MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

UNIVERSITY OF MALTA, MSIDA

MATRICULATION EXAMINATION
INTERMEDIATE LEVEL
SEPTEMBER 2013

SUBJECT:	ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION
DATE:	7th September 2013
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.

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;
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

Two triangles, the plan and an incomplete elevation of a screw conveyor which flows from A B to $A_1 B_1$ in the form of a surface helix is shown in Figure 1. The outer edge of the screw follows a 30º helix angle and the inner edge follows a 60º helix angle.
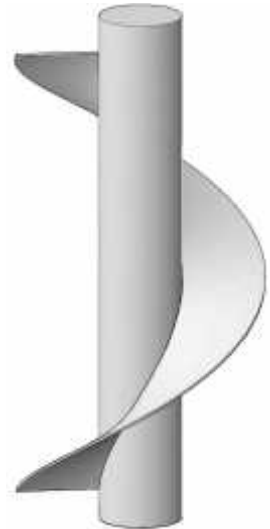
a)   The hypotenuse A A_1 of the right angled triangle A A_1 O represents the outer edge of the screw. Copy this triangle to determine the distance A A_1.   Write down the technical term for this distance and state its length. Copy the plan and elevation and construct the outer edge of the helix from A to A_1.

b)   Draw the other right angle triangle B B_1 O with the helix angle 60º and determine the diameter of the conveyor screw shaft.
Construct the inner edge of the helix from B to B_1.

c)   Complete the elevation of the screw conveyor by drawing the shaft.

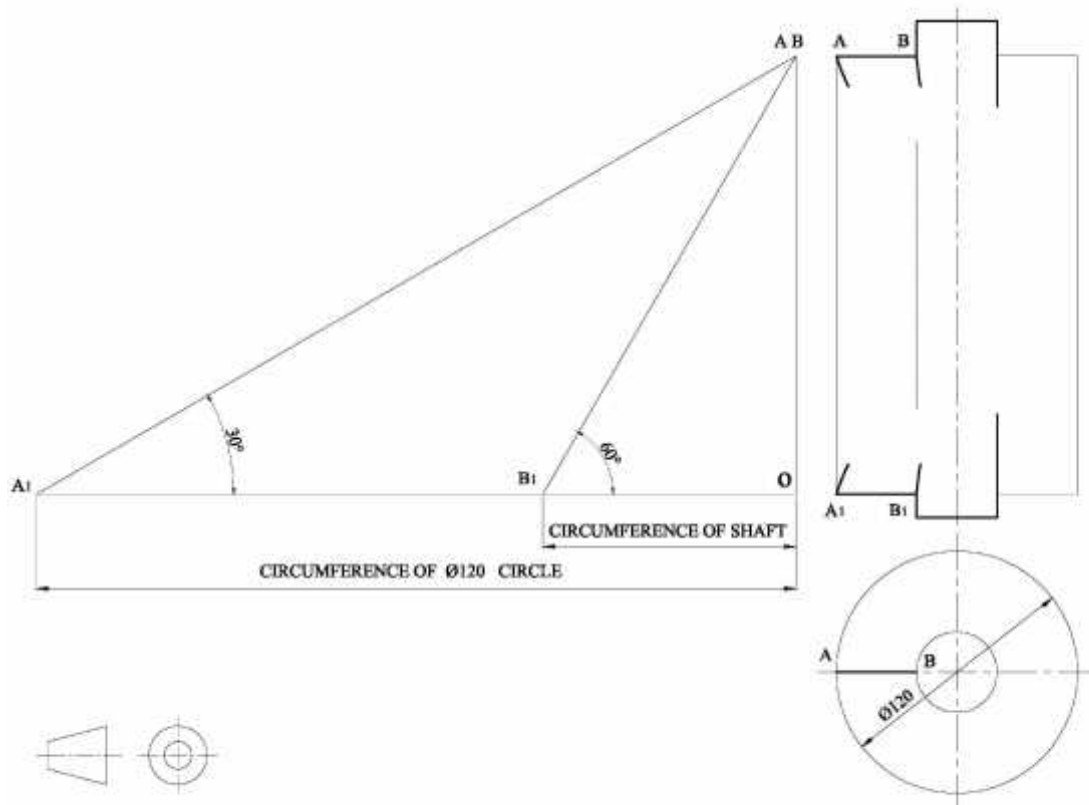*Show hidden detail and neglect the thickness of metal.*

(13 marks)

FIG. 1

Question 2

The free flowing curves represented on the right, are used as a monogram for a renowned old firm. They symbolize the letters V and A.

On analyzing and studying the monogram, a conversant student studying geometrical drawing will immediately associate the right-hand part of the curve with the construction of a particular cycloidal curve.

Trace the locus of the point P situated on the circumference of the 85 mm radius circle. The 90 mm diameter circle rolls on the inside of a larger circle 270 mm diameter for one and half of revolution, without slipping.

