Pre-Leaving Certificate Examination, 2011

Design & Communication Graphics
Higher Level
Section A *(60 Marks)*

Time: 3 Hours

This examination is divided into three sections:

SECTION A   (Core - Short Questions)
SECTION B   (Core - Long Questions)
SECTION C   (Applied Graphics - Long Questions)

SECTION A
- Four questions are presented.
- Answer **any three** on the A3 sheet overleaf.
- All questions in Section A carry **20 marks** each.

SECTION B
- Three questions are presented.
- Answer **any two** on drawing paper.
- All questions in Section B carry **45 marks** each.

SECTION C
- Five questions are presented.
- Answer **any two** (i.e. the options you have studied) on drawing paper.
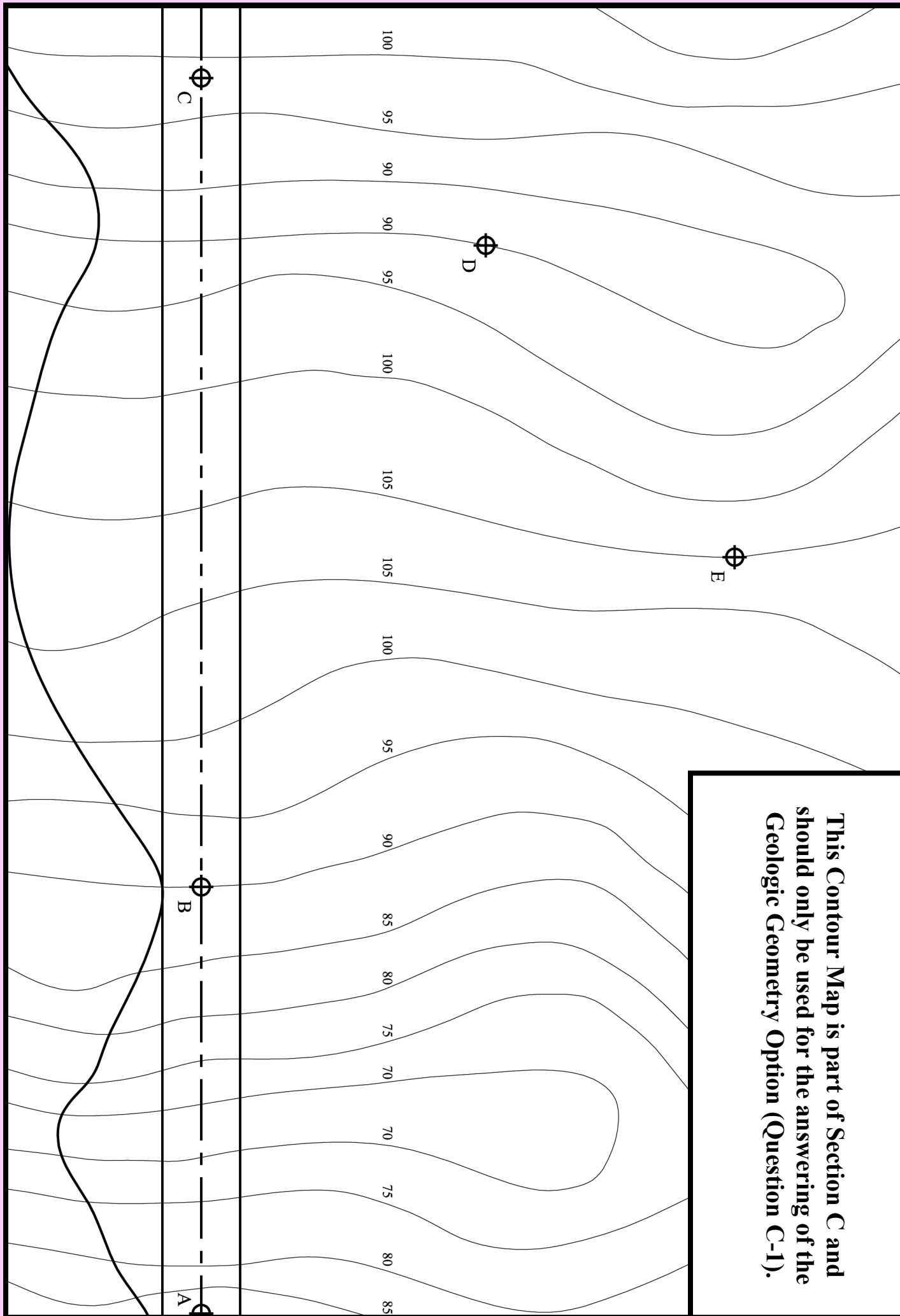- All questions in Section C carry **45 marks** each.

General Instructions:
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your name, school name and teacher name in the box below and on all other sheets used.*

Name:

School Name:

Teacher Name:

Page 1 of 3

This Contour Map is part of Section C and should only be used for the answering of the Geologic Geometry Option (Question C-1).

A-1. The drawing on the right shows the plan and elevation of a hemisphere. A point P on the front of the hemisphere is shown in the elevation.

A 3D graphic is also given below.

(a) Locate point P in plan and draw the projections of a sphere which rests on the horizontal plane and which touches the given sphere at point P.

(b) Determine the traces of the plane which is tangential to the two solids and is inclined at 45 degrees to horizontal plane.
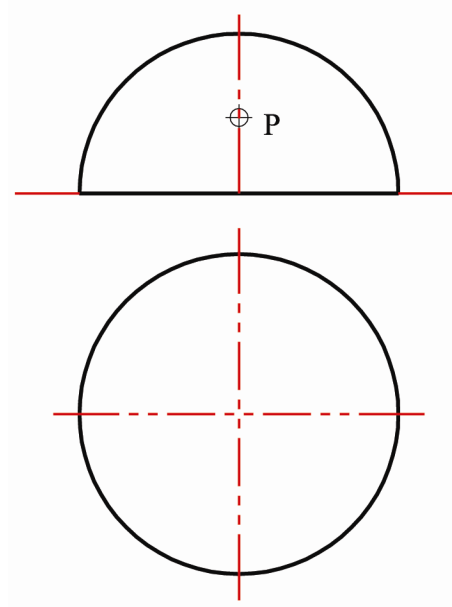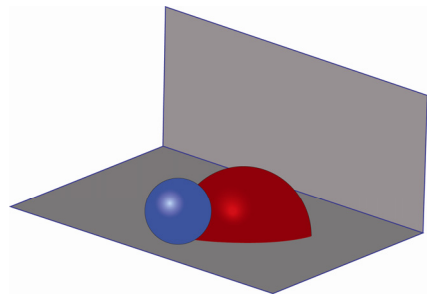
A-3. The 3D graphic below shows a litter bin.

The diagram on the right shows the elevation of the top section which is sectioned as shown. The true shape of the sloping section is elliptical.

(a) Use a focal sphere to find the focus, vertex and directrix of the elliptical section.

**(b)** Draw a portion of the ellipse.
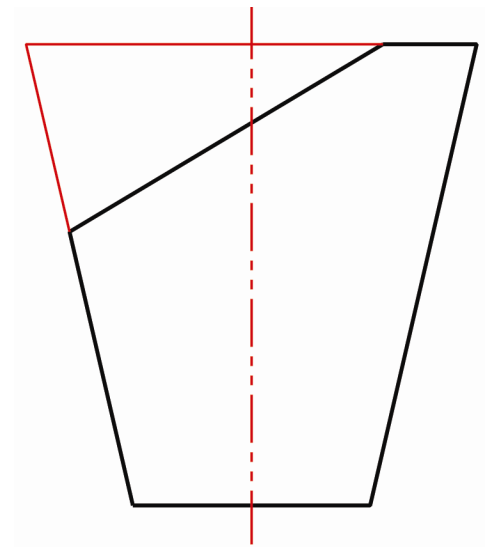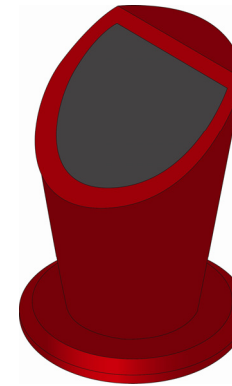
A-2. The 3D graphic below shows a triple pipe joint for a ventilation system.

