



SUBJECT:	Engineering Drawing and Graphical Communication
DATE:	5 th July 2021
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 six.

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

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

SECTION A

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

Question 1

A beam is supported at the extreme end on the right and at the left-hand side of the beam, with loads as shown in Figure 1b.

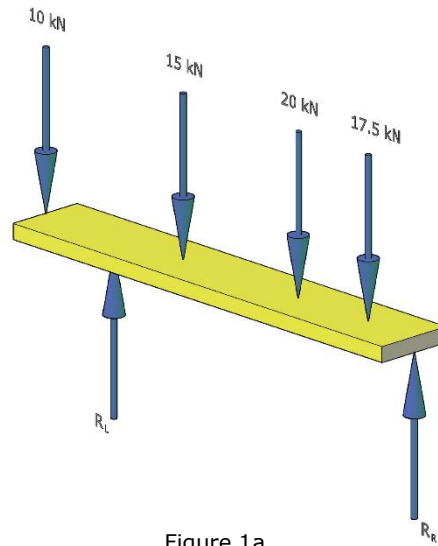


Figure 1a

- a) Using a scale of 10 mm representing 1 m, draw the diagram shown in Figure 1a. Write neatly the capital letters between the loads and complete the diagram by using Bow's notation. (2)
- b) Draw a vector diagram using a scale of 10 mm representing 5 kN and include a polar diagram. Use a suitable distance for the polar diagram. (3)
- c) Determine graphically, the magnitude of the support reactions on the left- and right-hand side of the beam. State the magnitude of each reaction, showing the necessary calculations. (4)
- d) Draw a shear force diagram. (3)
- e) Determine the position along the beam where the bending moment is zero. (1)

(Total: 13 marks)

SPACE DIAGRAM SCALE: 10 mm represent 1 m

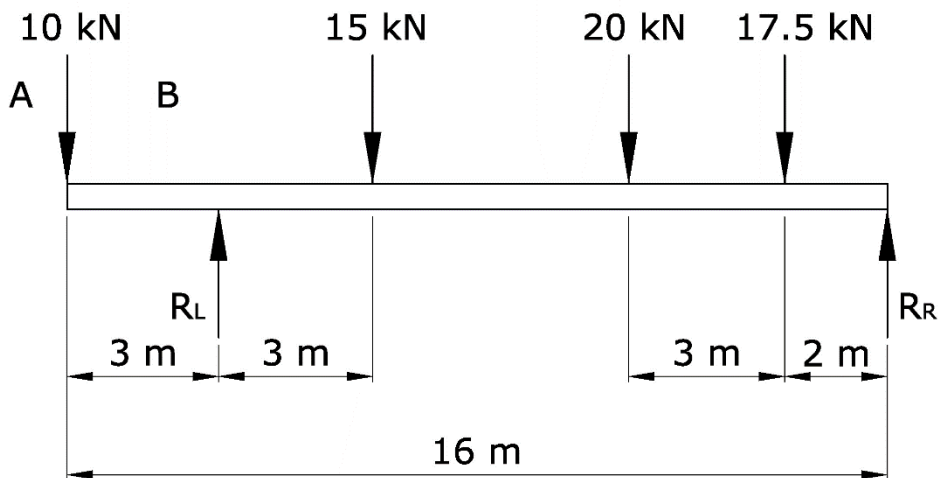


Figure 1b

Question 2

The layout for the basic design of a cam is shown in Figure 2a, while a pictorial drawing of the cam is shown in Figure 2b. Draw a follower displacement graph to a flat ended follower working in line with the axis of the cam from the data given below;

- a) i. 0° to 180° a uniform acceleration and uniform retardation lift of 72 mm; (4)
 - ii. 180° to 300° a simple harmonic motion fall of 48 mm; (2)
 - iii. 300° to 360° a uniform velocity fall of 24 mm. (1)
- b) Determine the cam profile for the flat ended follower. Note that the rotation of the cam is clockwise. (6)

(Total: 13 marks)

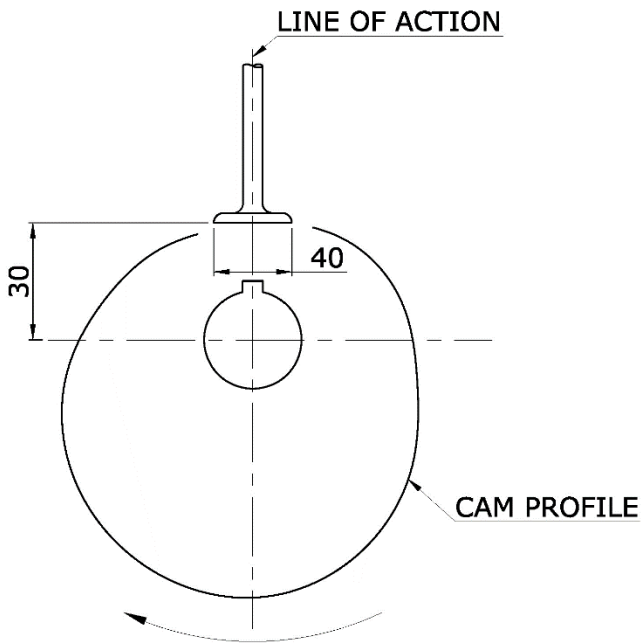


Figure 2a

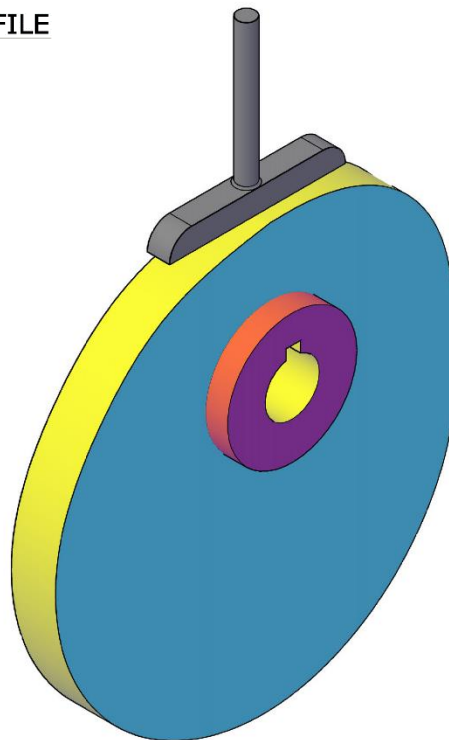


Figure 2b

Question 3

Two rolling wheels A and B shown in Figure 3a are stationed in front of each other on two different tracks. Both rotate anti-clockwise, moving in opposite direction.

a) Using the dimensions given in Figure 3b, plot the locus of the point P, situated on the circumference of the wheel A, as it rotates anticlockwise, for three fourths of a revolution, on the outside of the directing circle. Write down the technical term for the locus of the point P. (6)

b) The other wheel B rotates anti-clockwise, for one and quarter of a revolution on the inside of the directing circle. Plot the locus of the point Q and state the name of the locus traced. (7)

(Total: 13 marks)

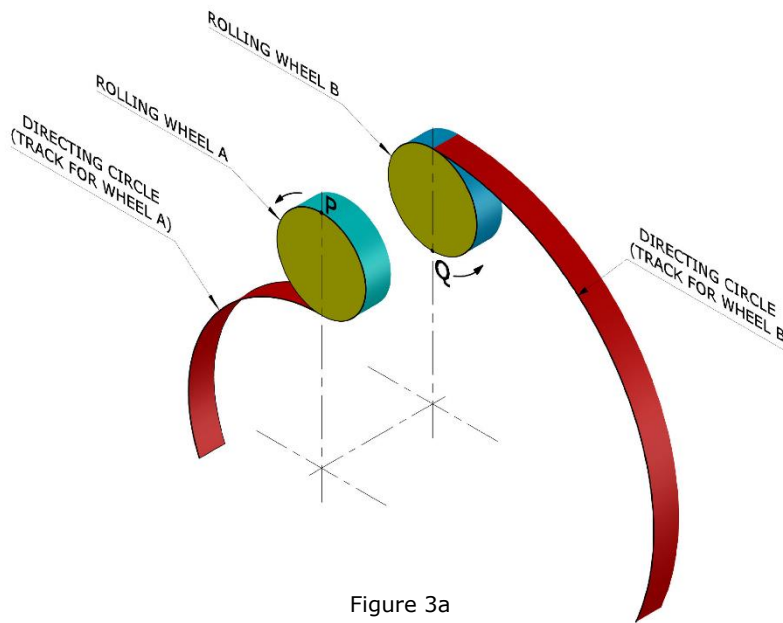


Figure 3a

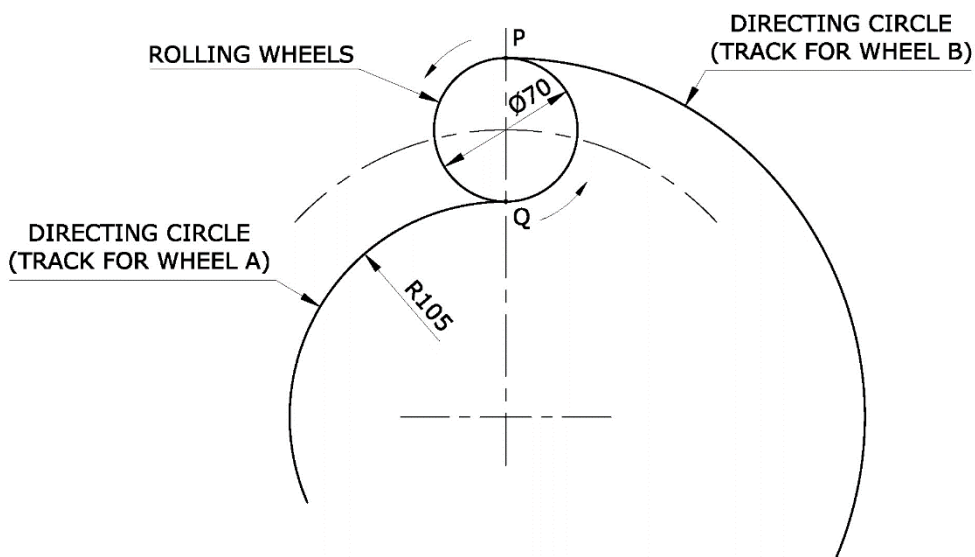


Figure 3b

Question 4

A funnel shaped as illustrated in Figure 4a, is used to move material from one receptacle to another.

