

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Advanced Level

**GEOMETRICAL AND MECHANICAL DRAWING**

**9351/01**

Paper 1

May/June 2006

**3 hours**

Additional Materials: A2 drawing paper (4 sheets)  
Protractor  
Standard drawing equipment

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name at the bottom right-hand corner of every sheet of paper you use.

Do not use highlighters, glue or correction fluid.

**Section I**

Answer **all** the questions.

**Section II**

Answer any **three** questions.

Write or draw your answers on the separate Drawing Paper provided.

Work **all** your answers in SI units. Use both sides of the Drawing Paper.

All solutions are to be drawn full-size unless a contrary instruction is given. Construction lines must be clearly shown.

The diagrams are not necessarily drawn to scale.

All dimensions are in millimetres unless otherwise stated.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **10** printed pages, **2** blank pages.



## Section I (40 marks)

Answer **all** questions in this section

- 1 Fig. 1 shows the outline of a mechanism in which a cylinder **C** rolls anti-clockwise in contact with a horizontal surface **HS**. Arm **OA** is rigidly attached to the cylinder. The connecting link **AB** is pin-jointed at **A** with **B** being constrained to slide along **XX**.

Draw the locus of **P** as the cylinder rolls to the left from the position shown, to the position where **OA** has turned through  $120^\circ$ . [8]

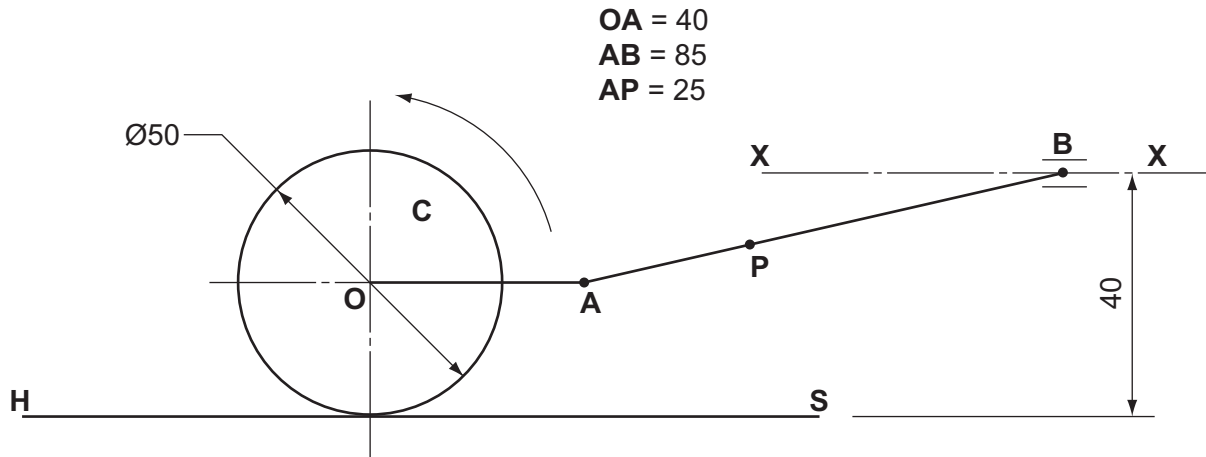


Fig. 1

2 Fig. 2 shows two views of a flat sheet **ABCDE**. Two lines **AC** and **EC** are marked on the upper surface.

(a) Draw, full size, the given views. [1]

(b) Determine the true shape of the flat sheet. [5]

(c) State the true lengths of **AC** and **EC**. [2]