It consists of two cylindrical portions extending from a conical portion and a cylindrical portion A intersecting with the conical portion.

The drawing on the right shows a partially completed elevation and plan of the joint.

Complete the elevation and plan to show how the cylindrical portion A intersects with the conical portion.
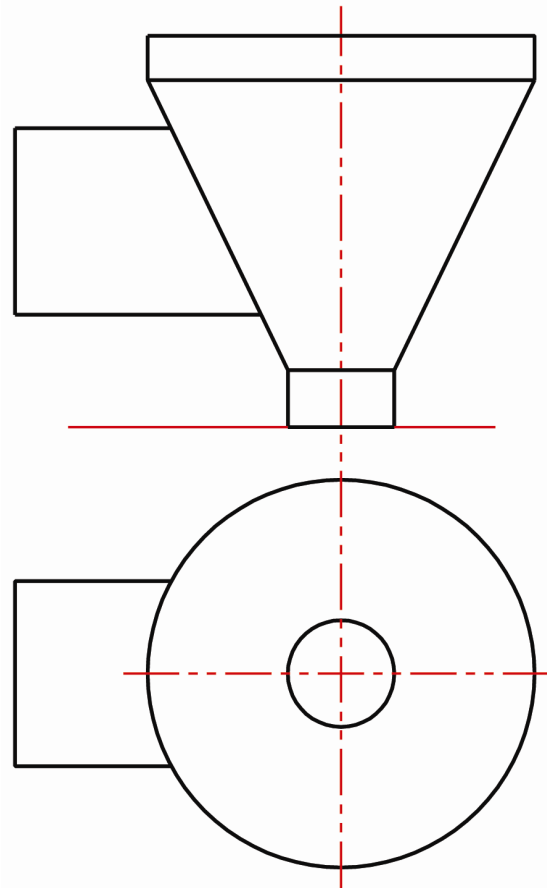
A-4. The 3D graphic below shows a table lamp.

The drawing on the right shows the elevation and plan of the lampshade.

Draw an auxiliary plan of the lampshade which will show the true shape of surface A.
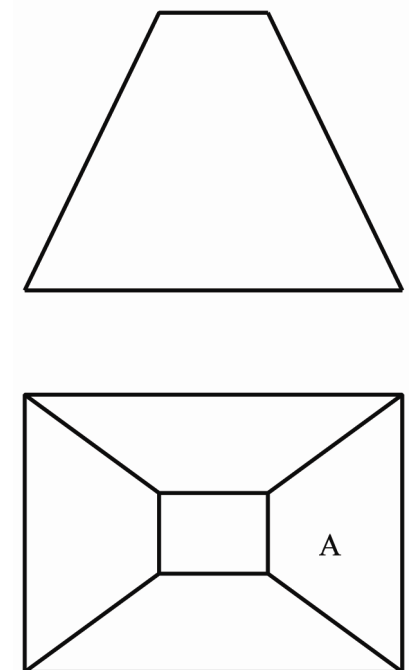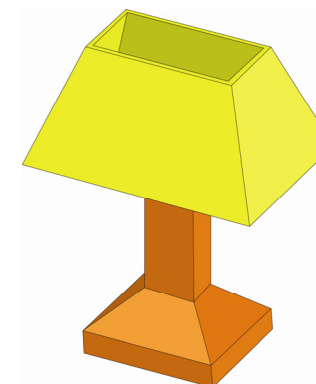
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Pre-Leaving Certificate Examination, 2011

Design & Communication Graphics
Higher Level
Section B and C (180 Marks)

Time: 3 Hours

This examination is divided into three sections:
SECTION A   (Core - Short Questions)
SECTION B   (Core - Long Questions)
SECTION C   (Applied Graphics - Long Questions)

SECTION A	• Four questions are presented. • Answer **any three** on the accompanying A3 examination paper. • All questions in Section A carry **20 marks** each.

SECTION B	• Three questions are presented. • Answer **any two** on drawing paper. • All questions in Section B carry **45 marks** each.

SECTION C	• Five questions are presented. • Answer **any two** (i.e. the options you have studied) on drawing paper. • All questions in Section C carry **45 marks** each.

General Instructions:
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your name, school name and teacher name in the box provided on Section A and on all other sheets used.*
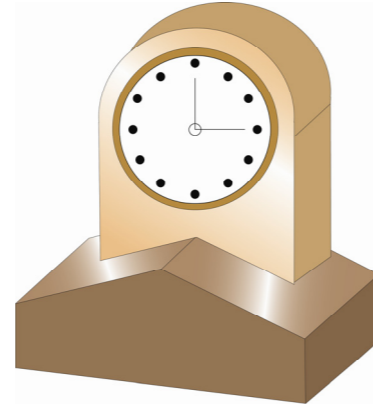
B-1. The 3D graphic on the right shows a mantelpiece clock.

Fig. B-1 below shows the plan and elevation of the clock. *(The details of the clock face may be ignored for the purpose of your drawing).*

Make a perspective drawing of the clock given the following:

- The picture plane passes through corner A
- The spectator S is 250mm from corner A
- The horizon line is 120mm above the ground line.

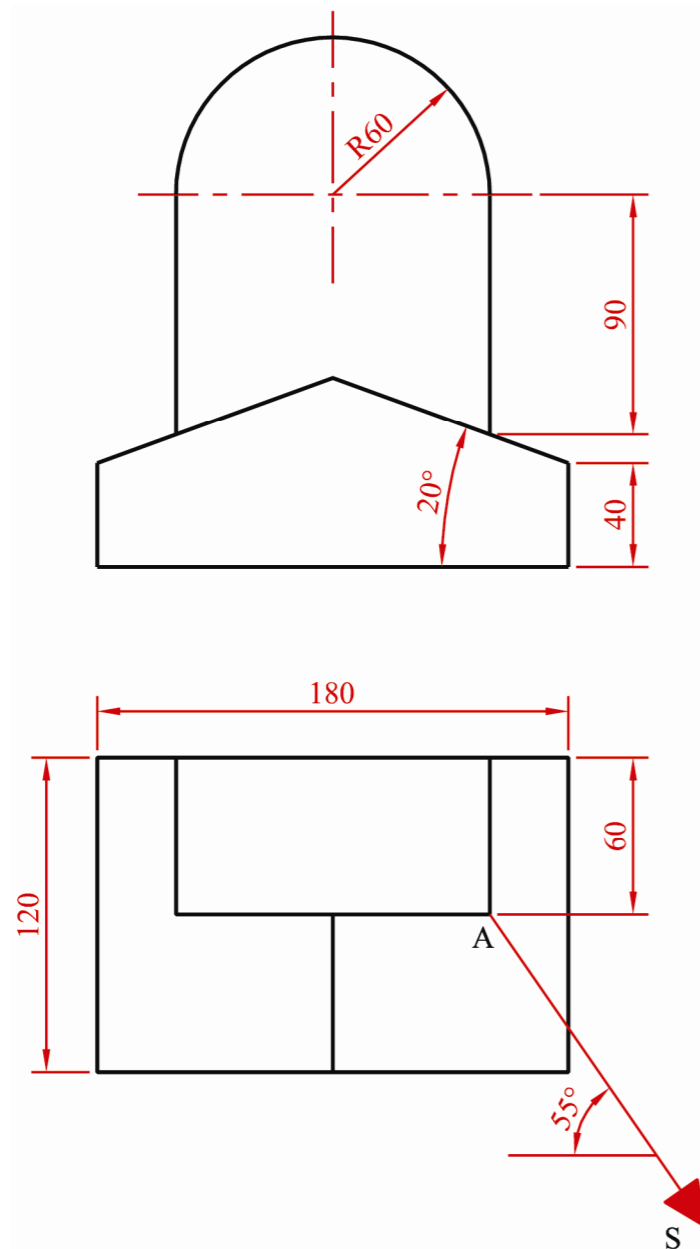*Use auxiliary vanishing points where appropriate.*

Scale 1:2

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R60

90

20°

40

180

60

120

A

55°

S

Fig. B-1

B-2. The 3D graphic on the right shows a square based litter bin with a sloping top.

