MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
ADVANCED LEVEL
MAY 2015

SUBJECT:	ENGINEERING DRAWING/GRAPHICAL COMMUNICATION
PAPER NUMBER:	I
DATE:	6th May 2015
TIME:	4.00 p.m. to 7.00 p.m

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:

a. drawings should conform to B.S. or equivalent (ISO) standards;
b. all dimensions are in millimetres;
c. all answers are to be accurately drawn with instruments;
d. unless otherwise stated, 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.

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Question 1

The cantilever pin-jointed frame is attached to a wall and loaded as shown in Figure 1.

a) Using a scale of 10mm representing 0.5m, copy the space diagram.
b) Label the frame using Bow's notation.
c) Determine graphically the:
   i) magnitude, direction and sense of the reactions exerted by the wall at the top and bottom joint.
   ii) magnitude of the forces in the members EM, FM, ML, LK, KF and KJ.
d) Show on the space diagram, by use of arrows, which members are in compression and which members are in tension.

(20 marks)

SPACE DIAGRAM SCALE: 10mm rep 0.5m

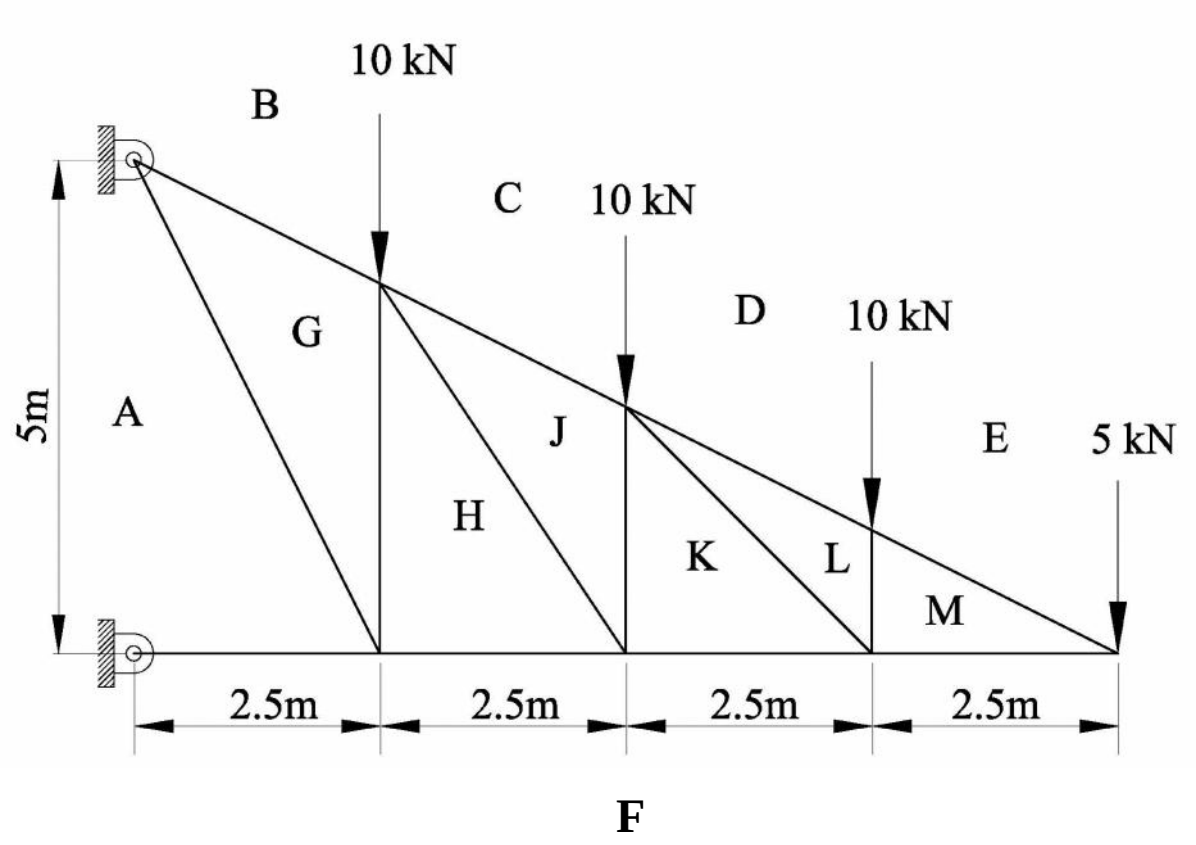

Figure 1

Question 2

A distance piece consists of a conical solid with a square hole machined through its centre (Figure 2a).
The elevation and plan of the distance piece and the traces of an oblique cutting plane are shown in Figure 2b.
Draw, full size, the following views of the distance piece with the part above the cutting plane removed.

a) Auxiliary elevation of the distance piece with the traces being represented by a straight line;
b) Front elevation;
c) Plan;
d) True shape of the cutting plane surface.

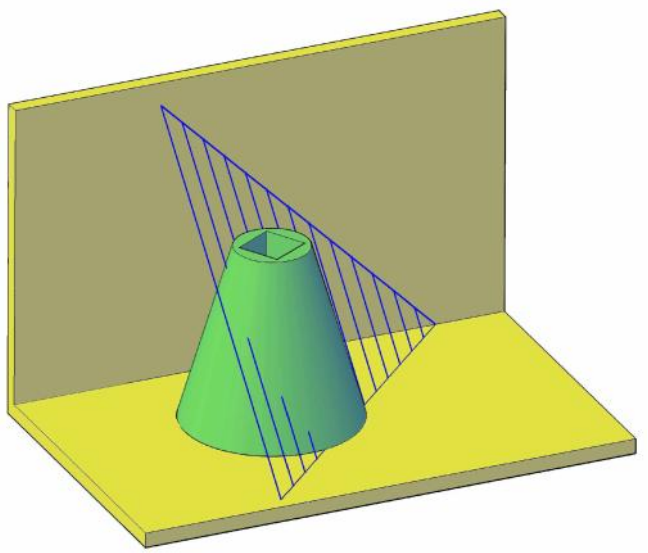

Figure 2a

(20 marks)