Construct the cycloidal curve by using the dimensions shown in Figure 2. Write down the technical term used for this curve.
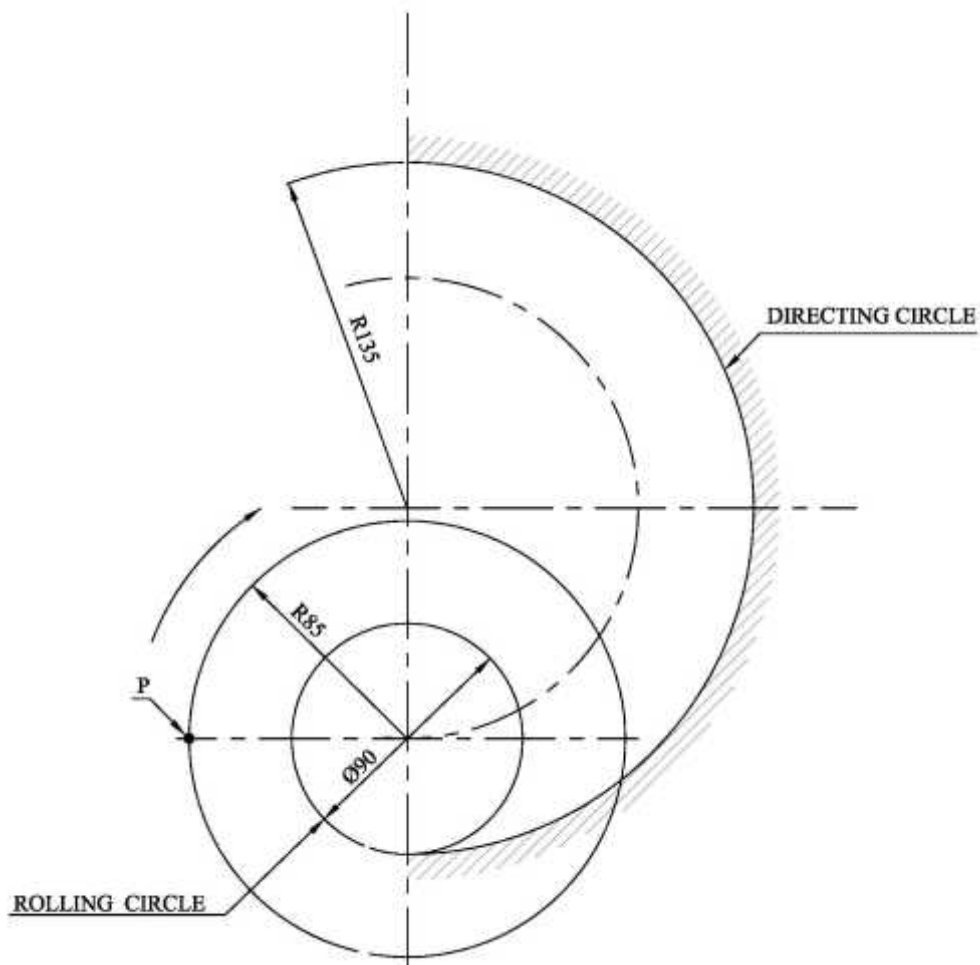
(13 marks)

FIG. 2

Question 3

A right pentagonal prism ducting is to be connected to a right square prism by means of a transition piece. An orthographic projection of the transition piece is shown in Figure 3.

a) Copy, full size, the given views.
b) Construct neatly and accurately the necessary true lengths required to be able to design a pattern for the transition piece.
c) Using the triangulation method, construct a half surface development of the transition piece.

Proper line types must be used, distinguishing between outlines and folding lines.

