IM09.24s

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

INTERMEDIATE MATRICULATION LEVEL
2024 SECOND SESSION

SUBJECT:	**Engineering Drawing and Graphical Communication**
DATE:	4th September 2024
TIME:	9:00 a.m. to 12:05 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:

a. B.S. or equivalent (ISO) recommendations should be adopted throughout your answers;
b. all dimensions are in millimetres, unless otherwise stated;
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.

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.

Figure 1a

A parasailing logo is shown in Figure 1a. The icon consists mainly of two cycloidal curves which form the top of the parasail and the sea wave. The arrangements of the rotating circles, the generating circles, the directing arc and the directing line are given in Figure 1b. The cycloidal curves are generated as follows:

Sea wave symbol

- The Ø54 wheel rolls without slipping on the directing line X Y clockwise and for two revolutions clockwise from the original position.
- Point 'Q' on the inner Ø28 wheel generates the required sea wave curve.

Parasail symbol

- The Ø72 wheel rolls without slipping clockwise for one revolution on the outside of the R108 directing arc.
- Point 'P' generates the required curve.

You are requested to:

a. copy Figure 1b; (1)
b. plot the locus of point 'Q'; (5)
c. plot the locus of point 'P'; (6)
d. name the two curves generated. (1)

(Total: 13 marks)

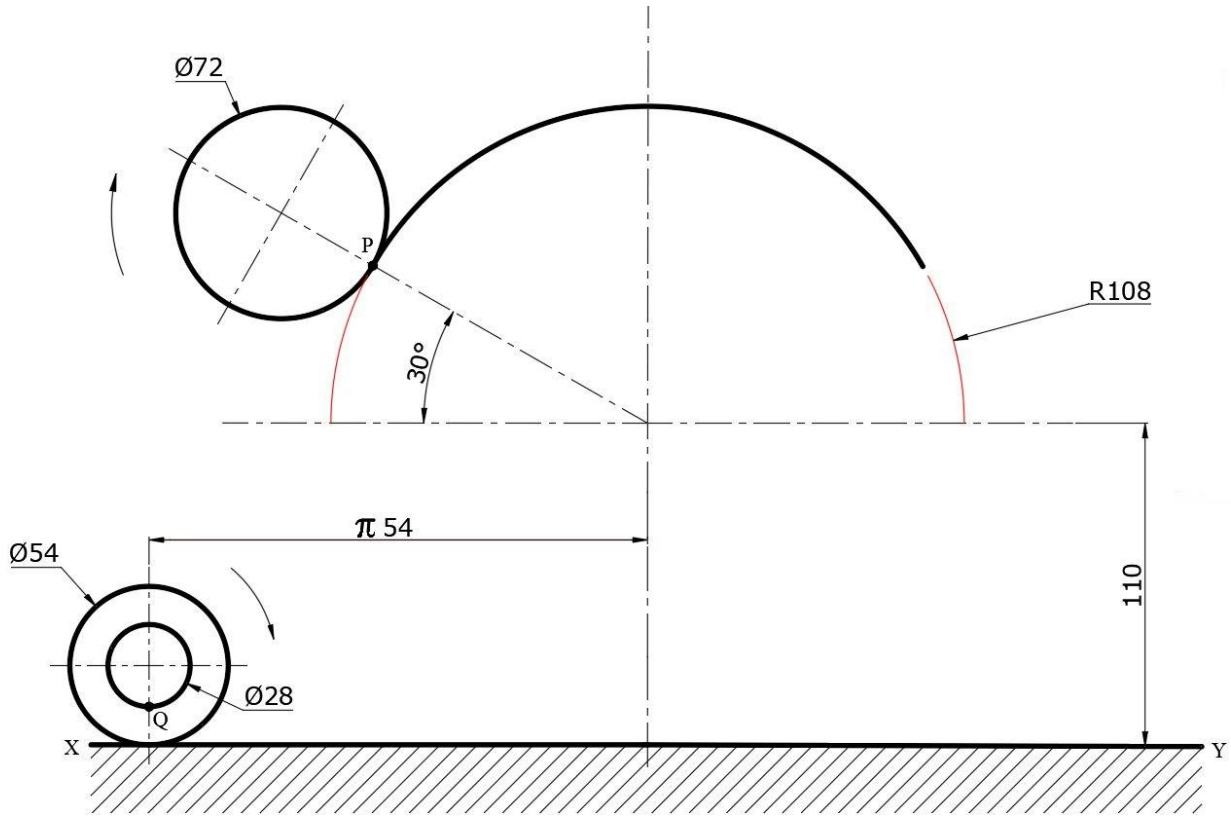


Figure 1b

Question 2.

An illustration of an offset sheet metal funnel is shown in Figure 2a. The funnel consists of an inverted truncated oblique cone. Details of the oblique cone are given in Figure 2b.

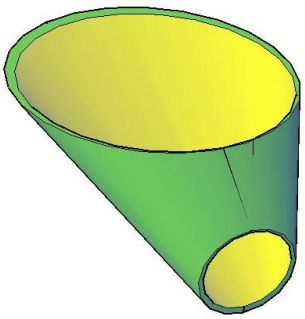


Figure 2a

a. Copy Figure 2b. (1)
b. Draw the generators in both views. (1)
c. Construct the necessary true lengths. (3)
d. Construct a full surface development of the truncated oblique cone. (8)

Note: Take the seam line of the oblique cone along 1S.