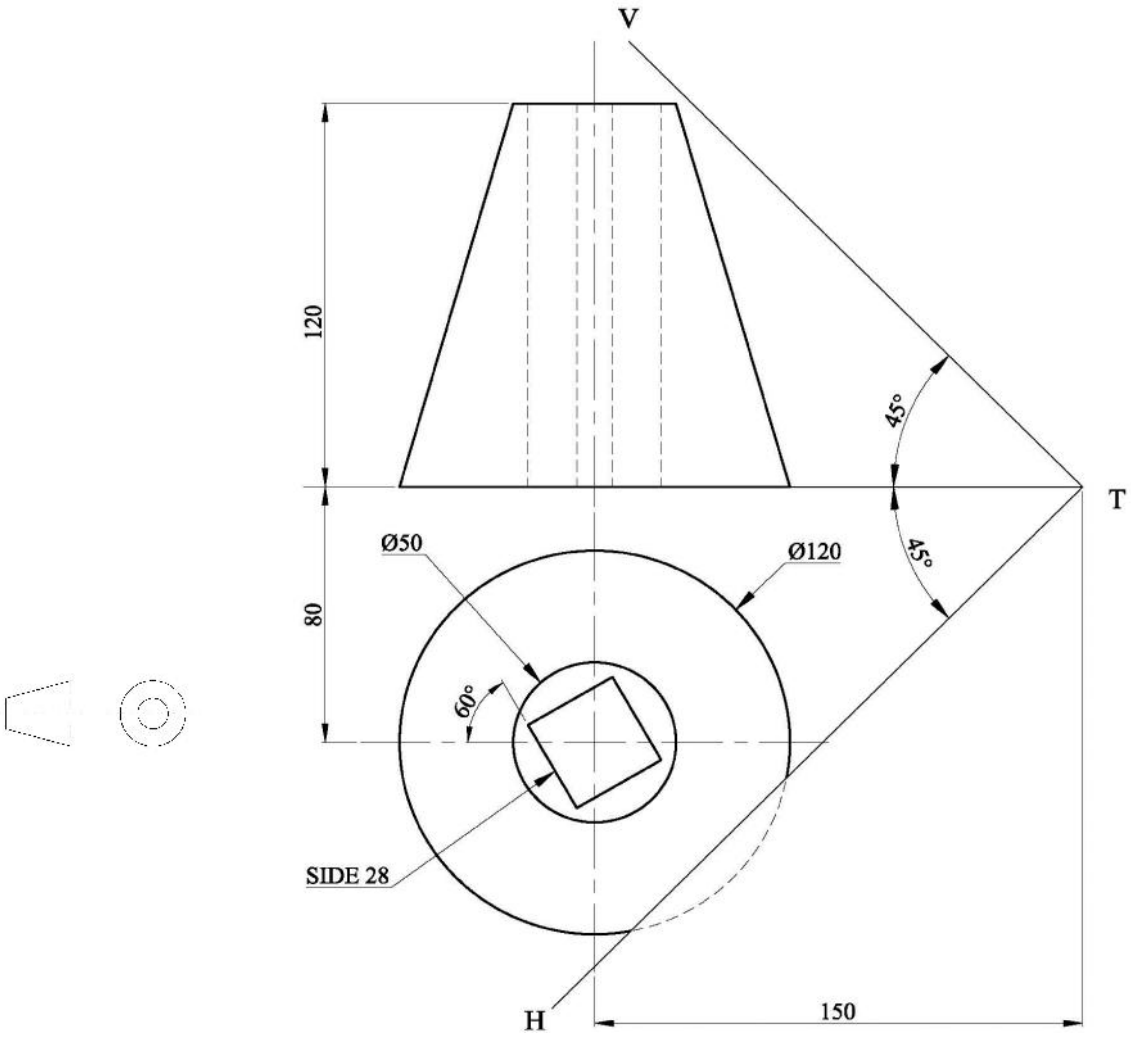

Figure 2b

Question 3

A carpenter designed a handle for a box sliding lid (Figure 3a), using three curves A, B and C as shown in Figure 3b. The three curves are generated by the locus of point P and point Q. Draw, using the dimensions shown in Figure 3c.

a) The curve A, which is the locus of the point P lying outside the generating circle which is rolling clockwise for one revolution on the outside of the base directing circle.

b) The curve C, which is the locus of point Q lying outside the generating circle which is rolling anti clockwise for half a revolution on the inside of the base directing circle.

c) The curve B which is a reflection of curve C.

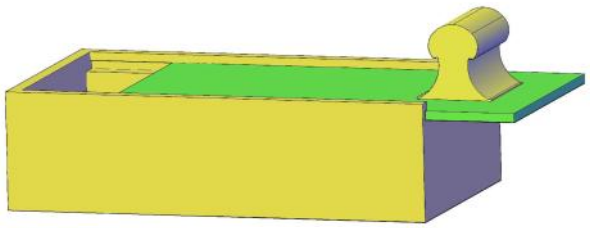

Figure 3a

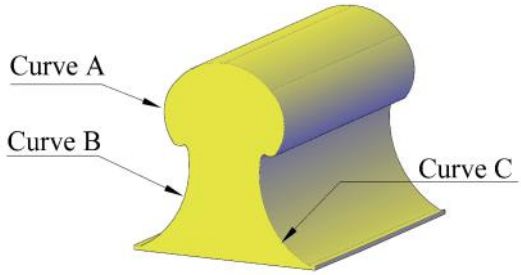

Figure 3b

(20 marks)