- a) Copy, full size, the **TWO** views shown in Figure 4b. (2)
- b) Project an end elevation as seen from the right-hand side, of the funnel. (2)
- c) Construct, using neat light lines, the curve of intersection between the cylinder and the inverted cone on the front elevation. (4)
- d) Project from the front elevation and construct the curve of intersection onto the plan. (5)

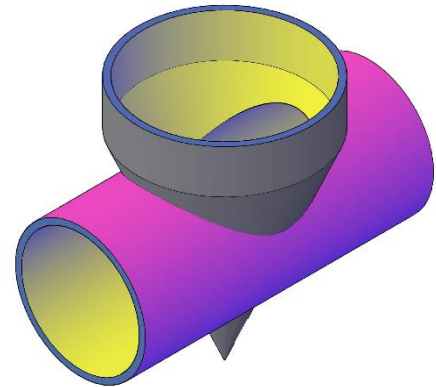


Figure 4a

(Total: 13 marks)

Show hidden detail.

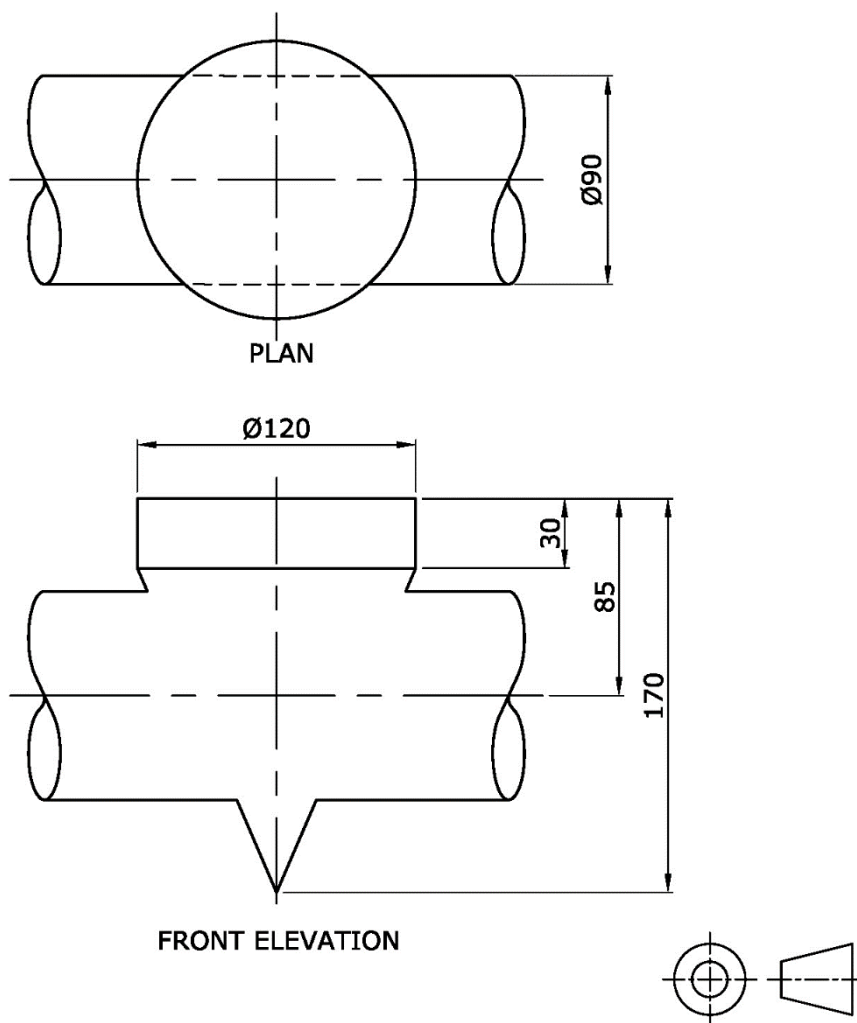


Figure 4b

Question 5

A signpost bearing two initials C and U superimposed on a rectangular board is shown in Figure 5a. The front view of the signpost is shown in Figure 5b.

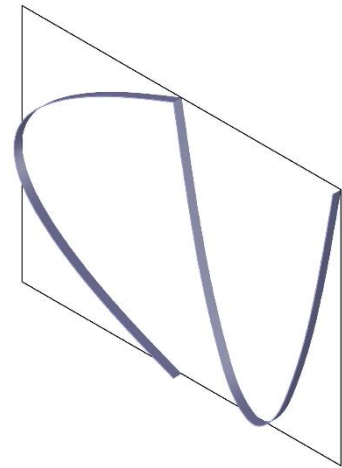


Figure 5a

- a) Divide the rectangle into two equal parts by a vertical line, so as to have two rectangles 100 mm by 150 mm. (1)
- b) Inscribe a parabola in each rectangle with the axis perpendicular to each other. (8)
- c) Find the focus and directrix of one of the parabolas. (3)
- d) State the:
 - i. length of the distance from the vertex to the focus; (1/2)
 - ii. eccentricity of the parabola. (1/2)

(Total: 13 marks)

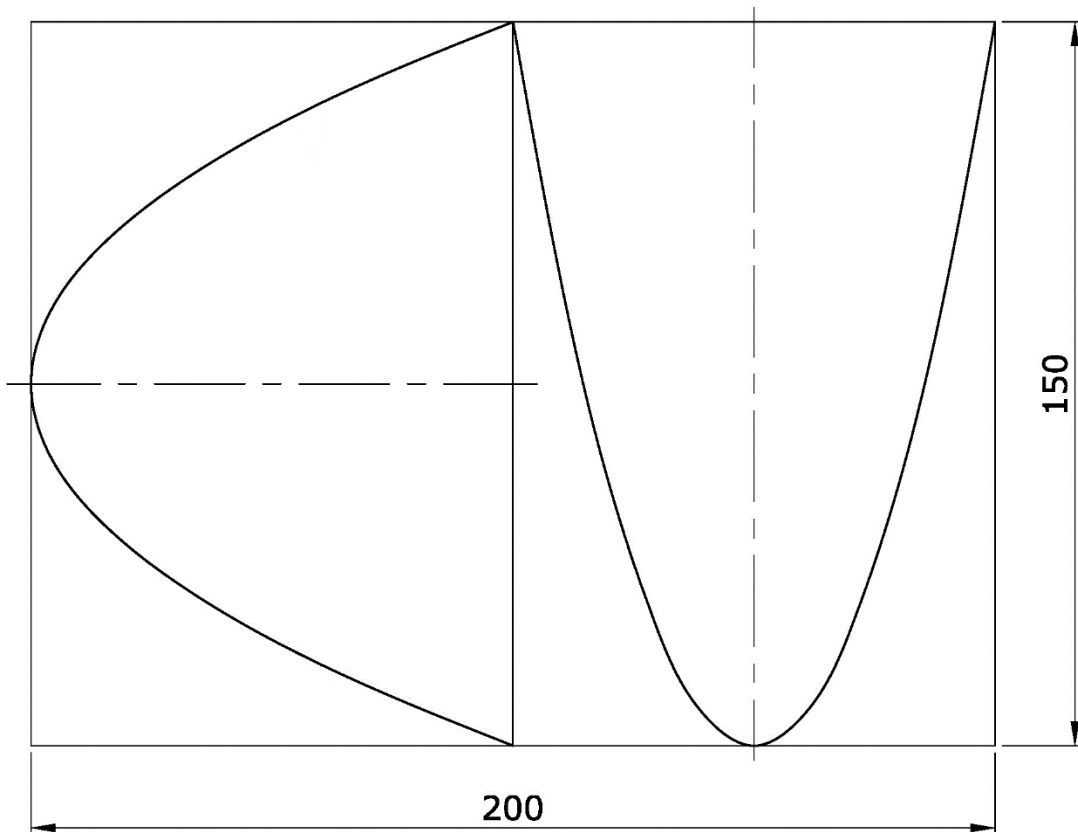


Figure 5b

Question 6

A pictorial drawing of a transition piece is shown in Figure 6a. The top part of the transition piece is to fit a half of a hexagonal prism and semi cylinder. The lower part is to fit a right small cylinder.

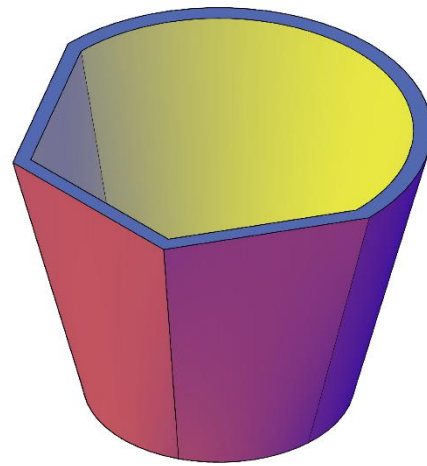


Figure 6a

- a) Copy, full size, the outline of the **TWO** views shown in Figure 6b. (2)
- b) Construct the necessary true length required for the development of the transition piece. The appropriate method used for finding the true length is to be clear and neat using light sharp lines. (3)

- c) Draw half surface development of the transition piece using the triangulation method. Annotate the drawing by letters / numbers so that the method used is clear and easily followed. (8)

(Total: 13 marks)

