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

MATRICULATION CERTIFICATE EXAMINATION
INTERMEDIATE LEVEL
MAY 2013

SUBJECT:	ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION
DATE:	8th May 2013
TIME:	9.00 a.m. to 12.00 a.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.

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

A mortar and pestle are used as a logo for a medical product as illustrated on the right. The pestle is a heavy, club shaped object, the end of which is used for crushing medical substance in the mortar (bowl). The shape of the rim of the bowl is represented as an incomplete ellipse. The pestle is represented by a centre-line marked NR in Figure 1.
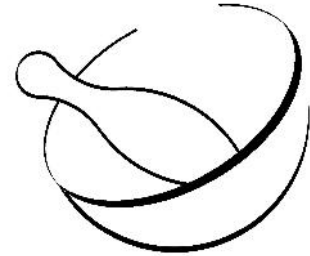
    a) Copy, full size, the transverse axis and directrix of the ellipse at the angle shown below.

    b) Using an eccentricity of 4 : 5, locate the position of the vertex and focus and construct the incomplete ellipse. The conic curve is to terminate at points A and B as indicated.

    c) Draw the normal NR of the ellipse by using the appropriate construction.
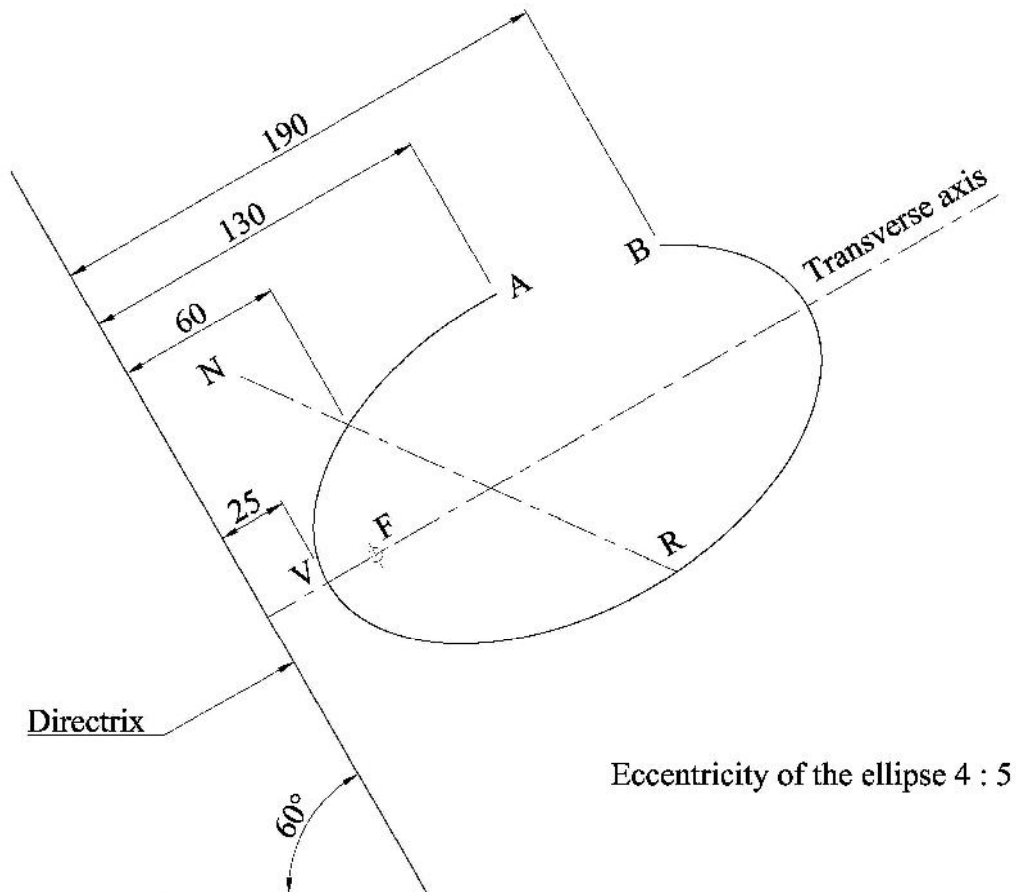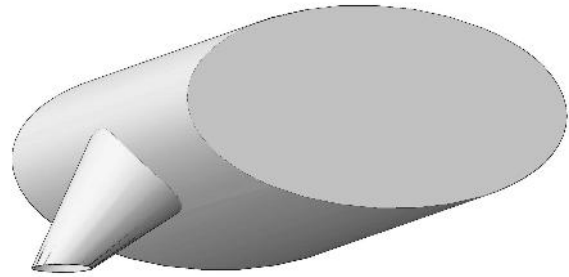
(13 marks)

FIG.1

Question 2

A delivery spout is fitted to a storage bunker as illustrated on the right. The cross section of the bunker is an ellipse and the shape of the spout is formed from an oblique cone.