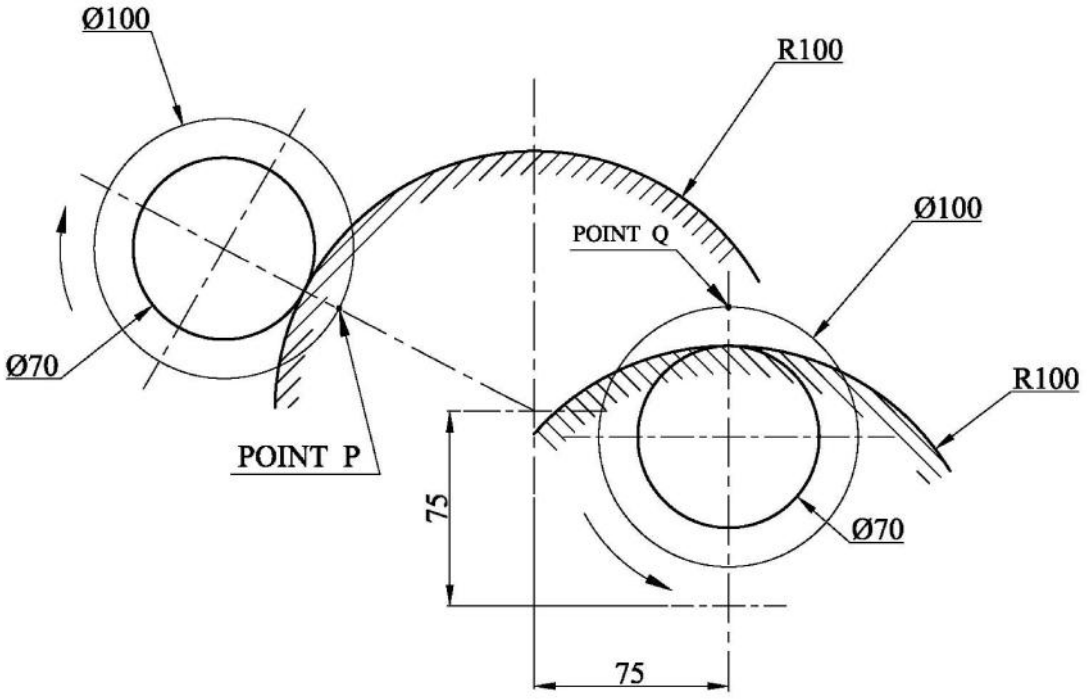

Figure 3c

Question 4

The essential details of a plate cam are shown in Figures 4a and 4b. The figures show the cam follower offset to the centre of the plate cam. The cam follower is presented on its initial position at the lowest displacement. The cam rotates anticlockwise at 100 rev/min on a 40mm diameter shaft and imparts the following motion to the follower:
Dwell for 0.075 sec;
Lift of 72mm with simple harmonic motion for 0.125 sec;
Fall of 24mm with uniform velocity for 0.1 sec;
Fall of 48mm with uniform acceleration and retardation for 0.3 sec.

a) Develop the cam displacement diagram and the cam profile to full scale.
b) Draw the position of the mechanism and state the maximum angular movement of the link PQ.

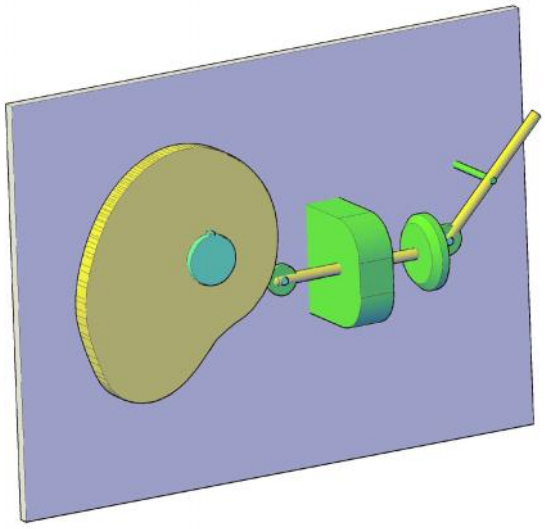

Figure 4a

(20 marks)

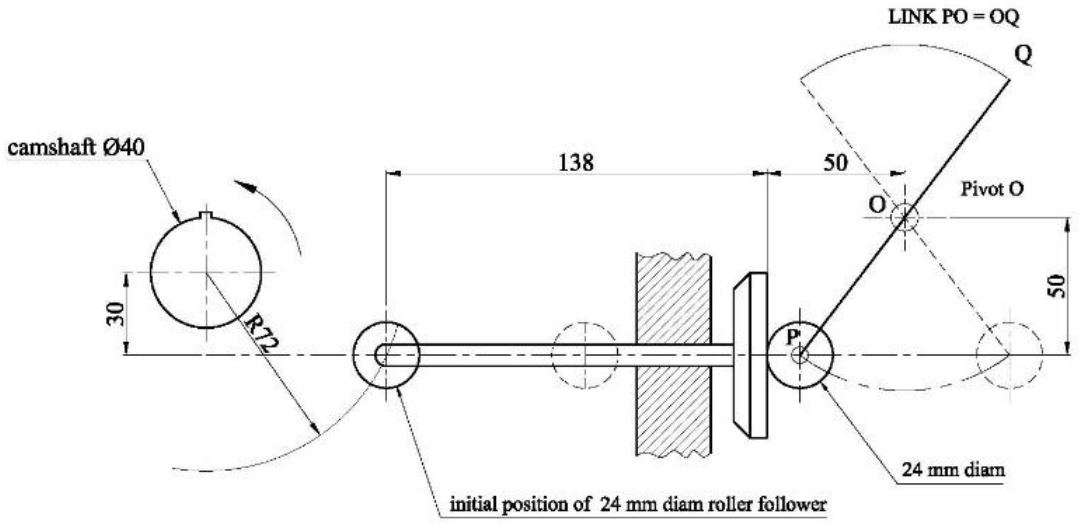

Figure 4b

Question 5

A conical transition piece is intersected by a right cylinder as shown in Figure 5a. The cylinder axis is perpendicular to the vertical plane and parallel to the horizontal plane.

a) Copy, full size, the incomplete views shown in Figure 5b.

b) Draw surface lines on the transition piece as required and present a complete plan, showing the curve of intersection.

c) Construct a half surface development of the conical transition piece.

Place the joint line along the line Y-Y. Material thickness is to be ignored.

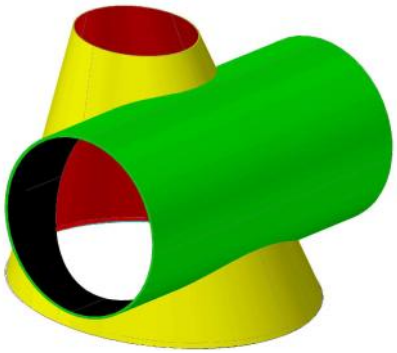

Figure 5a

(20 marks)