(Total: 13 marks)

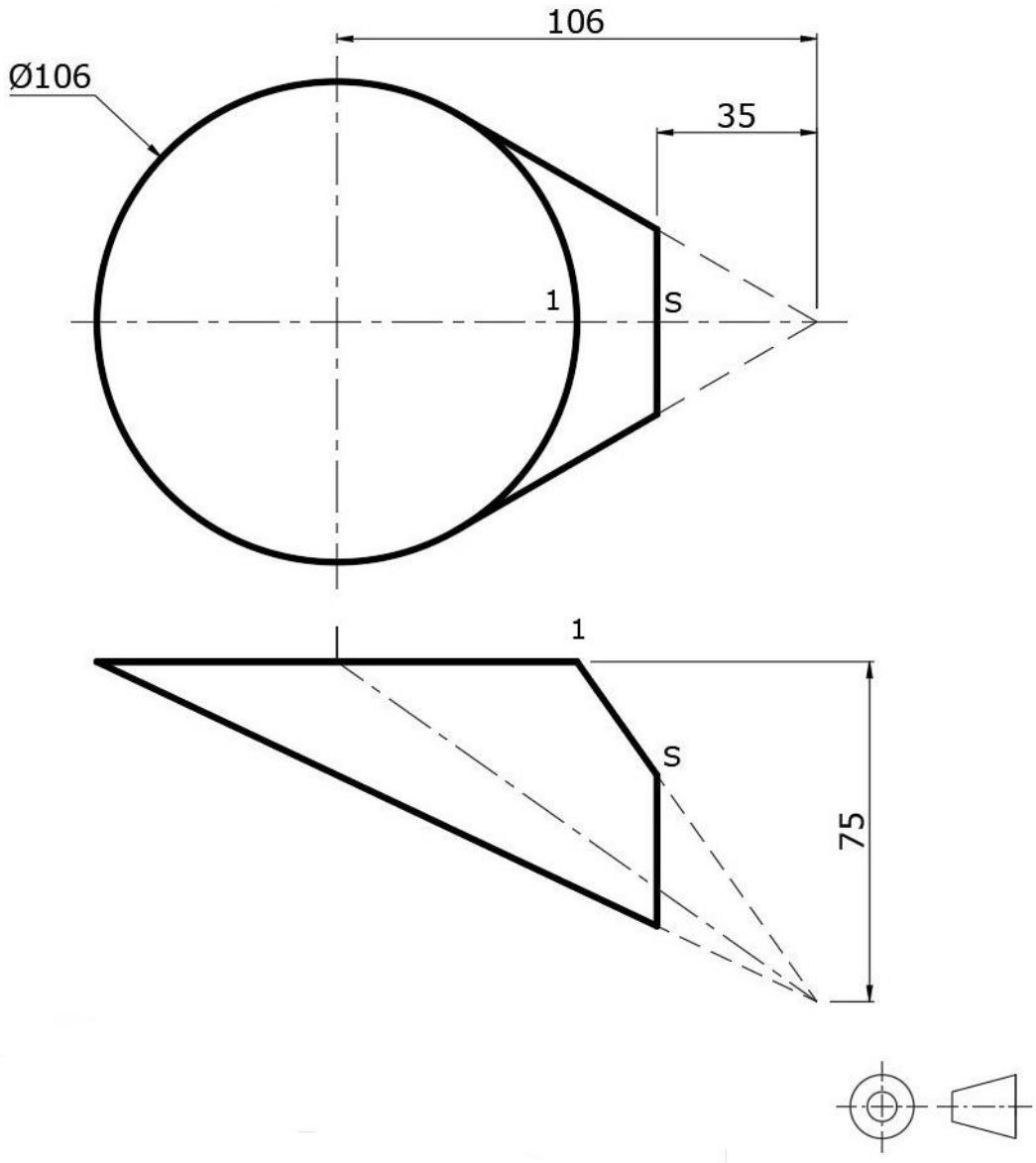


Figure 2b

Please turn the page.

Question 3.

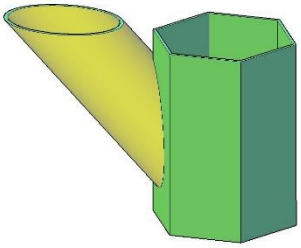


Figure 3a

An illustration of a hexagonal prism intersected by an inclined Ø60 cylinder is shown in Figure 3a. Two orthographic views of the interpenetrating objects are given in Figure 3b.

a. Copy the given views. (3)
b. Construct the curve of intersection in the front elevation. (3)
c. Construct the surface development of face CDE of the hexagonal prism (showing the hole resulting from the intersection). (4)
d. Construct a half surface development of the cylindrical branch pipe. (3)

(Total: 13 marks)