a) Copy the front elevation and incomplete plan of the oblique cone.
b) Draw the quarter ellipse on the front elevation and the cutting plane parallel to the base as shown in Figure 2.
c) Construct the necessary true lengths required to draw a half development of the surface of the oblique cone, marked A.
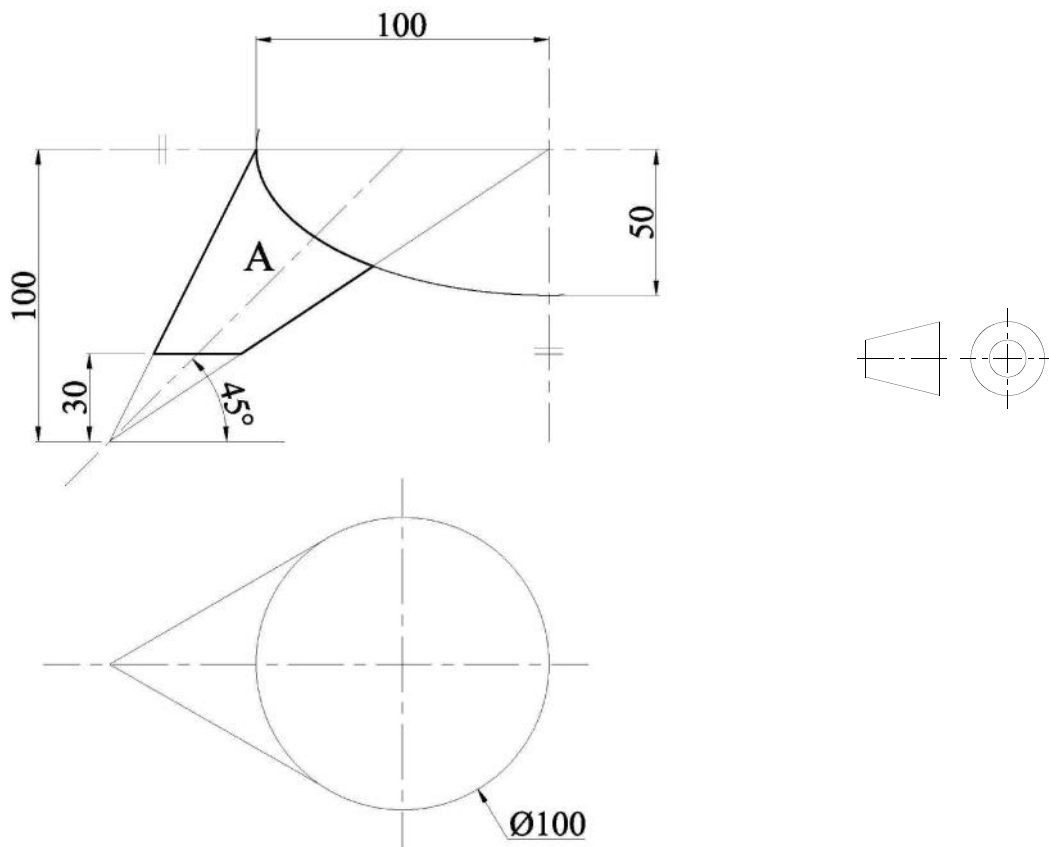
(13 marks)