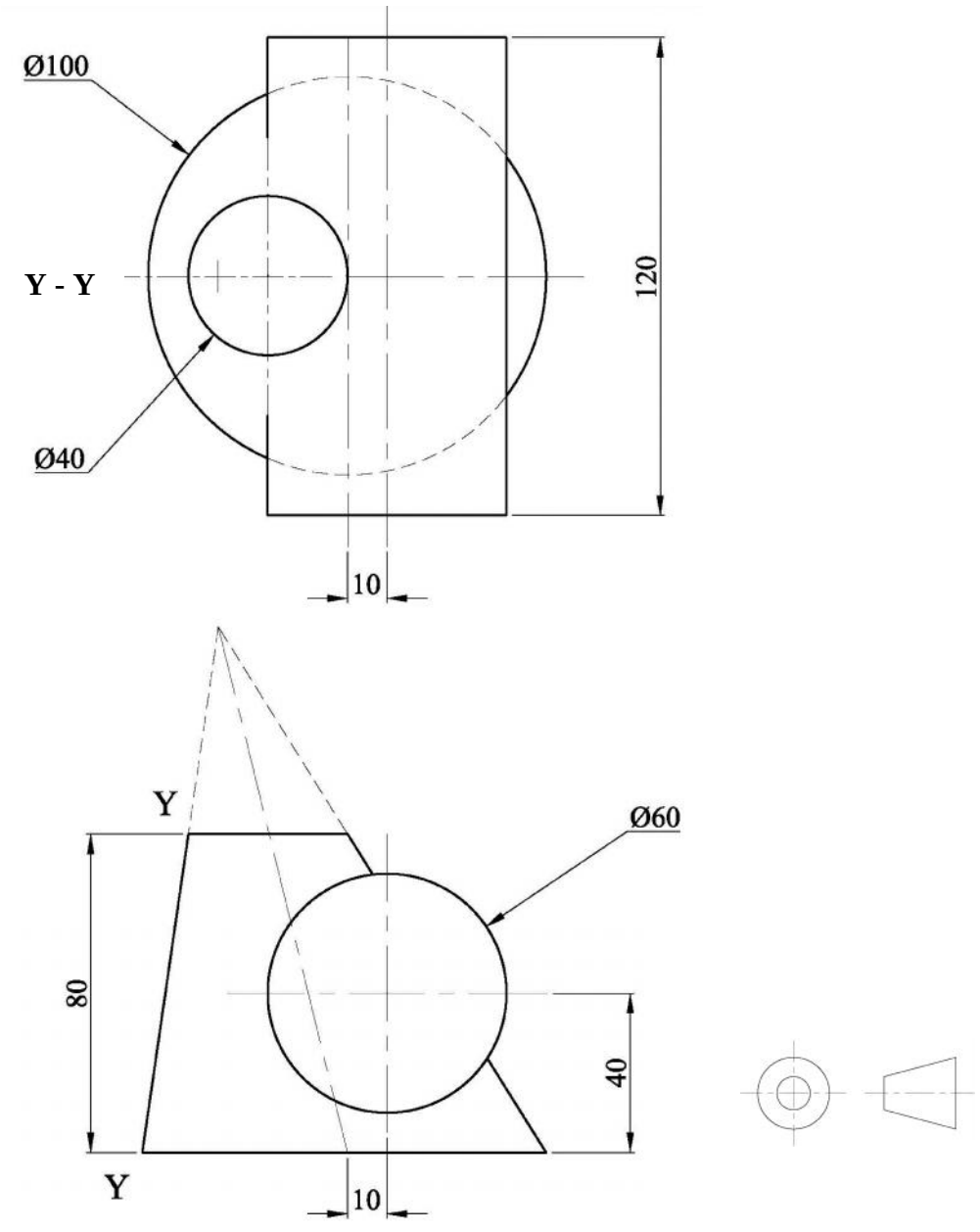

Figure 5b

Question 6

An illustration and orthographic views of a pipeline and a sphere are shown in Figures 6a and 6b. The pipe is 12mm diameter and its longitudinal axis is represented by the line **AB**.
C is the centre of the 120mm diameter spherical tank.

a) Copy full size the orthographic views.
b) Connect the centre of sphere C to each end of line **AB** to form a plane **ABC** and draw a first auxiliary elevation showing the plane **ABC** as an edge.
c) Construct a second auxiliary view to show the true shape of plane **ABC** and the clearance, if any, between the pipe and the sphere. Measure and state the clearance.
d) Indicate on the front elevation and plan the shortest distance between line **AB** and the centre of the sphere.

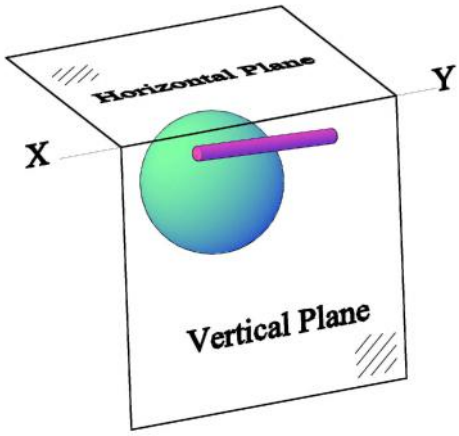

Figure 6a

(20 marks)