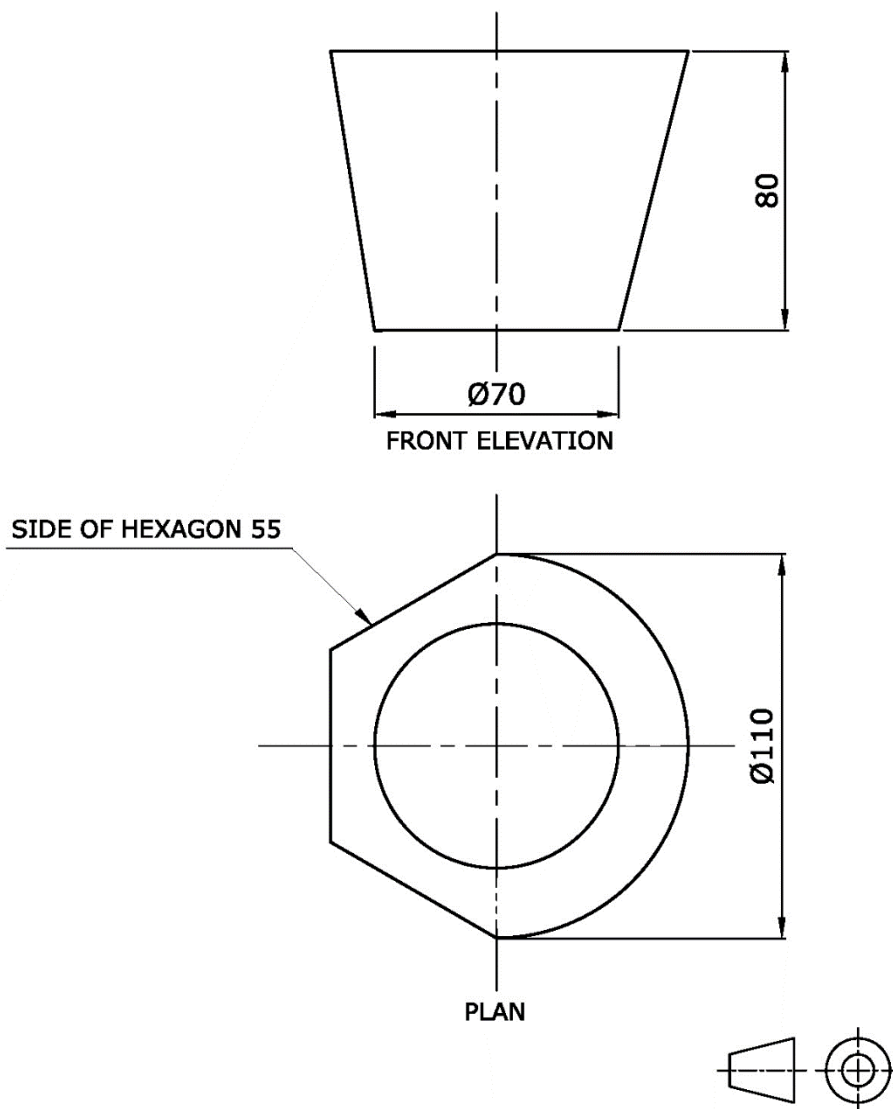


Figure 6b

SECTION B

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

Question 7

An illustration of an adjustable bar rest assembly with the parts pulled apart, is shown in Figure 7a. The assembly comprises of a body, a threaded adjuster, a rectangular block and a bar rest. The components of each item that is required for the assembled adjustable bar rest are printed in orthographic projection as shown on the attached A3 paper Figure 7b.

The following steps explain how the adjustable bar rest unit is assembled:

- the M24 external threaded end of the adjuster (Item 2) is partially screwed in the internal M24 threaded end of the block (Item 3);
 - the assembled block and adjuster are fitted vertically onto the top surface of the grooved vertical column of the body (Item 1) until the square ended part of the adjuster, rests on the top flat surface of the body. The block is free to slide vertically upwards or downwards when the lower end of the adjuster is turned clockwise or anti – clockwise.
 - The cylinder 24 mm diameter of the rest (Item 4) is fitted in the 24 mm diameter hole of the rest. The 34 x 24 mm rectangular flat part of this item rests on the top surface of the block.
- a) Draw, full size: a sectional front elevation of the assembled adjustable bar rest, on the section line X – X. (19)
- b) Project an end elevation of the adjustable bar rest. (5)

The top surface 92 x 72 mm of the block is to be drawn 15 mm above the top surface of the body.

Do **not** show hidden detail. Include suitable fillet radii.

(Total: 24 marks)

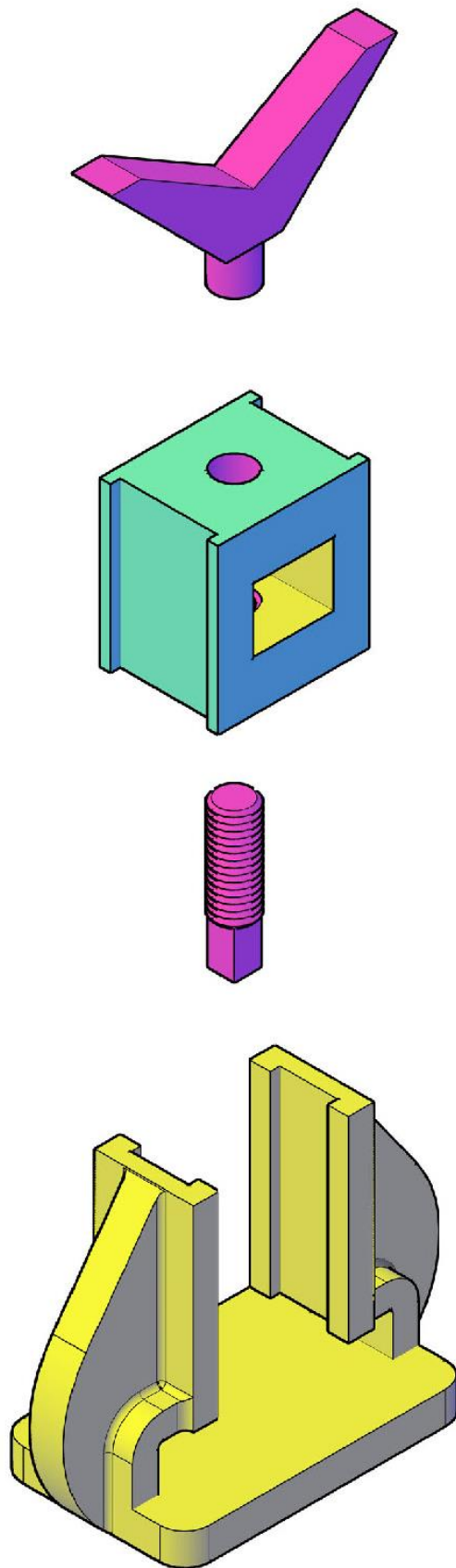


Figure 7a

Question 8

A pictorial drawing of a spring loaded safety valve is shown in Figure 8a. Detail drawings of the valve parts are shown in Figure 8b on the attached A3 paper and the components are assembled as follows.

- The brass valve seat 68 mm diameter and 18 mm thick (Item 2) is inserted in the 68 mm diameter x 18 mm bore of the valve body, (Item 1), with the countersunk hole on top.
- A mild steel valve (Item 3) is placed vertically into the valve body with the tapering end of the valve resting against the countersunk hole of the valve seat (closed position).
- The 50 mm outer diameter helical spring (Item 4) is placed vertically, on the 50 mm diameter face of the valve.
- The 22 mm diameter hole in the center of the hexagonal nut (Item 5) is fitted into the 20 mm outside diameter top end of the valve. The valve is free to slide vertically in the 22 mm diameter hole.
- The M 86 internal thread of the hexagonal nut is screwed in the M 86 internal thread of the valve body. The hexagonal nut secures the valve and the spring in position.

With the valve fully assembled, draw full size, omitting hidden detail, a sectional front elevation, on the cutting plane X - X.

The spring is to be represented in a schematic manner.

(Total: 24 marks)

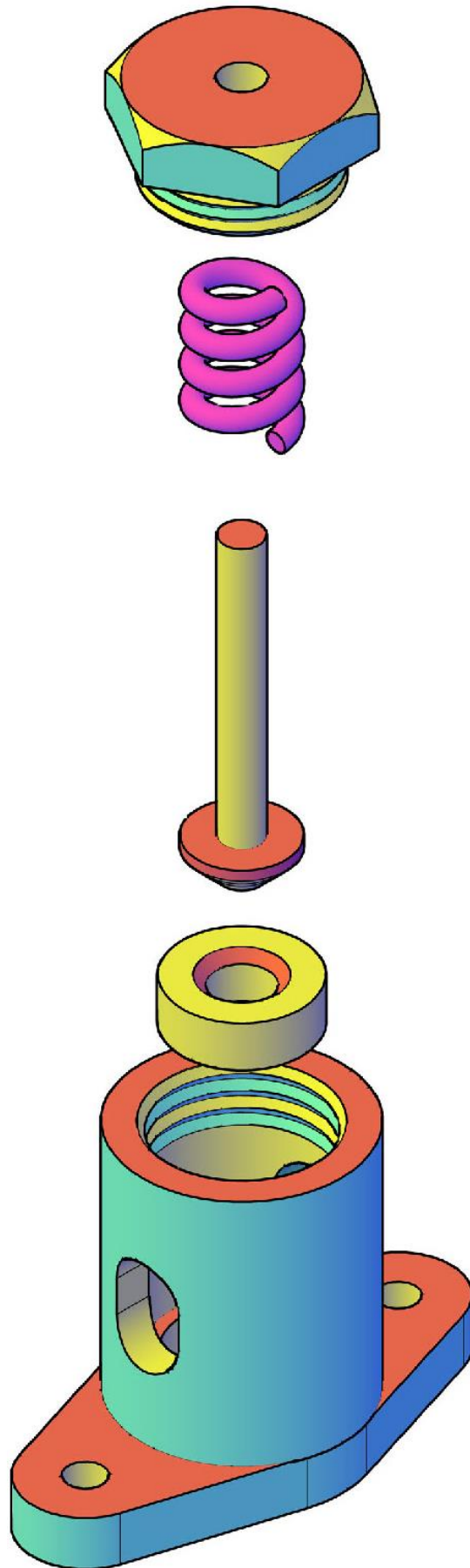


Figure 8a

Question 9

Detailed dimensioned drawing of the items that when fitted together form an assembly used for a particular machinery, are shown in Figure 9a. The items are assembled in the following manner as shown in Figure 9b.

- A key (Item 2) is inserted in the key slot of the shaft (Item 1).
- The shaft is inserted in the 40 mm diameter hole of the bracket (Item 3), with the key seated in the recess slot (face A in contact).
- The spindle (Item 5) is inserted in the 30 mm diameter hole of the wheel (Item 6).
- The thick washer (Item 4) is then inserted in the spindle from the threaded end, and in contact with the wheel.
- The spindle, wheel and washer are installed in the 24 mm diameter hole (face B in contact).
- A small washer (Item 7) 48 mm outside diameter x 3 mm thickness, is placed in the threaded end.
- A hexagonal nut (not shown) is tightened to the threaded end of the spindle. The nut secures the spindle to the bracket, while the wheel is free to rotate.

Assemble the components shown by;

- a) drawing a full size, a sectional view on the section X -X; (18)
- b) project an end view of the assembly as seen from the left hand side. (6)

Do **not** include hidden details.

