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конструювання та графіки

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METHODICAL GUIDELINES

and tasks to a practical training and independent work
IN THE DISCIPLINE
«DESCRIPTIVE GEOMETRY»
CREATION OF INTERSECTING LINES OF THE ROOF SLOPES

for higher education students of the first (bachelor) level
in the field of study 191 «Architecture and Urban planning»
of full-time education form

МЕТОДИЧНІ ВКАЗІВКИ

та завдання до виконання
практичних робіт та самостійної роботи
З НАВЧАЛЬНОЇ ДИСЦИПЛІНИ
«НАРИСНА ГЕОМЕТРІЯ»
ПОБУДОВА ЛІНІЙ ПЕРЕТИНУ СХИЛІВ ДАХУ

для здобувачів вищої освіти першого (бакалаврського) рівня
за спеціальністю 191 «Архітектура та містобудування»
денної форми навчання

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CONTENTS

INTRODUCTION

Methodical guidelines and tasks to a practical training and independent work are developed according to the syllabus of the course for higher education students of the first (bachelor) level in the field of study 191 «Architecture and Urban planning» of full-time education form.

The purpose of practical classes is to consolidate theoretical knowledge, to acquire skills in solving various problems of descriptive geometry that arise in the practice of architectural and construction design, as well as to develop spatial imagination by correlating geometric objects in three-dimensional space and their images on a plane.

All tasks are performed by pencil on A3 format. Basic data and results are allocated with the reinforced line. Auxiliary constructions are shown with a thin line with a hard pencil.

ВСТУП

Методичні вказівки та завдання до практичної та самостійної роботи розроблено згідно силабусу курсу «Нарисна геометрія» для здобувачів вищої освіти першого (бакалаврського) рівня за спеціальністю 191 «Архітектура та містобудування» денної форми навчання.

Мета практичних занять – закріплення теоретичних знань, набуття навичок розв'язання різноманітних задач нарисної геометрії, що виникають в практиці архітектурно-будівельного проектування, а також – розвинення просторової уяви шляхом співвіднесення геометричних об'єктів у тривимірному просторі і їх зображень на площині.

Завдання виконується олівцем на форматі А3. Вихідні дані та результати виділяються потовщеною лінією. Допоміжні побудови показують тонкою лінією твердим олівцем

1. MAIN THEORETICAL DATA

One of the most common cases when designing the shape of the roof of a low-rise building is the placement of the roof slopes with identical bias θ (fig. 1). It allows to simplify constructions and to receive esthetic and functional solutions of roofs.

At creation of crossing of slopes of the roof we shall consider that:

slopes form identical biases θ with the conditional horizontal surface (fig. 1);

overhangs of slopes are placed at one horizontal level (on the conditional horizontal surface) (fig. 1).

If traces of slopes are parallel, then slopes are crossed in a straight line, parallel to their traces. The line of crossing of slopes is the horizontal edge (roof ridge) equidistanted from traces of slopes (fig. 1).