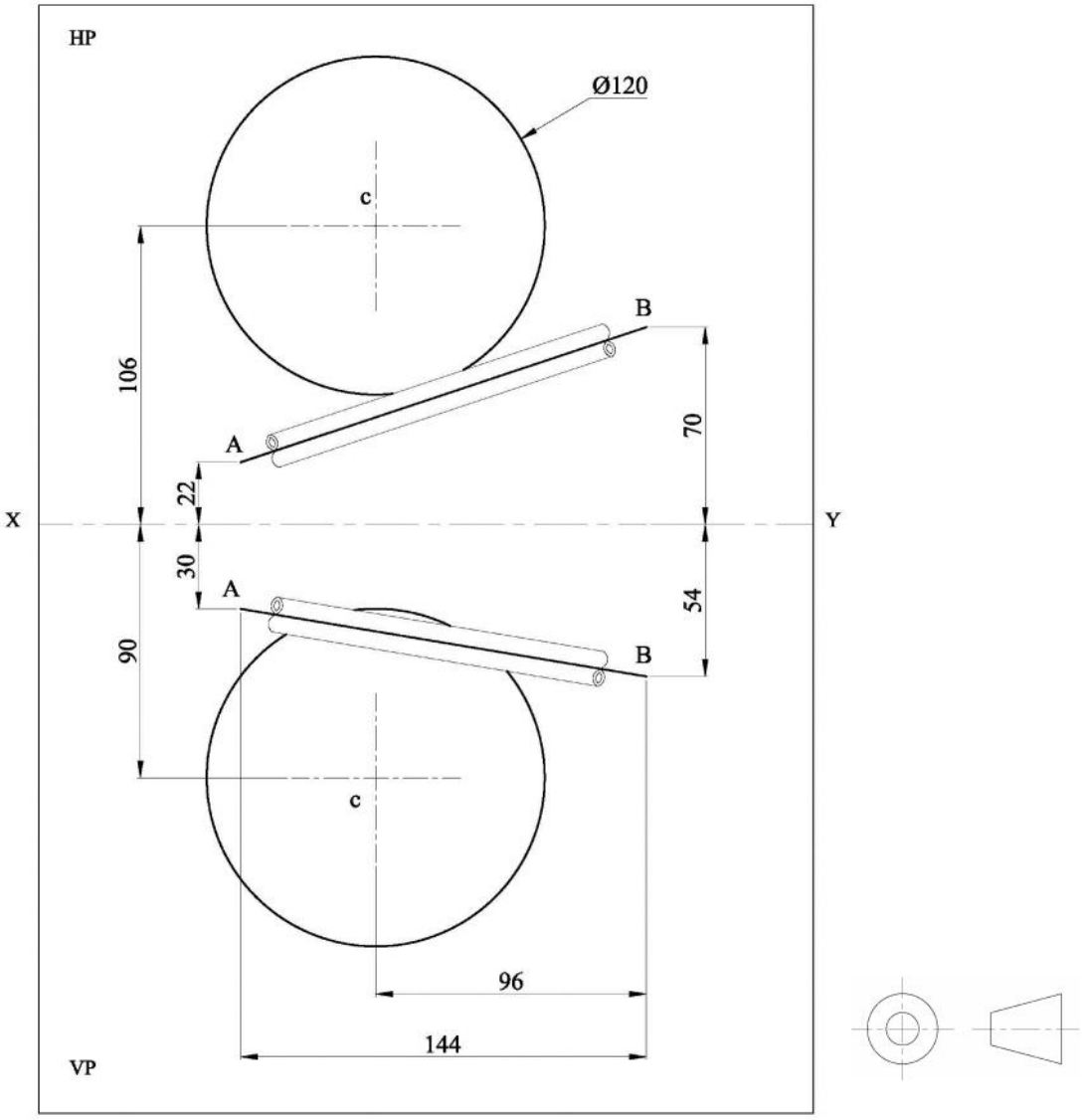

Figure 6b

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
ADVANCED LEVEL
MAY 2015

SUBJECT:	ENGINEERING DRAWING
PAPER NUMBER:	II
DATE:	7th May 2015
TIME:	4.00 p.m. to 7.00 p.m

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:

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

Dimensions not given should be estimated.

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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.

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Question 1

Details of the components parts of a Paper Press are shown in Figure 1 on the attached A3 sheet. The parts are assembled as follows.
The bush (item 2) with an outside diameter of 34mm is pressed into the 34mm diameter bore of the bracket (item 3).
The 24mm diameter spindle (item 4) is then inserted into the 24mm diameter bore of the bush. The bracket, with the bush and spindle, is bolted and secured to the frame (item 1) by means of the four M6 x1 Hex - head bolts (item 5).
The 22mm thick swivelling quadrant (item 6) is inserted (placed) between the 24mm gap of the fork of the frame such that the 10mm diameter hole is uppermost and located in the 10mm hole. The threaded M10x1 end of the main pivot pin (item 7) is inserted through the 10mm hole of the fork and the quadrant and screwed into the M10x1 threaded hole of the fork on the adjacent side.
The upper end of the spindle is attached (connected) to the quadrant by means of the two links (item 8) and the two link pins (item 9) in conjunction with four washers and four split pins. (not shown)
The 20mm wide part of the pressure pad (item 10) is attached to the lower end of the spindle and retained (secured) in position by means of the pressure pin (item 11).
Finally the M8 threaded end of the handle (item 12) is screwed into the M8 threaded hole in the quadrant.

Draw, full size:
a) a sectional elevation about the plane X – X of the assembled paper press,
b) an elevation in the direction of the arrow A.
Present the drawing with the handle in its horizontal position.

(60 marks total)

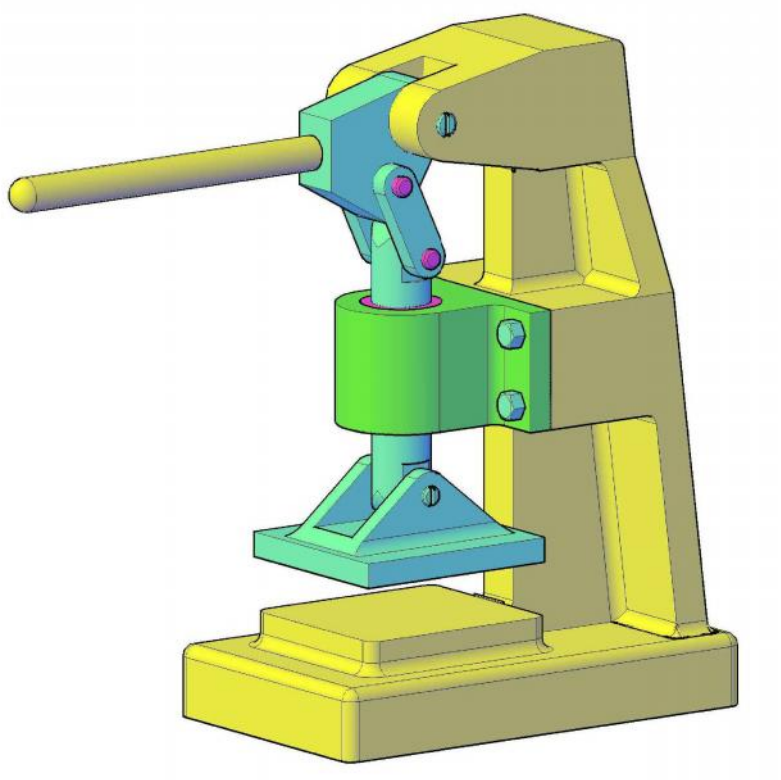


Figure 1

Question 2

a) Geometrical tolerance provides a precise brief method of indicating geometrical requirements on engineering drawing.
Complete the table of the symbols relating to geometrical tolerances shown in Figure 2a.

(14 marks)

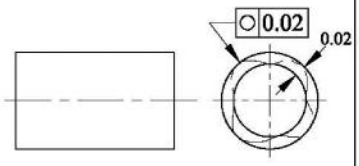
FORM TOLERACES	SYMBOL	INTERPRETATION
ROUNDNESS TOL	○	Roundness is a condition where a feature is a continuous curved surface, any point of its surface being a constant distance from its centre or axis. 
FLATNESS TOL		
PARALLELISM TOL		
SQUARENESS TOL		
ANGULARITY TOL		

Figure 2a

Please turn the page.

b) The diagram shows the tolerance zone applied to a cylindrical component.
Draw the;-
(i) symbol in the first compartment of the box;
(ii) tolerance text in the second box;
(iii) testing length in the third box;
(iv) interpretation of the given drawing showing the meaning of the term **STR TOL 0.04 - 120**.