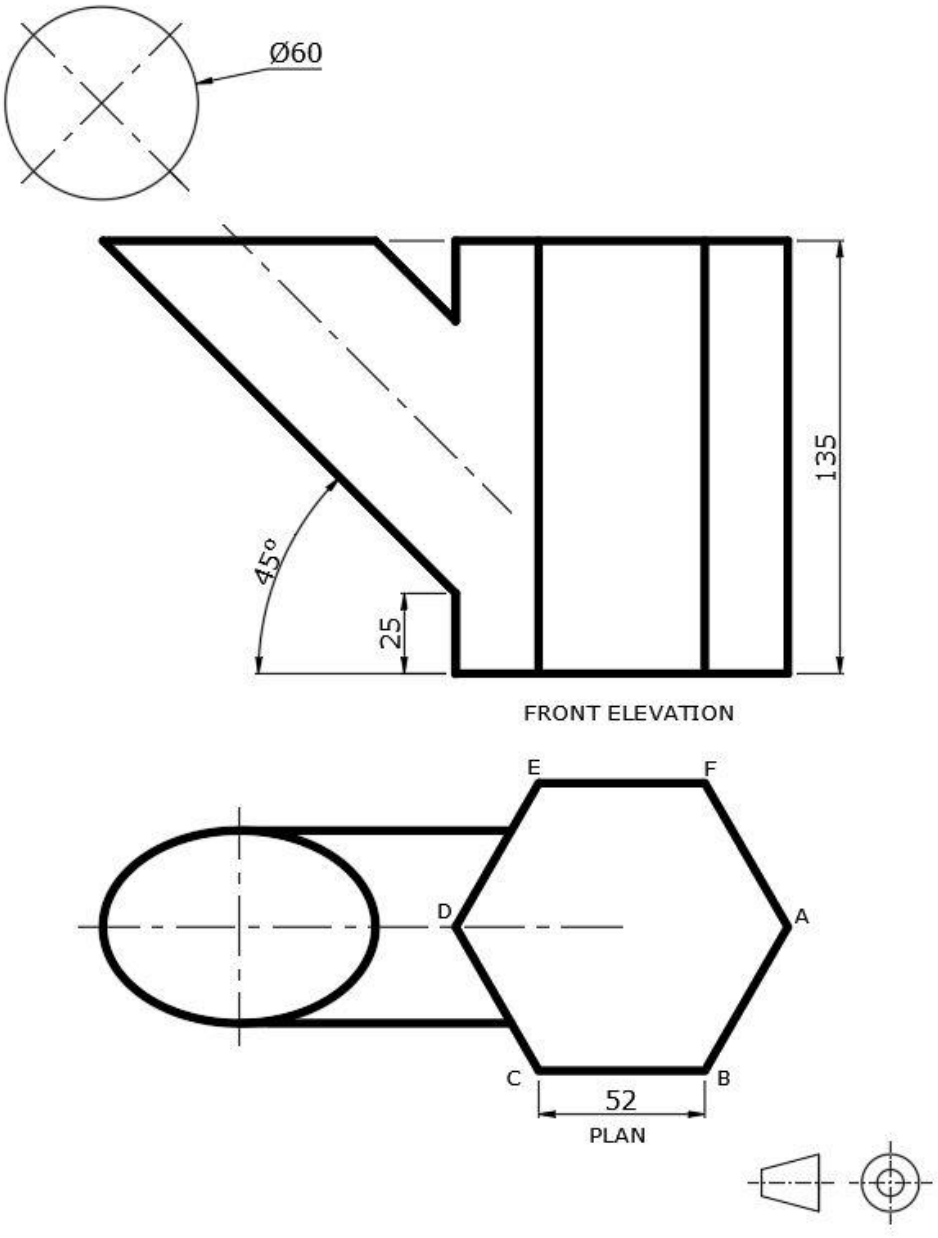


Figure 3b

Question 4.

The illustration of a plate cam, designed to drive an inline roller follower, in shown in Figure 4a. Details of the cam shaft and the roller follower are given in Figure 4b.

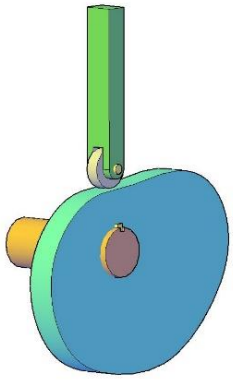


Figure 4a

The cam data is given below.

0° - 180°	Rise of 36 mm with simple harmonic motion
180° - 270°	Rise of 24 mm with uniform velocity
270° - 360°	Fall of 60 mm with uniform acceleration and retardation
The minimum distance between the cam centre and the roller centre is 50 mm.	
The rotation of the cam is clockwise.	

a. Copy the starting lines given in Figure 4b. (1)
b. Construct the follower displacement diagram. (5)
c. Draw the rotation arrow. (1)
d. Construct the cam profile. (6)

(Total: 13 marks)

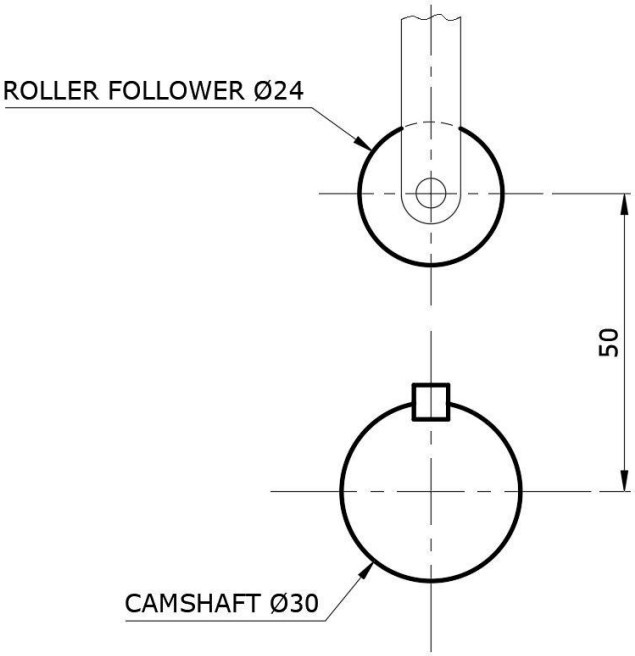


Figure 4b

Please turn the page.

Question 5.

Figure 5 shows a loaded beam overhanging both supports.

a. Copy the space diagram using a scale of 10 mm representing 1 m. (1)
b. Apply Bow's notation. (1)
c. Draw the load line and polar diagram using a scale of 1 mm representing 1 kN. (3)
d. Construct the bending moment diagram to determine R_L and R_R. (4)
e. Draw the shear force diagram. (3)
f. Determine the position of the equilibrant and state its distance from the left end of the beam. (1)

(Total: 13 marks)

SPACE DIAGRAM

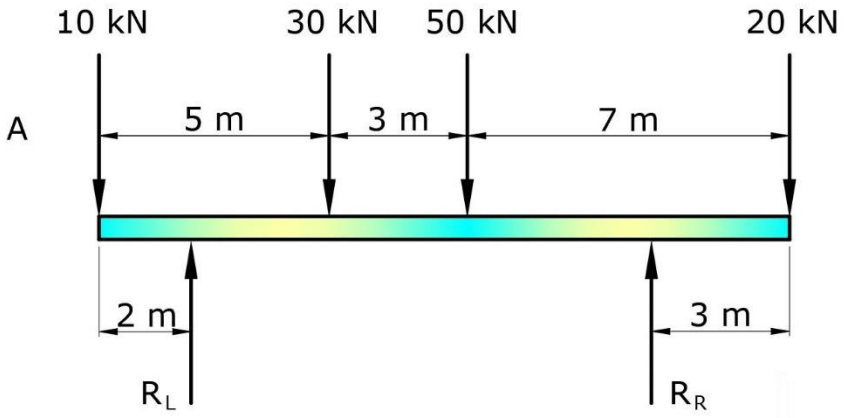


Figure 5

SECTION B

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

Question 6.

An exploded view of an Adjustable Shaft Support is shown in Figure 6a.
The assembly comprises of the following:

- a base (Item 1);
- a vertical shaft (Item 2);
- a yoke (Item 3);
- a bearing housing (Item 4);
- two brass bearings (Item 5),
- one slotted head grub screw (Item 6),
- two slotted head conical point grub screws (Item 7) and;
- an M10 hex bolt (Item 8).