(13 marks)
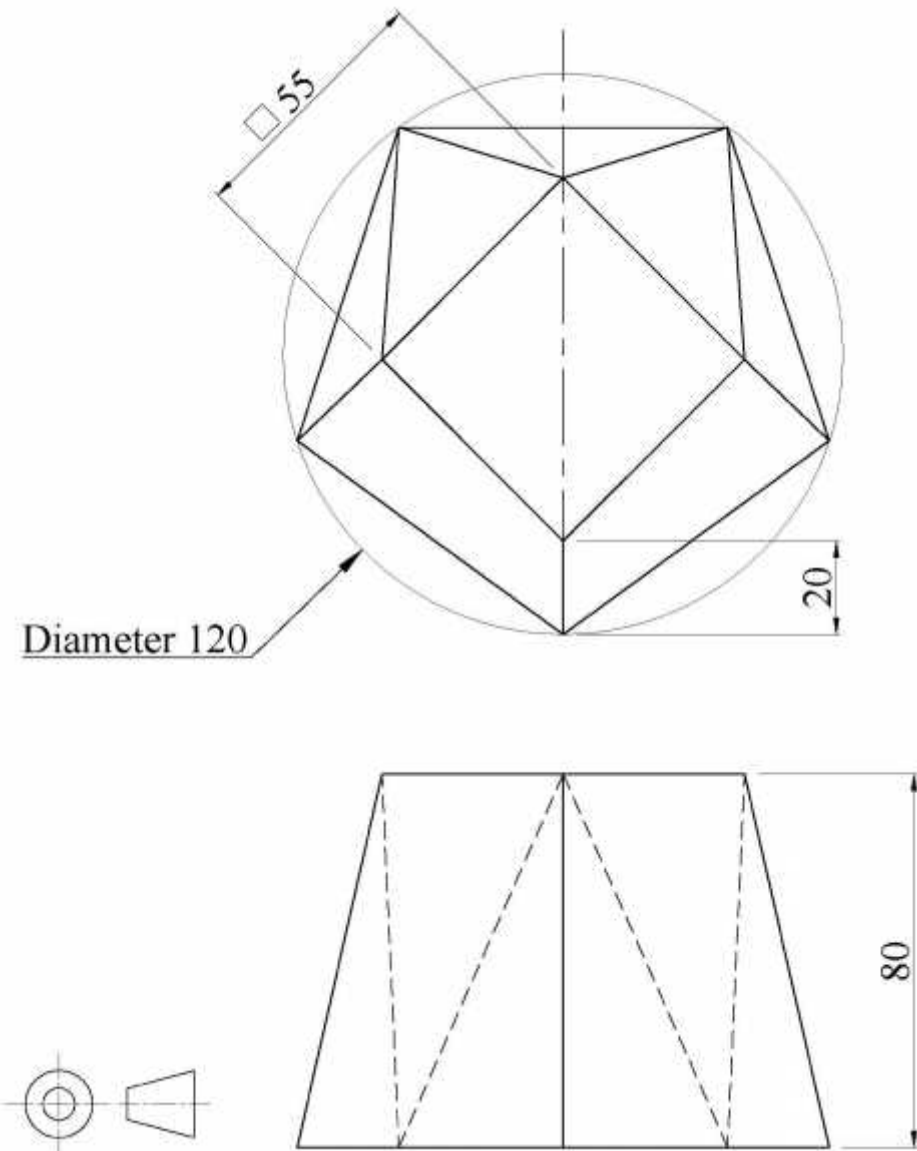

□55

Diameter 120

20

80

FIG. 3

Question 4

A fence surrounding a field is made up of timber vertical posts and horizontal rails. The vertical posts are triangular in shape with pointed tops. Horizontal rails, square in section are joined to the vertical posts.

a) Copy, full size the views shown in Figure 4.

b) Complete the front elevation and the plan by determining the intersection of the square prism with the irregular triangular pyramid.
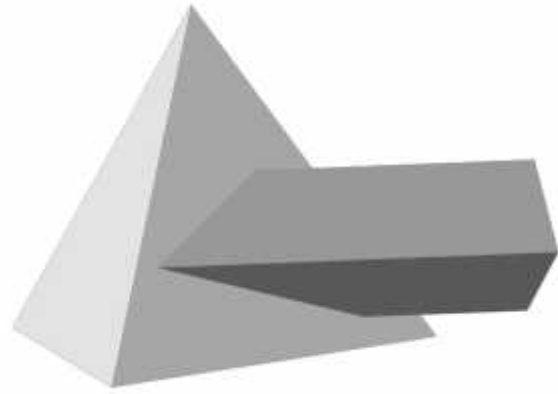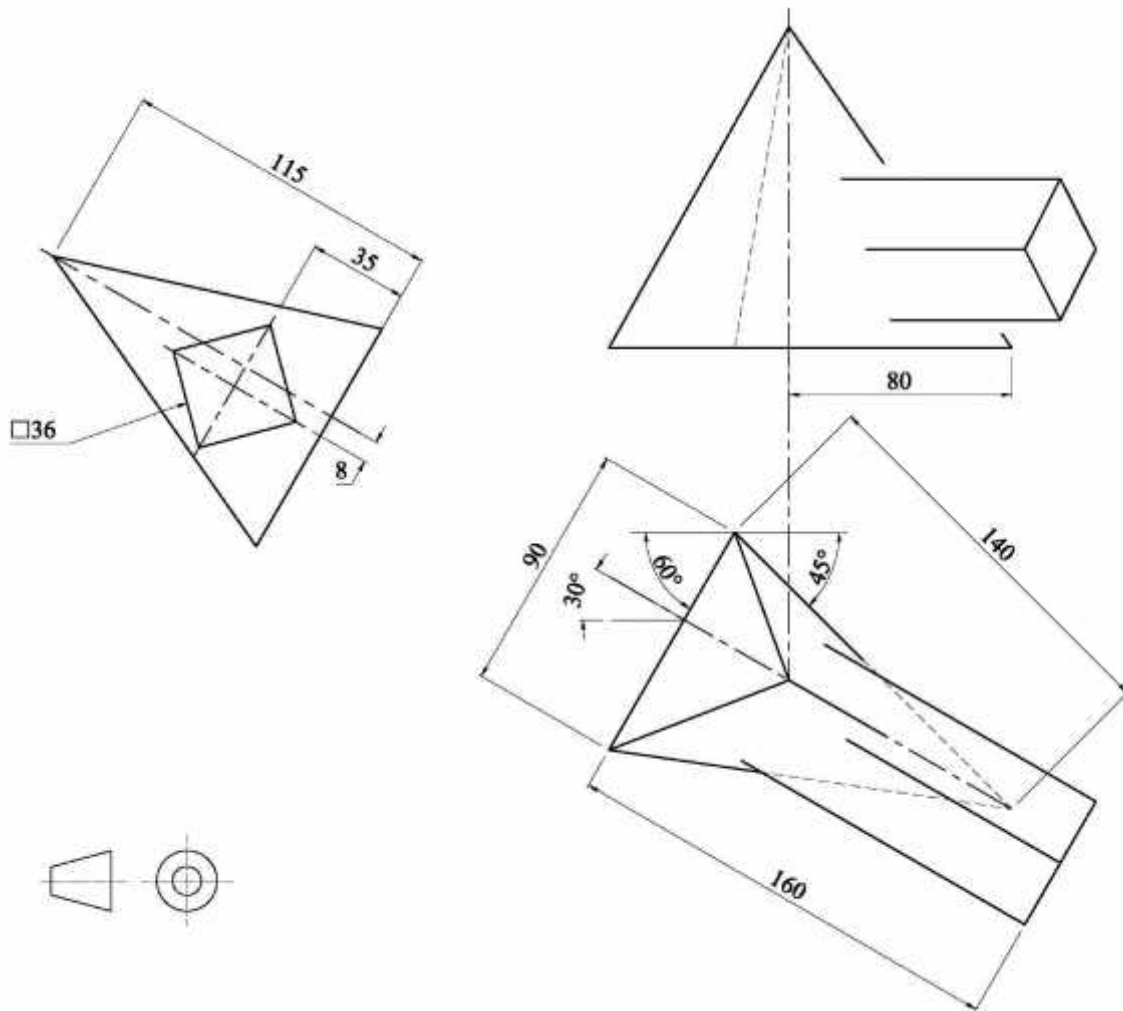
Show hidden detail.

