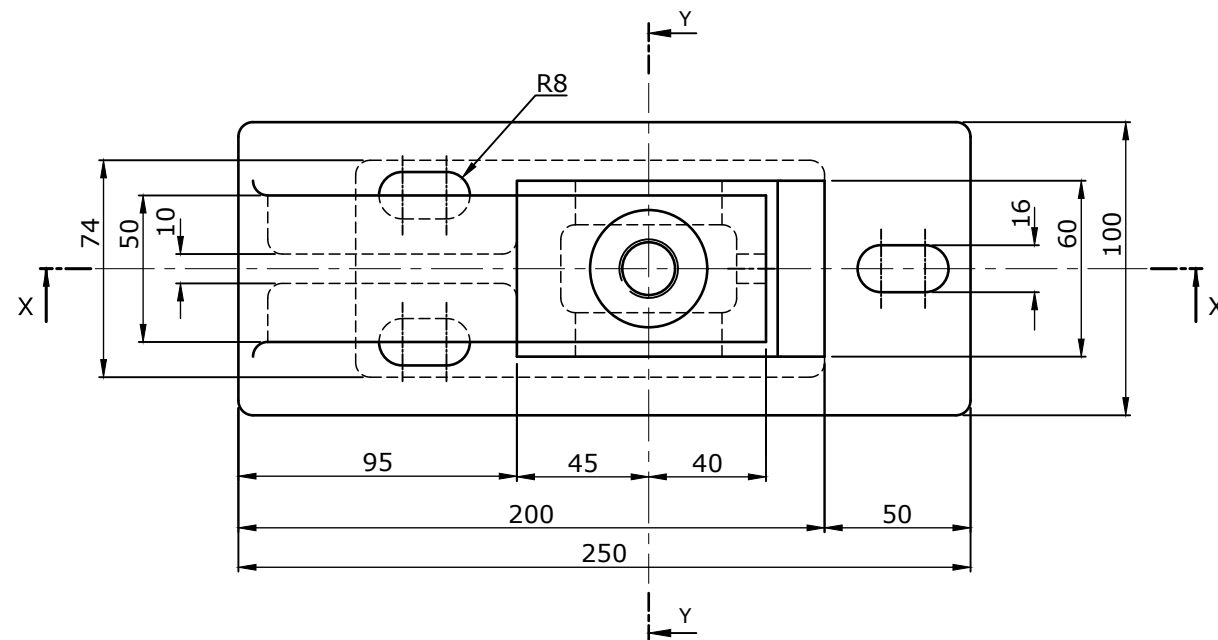
Figure 9b



SECTION Y - Y

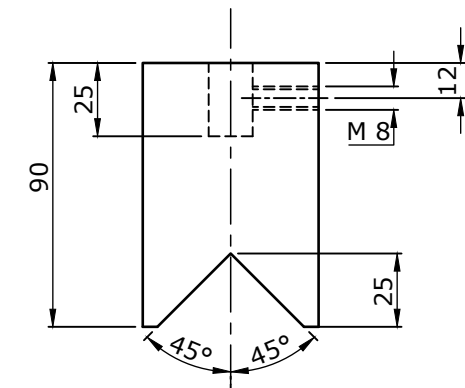


FRONT ELEVATION

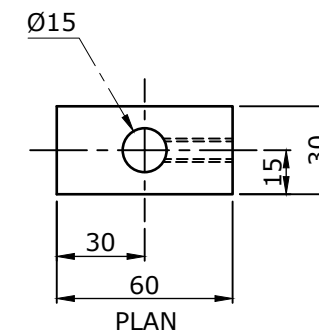


PLAN
Main BODY (Item 2)

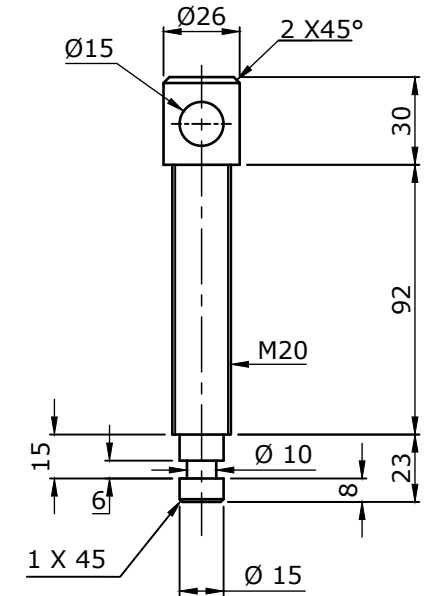
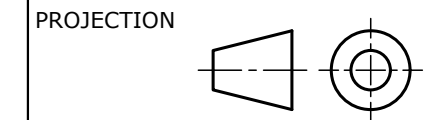
PIPE VICE
Figure 6b