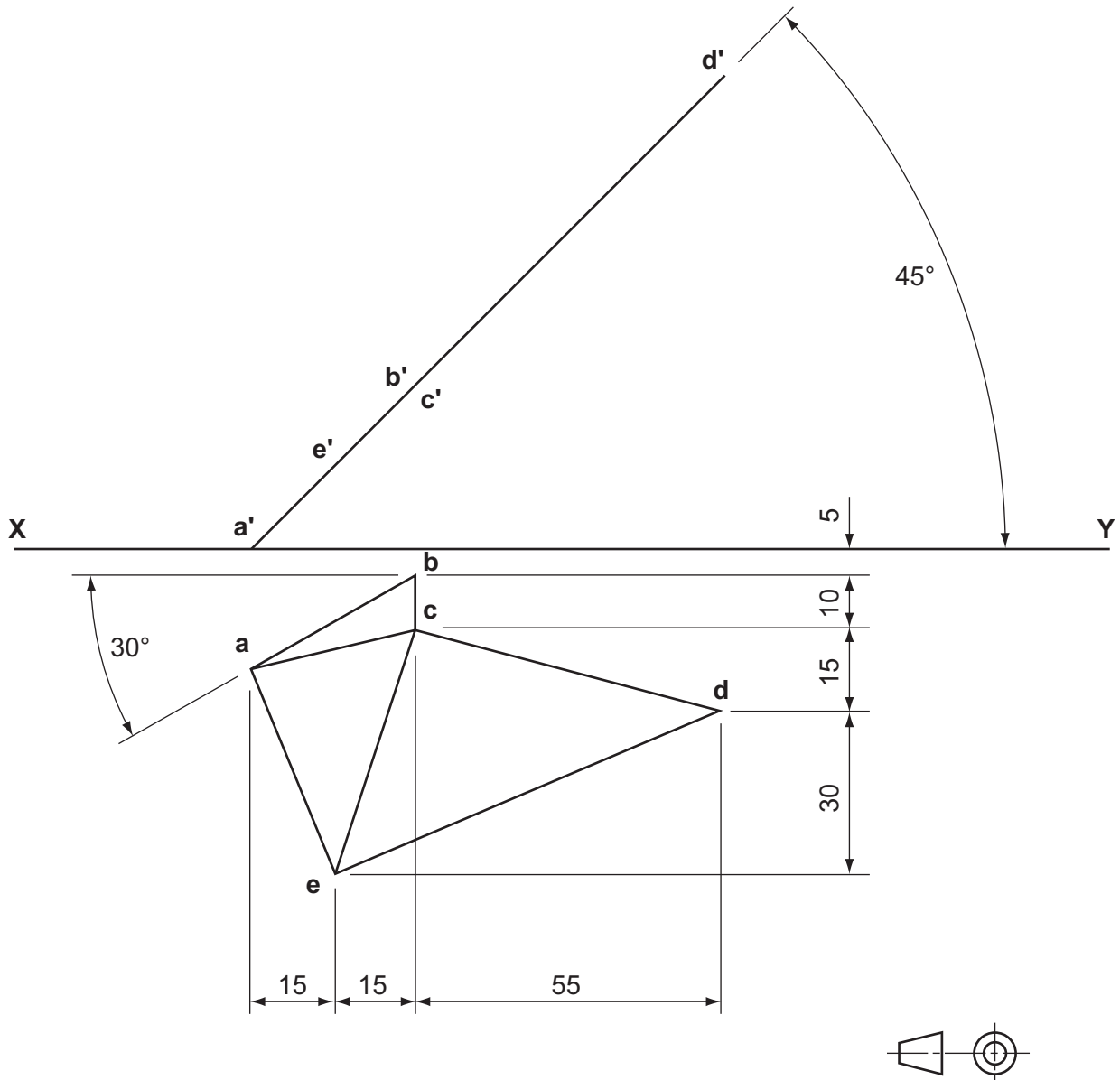


Fig. 2

3 Fig. 3 shows details of an aluminium handrail bracket.

Draw, full size, the given view of the bracket, clearly showing all construction and points of tangency. [10]