(13 marks)

FIG. 4

Question 5

Figure 5 shows a vertical post subjected to pulls from four cables. All forces are in one plane.
- a) To a scale of 20 mm representing 1 meter, copy the space diagram.
- b) Draw a force polygon to find the magnitude, direction and position of the resultant pull. Use a scale of 20 mm representing 1kN.
- c) Draw a polar diagram to determine the position of the resultant and show the position of the resultant on the space diagram. State the angle to the H.P.
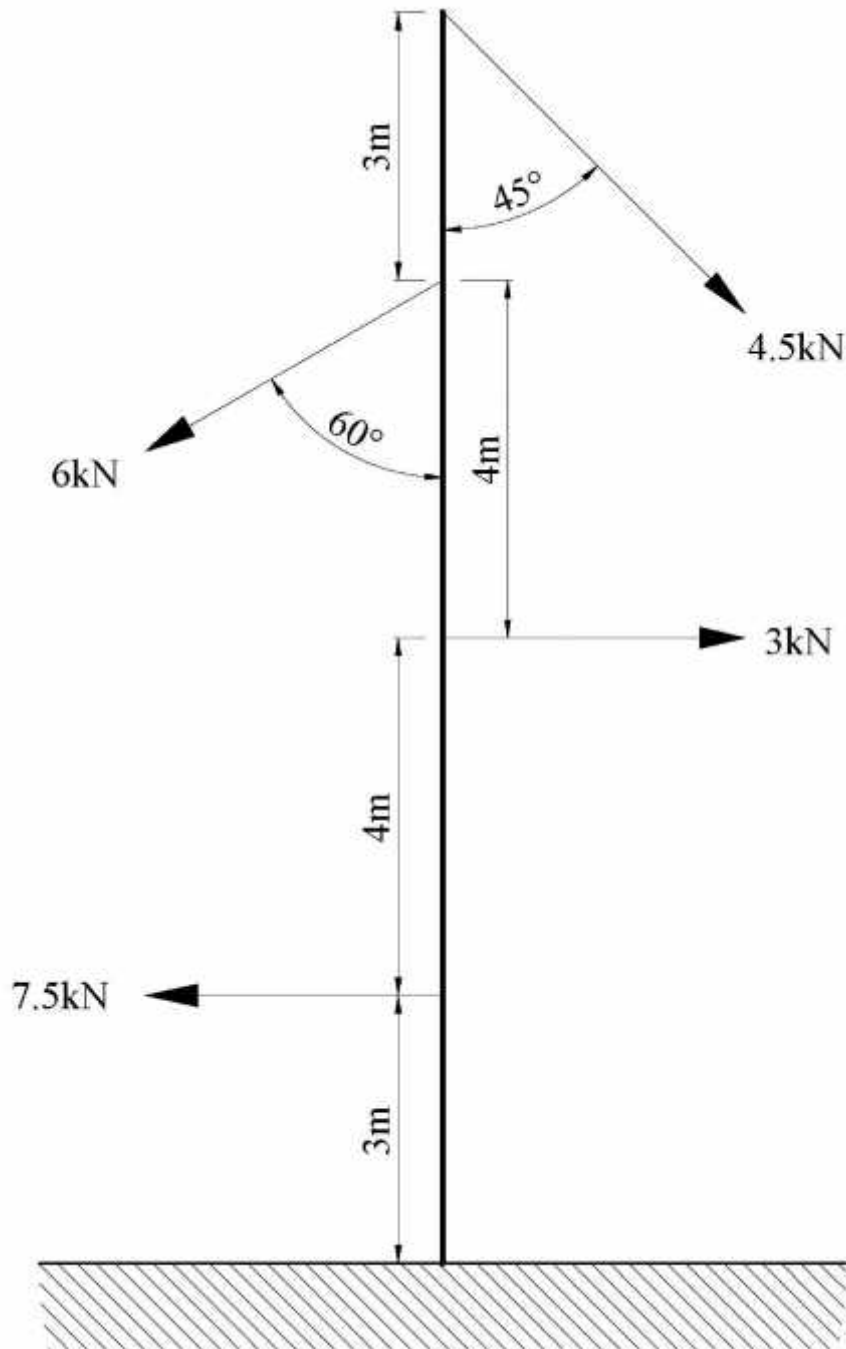
(13 marks)