FIG. 2

Question 3

A pictorial view, an auxiliary view and two incomplete views of a triangular prism intersecting a right square pyramid are shown in Figure 3.
  a) Copy, full size, the given auxiliary view.
  b) Project the plan view, and then the front elevation of the two geometrical solids. Show clearly the lines of intersection between the two solids.
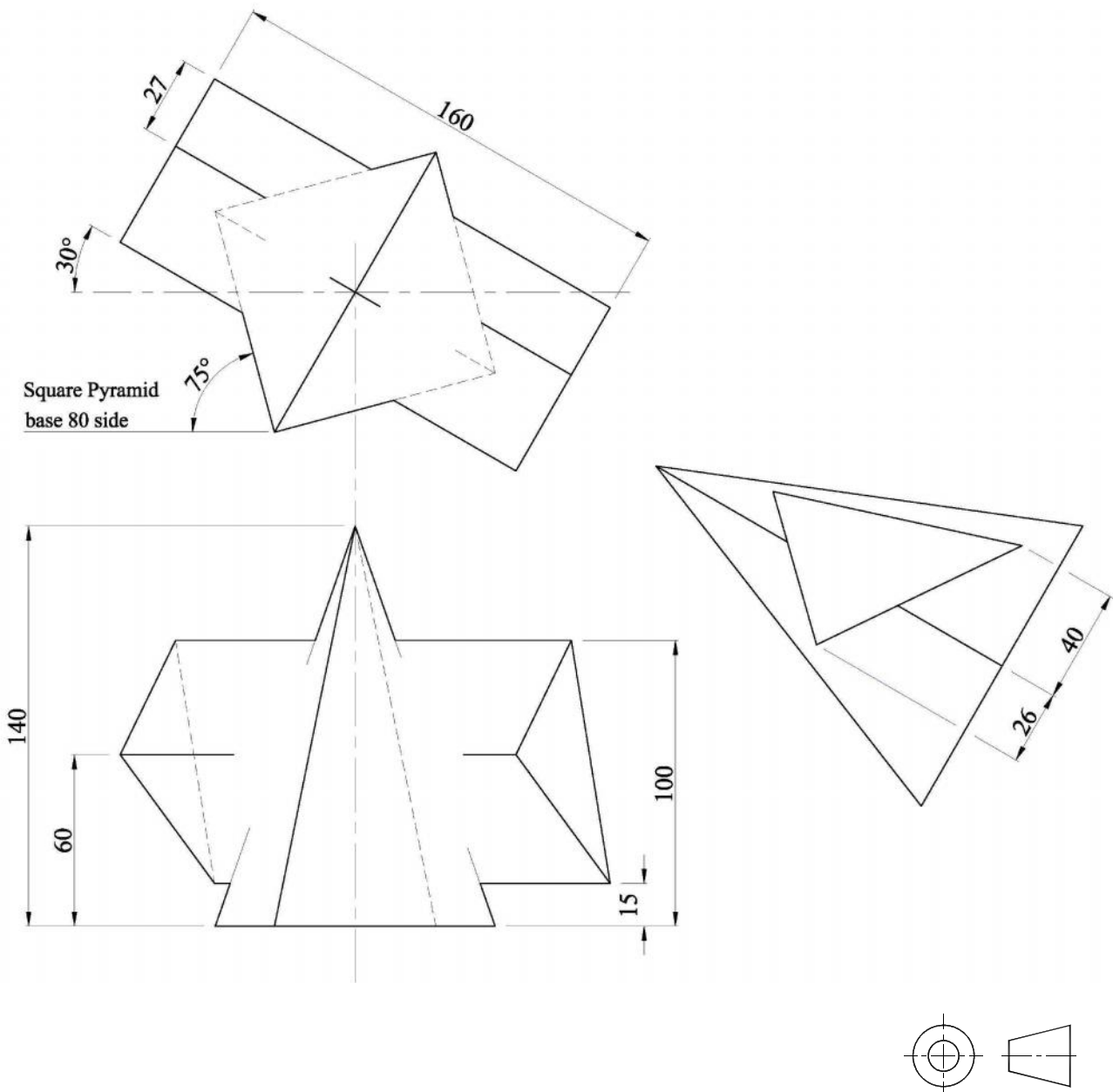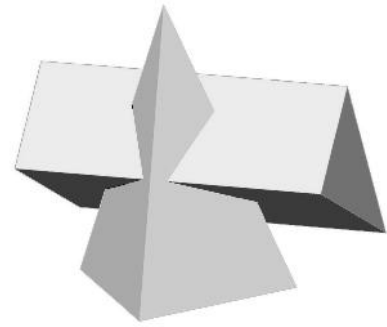Show all hidden detail.

(13 marks)

FIG. 3

Question 4

The square shown in Figure 4 represents the plan view of a stone with five forces acting on it. All forces act in one common plane represented by the square ABCD. The space diagram, Figure 4, shows the force vector, their magnitude, position and direction, relative to the plane ABCD.

 a) To a scale of 30mm representing 1metre, copy the space diagram.
 b) Draw a force diagram to determine the magnitude and direction of the equilibrant. Use a scale of 10mm representing 1kN.
 c) Draw a polar diagram to determine the position of the equilibrant and show the position of the equilibrant on the space diagram. State the angle relative to the side DC.
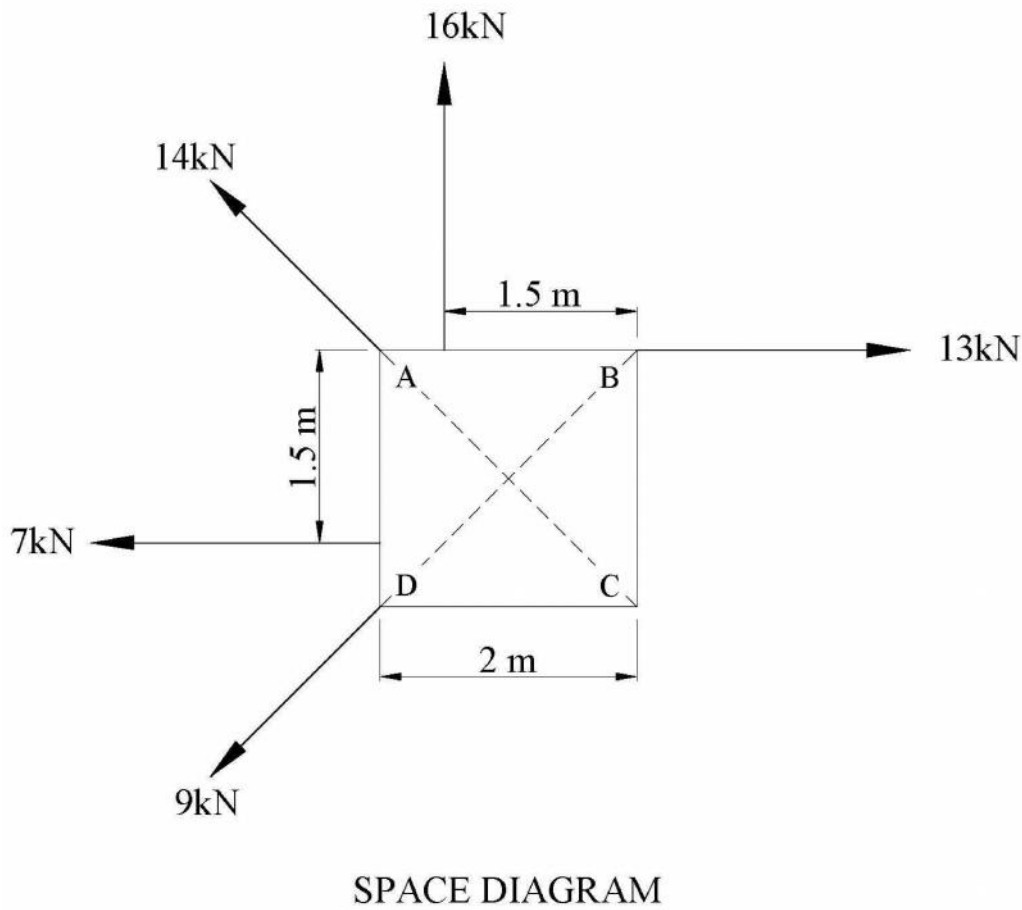
(13 marks)