(3 marks)

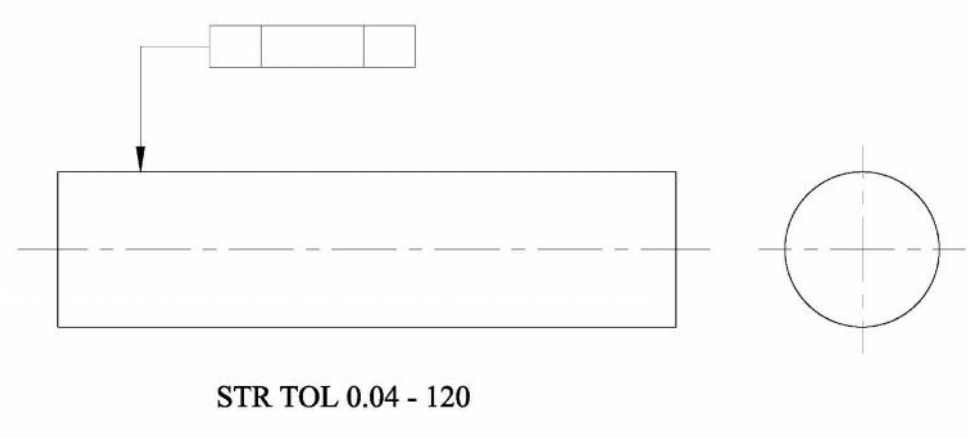


Figure2b

c) A drawing instruction of a product is shown below. The product requirement is to contain the axis of the right-hand cylinder within a cylindrical tolerance zone which is concentric with the axis of the datum cylinder.
The diagram shows the tolerance zone applied to a CONCENTRICITY TOLERANCE component.
Draw the:
(i) symbol in the first compartment of the box;
(ii) complete the table shown by inserting the text in the second and third box;
(iii) the interpretation of the given drawing showing the meaning of the term;
CONC TOL 0.02 dia. DATUM A.

(3marks)

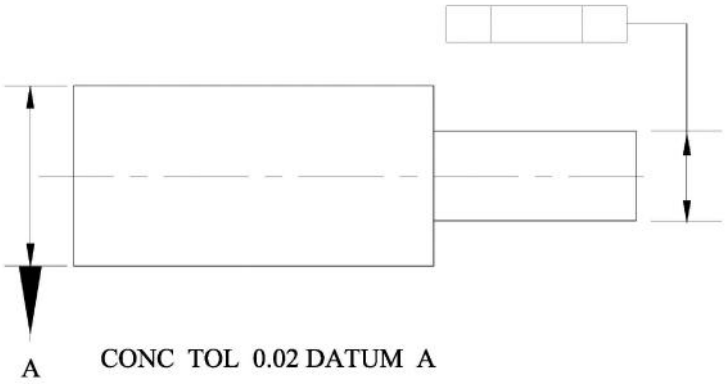


Figure 2c

Question 3

a) One of the requirements of mass production methods is that components parts must be interchangeable**.**
   i) Define the terms 'tolerance' and ' fit'.
   ii) Name the three classes of fit in common use using Figure 3a below. Complete the illustration showing the comparison between the three classes of fit, using the hole basis system.

Add short notes under each type of fit. Define and explain by terms to distinguish between fits. Include a shaft partially drawn to illustrate the fit configuration.

(15 marks)

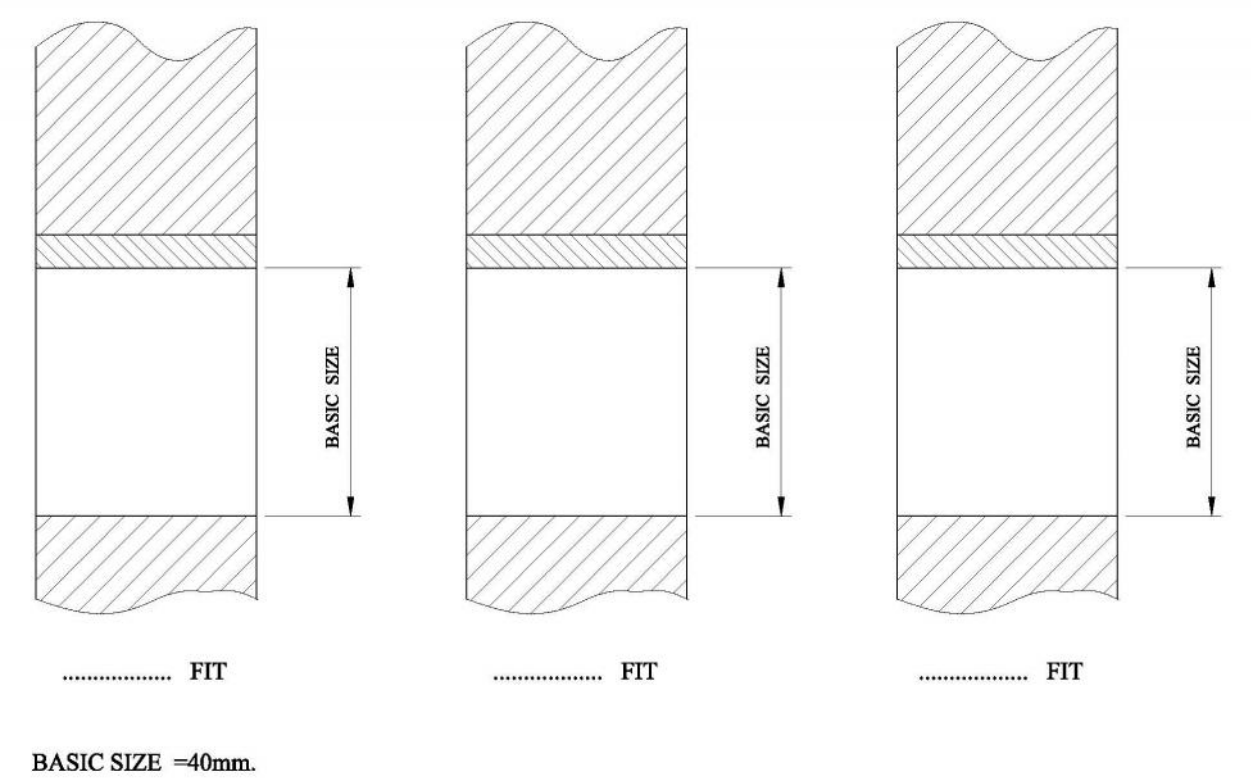


Figure 3a

Please turn the page.

b) A scrap view of a shaft, bush and housing is shown in Figure 3b.
Draw, a twice full size, fully dimensioned detailed drawing of each part. Refer to Table 1 below to obtain the correct value of tolerance. Present your working in a neat table.