FIG. 5

SECTION B

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

Question 6

Figure 6b and 6c on the attached A3 sheet show the details of the component parts of a ROLLER BRACKET. An exploded pictorial diagram of the separate parts is illustrated in Figure 6a below. The 100 mm by 60 mm outside diameter of the bush is fitted into the 60 mm diameter bore of the roller. The spindle is partially inserted through the 50 mm diameter bore of the bracket and the roller with the fitted bush is fitted on the 50 mm diameter shank of the spindle. The other end of the spindle is then pushed in the other 36 mm diameter bore of the bracket. These components are then secured in position by means of a washer and an M30 hexagonal nut.
Details of the washer and the nut are not shown in the figure.

Draw, FULL SIZE, in first angle orthographic projection;
a) a sectional front elevation of the assembled parts, looking in the direction of the section plane A-A. This view should show clearly the roller, bush and spindle in position, with the washer and nut fitted neatly on the end of the spindle.
b) a half end elevation in section, the cutting plane being indicated by B-B. The roller, bush and spindle are to be omitted completely in this view.

Notes:
- *Do not show hidden lines.*
- *Hatching lines can be widely spaced but all sections, which require hatching, must be fully hatched.*

(24 marks)
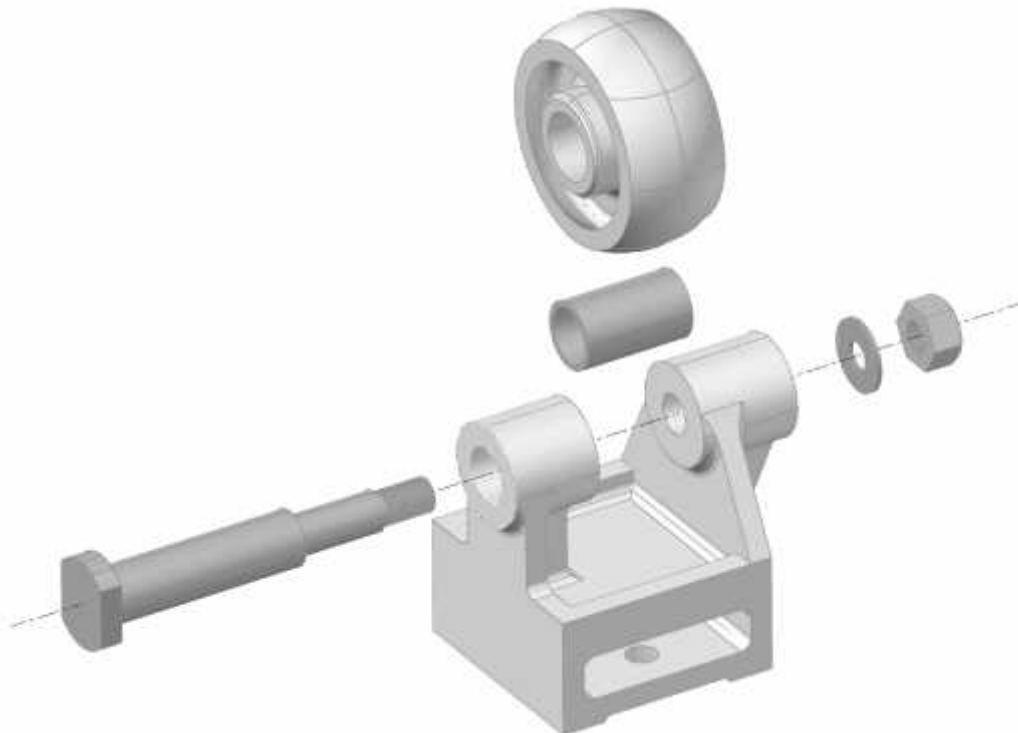
EXPLODED VIEW OF THE COMPONENT
FIG. 6a

Question 7

A pictorial view of a camshaft assembly is given in Figure 7a. Details of the camshaft, the camshaft bush, the cam follower and the follower bush are shown in Figure 7c.
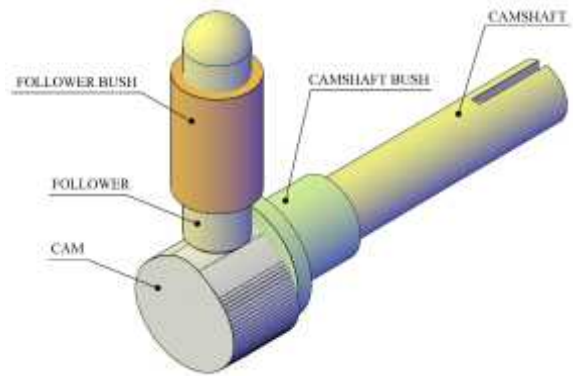
a) Draw a displacement diagram for the cam, rotating clockwise, using the data given below:

Cam Rotation	Follower Displacement
0° - 30°	Dwell
30° - 150°	Rise of 16mm with S.H.M.
150° - 210°	Dwell
210° - 330°	Fall of 16mm with S.H.M.
330° - 360°	Dwell

FIG. 7a

b) Construct the cam profile.
c) Draw an exploded isometric view of the:
   i) cam follower;
   ii) cam follower bush;
   iii) cam shaft;
   iv) cam shaft bush.