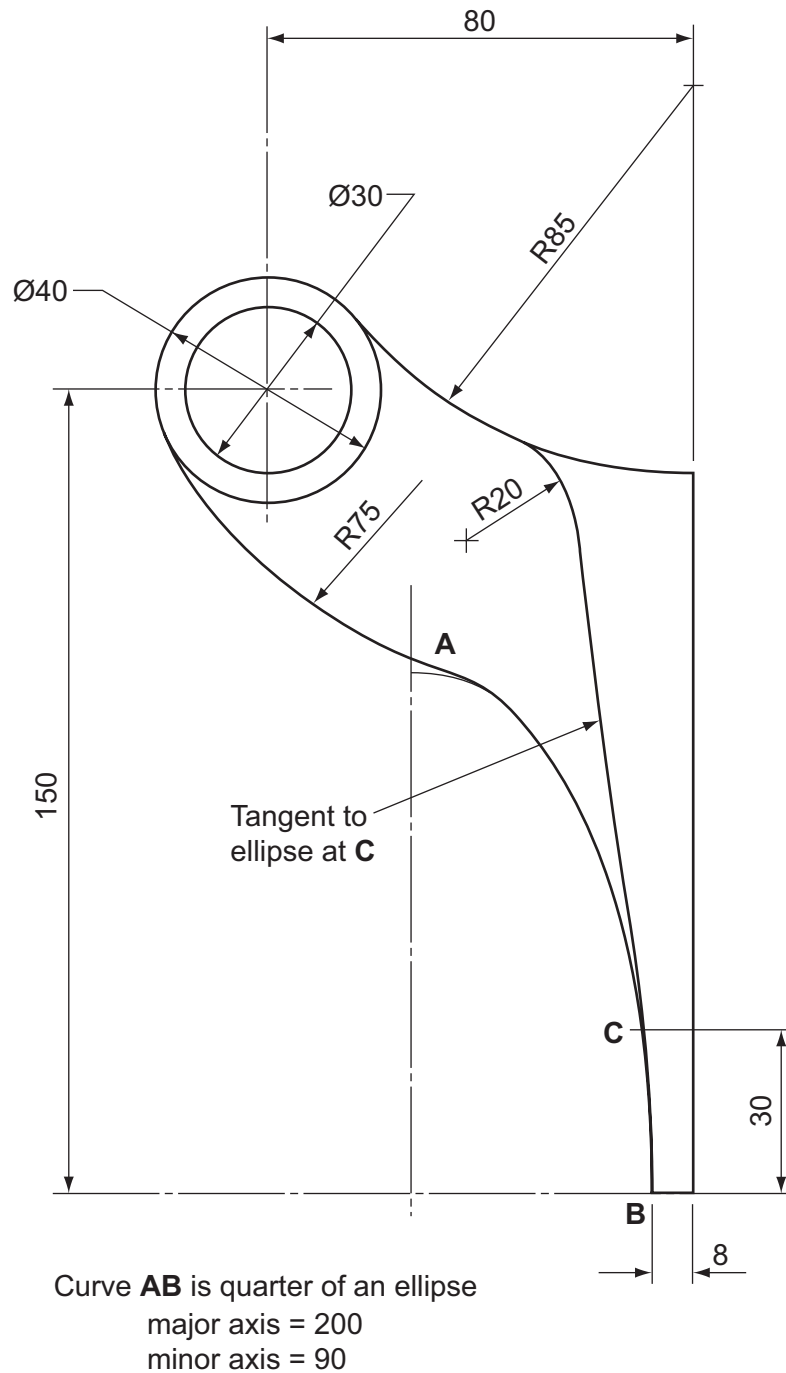


Fig. 3

- 4 Fig. 4 shows an elevation of an oblique thin sheet-metal cone cut by an inclined plane and a cylindrical surface.

(a) Draw the given view. [1]

(b) Develop the true shape of the outer surface of the modified cone. [13]