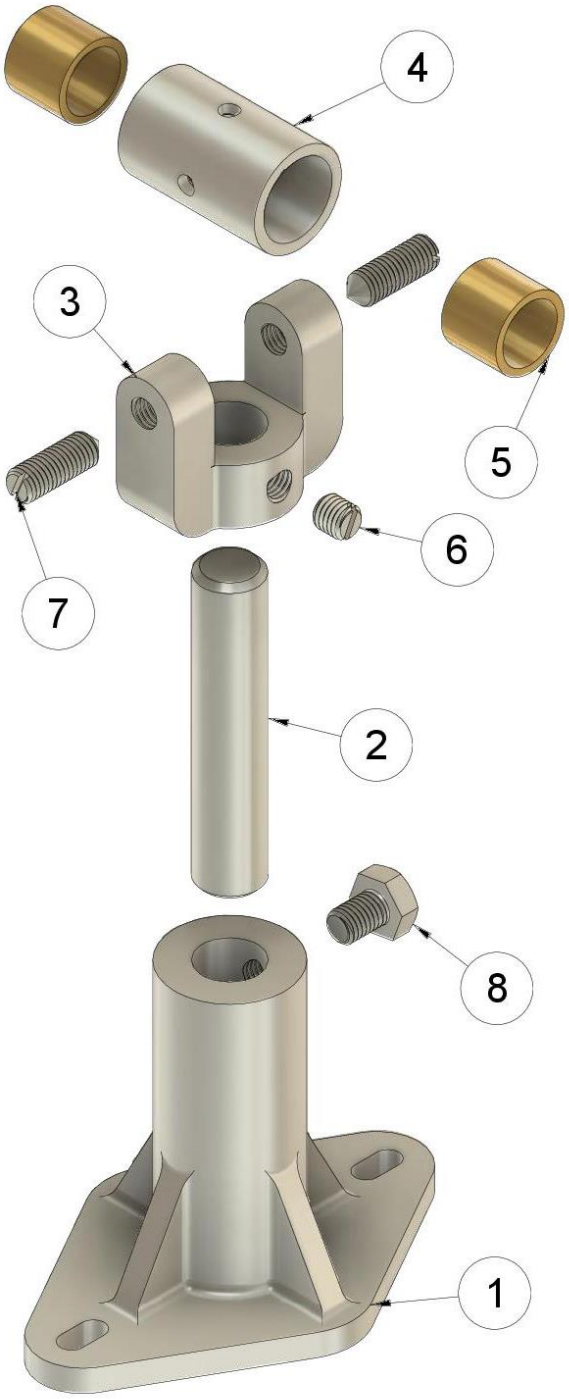


Figure 6a

Detailed orthographic views of the items that make up the assembly are shown on Figure 6b on the attached A3 paper.
The Adjustable Shaft Support is assembled as follows:

- the vertical shaft slides to the desired height in the base and locked in place by the hex screw.
- The yoke is connected to the shaft with its flat surface flush with the end of the shaft and held in place by the slotted grub screw.
- The bearings are press fitted in the bearing housing till they are flush as well.
- The bearing housing is held in the yoke with tightened cone point slotted screws so that it can swivel on those screws.

Draw, full size a half sectional front elevation of the complete assembly along the cutting plane XX.
Notes:

- The shaft is to be drawn raised 50 mm from the bottom of the base.
- Do **not** show hidden details.

(Total: 24 marks)

Please turn the page.

Question 7.

An exploded view of a **C-Clamp** is shown in Figure 7a. The clamp is made up of the following parts:

- a frame (Item 1),
- a square threaded screw (Item 2),
- a tommy bar (Item 3),
- a collar and pin (Item 4 and Item 5),
- a movable jaw (Item 6), and
- a cheese head screw (Item 7).

Detailed orthographic views of the items that make up the assembly are shown on Figure 7b on the attached A3 paper.

The parts are assembled by:

- fitting the screw into the threaded bore at the top of the frame;
- inserting the tommy bar into the hole at the top of the screw (the tommy bar has a fixed collar on one side);
- fitting the other collar on the other side and holding in position by means of a press-fitted pin;
- inserting the screw into the movable jaw and;
- securing the movable jaw to the screw by means of a cheese head screw.

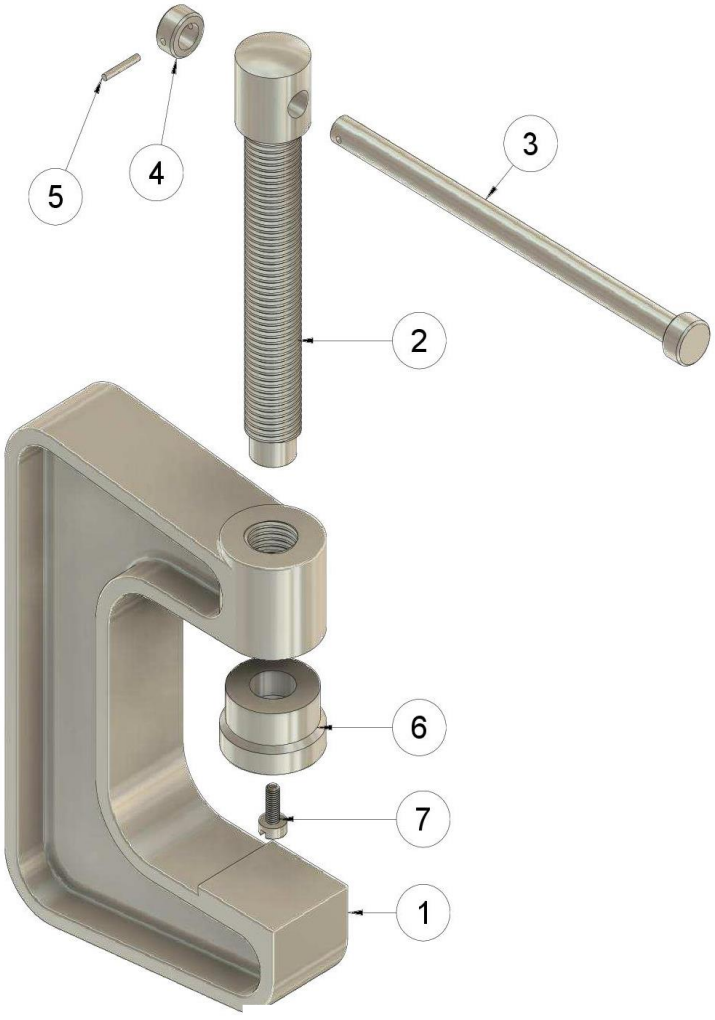


Figure 7a

a. Draw a freehand three-dimensional sketch of the assembled C-clamp in a rectangle 120 mm high and 80 mm wide. The rectangle is to be drawn in the lower left-hand corner of the drawing sheet. (4)