(Total: 24 marks)

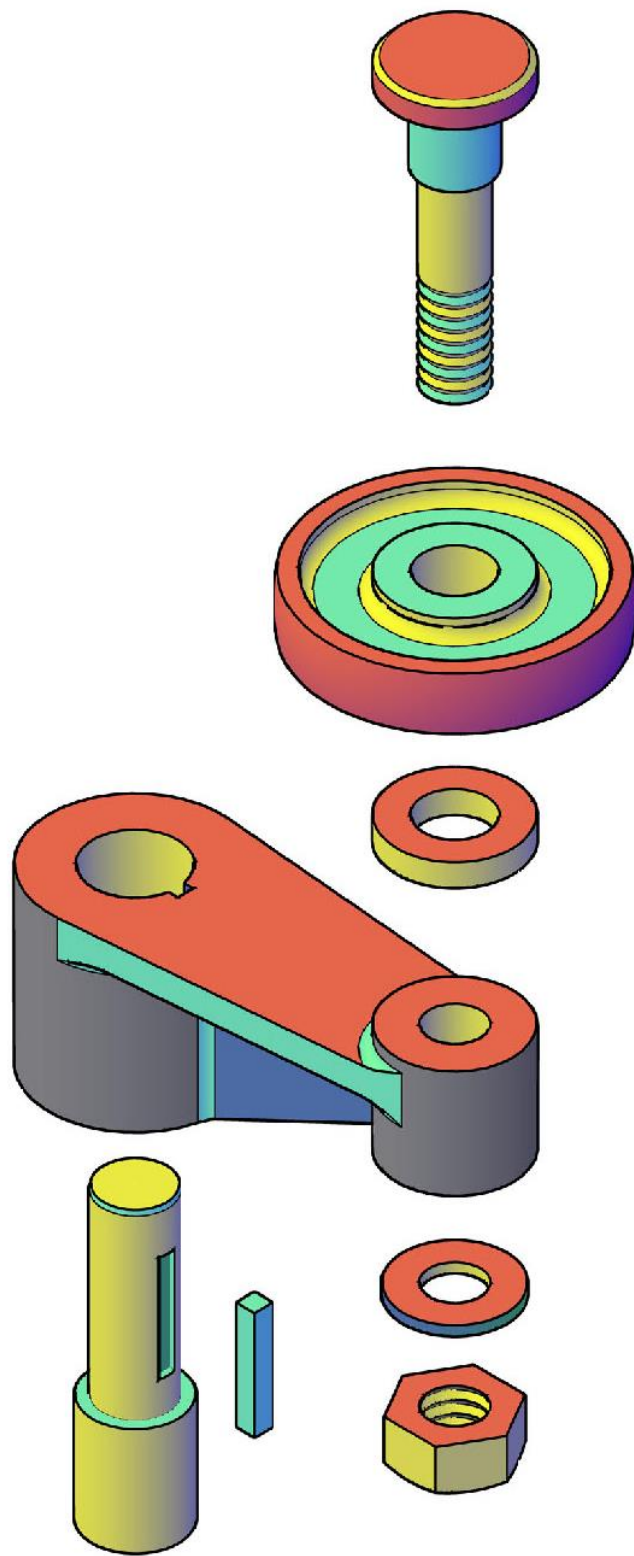


Figure 9a

SECTION C

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

Question 10

An architectural plan of a toy house designed for children is given in Figure 10a. An isometric projection of the toy house with a furnished kitchen is given in Figure 10b.

Using the given dimensions shown on the architectural plan of the toy house given in Figure 10a and assuming any missing dimension:

- a) Construct a planometric drawing of the toy house taking the height of all the wall being 60 mm and omitting some walls, so that the interior of the house could be visible as shown in the isometric projection in Figure 10b; (11)
- b) draw the furnishing of the kitchen; (6)
- c) draw the furnishing of **ONE** of the bedrooms; (4)
- d) render in colour your drawing to enhance its presentation. (3)

Furnish the kitchen and the bedroom with your own creative design.

(Total: 24 marks)

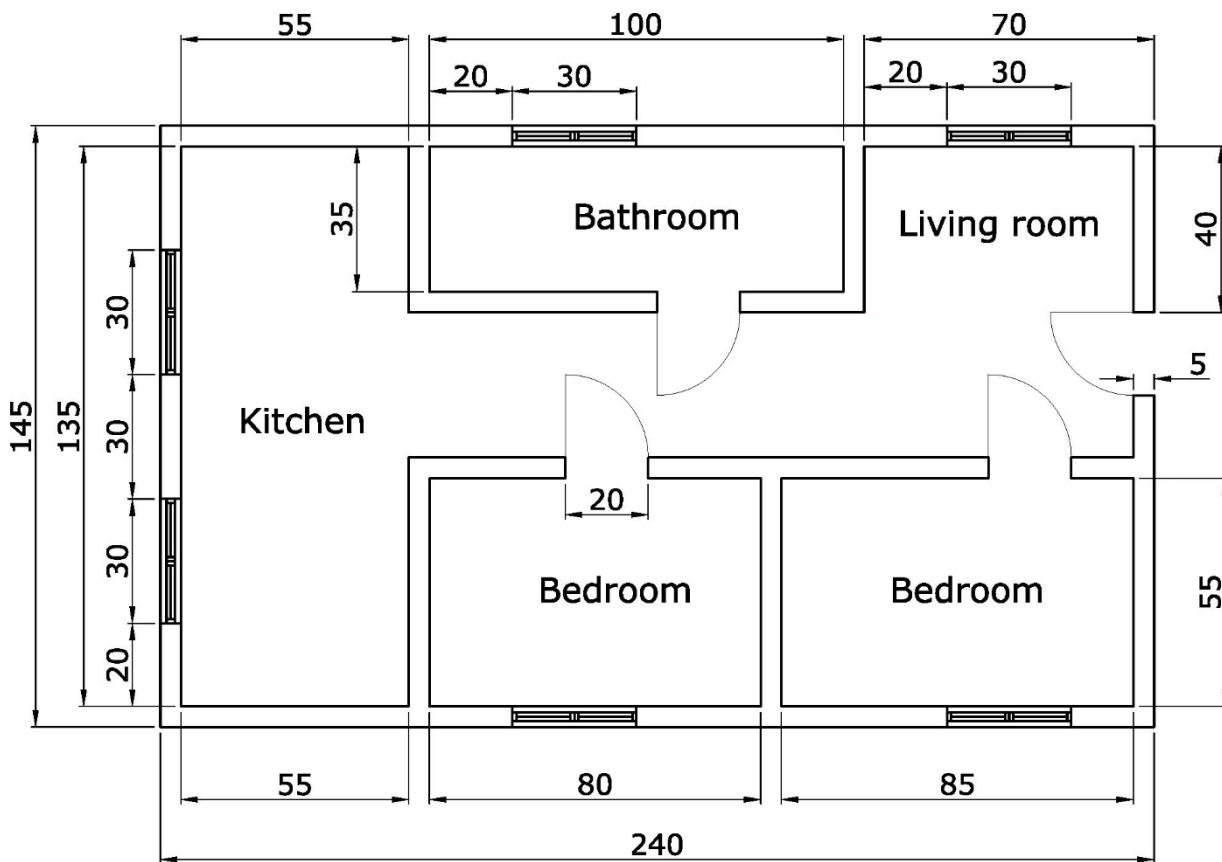


Figure 10a

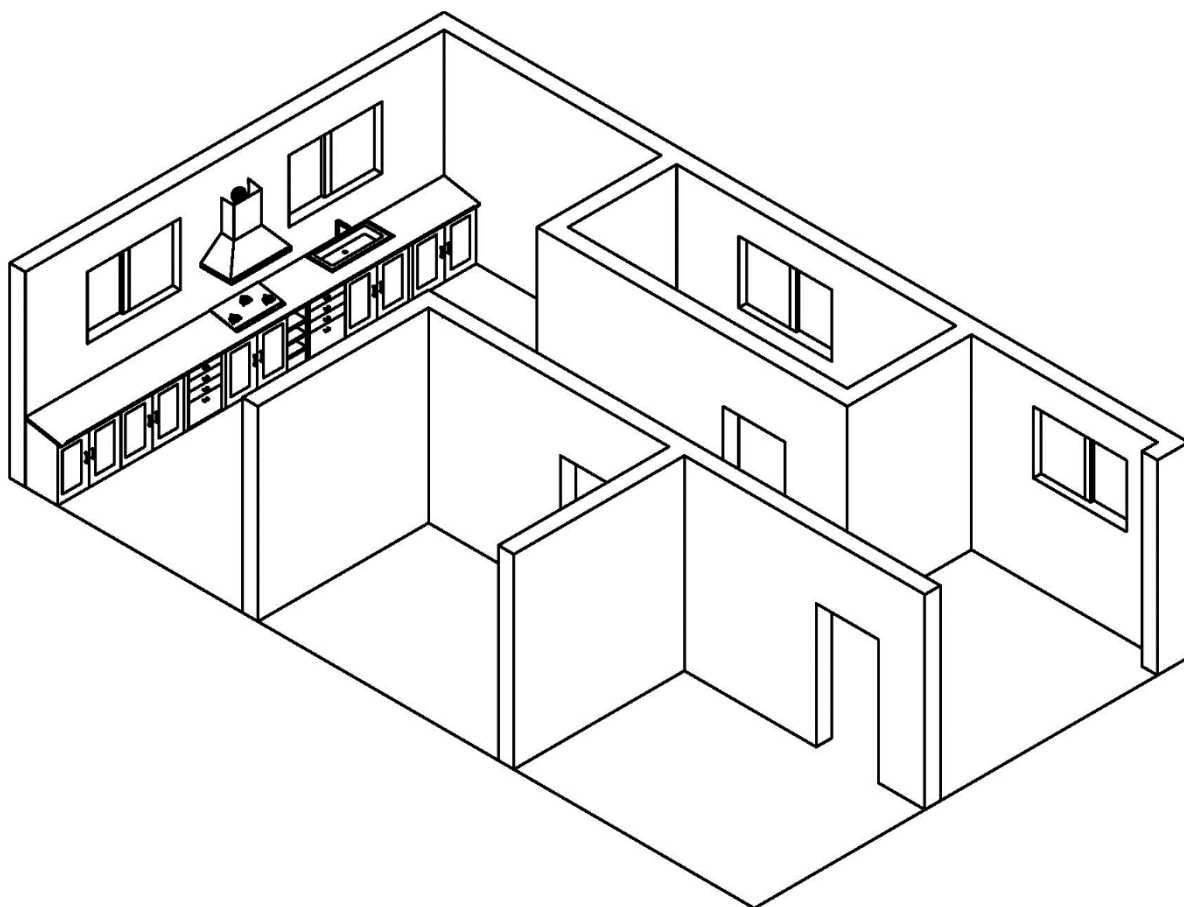


Figure 10b

Question 11

A private company is planning to invest on a new yacht marina named Luzzu Yacht Marina. The developers are proposing a place where 30 yachts from 6 to 24 meters can dock during the year. The company analyses the data from Malta National Statistics Office. They are also planning a mobile application that displays all the marina services.