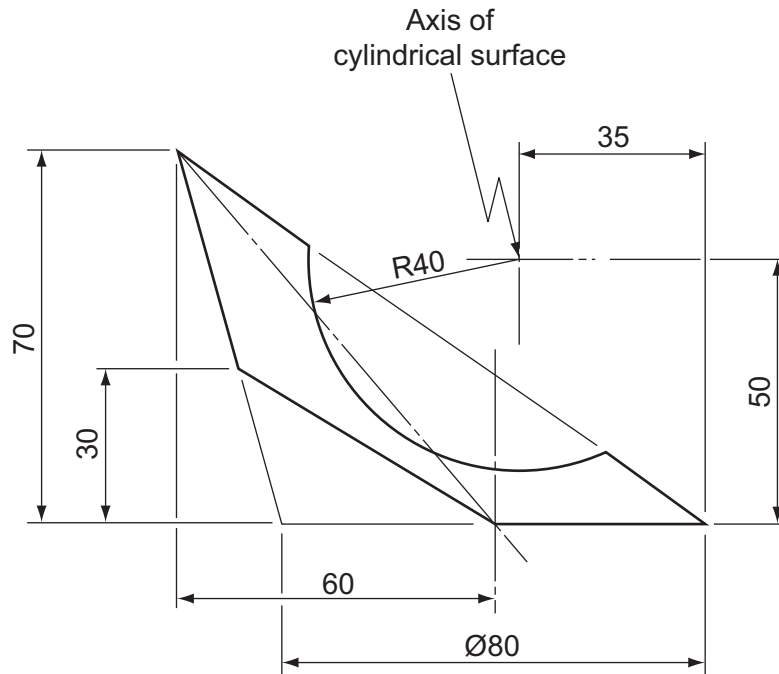


Fig. 4

## Section II (60 marks)

Attempt no more than **three** questions from this section.  
All questions carry equal marks.

- 5 Fig. 5 shows a pin-jointed roof truss carrying dead and wind loads as indicated. The truss is supported at the left hand end by a frictionless roller.
- (a) Draw the roof truss to a scale of 1:100 and use Bow's notation to identify the members of the truss. [3]
- (b) Determine by construction the magnitude of the reaction at the roller and the magnitude and direction of the right hand reaction. Use a scale of 10 mm = 100 kN. [10]
- (c) Construct a force diagram for the roof truss. [4]
- (d) Use the force diagram to determine the magnitude and sense of the forces indicated by \*. [3]

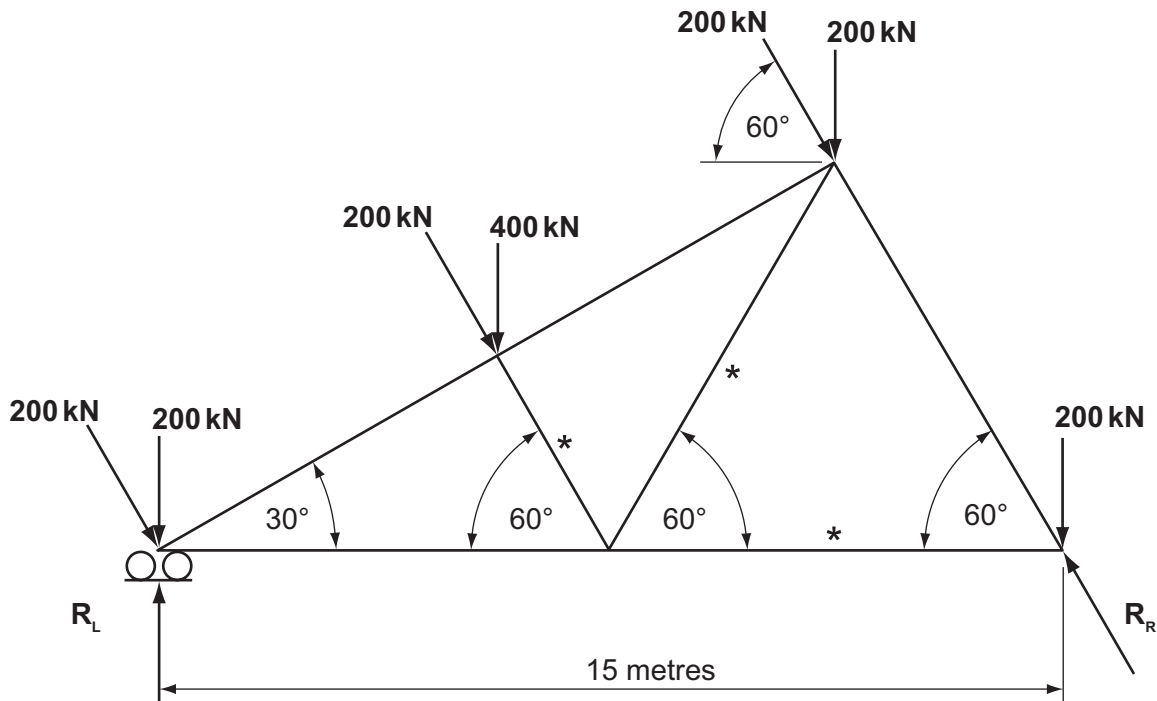


Fig. 5

6 Fig. 6 shows an elevation and plan in first-angle projection of a machine clip.

(a) Draw the given views. [4]

(b) Construct an auxiliary elevation as seen when viewed in the direction of the arrow P. [16]

Hidden detail is not required.