b. Draw, full size, a sectional elevation along the cutting plane Y-Y of the complete assembly. Note that the screw is to be drawn in such a way that the opening between the movable jaw and the lower fixed jaw is 35 mm. Also note that the tommy bar is to be centred on the screw. (20)

(Total: 24 marks)

SECTION C

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

Question 8.

A kayak rental company requires a poster to illustrate the six safety rules each client is required to adhere to. The client is expected to:

- be able to swim;
- wear a buoyancy aid;
- not paddle alone (must be accompanied by a buddy on another kayak);
- have a method of calling for help;
- let someone know the location of the intended destination;
- check the weather forecast.

The poster is to be titled *Safe Kayaking* and should include an illustration of a kayak at sea being paddled by a human pictogram. The poster should also include six icons that represent the safety rules in a graphic form. Marks are allotted for the:

a. title typography; (1)
b. composition of the poster; (1)
c. ability to draw the kayak in 3-D form; (4)
d. skill to draw the human pictogram in a paddling action; (2)
e. competence to translate the textual regulations into graphic symbols; (12)
f. proficiency in using colour to enhance the poster. (4)

Note:
Illustrations of a kayak, a paddle and a human figure are given in Figure 8 to facilitate the idea generation.

(Total: 24 marks)

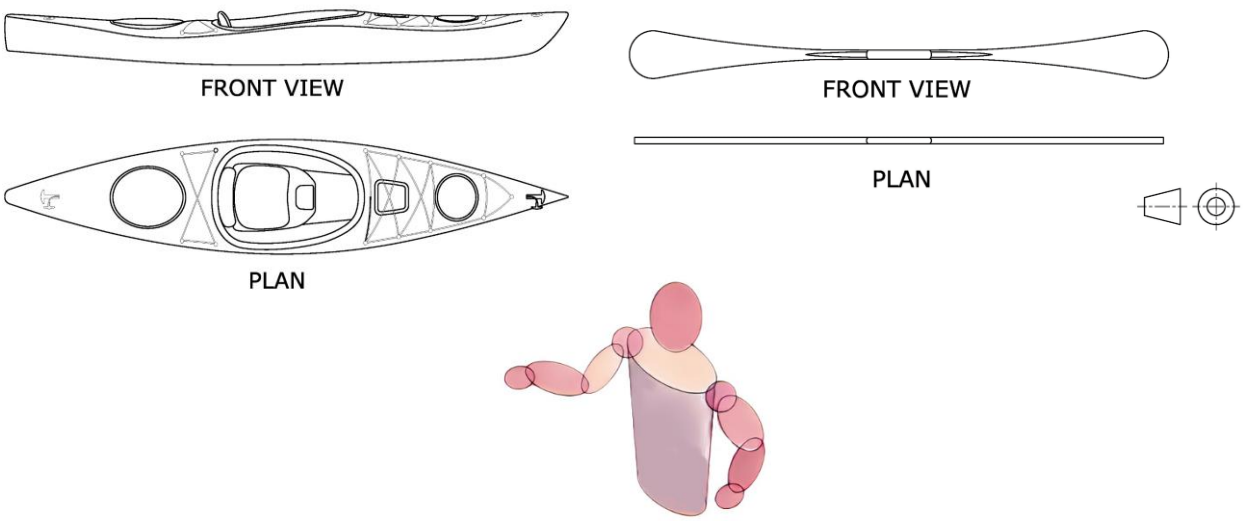


Figure 8

Please turn the page.

Question 9

Parts of a sitting room are shown from different angles in Figures 9a and 9b. The room features a wooden frame sofa with comfortable cushions, a painting hanging over the sofa, an old stone fireplace, a wooden door leading to the garden, two windows to maximise natural light, a soft wool carpet and a sturdy wooden coffee table. The two wooden beams that add a rustic charm to the space.

a. Use the dimensions given in the orthographic projection (Figure 9c) to construct an estimated one-point perspective drawing of the room. The viewing direction required is indicated by the arrows in the plan. Use the vanishing point for the one-point perspective given in the Front view. (21)

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

(Total: 24 marks)