Table 11.1: Number of foreign yachts arriving in Malta during the first six months of 2018
[NSO Transport Statistics reference year 2018]

Month	Foreign yachts arriving in Malta: 2018		
	1-12 m	13-23 m	Total <24 m
January	14	6	20
February	6	8	14
March	6	12	18
April	34	50	84
May	64	77	141
June	86	99	185

You are required to design a poster. Your presentation must follow the steps given below and organised as suggested in Figure 11a.

- a) Label the poster with the heading "Luzzu Yacht Marina". (2)
- b) Draw **THREE** graphic app icons to use as a mobile application to display the marina services so that the company could choose one of them. Sketches to develop ideas can be drawn at the side of your A2 sheet. (8)
- c) Draw a bar chart on your poster showing the number of foreign yachts 1-12 m arriving in Malta between January and June 2018. (4)
- d) Draw a line graph showing the number of foreign yachts 13-23 m arriving in Malta between January and June 2018. (4)
- e) Draw a pie chart showing the total number of foreign yachts <24 m arriving in Malta between January and June 2018. Working can be worked at the side of your A2 sheet. (4)
- f) 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 accomplishment:

- i. use colour and shading to render the drawing;
- ii. make use of typography (fonts);
- iii. form an attractive presentation, clearly conveying the information.

(Total: 24 marks)

Question 12

An isometric drawing of a sauna is shown in Figure 12a. An orthographic projection of the sauna is shown in Figure 12b. The sauna consists of two L shape benches made of soft wood planks, a horizontal wood plank for back support and a brick heater enclosure for the sauna rocks. The sauna also has a towel rack and a vapour-proof light fixture and a non-slip plastic mat (not shown).

- a) Use the dimensions given in the orthographic projection to construct an estimated one-point perspective of the sauna. The viewing direction required is indicated by the arrow in the plan. Use the suggested vanishing point shown on the front view. (18)
- b) Add the towel rack, the vapour-proof light fixture and the non-slip plastic mat. (3)
- c) Render in colour your drawing to enhance its presentation. (3)

(Total: 24 marks)

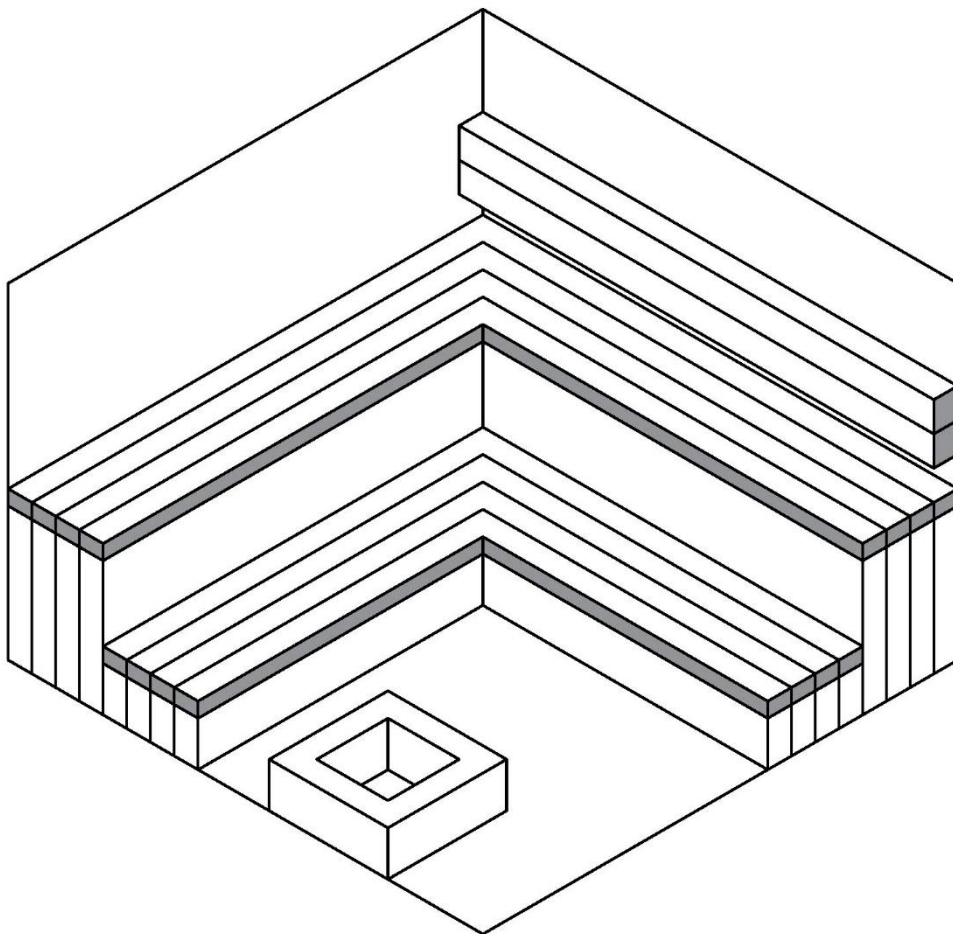
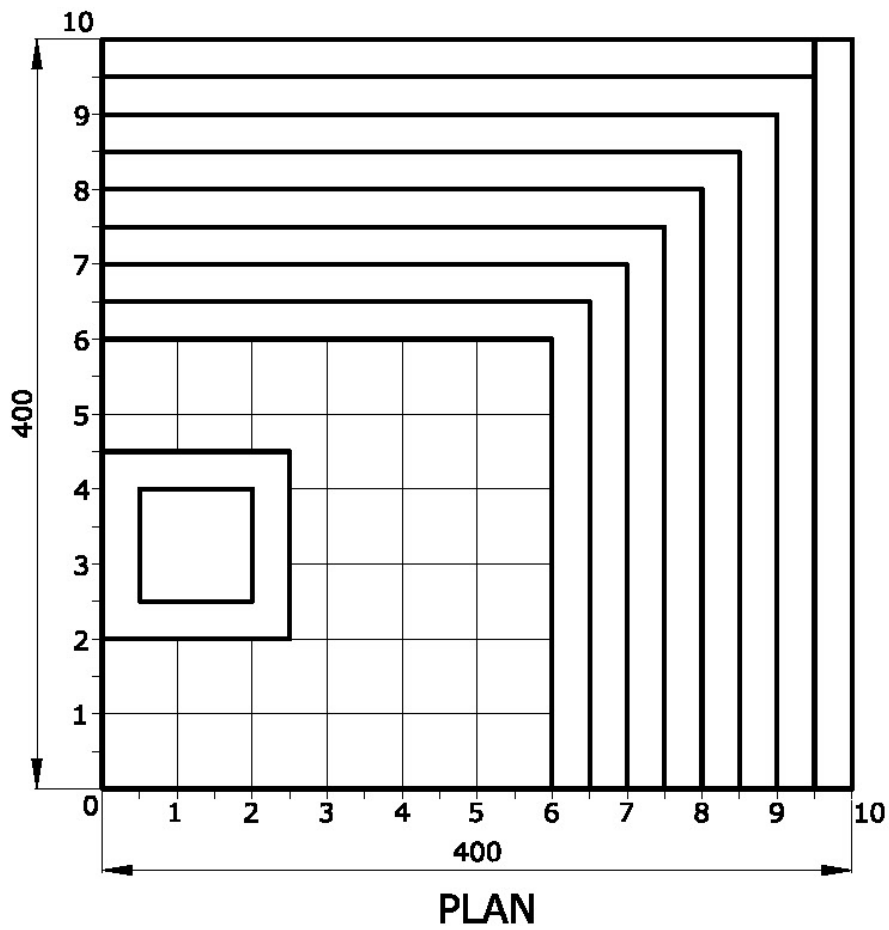