Fig. B-2 below shows the plan and elevation of the bin.

(a) Draw the plan and elevation of the bin where point B is 50mm from the vertical plane and the line AB is inclined at 60 degrees to the vertical plane.
(The openings at the top of the bin are not included in the drawing and are not required).

(b) Draw the traces of the oblique plane VTH which contains surface S.

(c) Find the dihedral angle between the surfaces S and T.
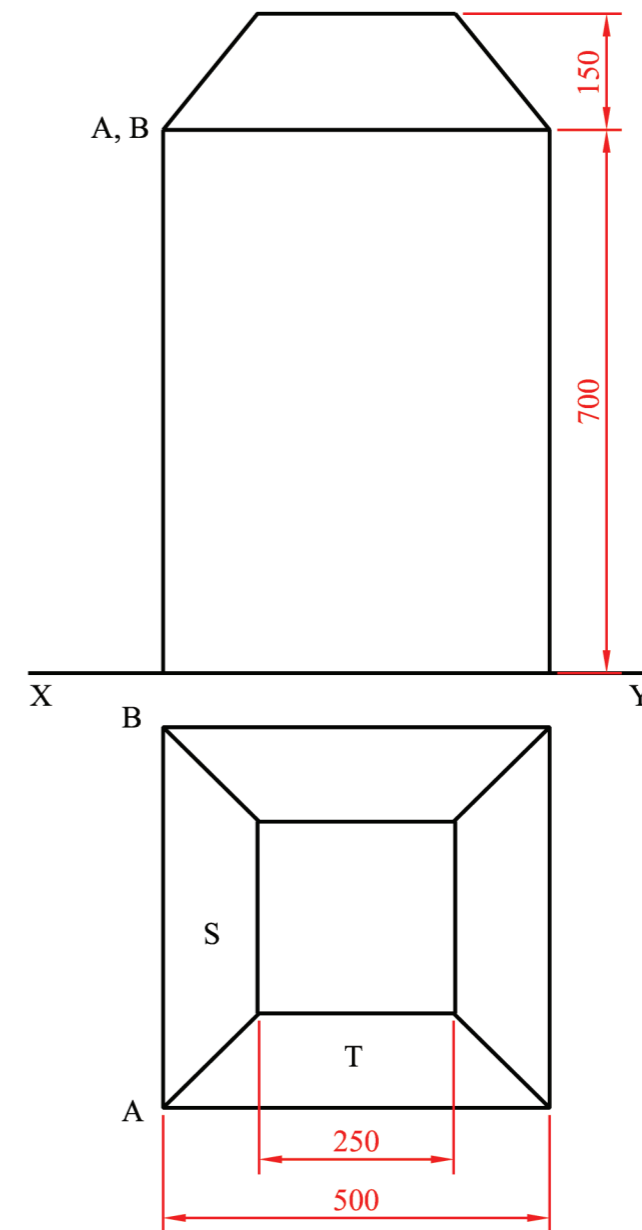
Scale 1:10

Fig. B-2

B-3. The 3D on the right shows a whistle.

Fig. B-3 below shows the plan and elevation.
The orientation of a trimetric axes is also shown.

(a) Draw the trimetric axes.

(b) Draw the elevation and plan in their correct positions relative to the axis.

(c) Draw a trimetric projection of the whistle.

Scale 2:1

Fig. B-3

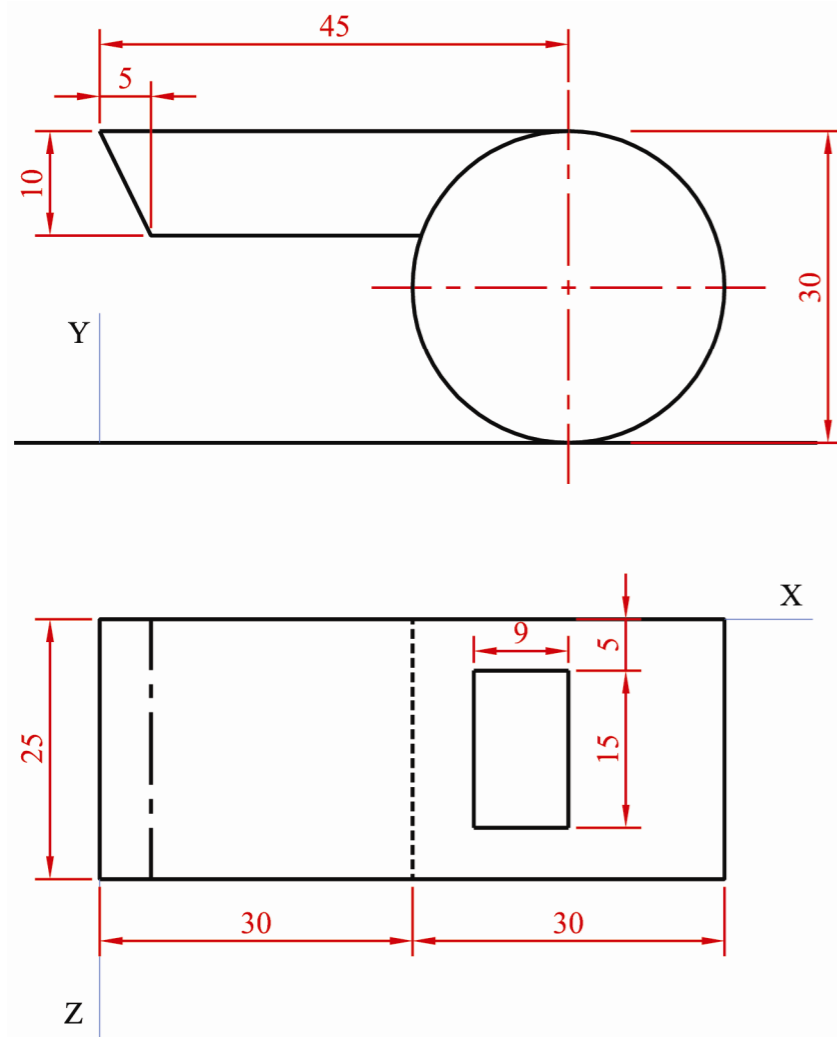
Assemblies

C-5. Details of a Pull Along Toy which was bought in a pre-assembled format are shown in Fig. C-5. The **Toy** has been disassembled. The parts list is given on the right and a 3D Graphic of the assembled toy is also shown.

(a) Draw a full size sectional elevation on a A-A showing the parts fully assembled. The Tail should be at its highest altitude in the assembly.
(All drilled holes are 5mm diameter and any omitted dimensions may be estimated).

(b) Determine and indicate on your drawing the height difference the tail is subject to as the toy rolls through a complete revolution.