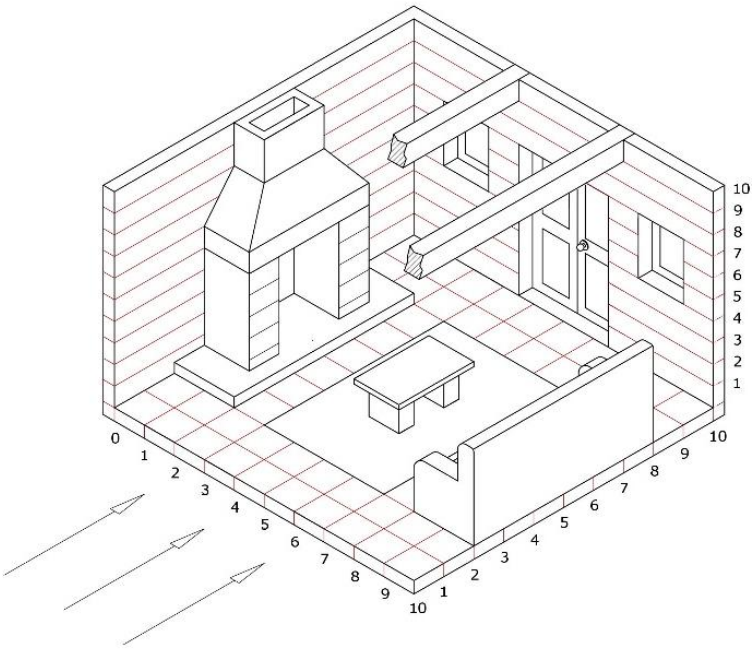


Figure 9a

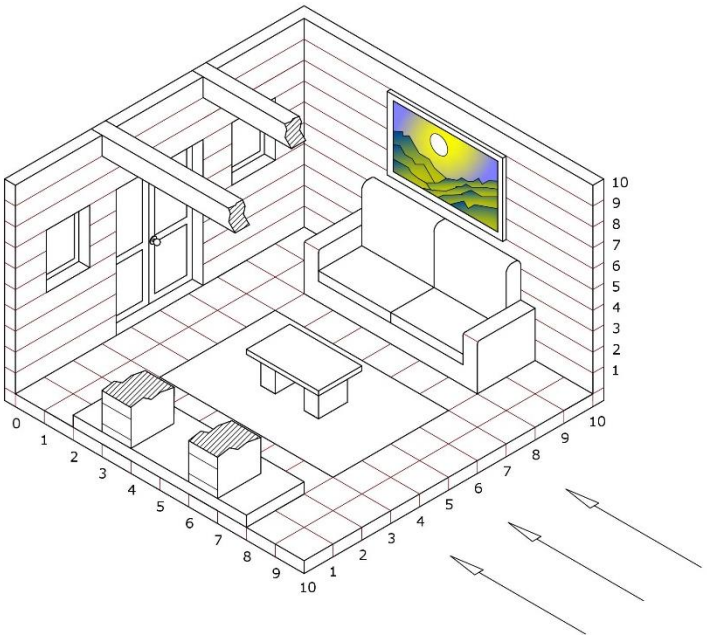
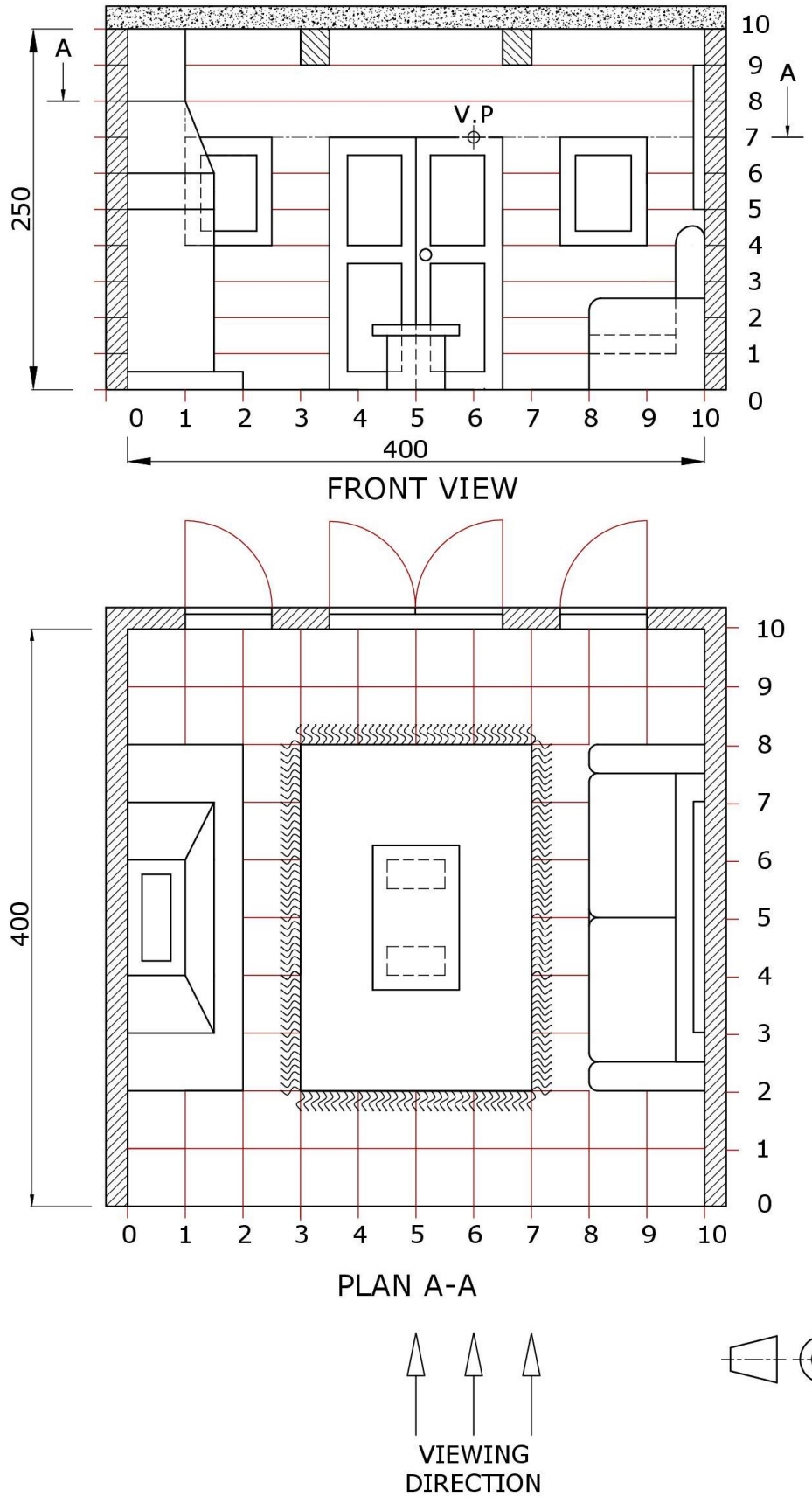