(5 marks)

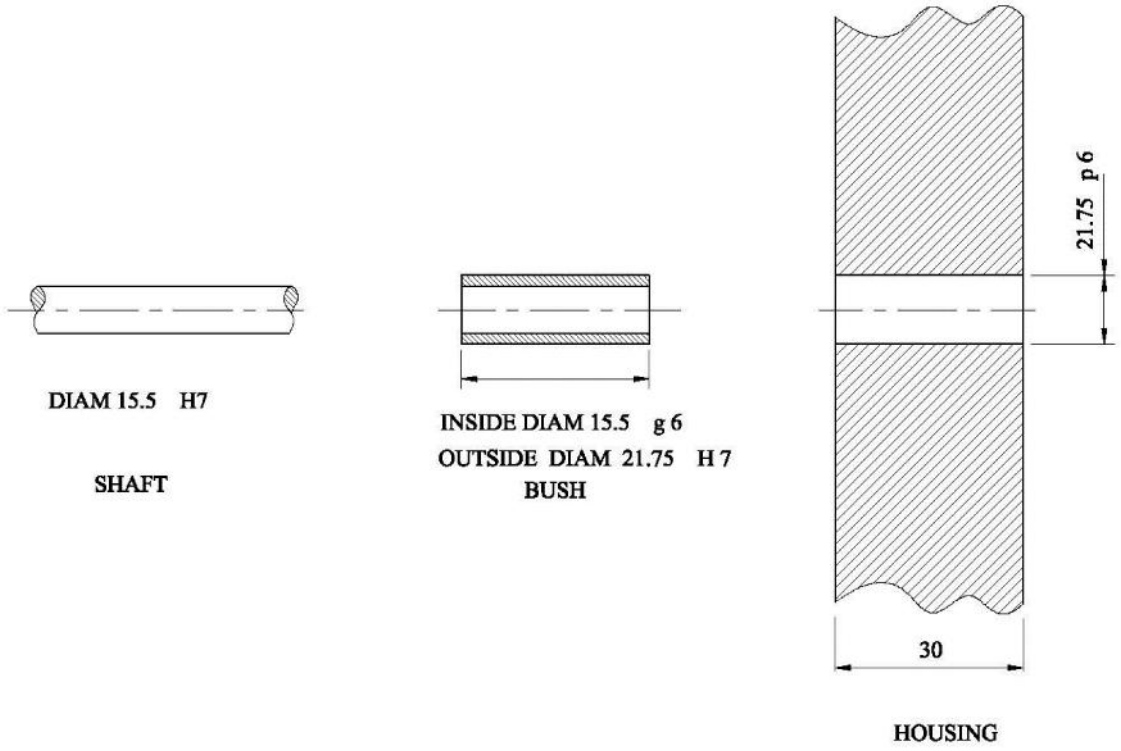


Figure 3b

Table 1

LIMITS OF TOLERANCE											
NOMINAL SIZE		H 7		H 8		f 7		g 6		p 6	
Over	Up to	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
3	6	+ 12	0	+ 18	+ 0	- 10	- 22	- 4	- 12	+ 20	+ 12
6	10	+ 15	0	+ 22	+ 0	- 13	- 28	- 5	- 14	+ 24	+ 15
10	18	+ 18	0	+ 27	+ 0	- 16	- 34	- 6	- 17	+ 29	+ 18
18	30	+ 21	0	+ 33	+ 0	- 20	- 41	- 7	- 20	+ 35	+ 22
30	50	+ 25	0	+ 39	+ 0	- 25	- 50	- 9	- 25	+ 35	+ 22

FIT DESIGNATION	UPPER / LOWER DEVIATION	MAX / MIN LIMITS
LIMITS Outside diam of shaft Diam 15.5 H 7 Bore of bush Inside diam 15.5 g 6 Bush into bore of bracket Outside Diam 21.75 H 7 Housing Bore of housing Inside Diam 21.75 p 6		

Question 4

In most cases, pistons, transmit power to the crankshaft, through the connecting rod.

Make an exploded isometric sketch of a piston and a connecting rod.

Fully annotate each part using leaders.

In your presentation show also the following:

(i) piston rings; (Label the piston rings according to their use.)

(ii) how the gudgeon pin is assembled on to the small end of the connecting rod and inserted into the piston;

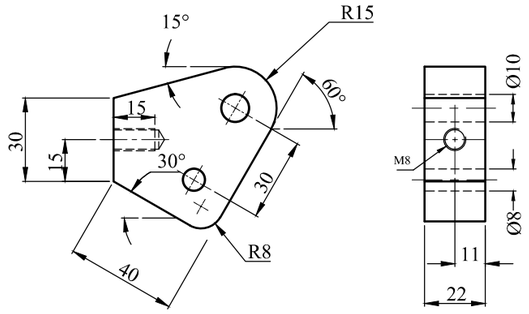
(iii) how the big end of the connecting rod is fitted onto the crankshaft;

(iv) the item used between the:

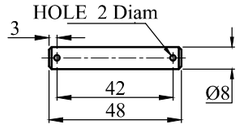
  (a) small end of the connecting rod and the piston gudgeon pin. (Label and suggest material);

  (b) big end of the connecting rod and the crankshaft. (Label and suggest material).

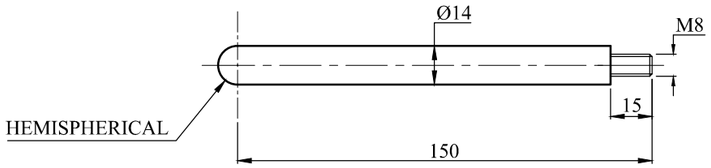
(20 marks)