Figure 12a



↑
Viewing position

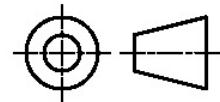
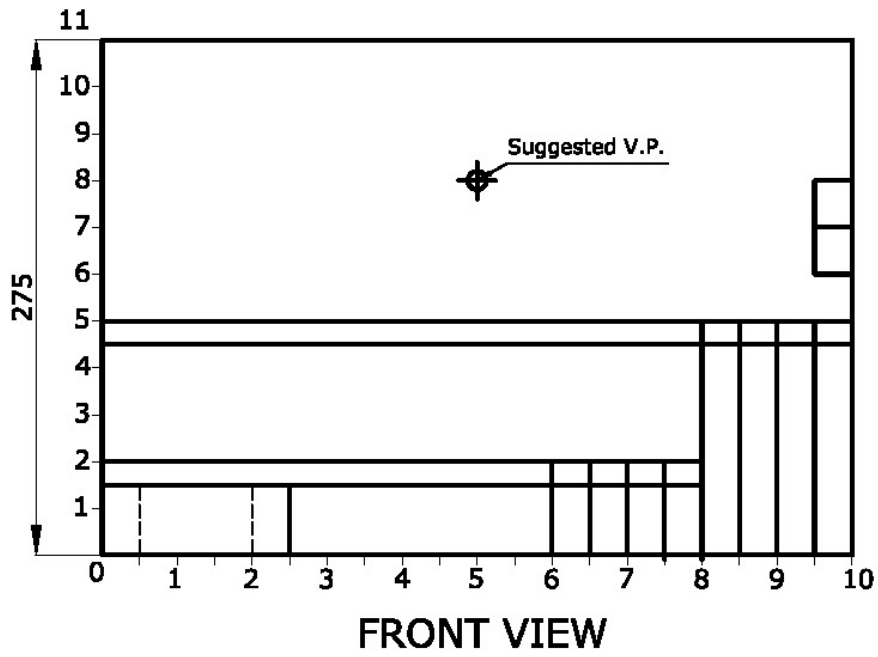
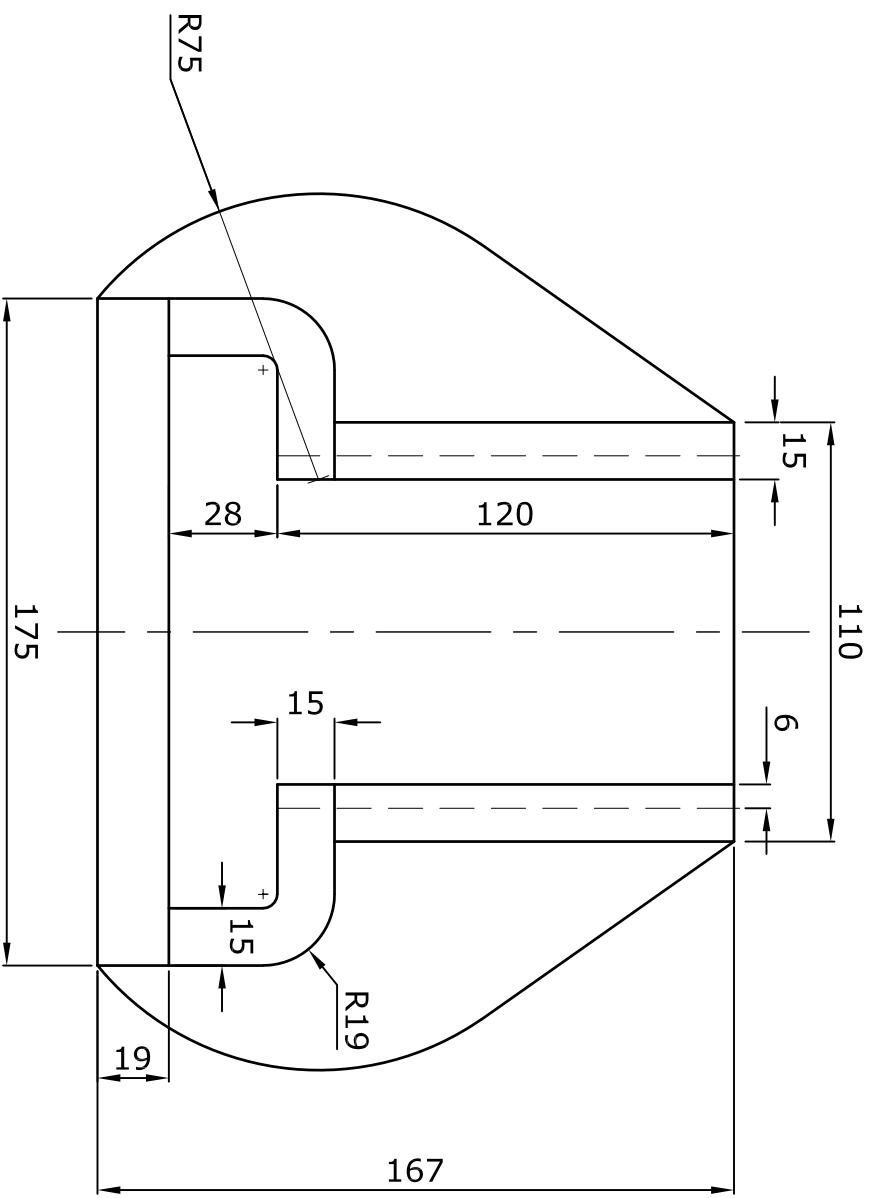
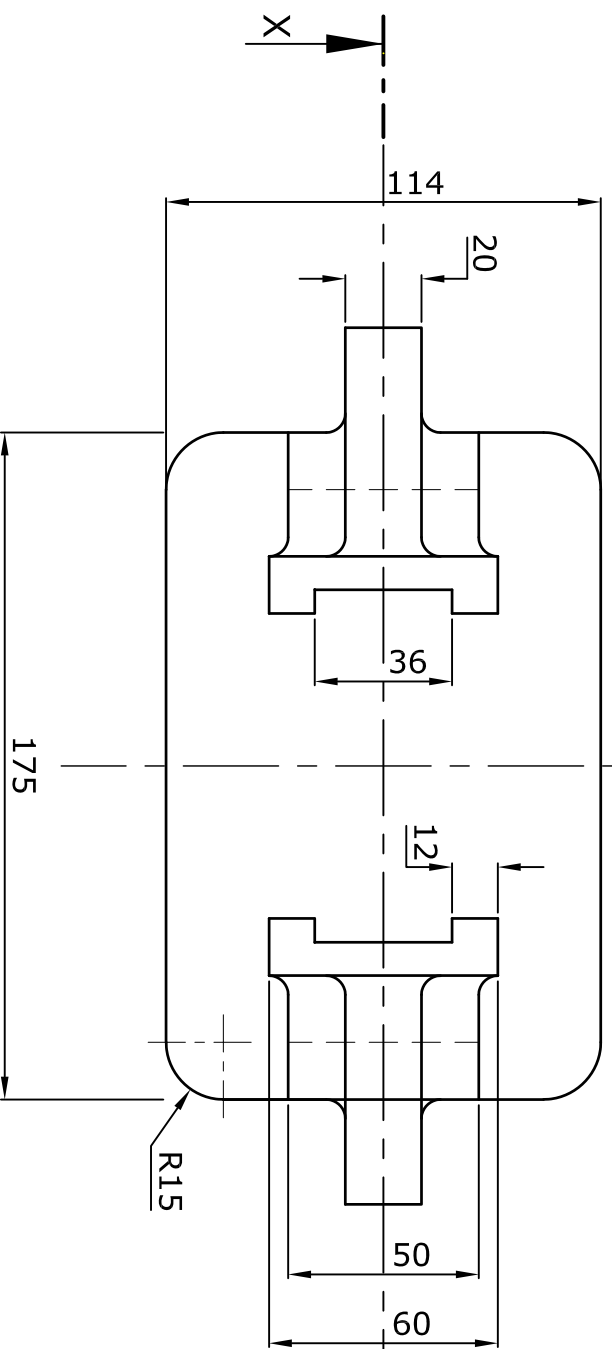


Figure 12b

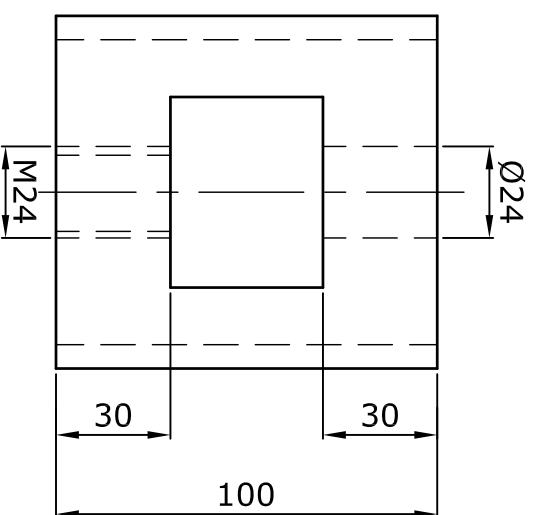


FRONT ELEVATION

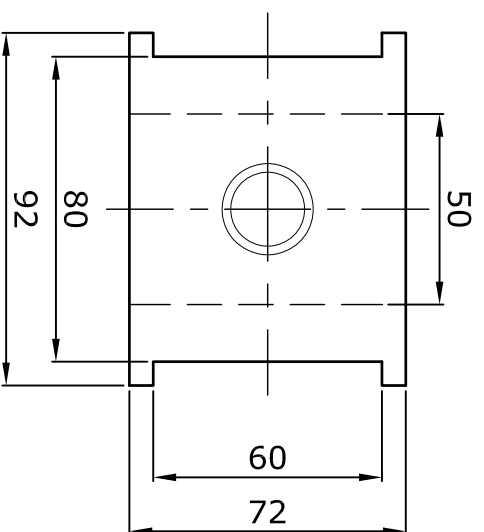


PLAN

BODY (ITEM 1)

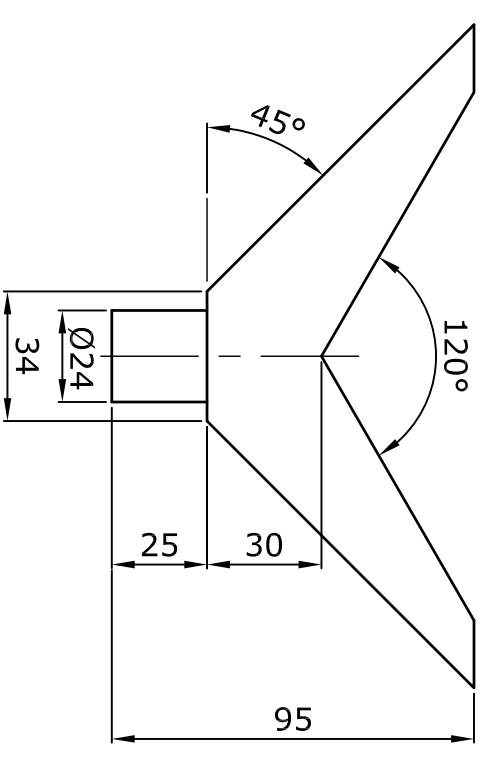


FRONT ELEVATION

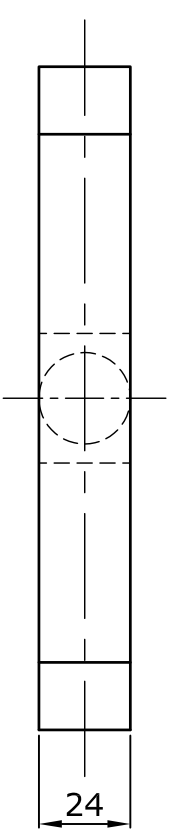


PLAN

BLOCK (ITEM 3)