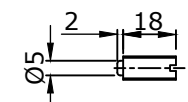
FRONT ELEVATION



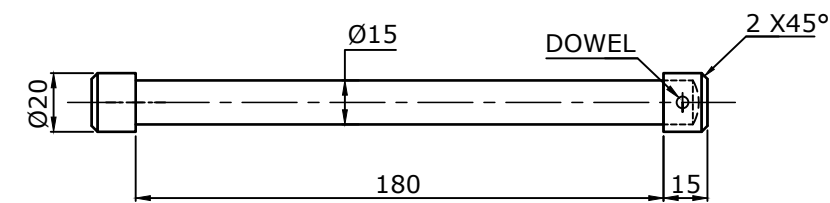
PLAN
SLIDING VEE PIECE (Item 1)



CLAMPING SPINDLE (Item 3)



SPINDLE M 8 SCREW (Item 4)



CLAMPING HANDLE (Item 5)



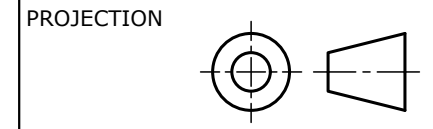
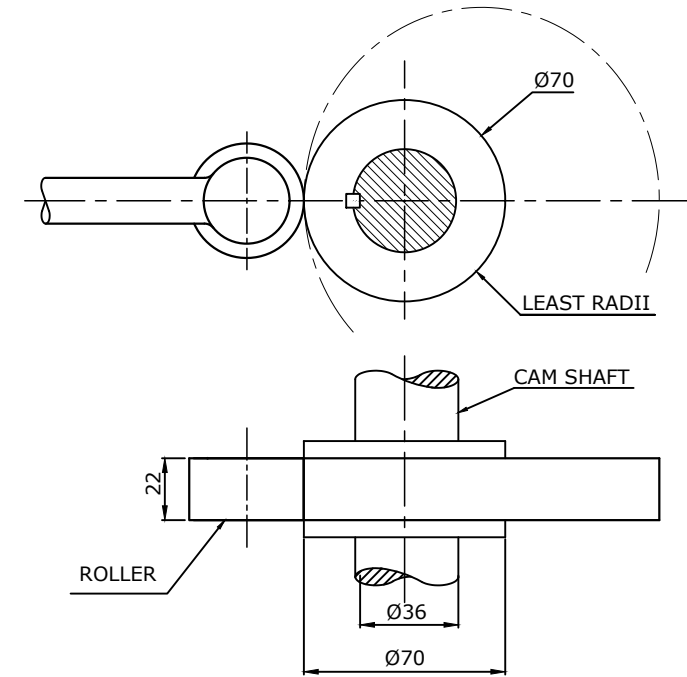
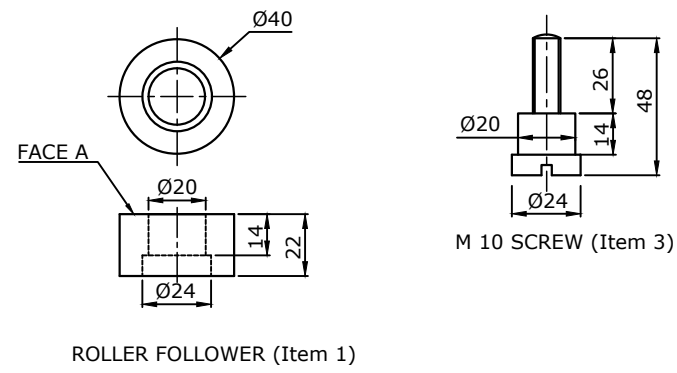
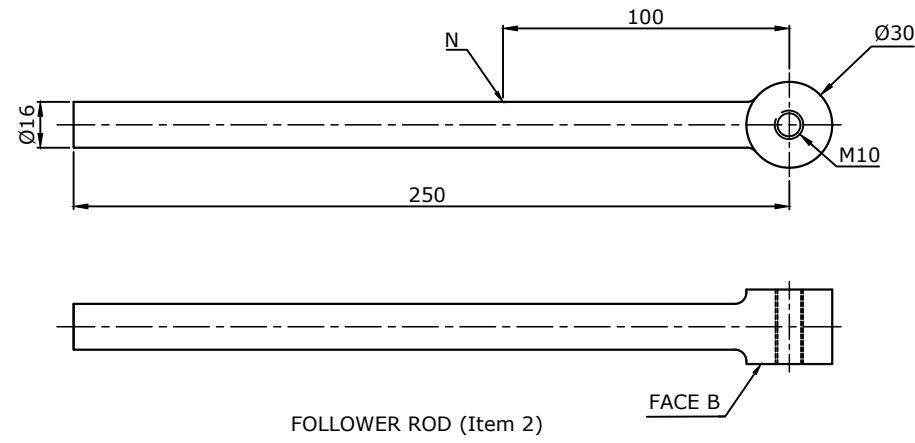
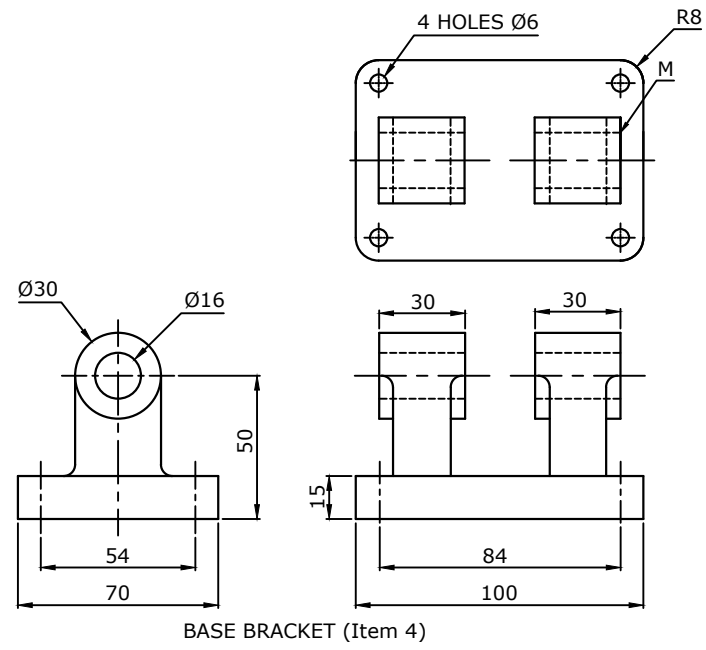