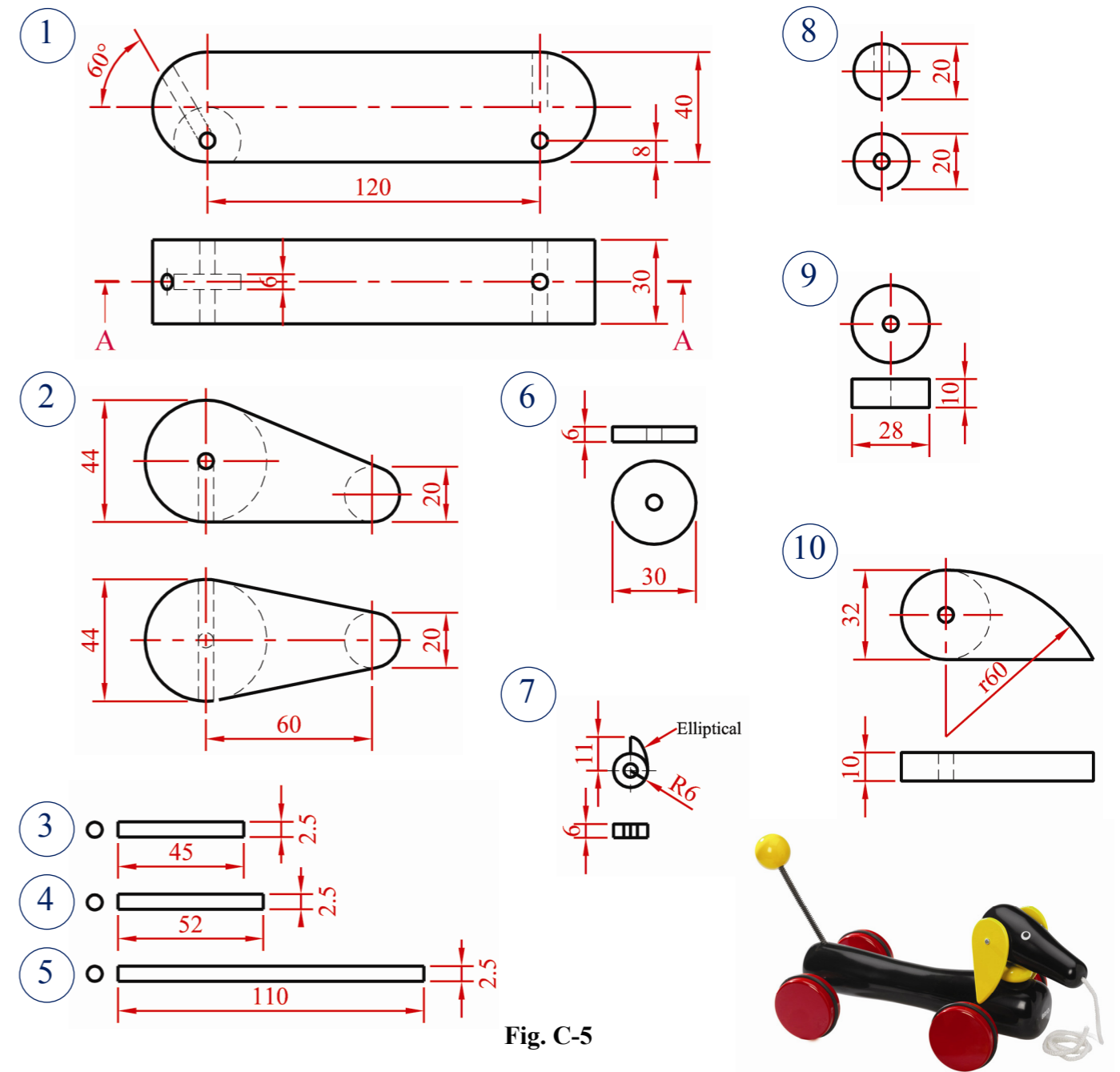| Part	Name	Qty.
1	Body	1
2	Head	1
3	Dowel	1
4	Axle / Dowel	3
5	Tail	1
6	Neck	1
7	Cam	1
8	Tail End	1
9	Wheels	4
10	Ear	2

Fig. C-5

Dynamic Mechanisms

C-4. **(a)** The 3D graphic on the right shows a pull-along toy. A cam is attached to the front axle of the toy which causes the head to move up and down as the toy is pulled along.

The nearest approach of the in-line follower to the cam centre is 18mm. The plate cam rotates in a clockwise direction imparting motion to an in-line flat follower that extends 6mm to either side of the centre line:

Draw the cam profile and displacement diagram given the following data:

0°	to	90°	Uniform acceleration and retardation rise of 30mm;
90°	to	180°	Uniform velocity rise of 15mm;
180°	to	240°	Dwell;
240°	to	360°	Simple harmonic fall of 45mm.

(b) The 3D graphic on the right shows an elliptical trainer. The mechanism is shown in line-diagram format in Fig. C-4 below.
In the diagram, points O and C are fixed. A and B are pin joints and A rotates about O. Point F represents the position of the foot and is in a fixed position on AB.

Plot the locus of point P for the movement of the trainer.
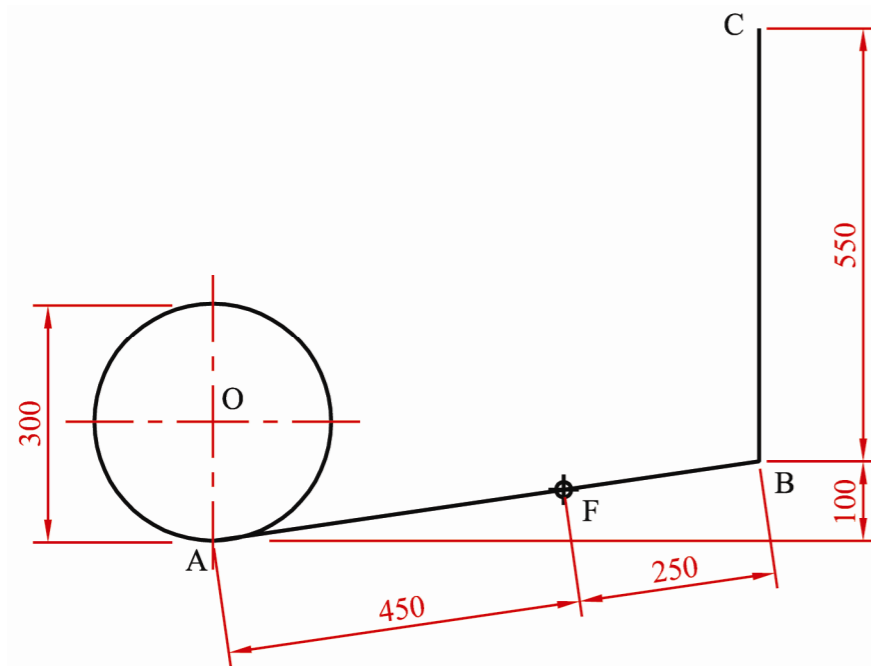
Scale 1:10

Fig. C-4(b)

SECTION C - Applied Graphics
Answer **Any Two** questions (i.e. the options you have studied)
from this section on drawing paper.

Geologic Geometry

C-1. **(a)** The accompanying map, located on the back page of section A, shows ground contours at five metre vertical intervals.

ABC is the centreline of the proposed roadway. The section of roadway between A and B is level at an altitude of 90m. The section from B to C has a gradient of 1 in 15 rising.

Using side slopes of 1 in 1 for the embankments and 1 in 1.5 for the cuttings, complete the earthworks necessary to accommodate the roadway.

Note: The earthworks on the southern side of the roadway have already been completed.

(b) On the map, D and E are outcrop points on the top surface of a stratum of ore. The strike of the stratum is N60W.

(i) Determine the dip of the stratum.

A skew bore-hole at E is drilled in a westerly direction in plan and has an actual inclination of 45 degrees to the horizontal plane. It reveals the actual thickness of the stratum equal to 20m.

(ii) Find the true length of the bore-hole.

Scale 1:1000

C-2. The 3D graphic on the right shows a modern chair, which has a seat in the form of a hyperbolic paraboloid ABCD.

The projections of the chair are shown in Fig. C-2 below. The back of the chair is a ruled surface which intersects the seat to form a line in plan.

(a) Draw the given plan and elevation of the chair.