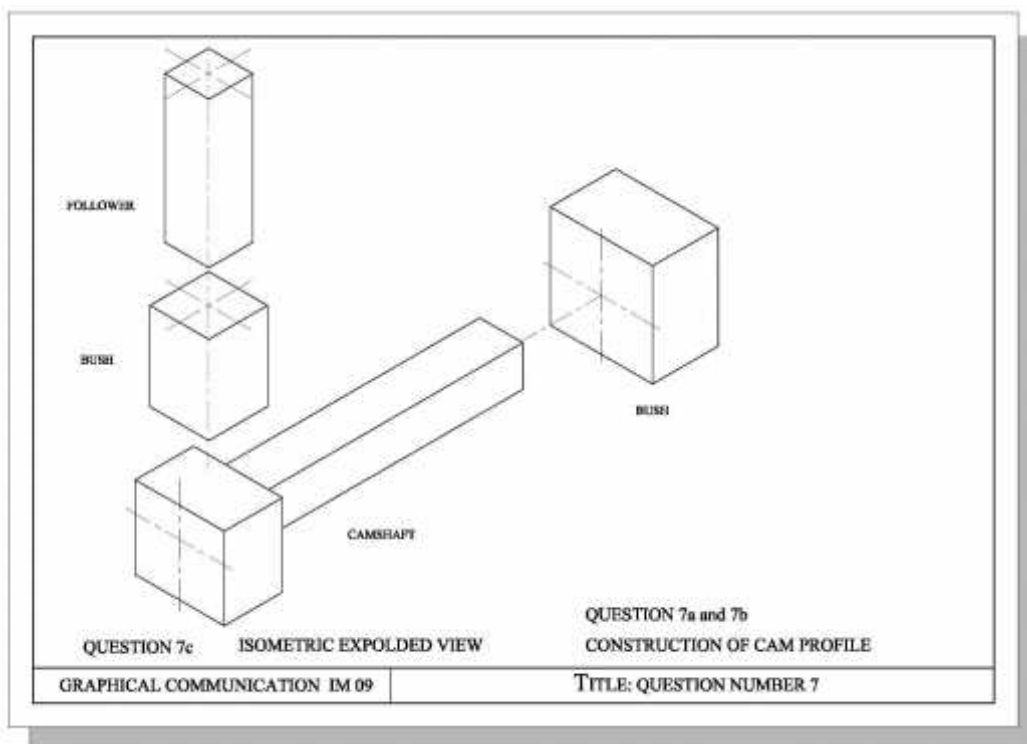*Note: The sequence of assembly and the proposed paper layout are indicated in Figure 7b.*