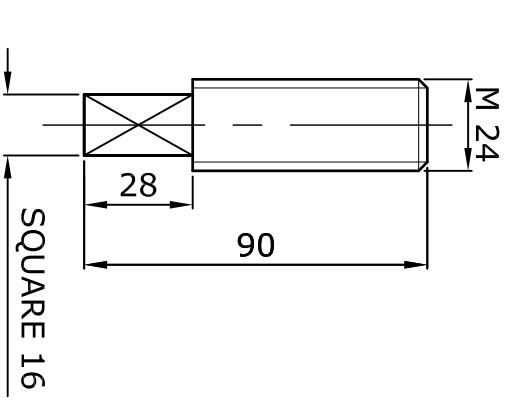


FRONT ELEVATION

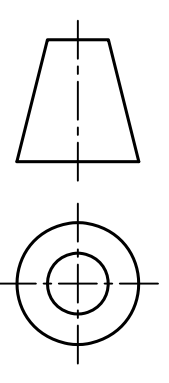


PLAN

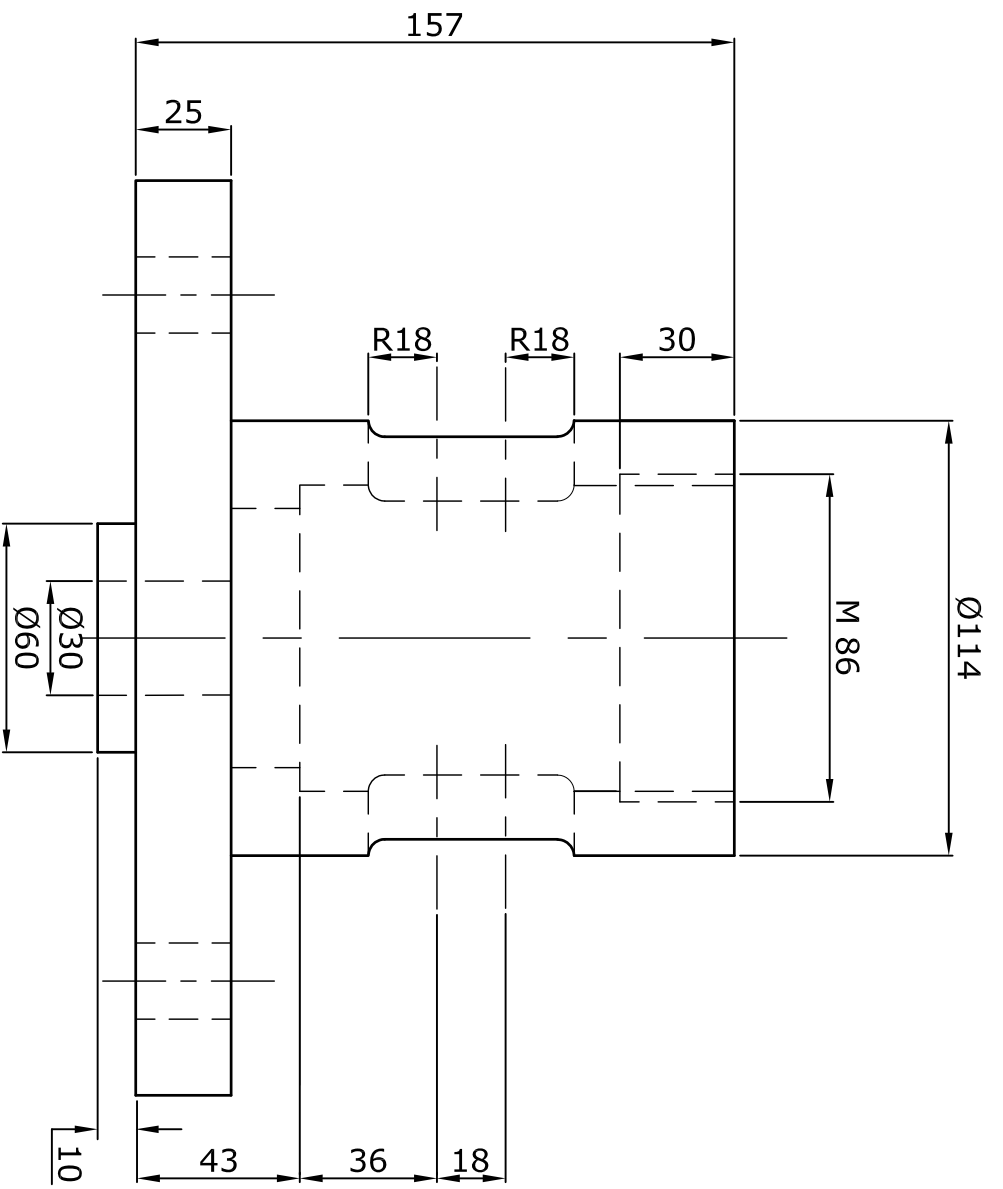
REST (ITEM 4)



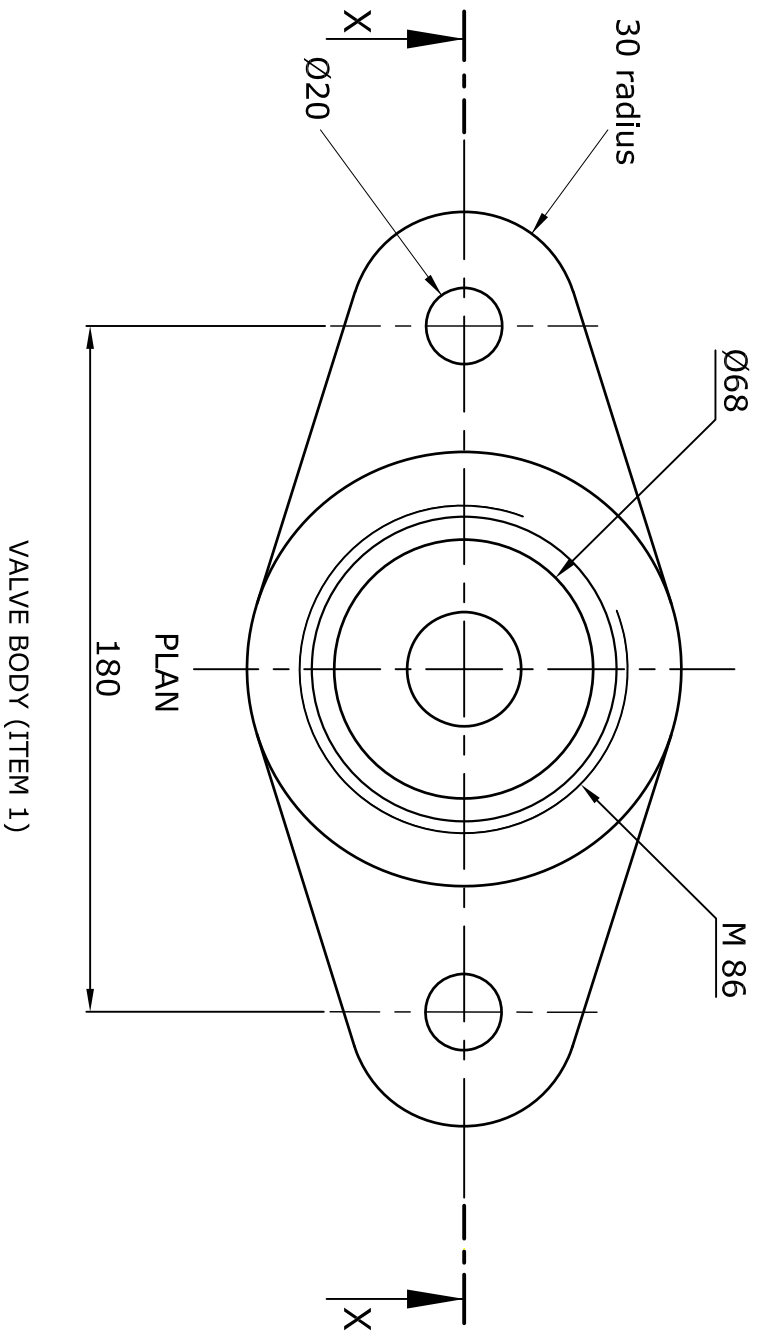
ADJUSTER (ITEM 2)



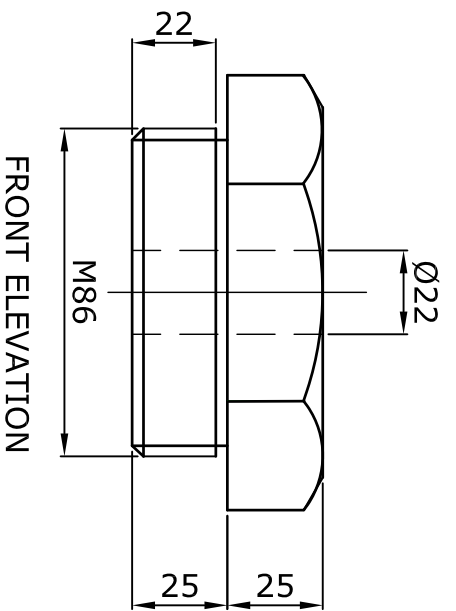
ADJUSTABLE BAR REST



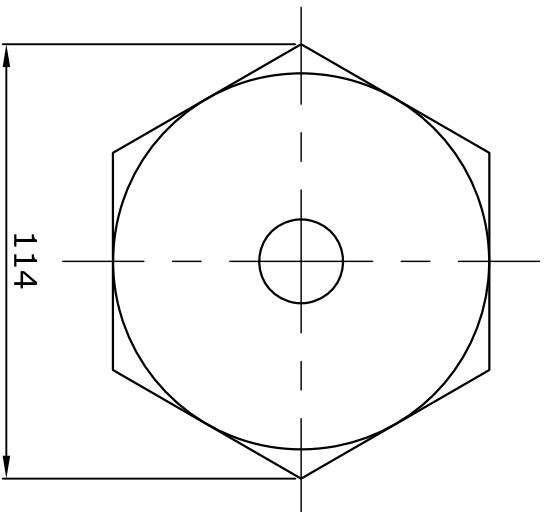
FRONT ELEVATION



VALVE BODY (ITEM 1)

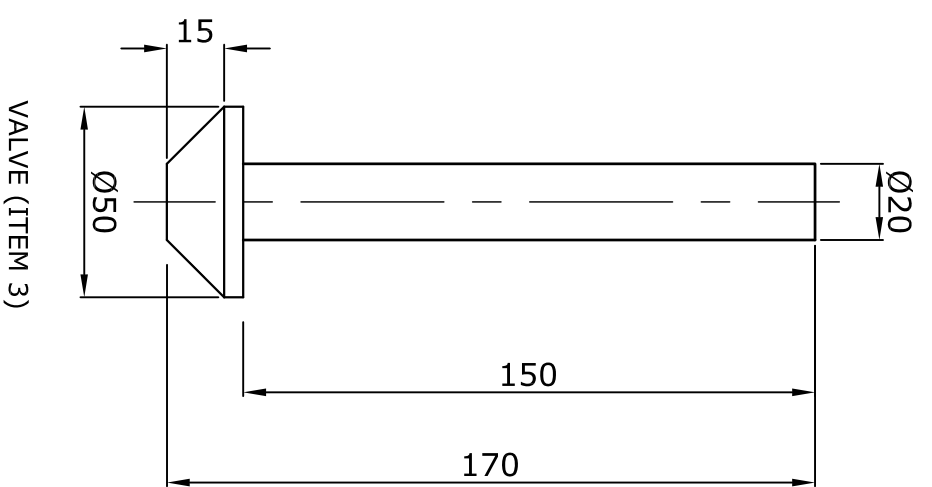


FRONT ELEVATION

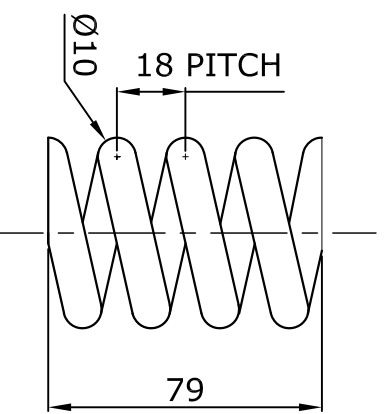


PLAN

M 86 HEXAGONAL NUT (ITEM 5)