(b) Find the true inclination between the plane director for the elements AB, CD and BC.
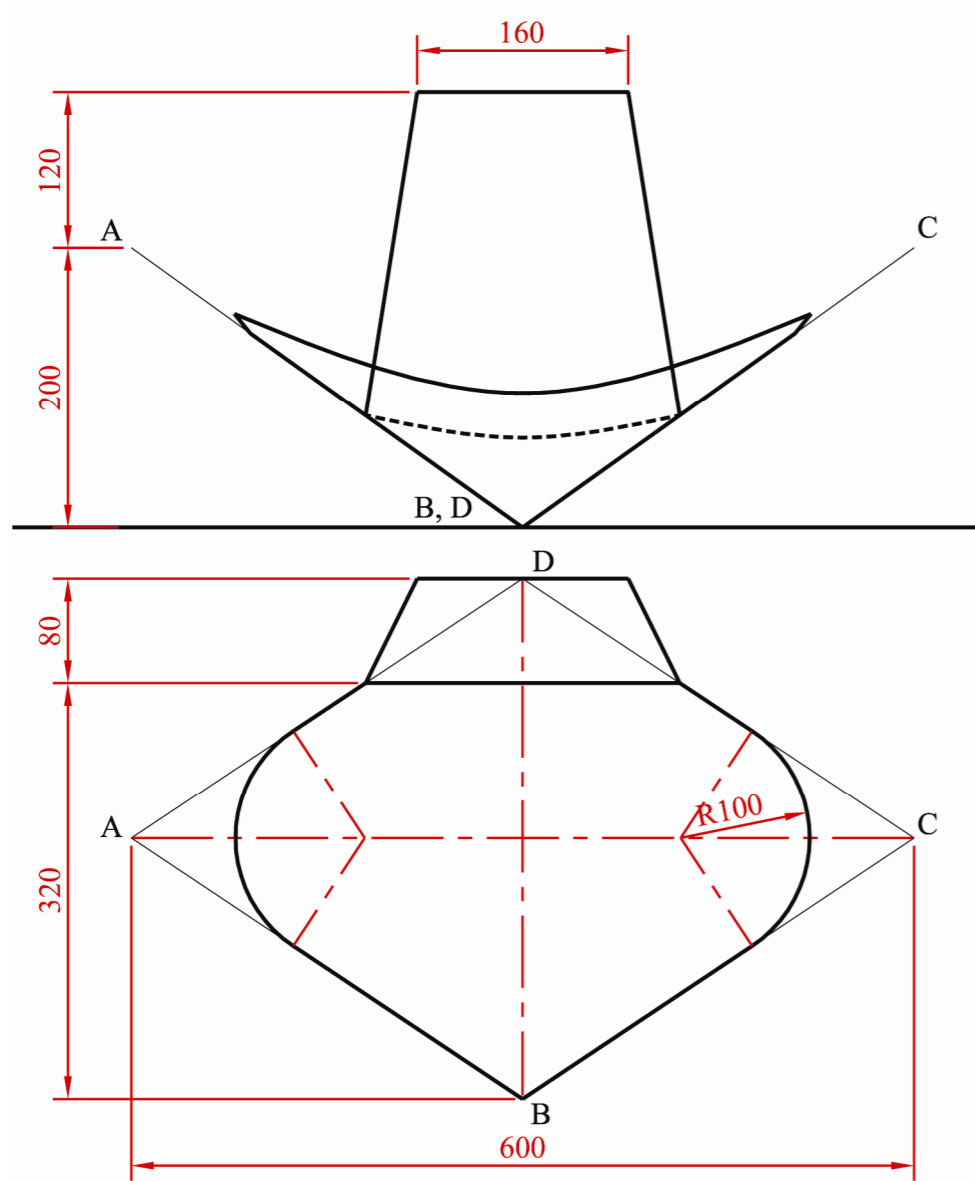
Scale 1:4

Fig. C-2

C-3. The photograph on the right shows the roof of a house.

The projections of a portion of the roof are shown in Fig. C-3 below. Roof surfaces A and B are inclined at 60° and 45° respectively.

(a) Draw the elevation and plan of the roofing surfaces A and B.

(b) Find the dihedral angle between surfaces A and B.

(c) Draw the elevation and plan of the conical and cylindrical surfaces showing clearly how to find the curve of intersection with surfaces A and B.
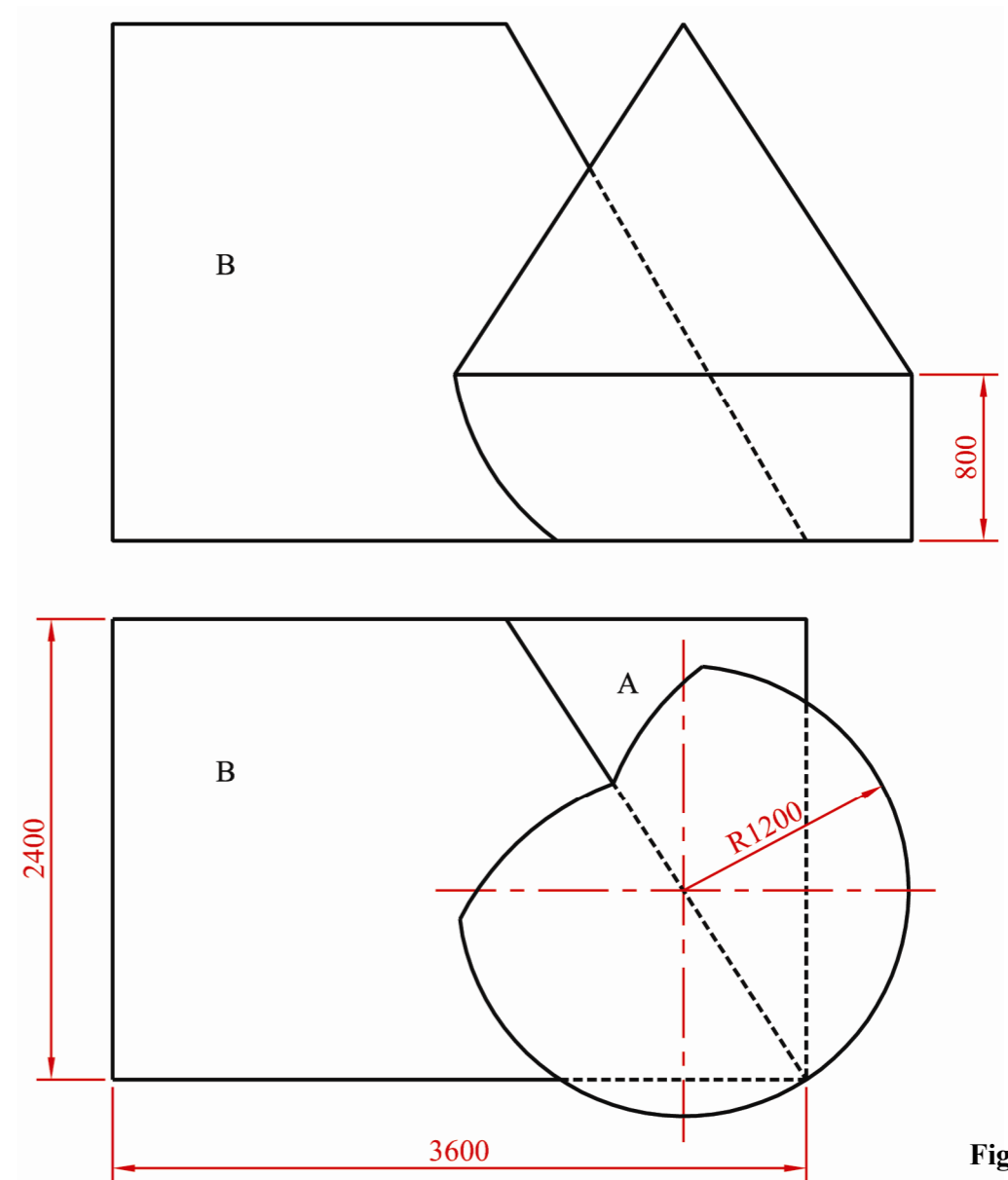
Scale 1:40

Fig. C-3

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Pre-Leaving Certificate Examination, 2012

Design & Communication Graphics
Higher Level
Sections B and C (180 marks)

Time: 3 Hours

This examination is divided into three sections:
SECTION A   (Core - Short Questions)
SECTION B   (Core - Long Questions)
SECTION C   (Applied Graphics - Long Questions)

SECTION A	• Four questions are presented.
	• Answer **any three** on the accompanying A3 examination paper.
	• All questions in Section A carry **20 marks** each.

SECTION B	• Three questions are presented.
	• Answer **any two** on drawing paper.
	• All questions in Section B carry **45 marks** each.

SECTION C	• Five questions are presented.
	• Answer **any two** (i.e. the options you have studied) on drawing paper.
	• All questions in Section C carry **45 marks** each.

General Instructions:
- *Construction lines must be shown on all solutions.*
- *Write the question number distinctly on the answer paper in Sections B and C.*
- *Work on one side of the drawing paper only.*
- *All dimensions are given in metres or millimetres.*
- *Write your name, school name and teacher name in the box provided on Section A and on all other sheets used.*

B-1. The 3D graphic on the right shows a building which is located in Dublin.