Figure 9b


A
250
V.P
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FRONT VIEW
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1
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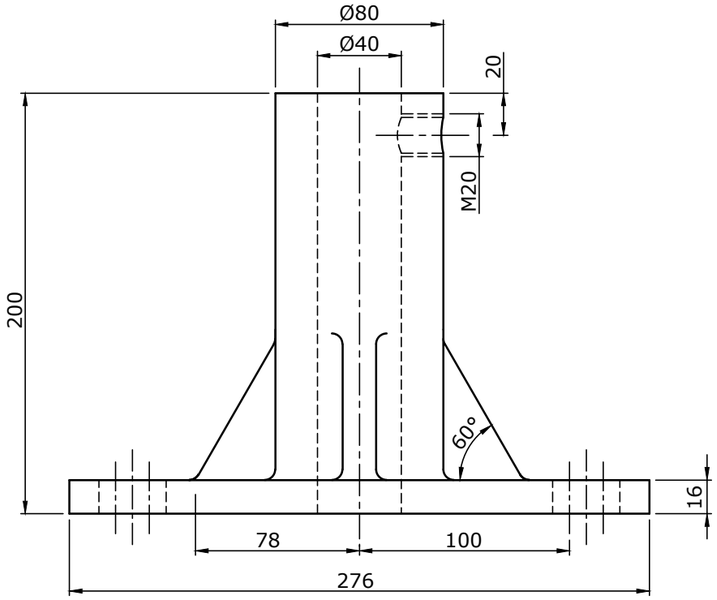
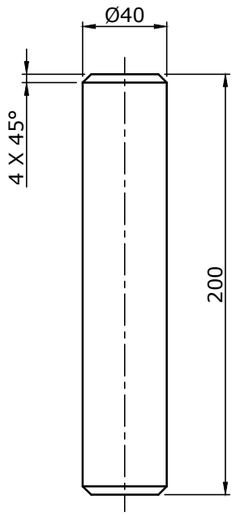
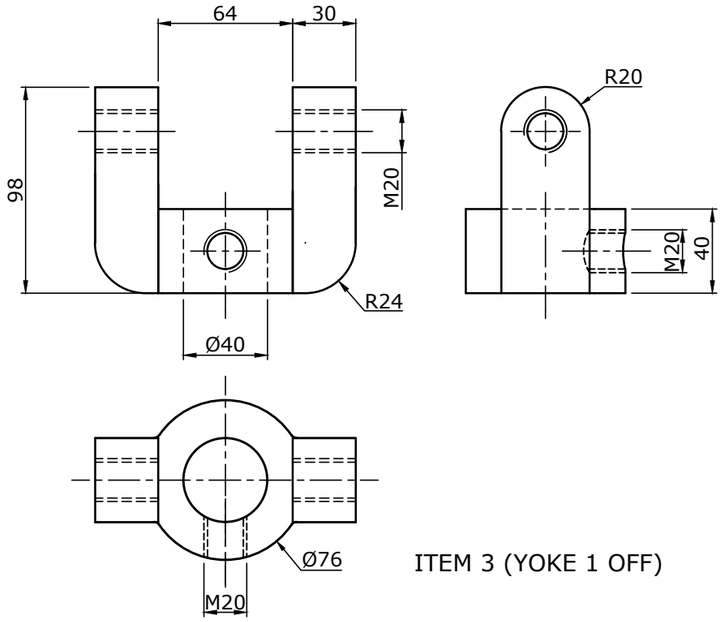
0 1 2 3 4 5 6 7 8 9 10
PLAN A-A
VIEWING
DIRECTION

Figure 9c

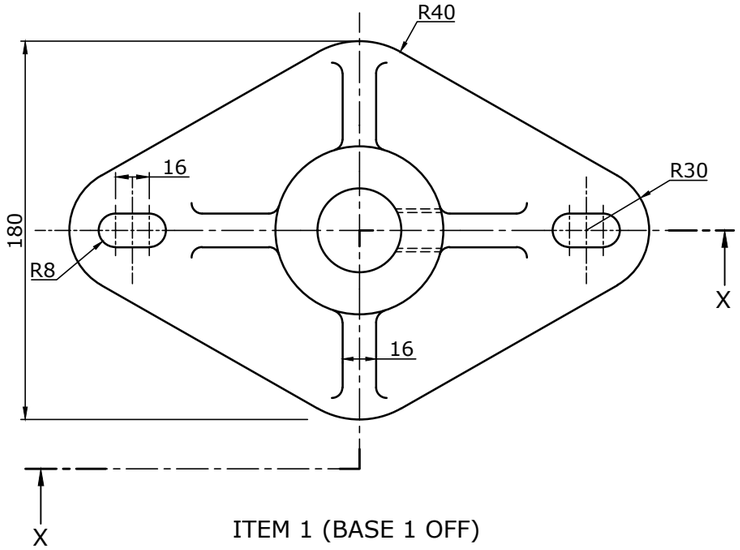




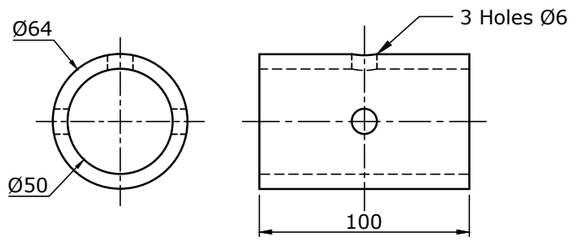
ITEM 2 (VERTICAL SHAFT 1 OFF)



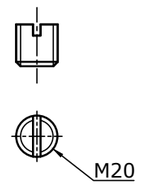
ITEM 3 (YOKE 1 OFF)



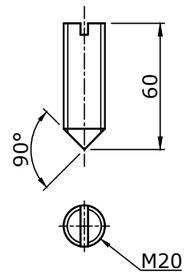
ITEM 1 (BASE 1 OFF)



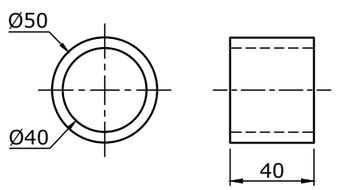
ITEM 4 (BEARING HOUSING 1 OFF)



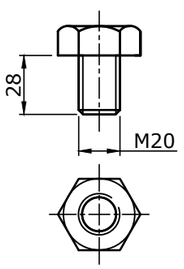
ITEM 6 (SLOTTED HEAD
GRUB SCREW - 1 OFF)



ITEM 7 (SLOTTED HEAD
CONICAL POINT
GRUB SCREW - 1 OFF)