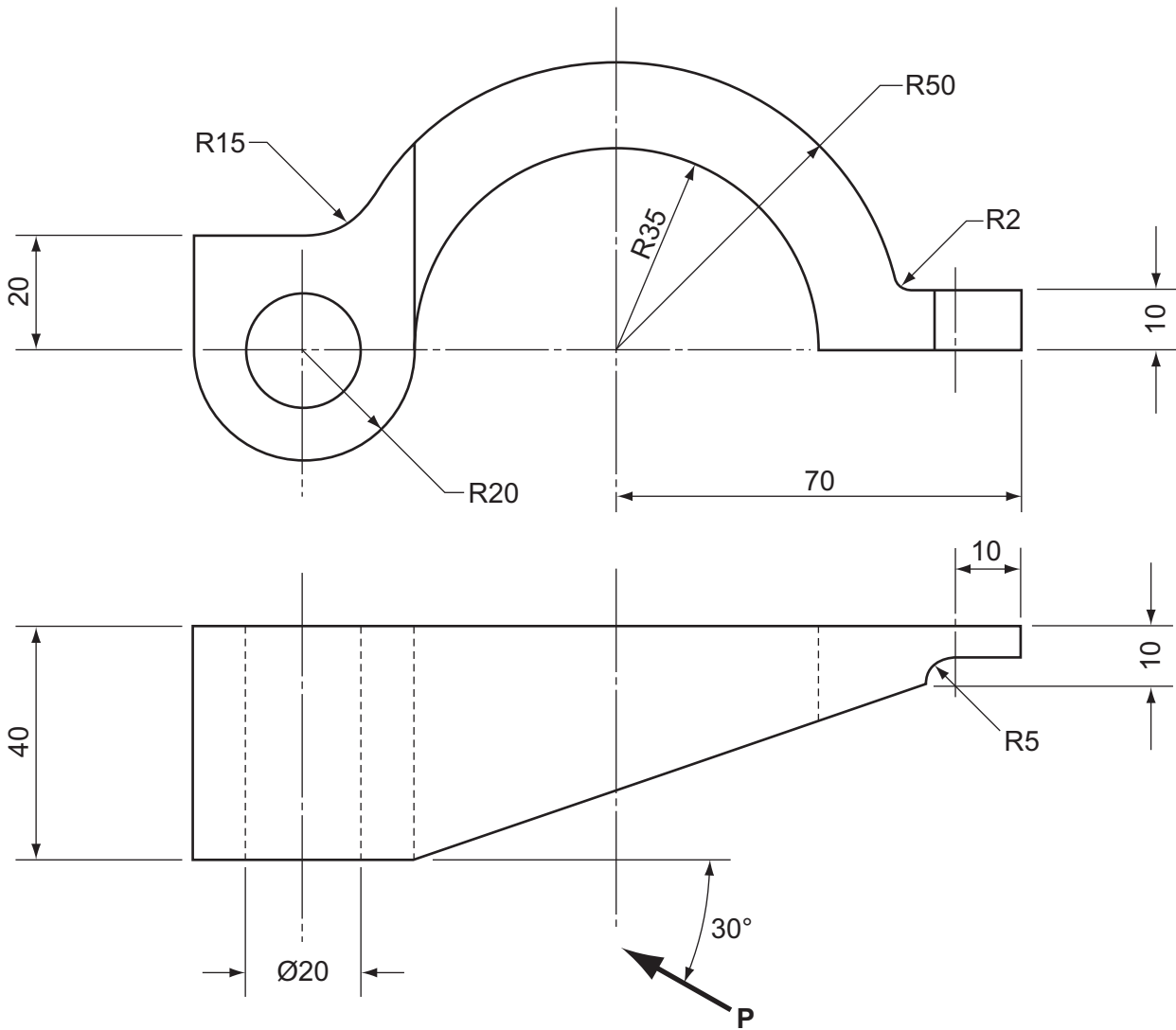


Fig. 6

7 Fig. 7 shows the general arrangement of a plate cam having a base diameter of 80 mm and an off-set roller follower. The diameter of the roller follower is 16 mm, is off-set 16 mm and has a vertical lift of 30 mm. The sequence of motion required of the follower in completing one revolution in 0.24 seconds is:

- (i) lift of 10 mm with uniform acceleration in 0.03 seconds;
- (ii) lift of 10 mm with uniform velocity in 0.02 seconds;
- (iii) lift of 10 mm with uniform retardation in 0.03 seconds;
- (iv) dwell at the uppermost position for 0.03 seconds;
- (v) fall of 30 mm with one half cycle of simple harmonic motion in 0.12 seconds;
- (vi) dwell at the lowest position for 0.01 seconds.