The front portion of the building is comprised of a cylinder which is inclined to the horizontal plane and is cut by two cutting planes. The dihedral angle between the cutting planes is 90°.

Fig. B-1 below shows the outline plan and elevation of the cylindrical portion of the building orientated with its axis in a vertical position.

(a) Draw the given plan and elevation of the building.

(b) Determine the horizontal and vertical traces of the oblique plane that contains the surface **A** of the building.

(c) Determine the inclination of this oblique plane to the vertical plane.

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Scale 1:200
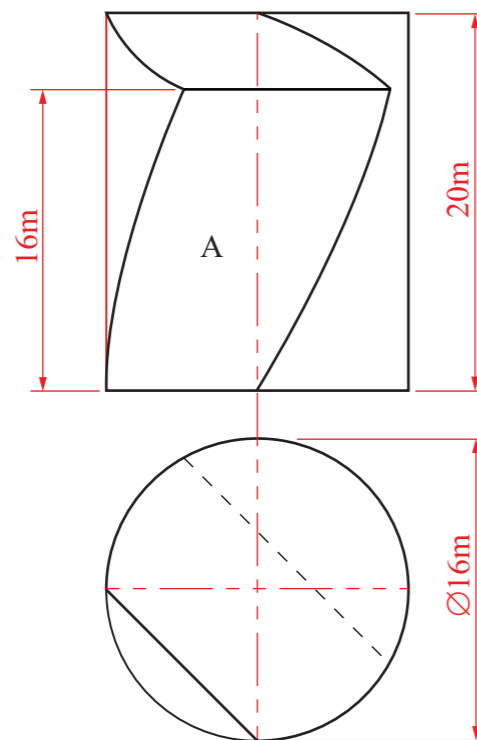
Fig. B-1

B-2. The 3D graphic on the right shows a crusader helmet from a suit of armour. It consists of two truncated cones.

Fig. B-2 below shows the elevation of the helmet.

(a) Draw the given elevation and project an end view in the direction of arrow **A**.

(b) Draw the true shape of the elliptical opening.

(c) Draw the elevation of a focal sphere and, on your drawing, establish the position of the focal point and directrix for the elliptical opening at the bottom of the helmet.

Scale 1:4

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400

240

160

A

75°

30°
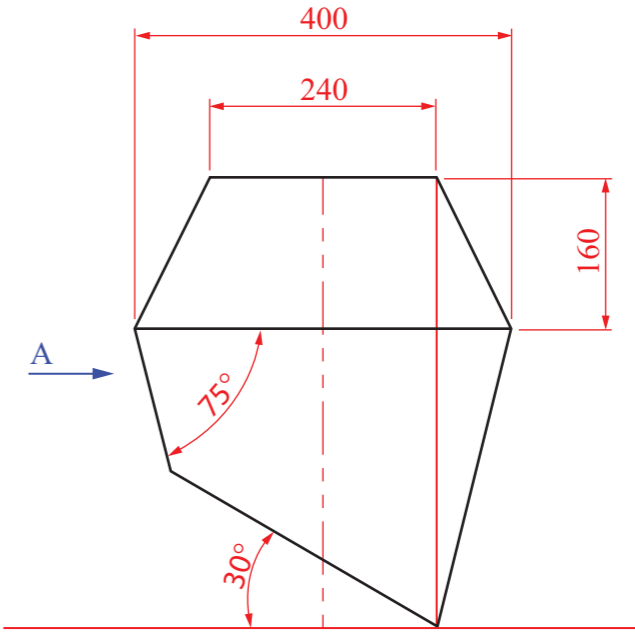
Fig. B-2

B-3. The 3D graphic on the right shows three stability balls. The red and green balls are in contact and the red and orange balls are in contact. All three balls rest on the horizontal plane.

Fig. B-3 below shows the elevation of the red and green balls. The elevation of the point of contact between the red and orange balls is also shown.

(a) Draw the given elevation and project the plan of the red and green balls.

(b) Draw the projections of the orange ball in contact with the red ball at point **P**.

(c) Determine the traces of the tangent plane to the red and orange spheres which passes between spheres.
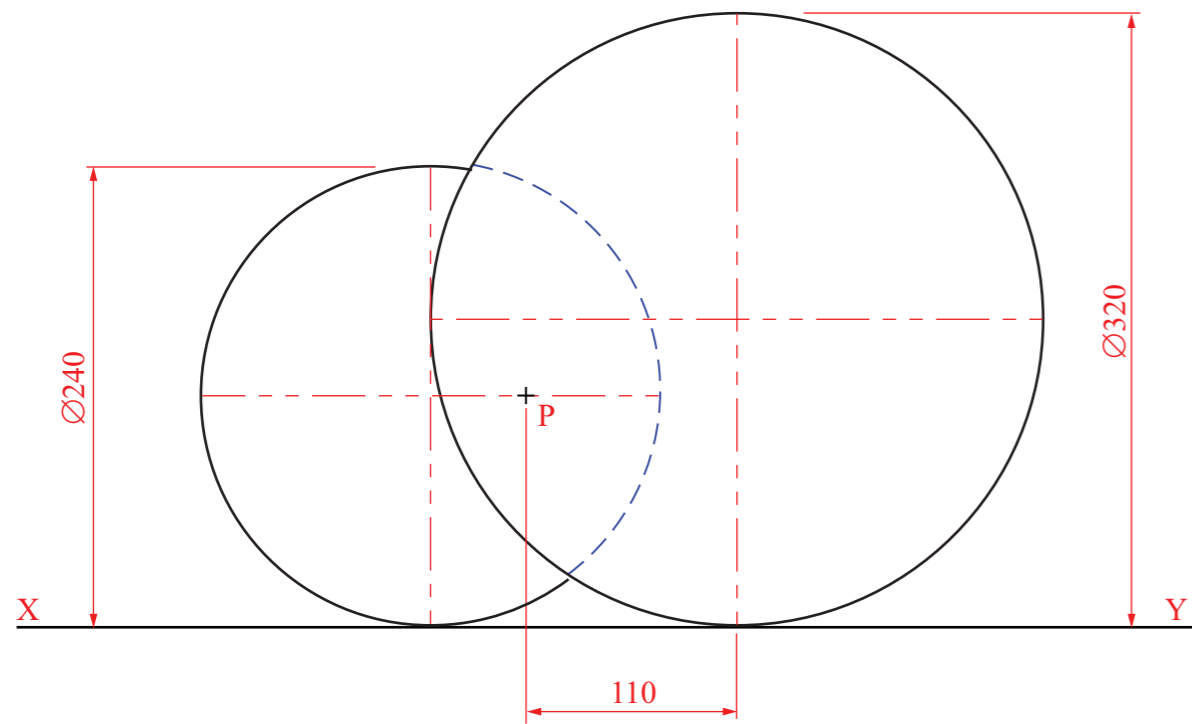
Scale 1:4

Ø320

Ø240

P

X   Y

110

Fig. B-3

C-5. (a) Details of a disassembled ***Toy Train*** are shown in Fig. C-5. The parts list is given on the right and a 3D Graphic of the assembled ***Toy*** is also shown.

Draw a full size sectional elevation on A-A₁ showing the parts fully assembled.
(All drilled holes are 5mm diameter and can be drawn freehand.)

(b) Establish the height difference that can be achieved by the chimney.