(**24 marks***)*

FIG.7b

40

30

R15

Ø30

20

36

CAMSHAFT

8   40

Ø40

Ø60

Ø30

220

CAMSHAFT BUSH

100

Ø26

Ø30
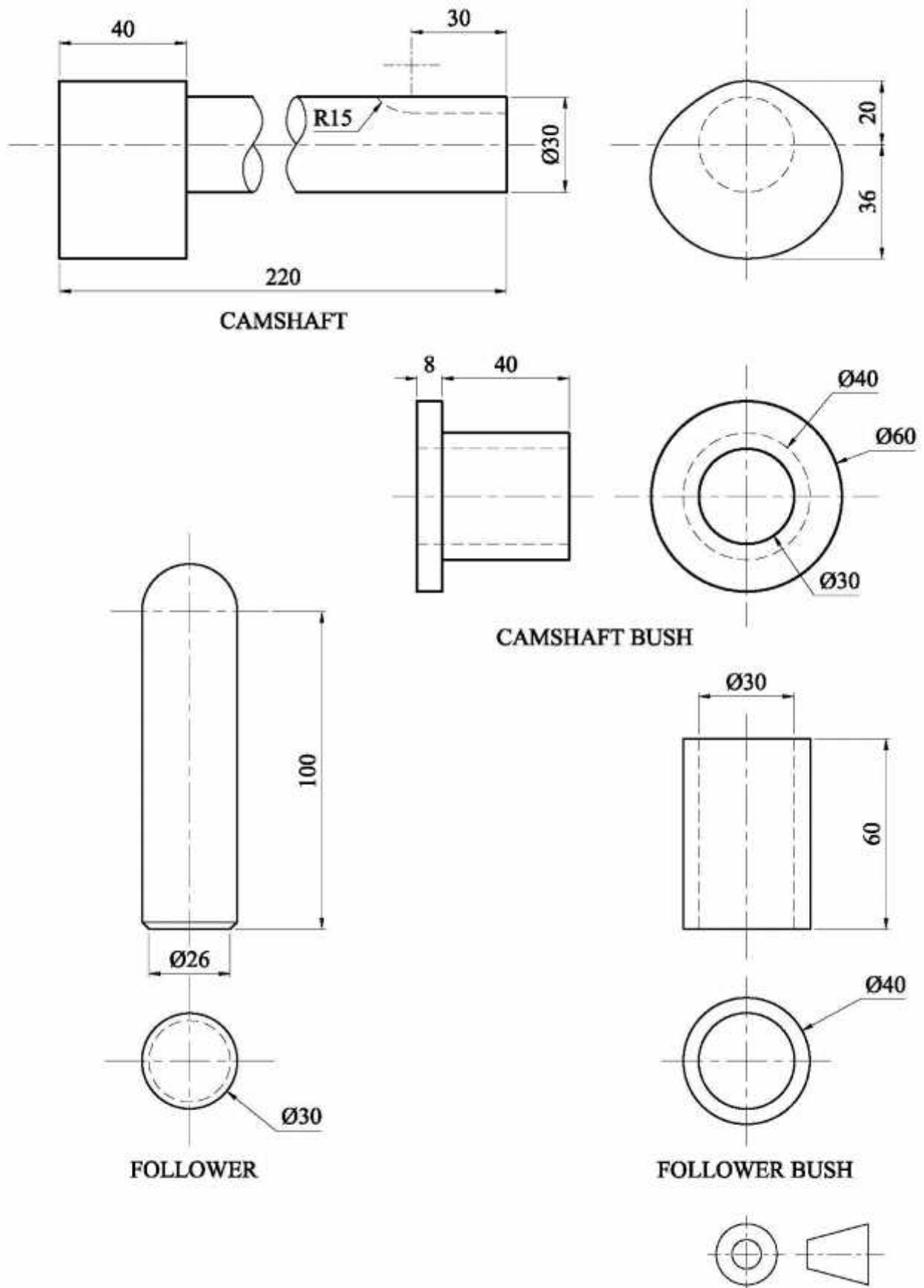
FOLLOWER

Ø30

60

Ø40

FOLLOWER BUSH

FIG. 7c

SECTION C

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

Question 8

The front view and the plan of a **Kids' Indoor Swimming Pool** are shown in Figure 8b. The scaled down measurements of the pool area, which forms part of a sports complex, are 490 mm x 490 mm x 280 mm high (from floor to ceiling). The floor tiles dimensions are 35 mm x 35 mm and the height of the courses is 35 mm.

The following information is intended to help you visualise the site.

- The pool, situated almost in the centre of the area is filled with water as indicated.
- The skylight, which consists of four rectangular polycarbonate transparent panels mounted on an extruded aluminium frame, has the same size of the pool and is situated directly above it.
- The first step which leads into the pool, has a rectangular shape and is recessed. The remaining steps have a segmental shape; however, these will not be visible in your drawing since they happen to be below the water level.
- Four concrete benches are situated beneath the side windows.

Details of one bench and the skylight are given in Figure 8a.

On an A2 drawing paper, produce an estimated single point perspective view of the pool area. The viewing position is indicated by arrows and the suggested vanishing point is indicated in Figure 8b.