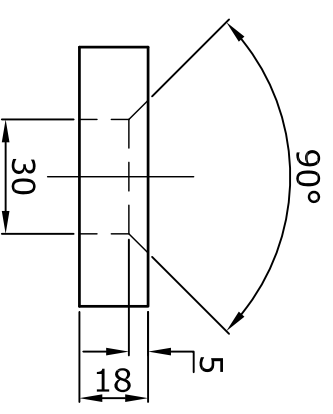


VALVE (ITEM 3)

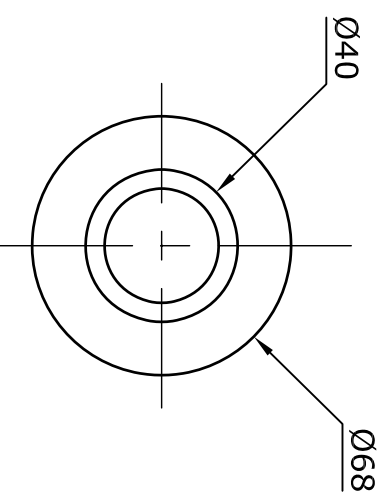


SPRING (ITEM 4)

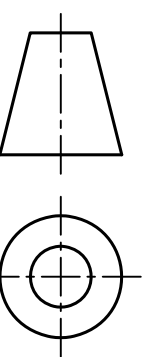
SPRING LOADED VALVE

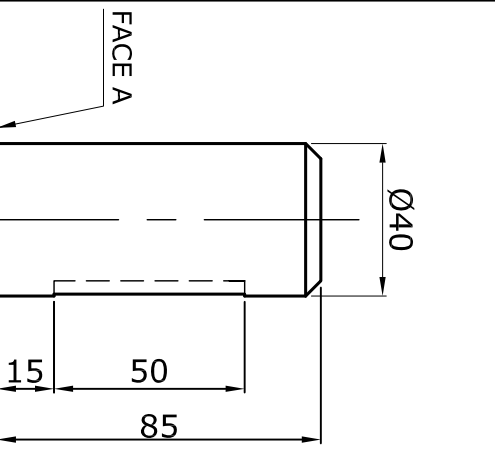


FRONT ELEVATION

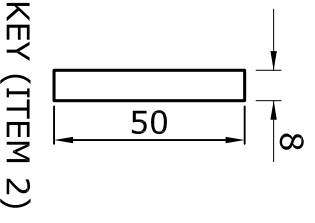


VALVE SEAT (ITEM 2)

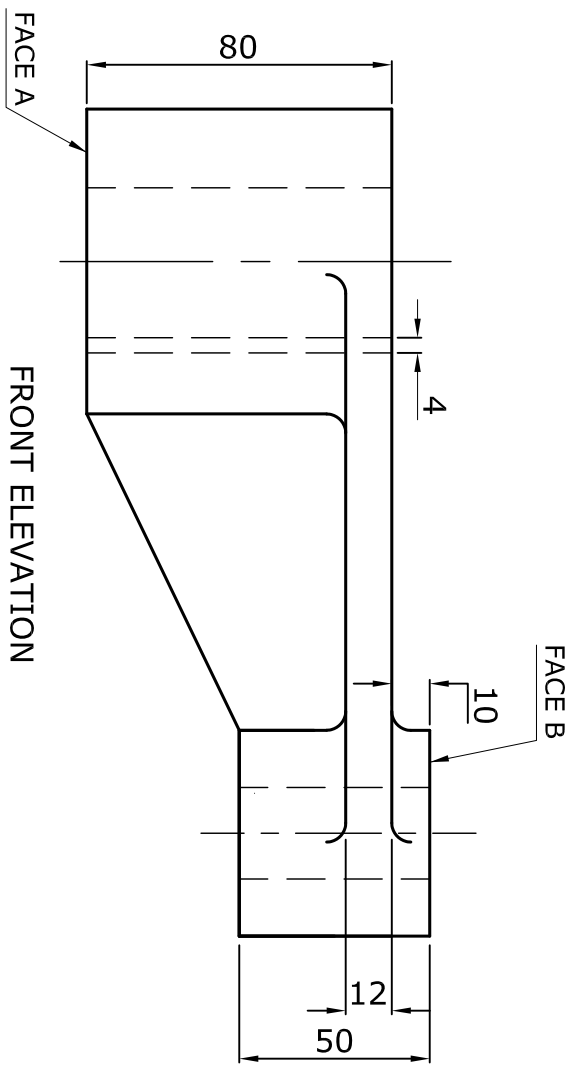




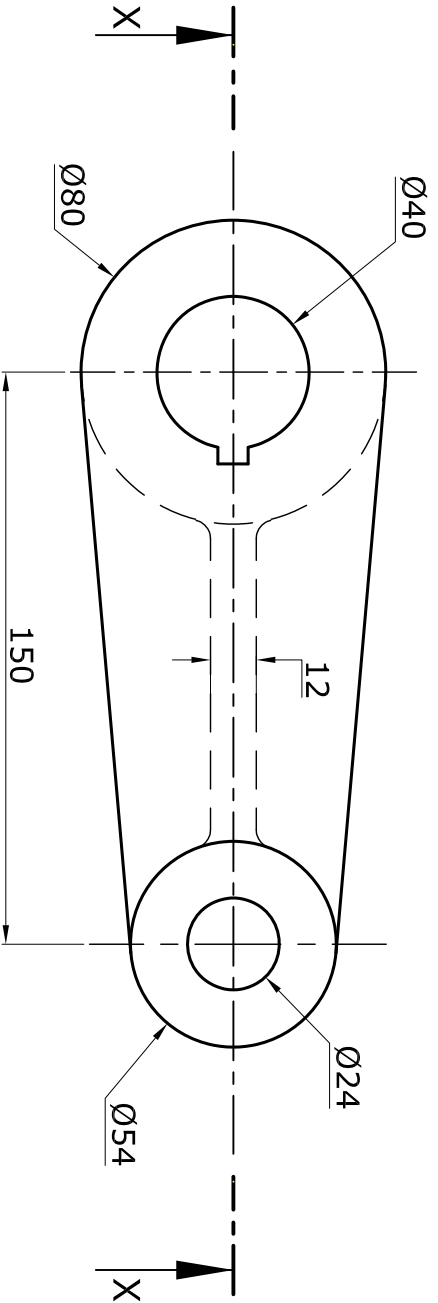
SHAFT (ITEM 1)



KEY (ITEM 2)

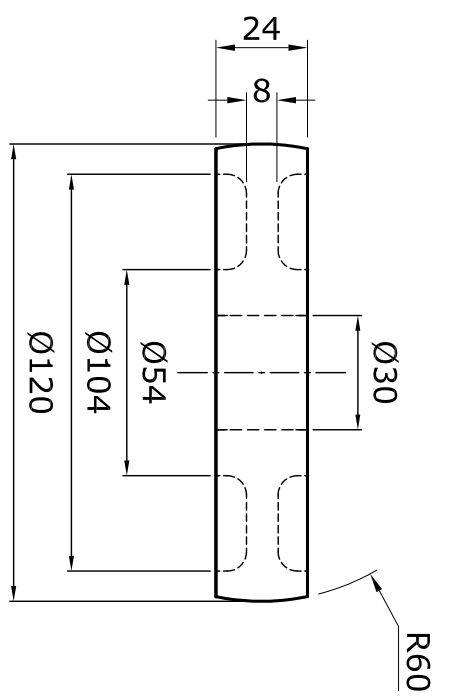


FRONT ELEVATION

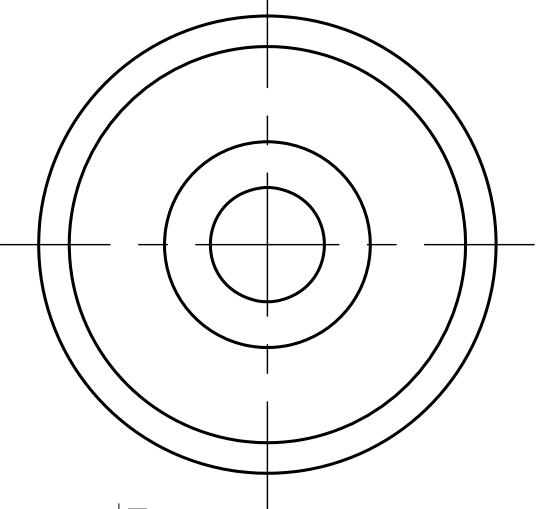


PLAN

BRACKET (ITEM 3)

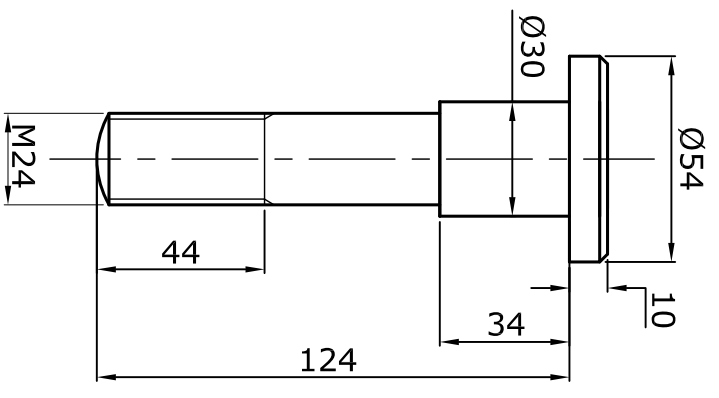


FRONT ELEVATION

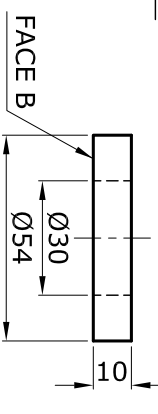


PLAN

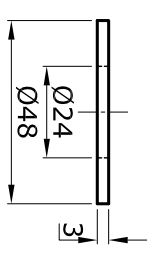
WHEEL (ITEM 6)



SPINDLE (ITEM 5)



WASHER (ITEM 4)



WASHER (ITEM 7)

ASSEMBLY