Scale 1:1

Part	Name	Qty.
1	Base	1
2	Cabin	1
3	Dowel	2
4	Axle	3
5	Cam	1
6	Engine	1
7	Moving Stack	1
8	Chimney	1
9	Wheels	6

1

20   40   40   30   20

20

10

A   A₁

6

50

30

200

5

Elliptical

13

R6   5

2   6   15   Ø40

70

20 20 20

10   20

50   10   10

Ø15   10   20   30

70

50

3

16

4   7   8   9

74

10   30   12

40   20
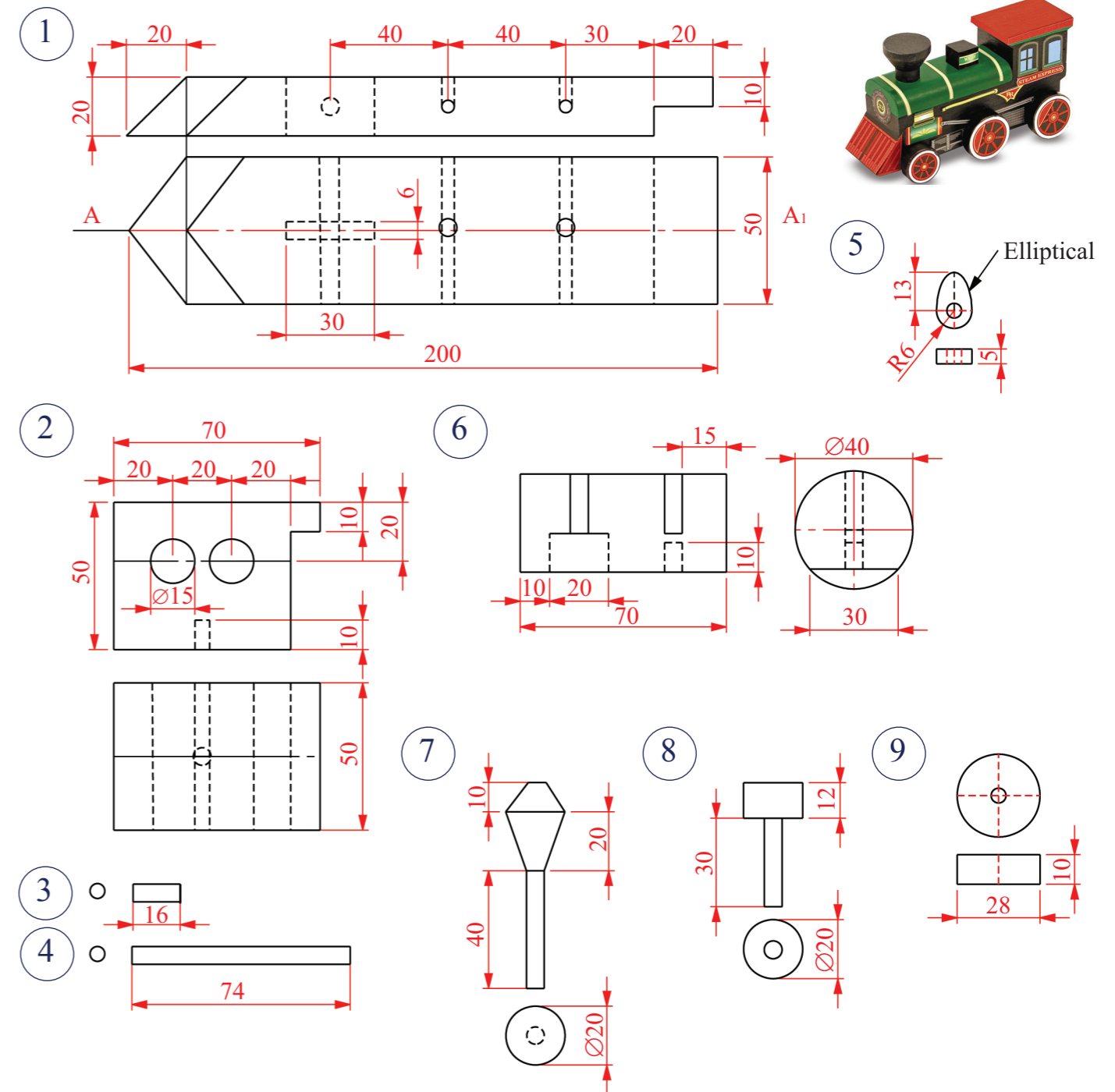
Ø20   28   10

Ø20   Ø20

Fig. C-5

Dynamic Mechanisms

**C-4. (a)** The 3D graphic below shows a cylindrical storage container.

Fig. C-4(a) on the right shows the projections of the storage cylinder.

A helical stairs is to be fitted to the outside of the storage cylinder to act as a fire escape. It will travel from top to bottom of the cylinder and pass through points **A** and **B**.

(i) Draw the given views.

(ii) Draw the elevation of the helix.

Scale 1:50

20m 20m 20m 50m

A

B

Fig. C-4(a)

$\varnothing$40m

A

40°

B
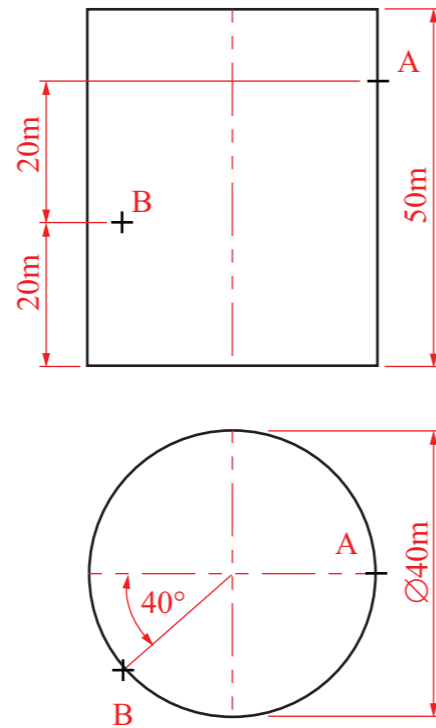
(b) The 3D graphic on the right shows a person on a swing.

Fig. C-4(b) below is a line diagram showing the movement of the swing.
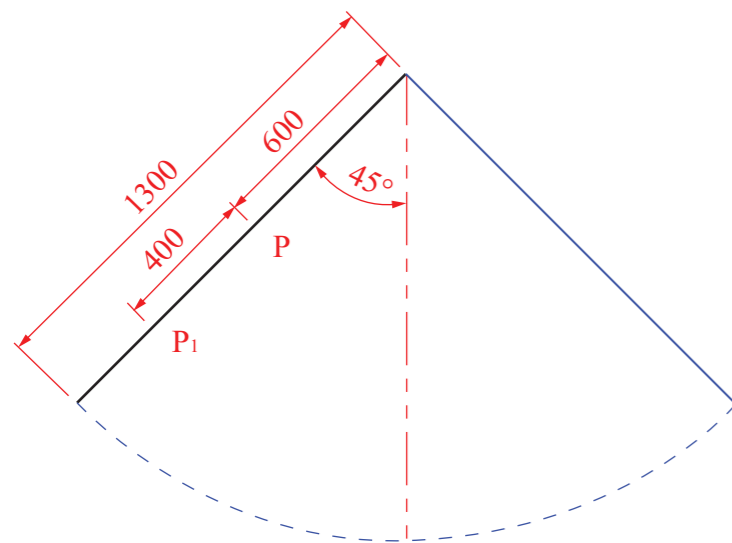
Point **P** shows the position of the person's hands when the swing is in a stationary position and about to rotate to the right.

As the swing rotates to the right through an angle of 90° and back to its pre-set position she moves her hands along the rope from **P** to **P₁**.

Plot the locus of point **P** for the combined movement.

Scale 1:10

1300 600 400 45° P P₁

Fig. C-4(b)

Geologic Geometry

C-1. (a) The accompanying map, located on the back page of Section A, shows ground contours at five metre vertical intervals.

ABC is the centreline of a proposed roadway.

The roadway has the following specification:

(i) the section of the roadway between **A** and **B** is level at an altitude of 70m

(ii) the section from **B** to **C** has a gradient of 1 in 20 rising.

Using side slopes of 1 in 1.5 for the cuttings and 1 in 2 for the embankments, complete the earthworks necessary to accommodate the roadway.

(b) On the map, **D**, **E** and **F** are outcrop points on the top surface of a stratum of ore.

(i) Determine the dip and strike of the stratum.

A skew bore-hole at **E** is drilled in a southerly direction in plan and has an actual inclination of 45° to the horizontal plane. It reveals the bottom surface of the stratum at a distance of 35m for **E**.

(ii) Find the thickness of the stratum.