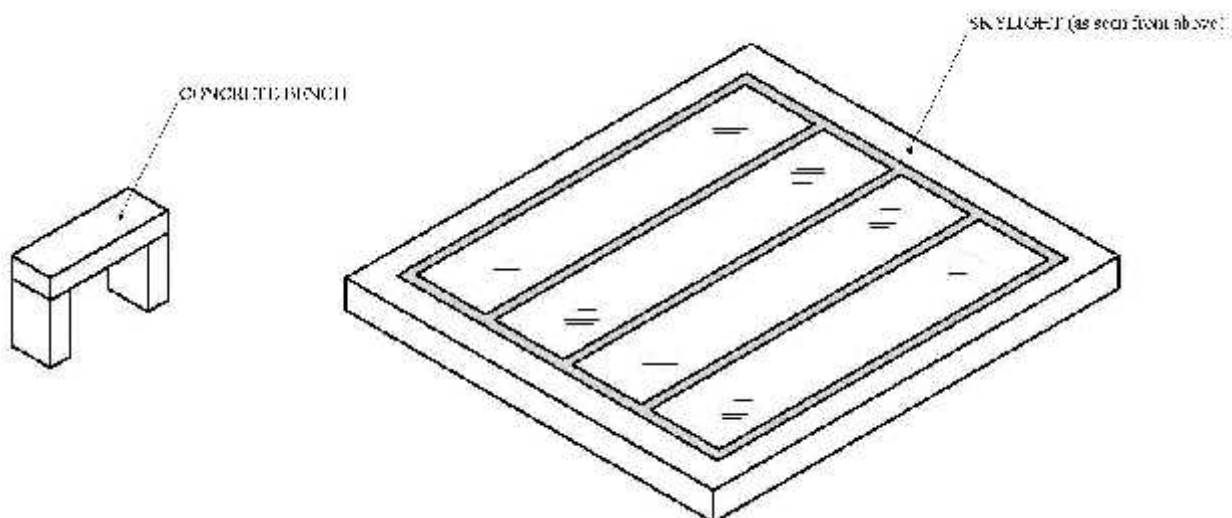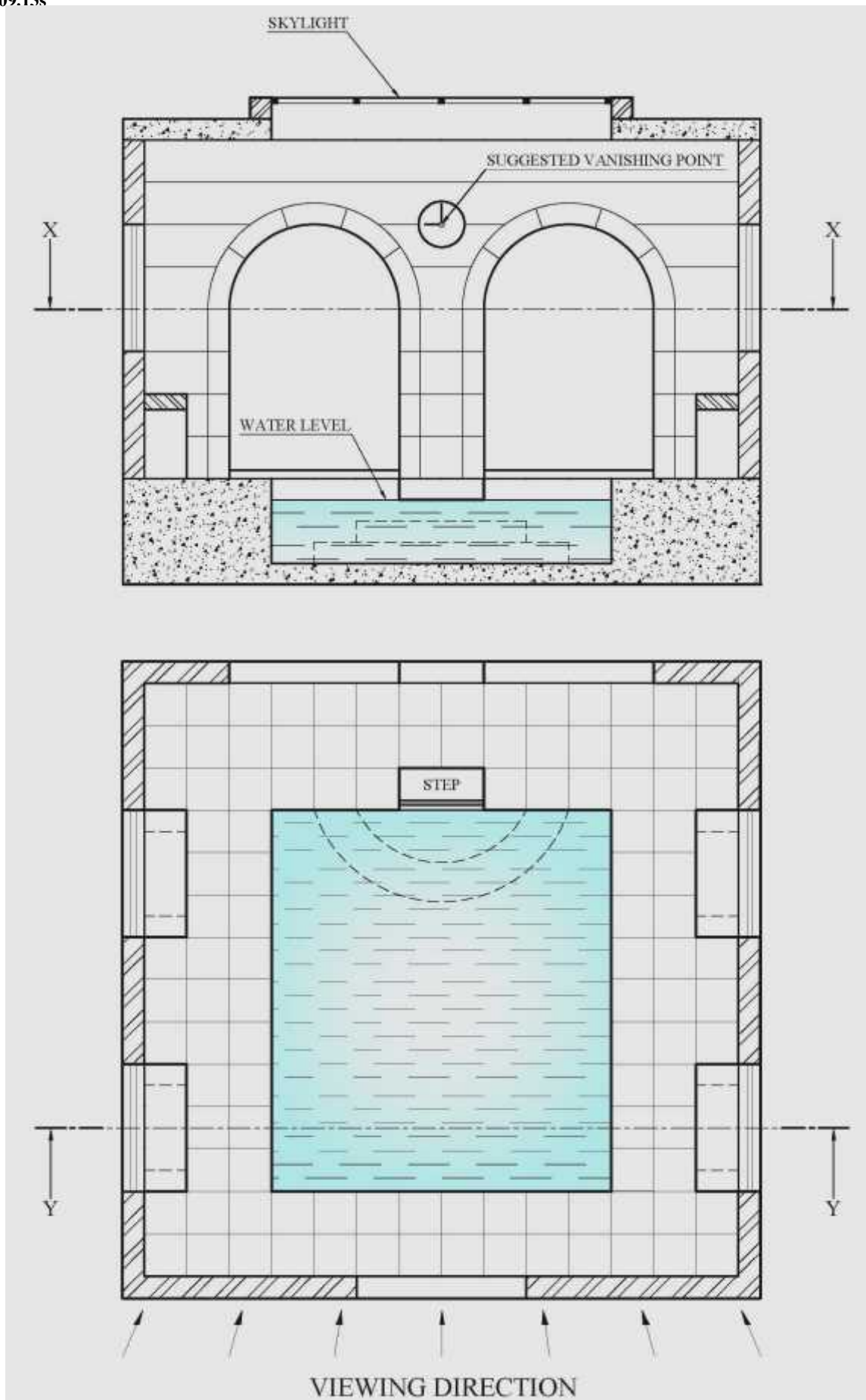Render your drawing to enhance your solution.

(24 marks)

FIG. 8a

FIG. 8b

Question 9

POOL SERVICES, a new swimming pool service and maintenance company, requires a logo to give a visual representation of the company brand. The following is an excerpt from their design brief:

"We are looking for a logo for our new company which does swimming pool service, maintenance, repairs, remodelling, and leak detection. We would like something that is distinctive from a distance, so even if people just get a glance of our truck going by, they will know from the general shape, or colours, or layout, that it is of our company. The logo should somehow indicate that we work on pools. We are open to different fonts for the company name, but we need the font to be legible and prominent so people can recognise it quickly. Colours from the cool group are preferred. We intend to use the chosen logo on business cards, letterheads, brochures, online advertising, mugs, T-shirts, billboards, truck panels etc."

You have decided to submit your design. Your work is to be broken down in four steps (a, b, c and d) with each part clearly identified as indicated in Figure 9.

a) **Written analysis**
   Write a list of words or short phrases to describe elements, such as graphic symbols, the fonts or typeface and the colour palette that you intend to include in the logo design.

b) **Graphical analysis**
   Based on your response to (a), produce a series of sketches to illustrate your developing ideas of the logo composition including the fonts.

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 200mm x 200mm. **Neatly** render the logo.

(24 marks)

FIG. 9