(a) Construct the displacement-time diagram for the required motion of the follower. [12]

(b) Construct the profile for the cam. [8]

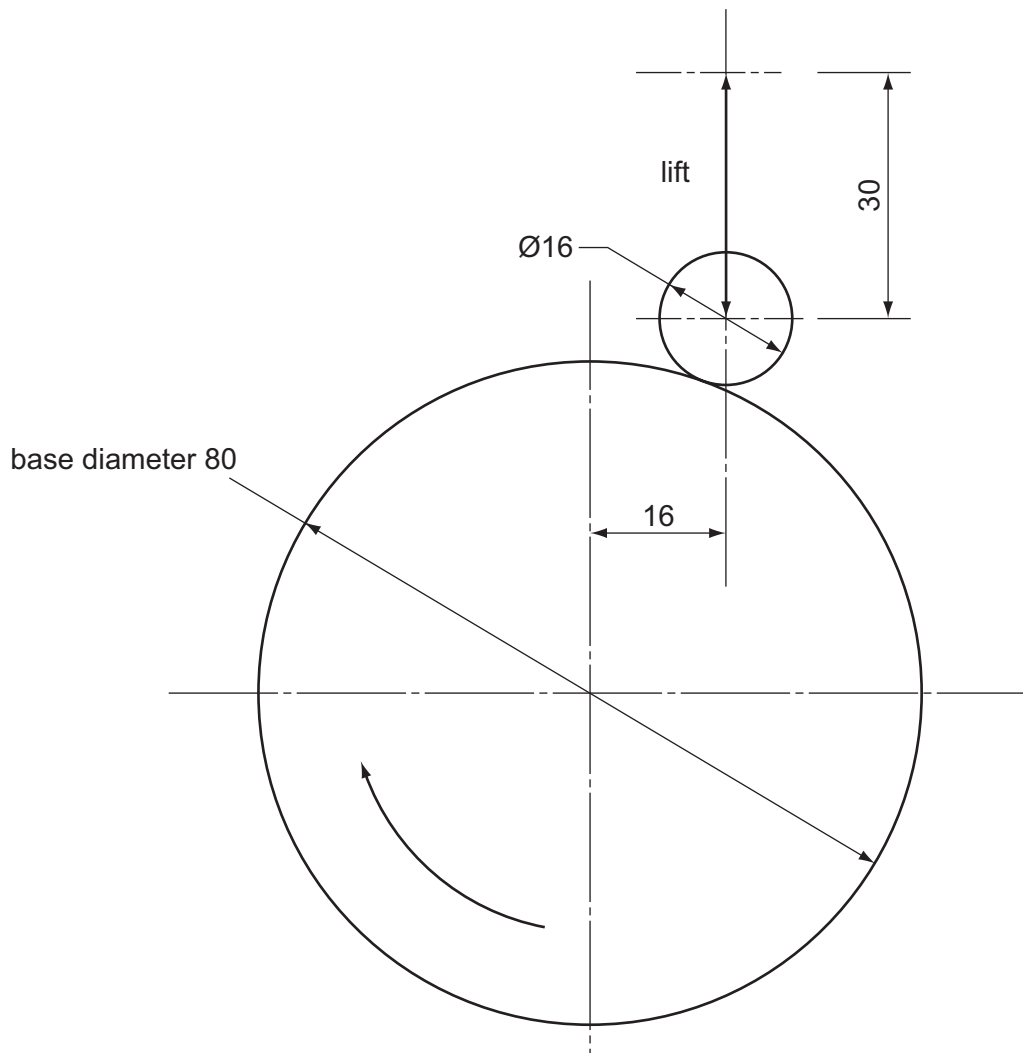


Fig. 7



- 8 Two spheres, one of diameter 80 mm and the other of diameter 40 mm, lie on the horizontal plane in contact with each other and both in contact with the vertical plane.