Scale 1:1000

Structural Forms

C-2. The 3D graphic on the right shows a building which consists of five roofing shells.

Fig. C-2 below shows the projections of one roofing shell. It is created by translating the parabola **ABC** in a vertical position along the parabola **BD** which has its vertex at **D**.

The roofing shell is sectioned as shown and a vertical curved glass wall intersects the roofing shell.

Draw the given views and project an end view of building.
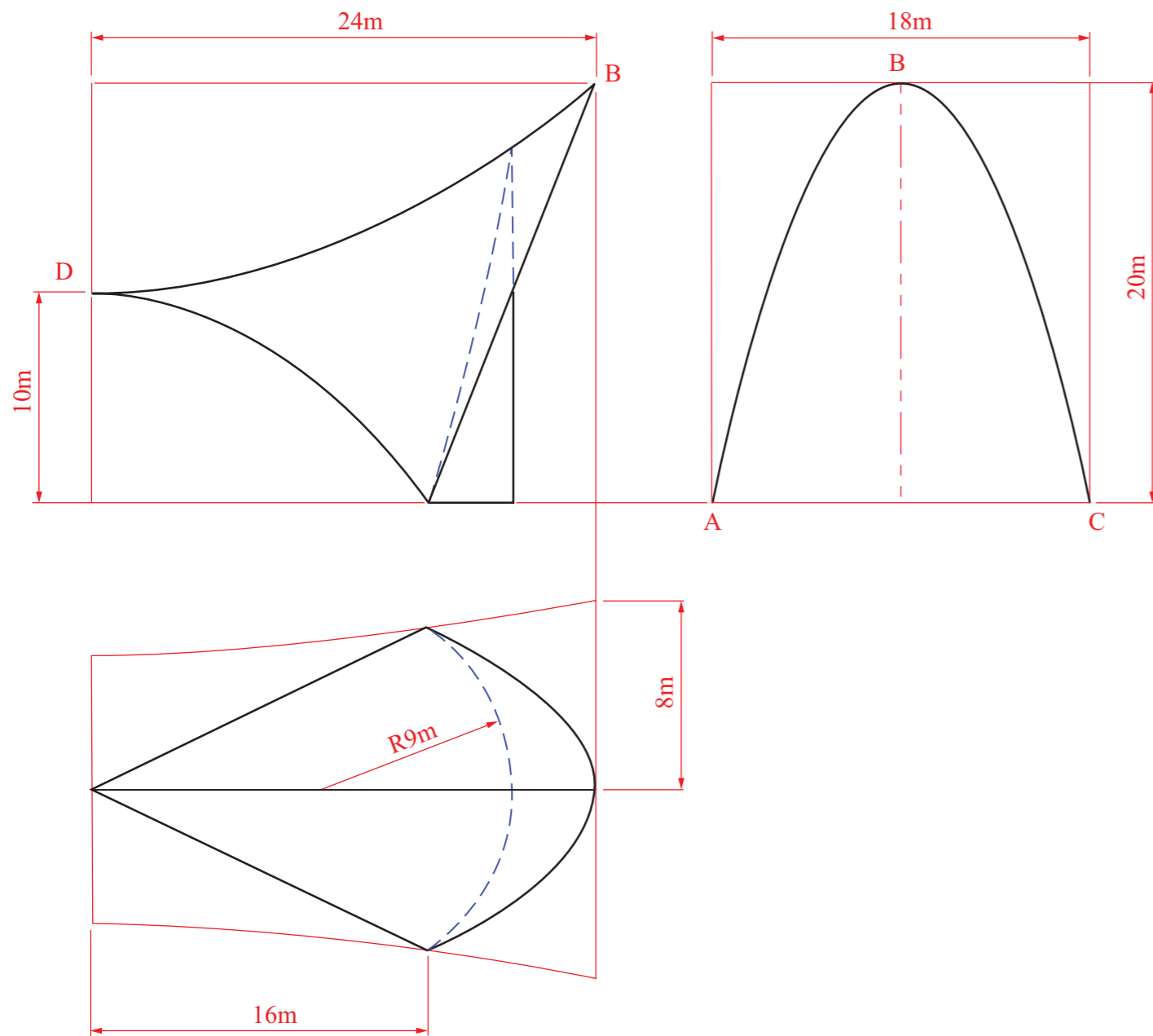
Scale 1:200

24m

B

18m

B

D

10m

20m

A

C

8m

R9m

16m

Fig. C-2

Surface Geometry

C-3. The 3D graphic on the right shows a modern house. It is based on a right cone which rests on one of its elements and is sectioned as shown.

Fig. C-3 below shows the projections of the outline of the house.

(a) Draw the given views.

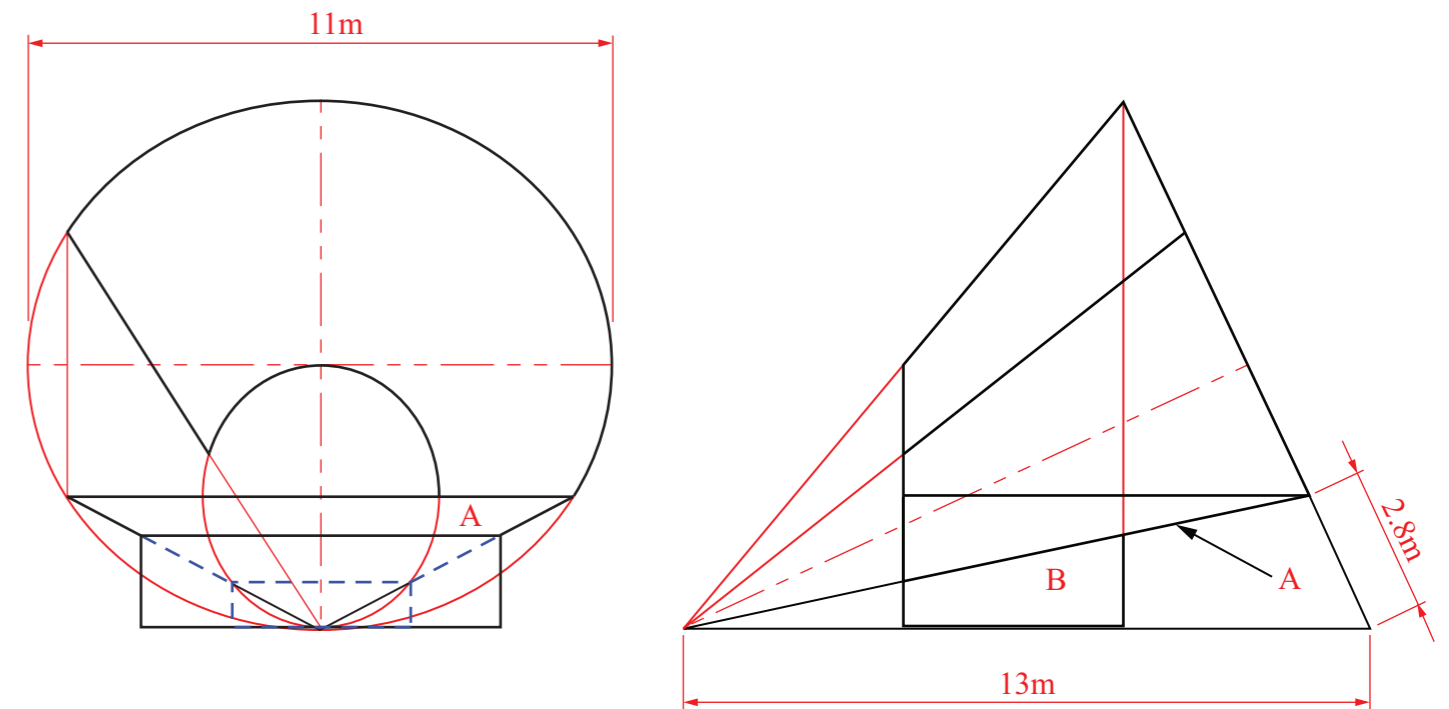**(b)** Find the dihedral angle between surfaces **A** and **B**.

Scale 1:100

11m

A

2.8m

B

A

13m

Fig. C-3