16kN

14kN

1.5 m

13kN

A   B

1.5 m

7kN

D   C

2 m

9kN

SPACE DIAGRAM

FIG. 4

Question 5

A sphere of 70mm diameter is in mutual contact with a larger sphere of 100mm diameter, both solids resting on the same horizontal plane, as shown in Figure 5. A right cone 100mm diameter and 130mm high has its base resting on the horizontal plane and is to be placed in contact with the two spheres.
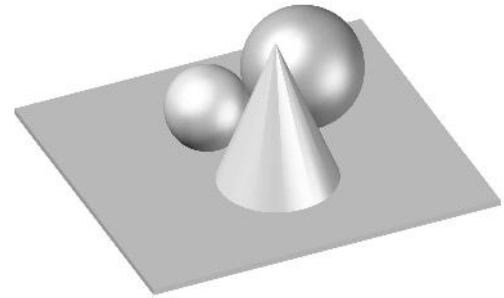
 a) Draw, full size, the front elevation and plan of the two spheres showing the points of contact between the two geometrical solids.
 b) Place the right cone in mutual contact with both spheres, showing the construction of how the points of contact in both views are found.
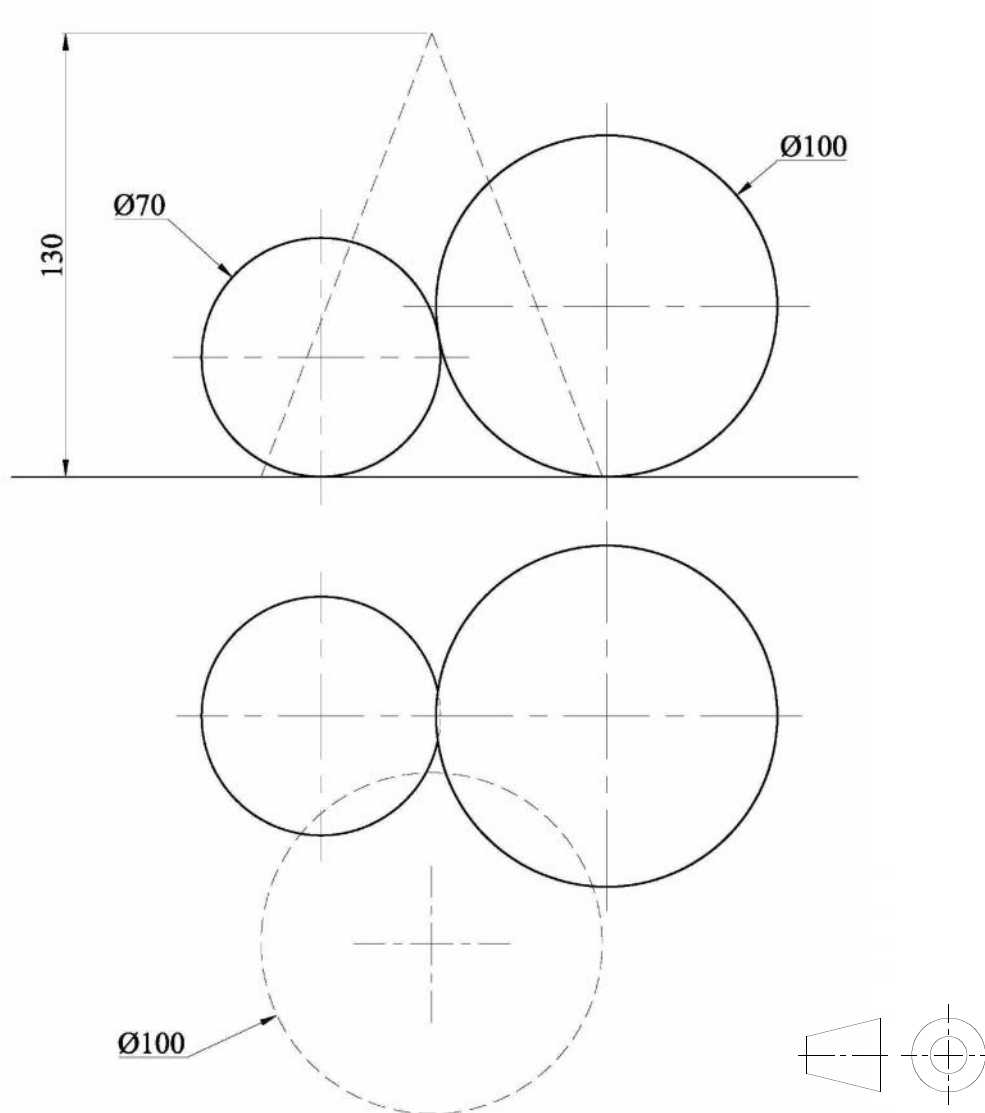
Show all hidden detail.