Figure 7a

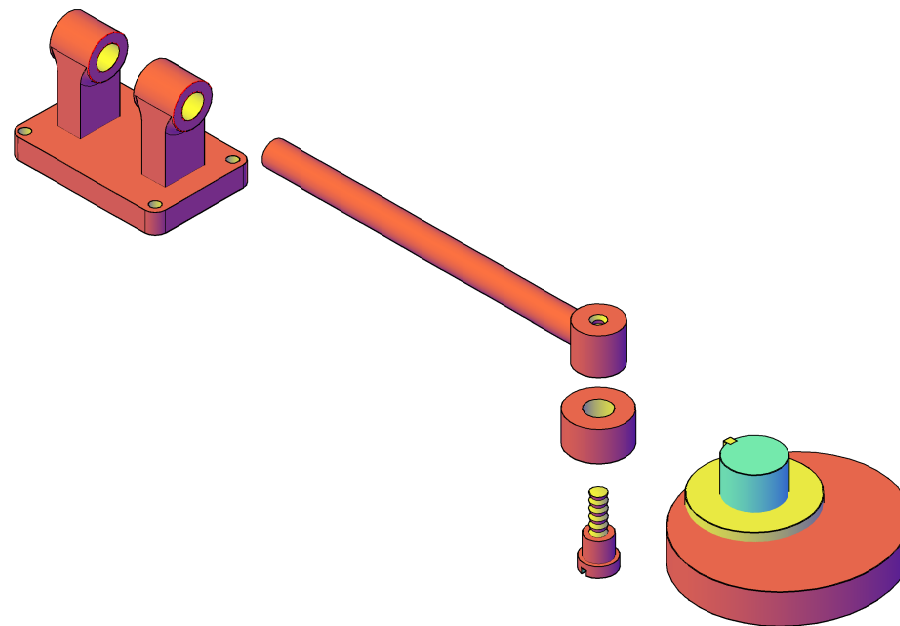


Figure 7b