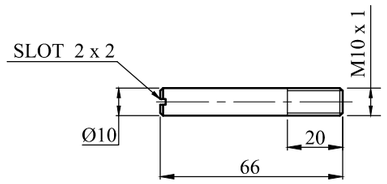
(ITEM 6) QUADRANT
1 REQ ' D



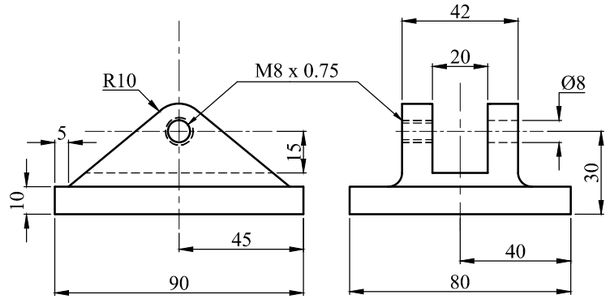
(ITEM 9) LINK PIN
2 REQ ' D



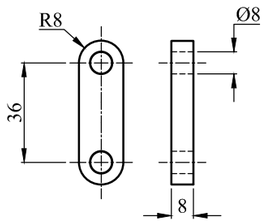
(ITEM 12) HANDLE
1 REQ ' D



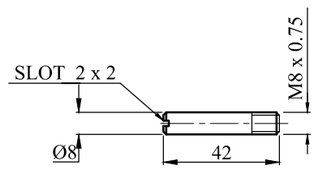
(ITEM 7) MAIN PIVOT PIN
1 REQ ' D



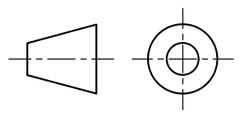
(ITEM 10) PRESSURE PAD
1 REQ ' D



(ITEM 8) LINK
2 REQ ' D



(ITEM 11)
PRESSURE PIN
1 REQ ' D



FILLET RADII : 5mm

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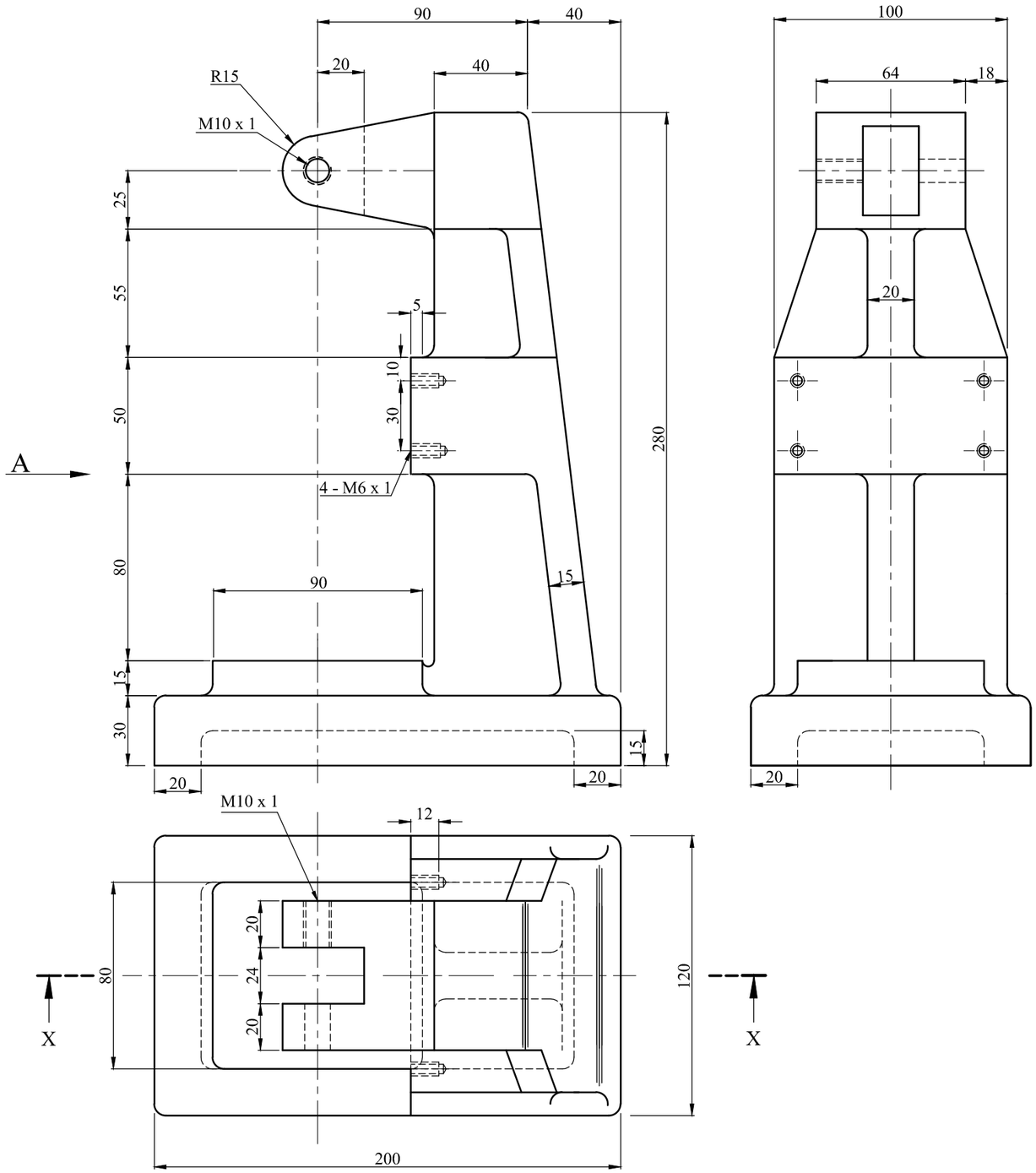
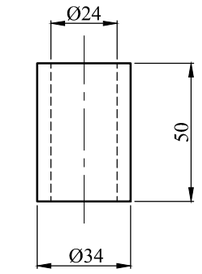
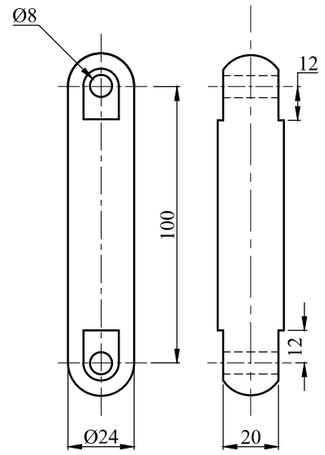


(ITEM 1) FRAME 1 REQ'D



(ITEM 2) BUSH

1 REQ ' D



(ITEM 4) SPINDLE

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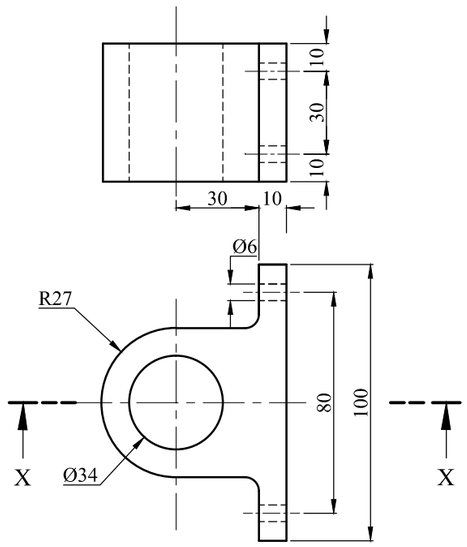

(ITEM 3) BRACKET

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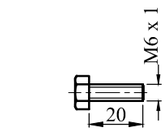
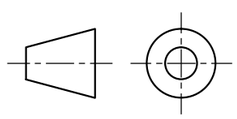


(ITEM 5)

HEX - BOLT

4 REQ ' D



FILLET RADII : 5mm

PAPER PRESS

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