(13 marks)

FIG. 5

SECTION B

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

Question 6

Details of the component parts of an ADJUSTABLE BEARING are shown on the attached A3 sheet. An exploded pictorial diagram of the separate parts is illustrated below. The component parts are represented in the sequence that they are to be assembled.

The 20mm diameter end of the POST (2) is inserted in a vertical position and rests into the 20mm diameter hole of the BASE PLATE (1). One post is to be fitted on the left of the base plate into the 20mm diameter hole. A similar post is symmetrically positioned about the centre line. The BEARINGS (3) are fitted into the 80mm diameter hole of the BEARING BRACKET (4). The bearings and bearing body slide onto the vertical posts, through the 26mm diameter holes of the bearing bracket. The bearing body is adjusted at the required position and secured in place by means of two M18 bolts (not shown).

Draw, FULL SIZE, a sectional elevation of the assembled parts, including the M18 bolts. The plane of the section and the direction of viewing is indicated by X-X:

Notes:
    i)   The centre of the bearing is to be drawn 220mm above the lowest point of the base body.
    ii) Omit all hidden details.
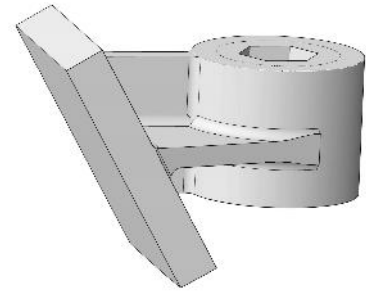   iii) Hatching lines can be widely spaced but all sections which require hatching must be fully hatched

(24 marks)
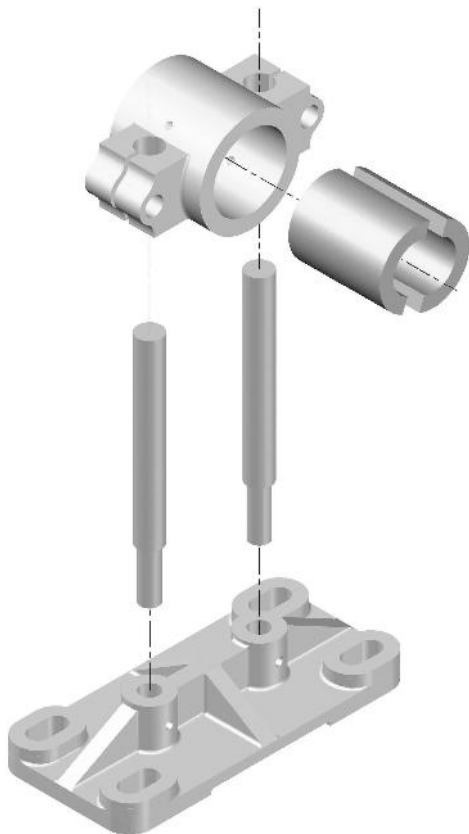
EXPLODED VIEW OF THE COMPONENT
PARTS OF THE ADJUSTABLE BEARING