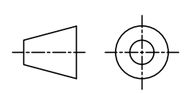


ITEM 5 (BRASS BEARING - 2 OFF)

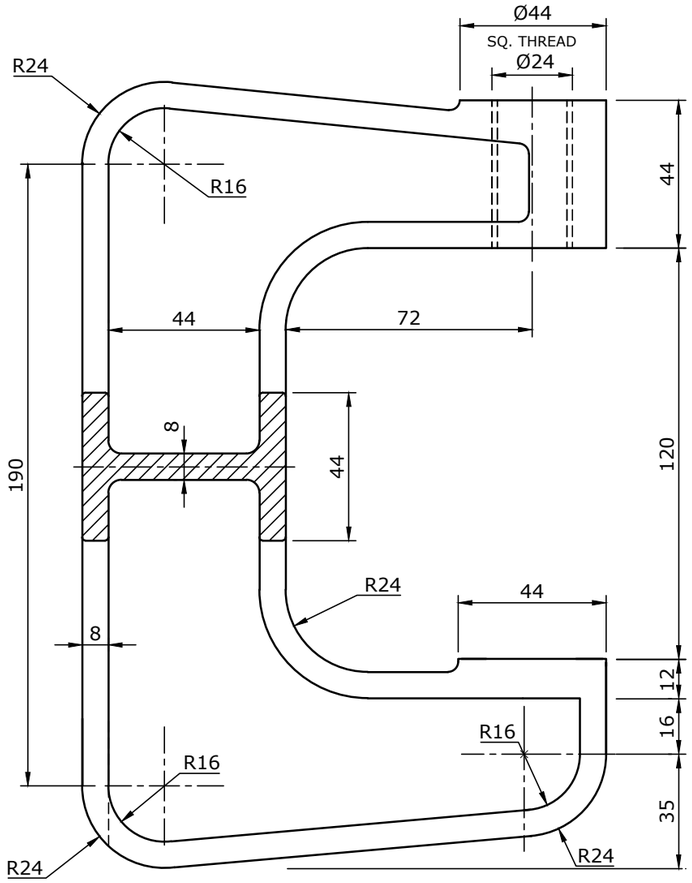


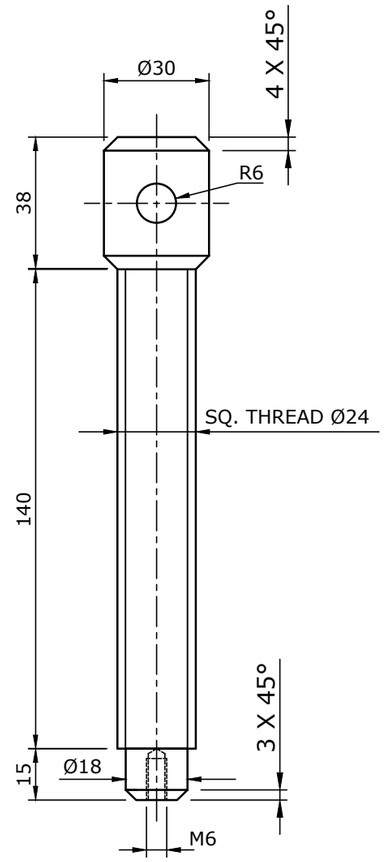
ITEM 8 (HEX HD BOLT- 1 OFF)

FILLET RADII = 5 mm

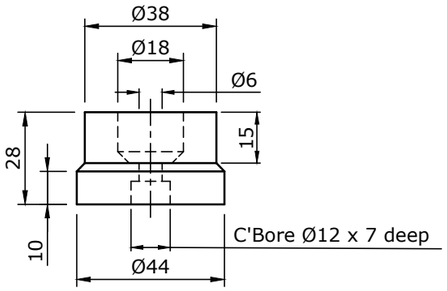


UNIVERSITY OF MALTA	MATRICULATION CERTIFICATE EXAMINATION	IM 09.24s ENG. DRG. & GRAPH. COMM.	FIGURE 6b

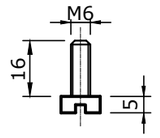




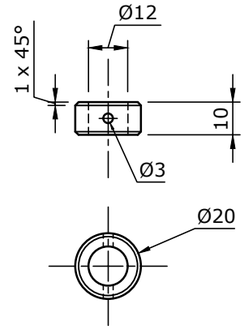
ITEM 2 (SCREW 1 OFF)



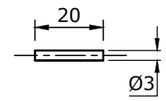
ITEM 6 (MOVABLE JAW 1 OFF)



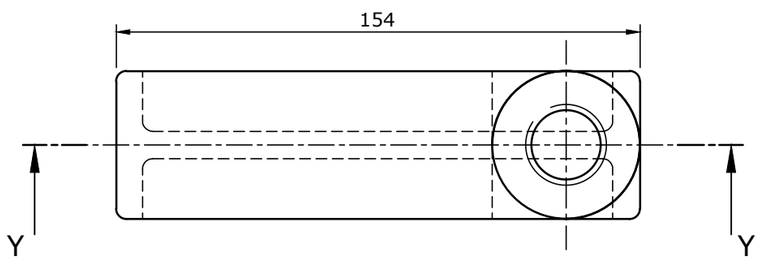
ITEM 7 (CHEESE HD. SCREW 1 OFF)



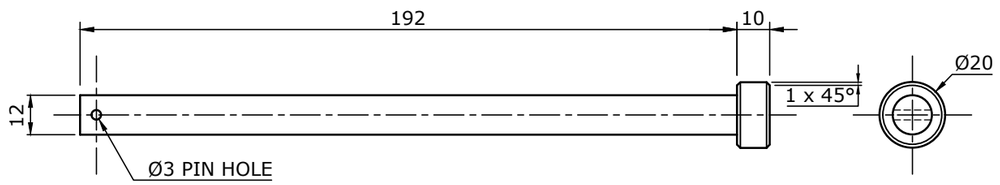
ITEM 4 (COLLAR 1 OFF)



ITEM 5 (PIN 1 OFF)



ITEM 1 (BASE 1 OFF)



ITEM 3 (TOMMY BAR 1 OFF)

FILLET RADII = 3 mm

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