Fig. 8 shows in first angle projection an elevation and plan of the larger sphere together with an indication of the position of the centre of the smaller sphere. Also shown in the figure are the traces of an oblique plane which cuts both spheres.

- (a) Draw the given views with the diameter 40 mm sphere shown in position. [6]
- (b) Complete the two given views of the two spheres with any portion of the spheres above the oblique cutting plane removed. [14]

All contact points of the two spheres to be clearly marked.

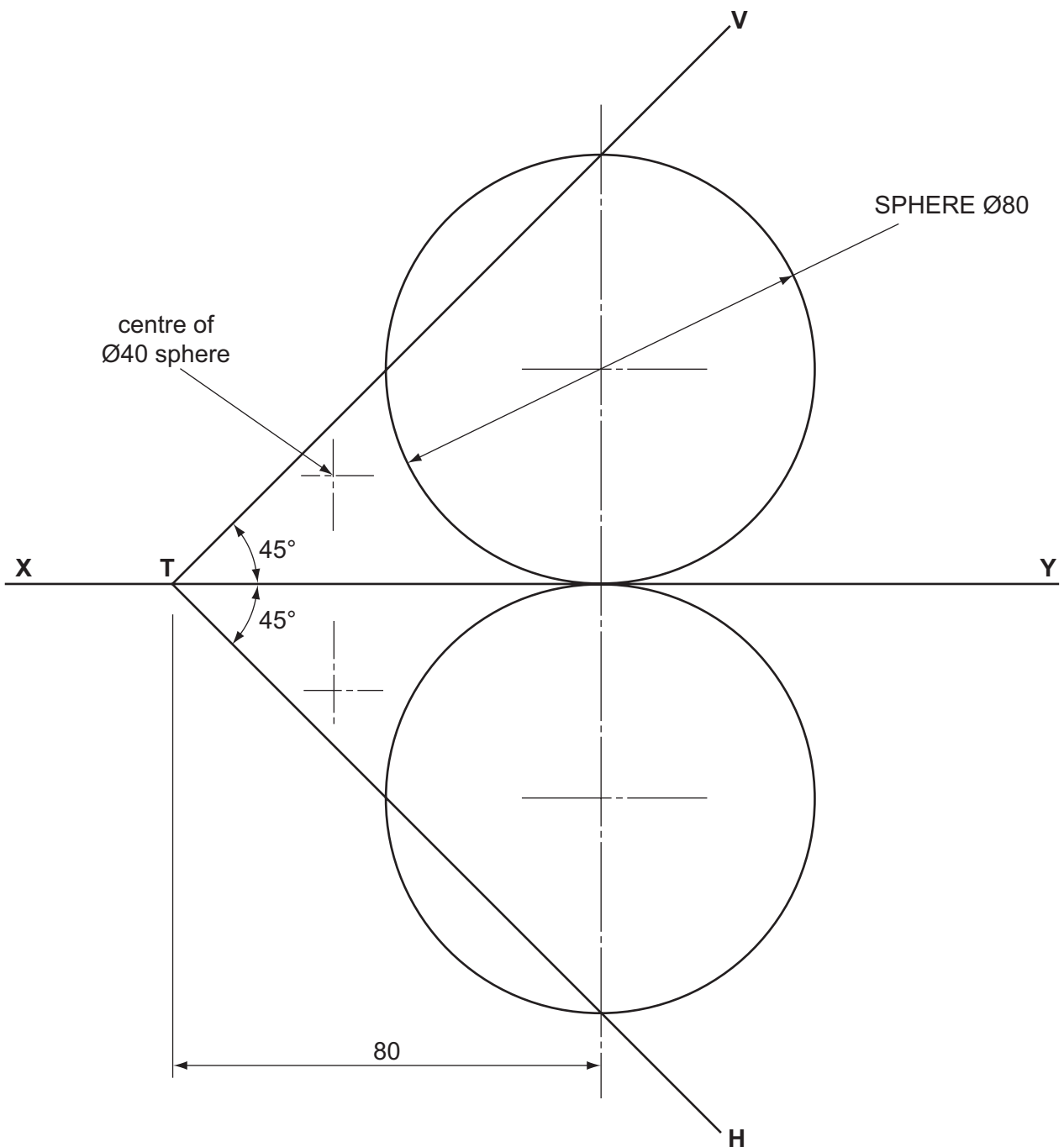


Fig. 8

- 9 Fig. 9 shows, in first angle projection, two views of a gear-shifter link casting before machining.