Question 7

The illustration shows a bracket which slides vertically upwards and downwards as required. The hexagonal hole is machined so that the bracket fits onto a hexagonal bar and secured at a specific position. Figure 7 shows the front elevation and plan of the bracket.
Draw, full size, an isometric view of the bracket.
Notes:
 - *Place point P the lowest point of the drawing.*
 - *Omit hidden detail.*
 - *Isometric scale is not required.*
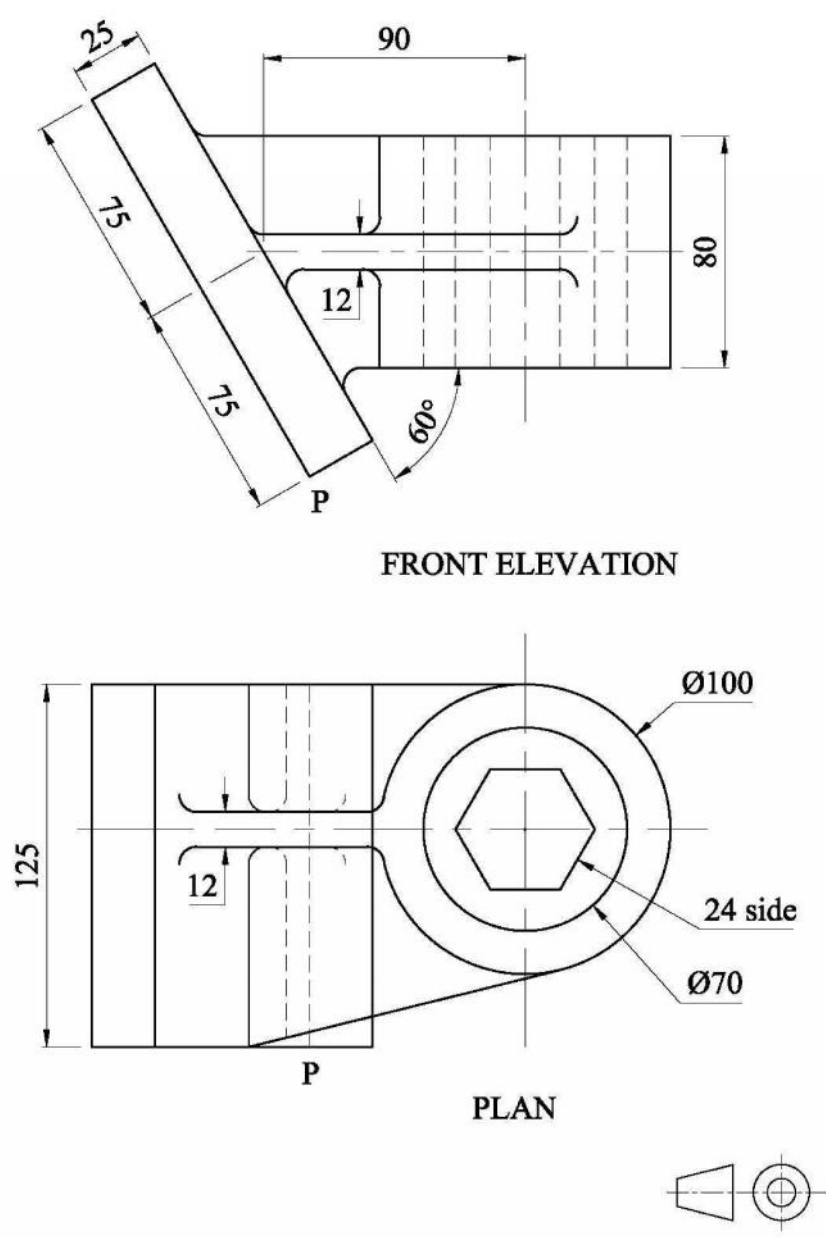
(24 marks)

FRONT ELEVATION

PLAN

FIG. 7

SECTION C

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

Question 8

Most adolescents, who spend hours in front of their computer, are unaware that bad posture over long periods of time causes muscle fatigue which can eventually lead to muscle pain and injury. Figure 8 (below) illustrates that inadequate posture can cause a lot of distress in a number of different parts of the body.

Design brief

Design a poster to suggest that **GOOD COMPUTER POSTURE** will increase comfort and efficiency.

You may use the given figure but the workplace has to be ergonomically optimized. Particular attention is to be paid to the height of the monitor in relation to the eye level, the knee angle, the elbow angle, the seat back angle, the lower back and the arms support, adjustable furniture and footstool, if necessary.

Your work must be broken down in four steps (a, b, c and d) with each part clearly identified.

a) **Written analysis**
   After analysing the given figure, identify the main areas that you intend to improve and write keywords and short phrases to suggest possible changes.

b) **Graphical analysis**
   Based on your response to (a), produce a series of sketches of the required modifications.

c) **Graphical synthesis**
   Clearly identify those elements produced in your response to (b) that you intend to use in your final image.

d) **Final realization**
   Produce your final solution in a rectangle 150 mm x 210 mm. **Neatly** render the poster.
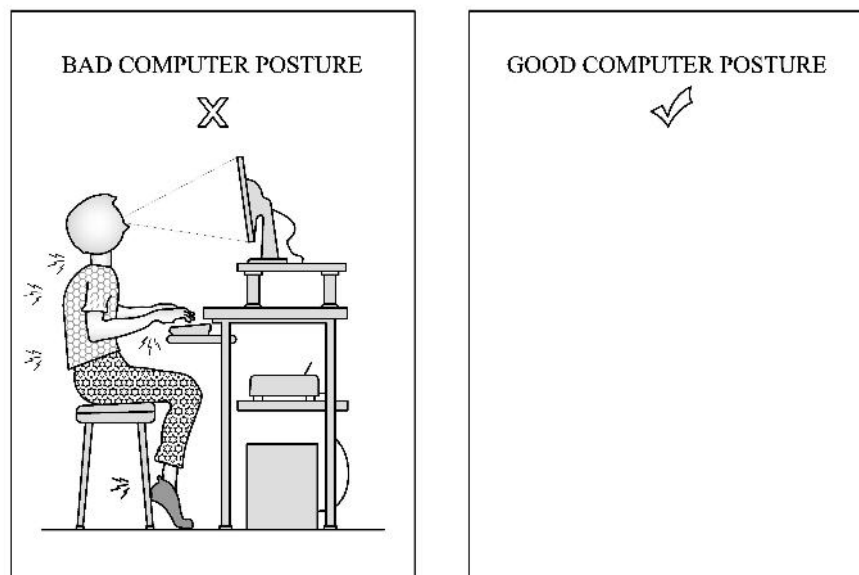
(24 marks)

FIG. 8

Question 9

The corner of a living area is the be converted into a home office. The front view and the plan of the suggested conversion are shown in Figure 9b. The floor area allocated for the conversion measures 10 tiles x 10 tiles and the height of the room is 8 courses. The dimensions of the square tiles and the height of the courses are equal.