Construct an isometric view of the link arranged with the axis **X–X** of the link aligned along one of the main isometric axes and with the point **N** in the front of the view.

Omit hidden details but the isometric scale must be used.

[20]

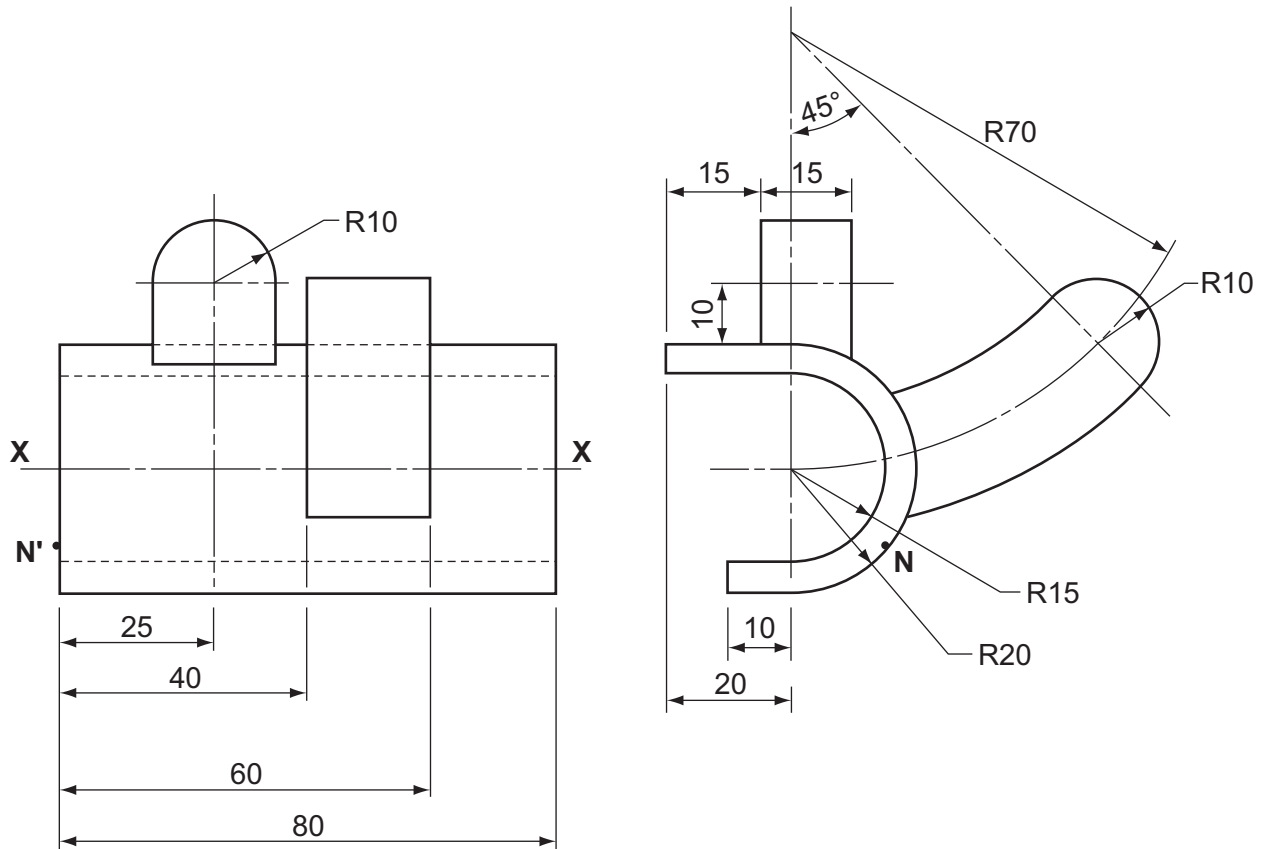


Fig. 9

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