The proposed furniture consists of:

- one drafting desk 'A';
- one photocopier stand 'B';
- one computer desk 'C';
- one cork board 'D'

Details of the furniture are given below, in Figure 9a.

Using an appropriate scale, produce an **estimated two-point perspective view** of the room corner.

Notes:
- *The viewing direction is indicated by the large arrows at the bottom of Figure 9b.*
- *It is suggested that the vanishing points are to be set on the mid-points of the vertical border lines of your drawing paper.*
- *It is also suggested that the eye-level will be set on the middle height of the room.*
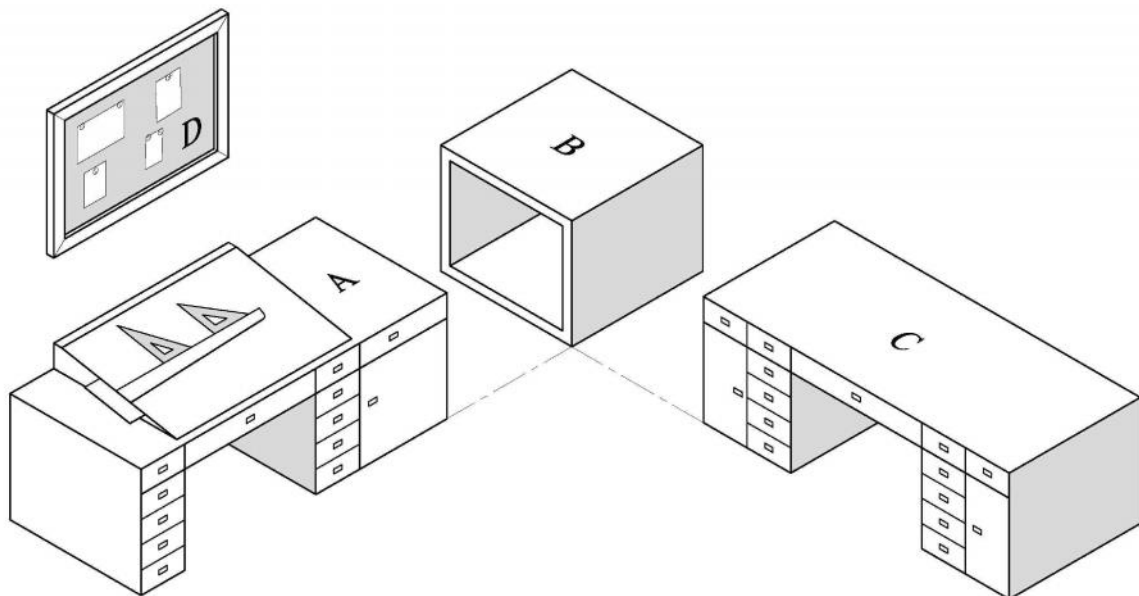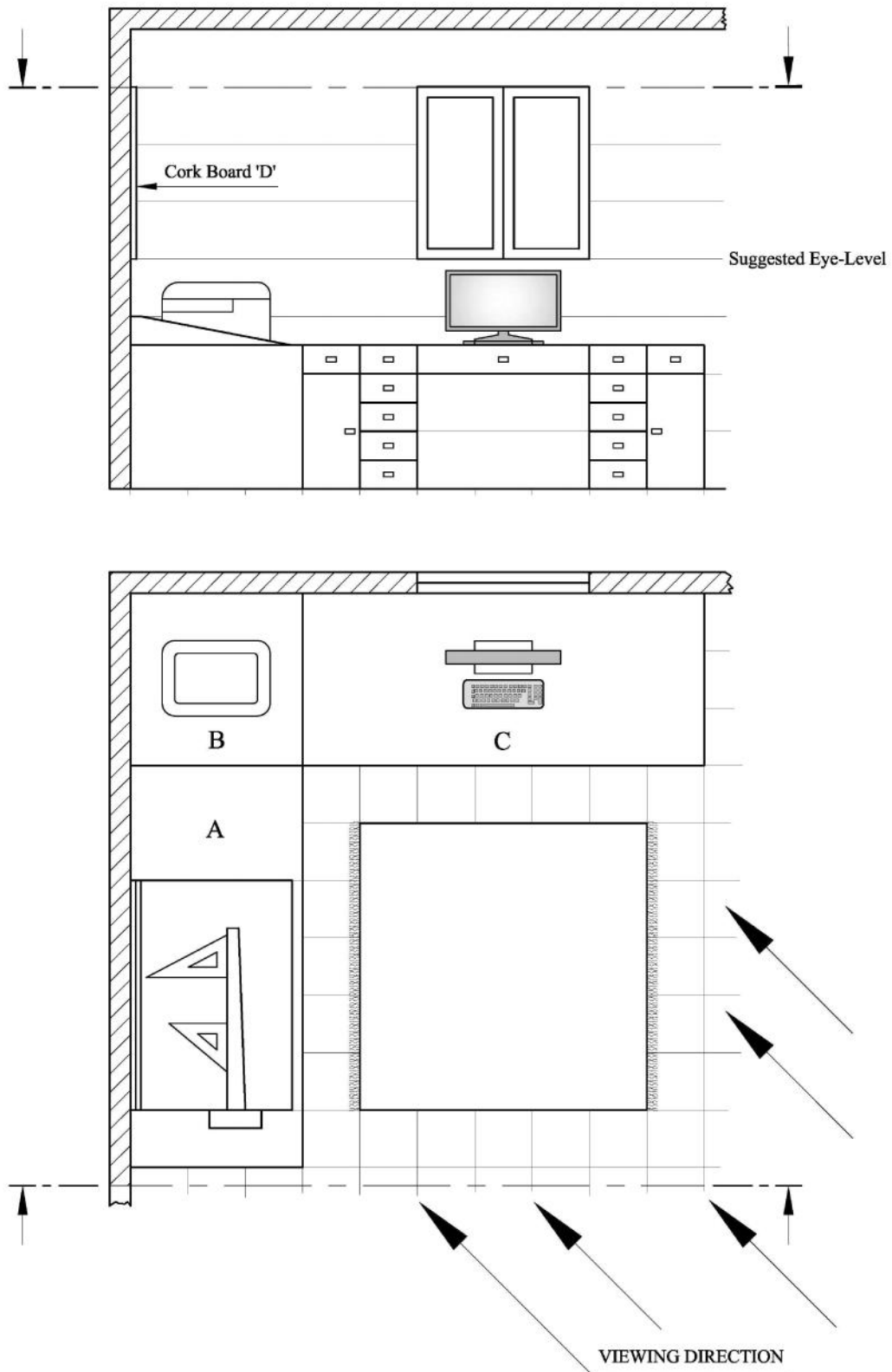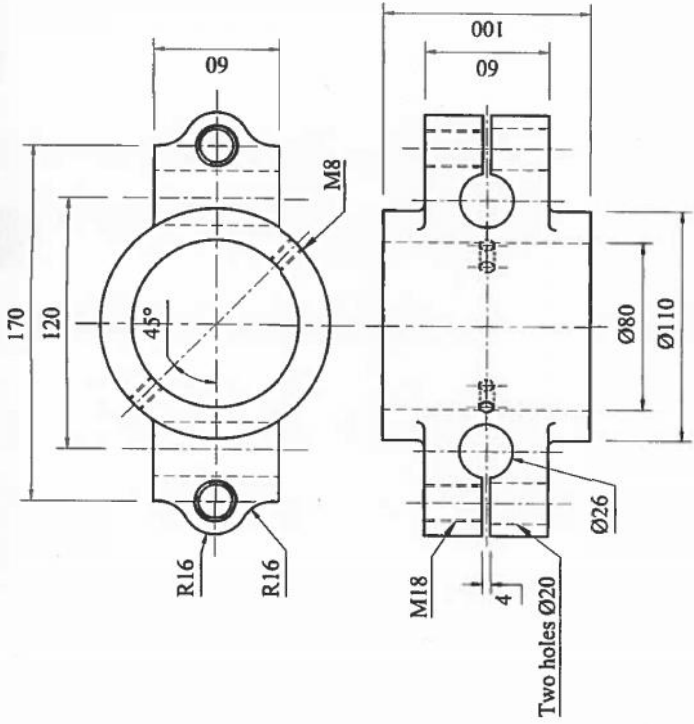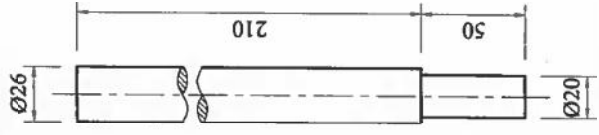- *Render your drawing to enhance the solution.*

(24 marks)

FIG. 9a

Cork Board 'D'

Suggested Eye-Level

B

C

A

VIEWING DIRECTION

FIG. 9b

PART 3
HALF ROUND BEARING
2 - OFF

Ø40

100

PART 2
POST
2 - OFF

Ø26
210
50
Ø20

ALL FILLET RADII 3mm

PART 4
BEARING BRACKET
1 - OFF

09
170
120
45°
R16
R16
M8

100
09
Ø80
Ø110
M18
4
Two holes Ø20
Ø26

PART 1
BASE PLATE
1 - OFF

25
16
Ø20
M8
5
5
120
130
Ø44
20
R23
R10
X
X

146
100
X
16
310
60
09