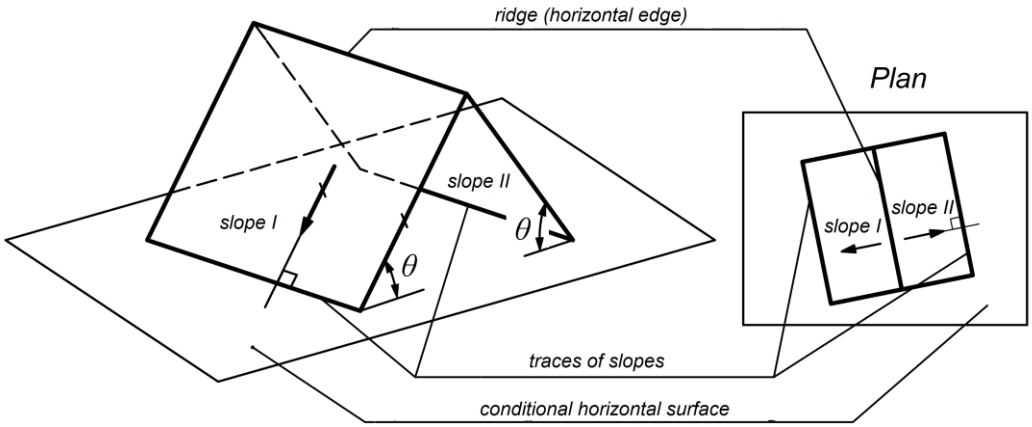


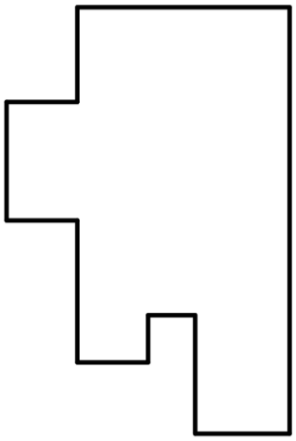
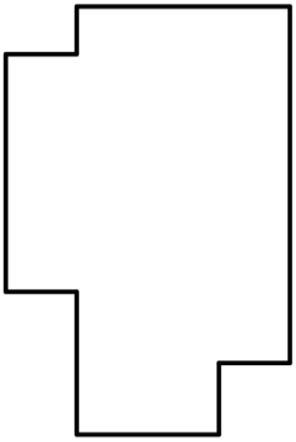
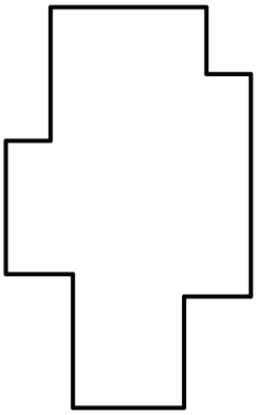
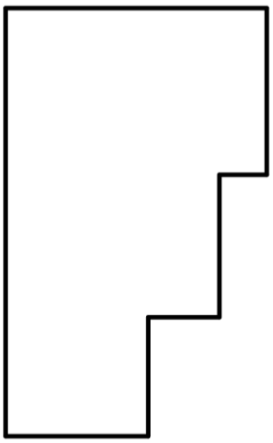
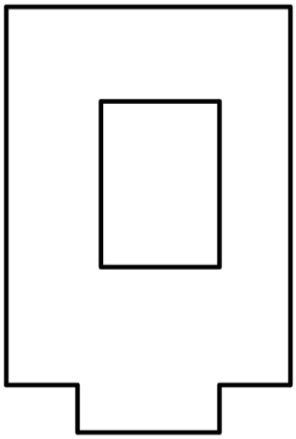
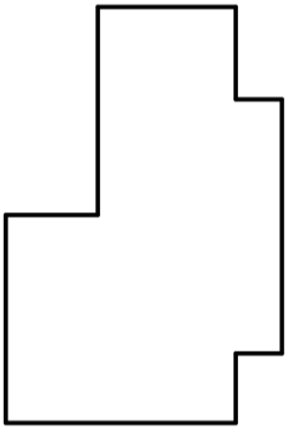
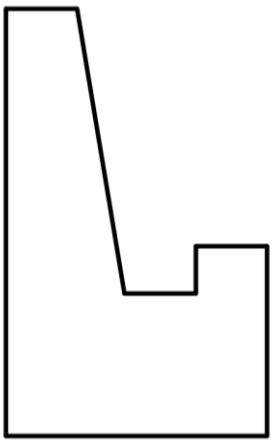
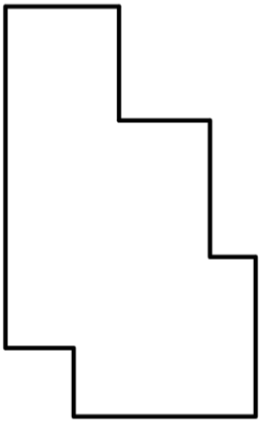
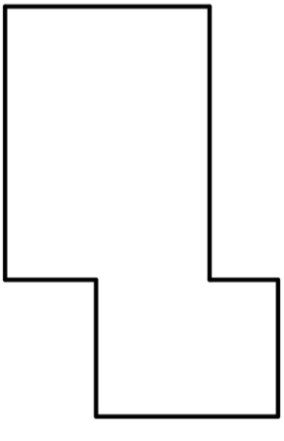
Fig. 1. The scheme of the roof with two slopes: the basic concepts and simplification
(shooters show biases of slopes; build them parallel to lines of the greatest bias, that is perpendicular to horizontal traces of slopes)

2. INPUT DATAS FOR CREATION OF INTERSECTING LINES OF THE ROOF SLOPES

TASK. To construct intersecting lines of slopes of roof provided that lines of overhang of roof lie in one horizontal plane and biases of all slopes of roof are identical.

Input datas to the task get out of table 1 according to number of the option matching number in the order of the list in the magazine.

Table 1

1 	**2** 	**3** 
4 	**5** 	**6** 
7 	**8** 	**9** 

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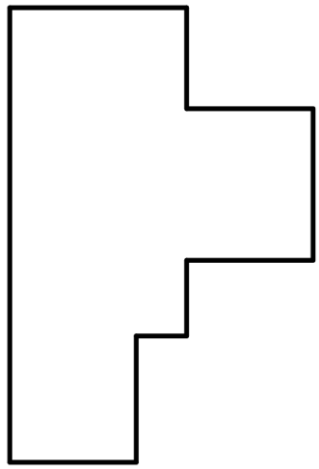
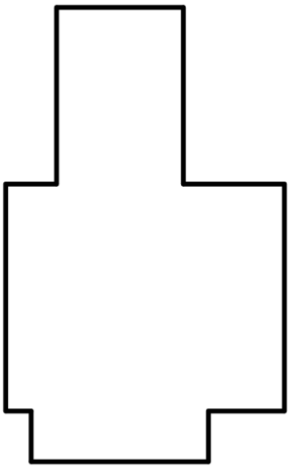
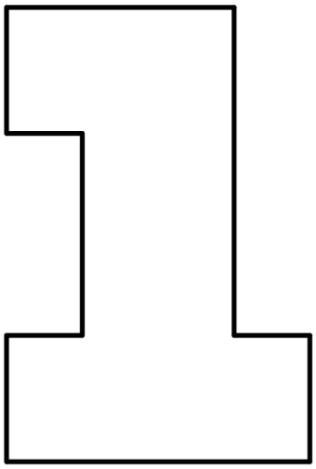
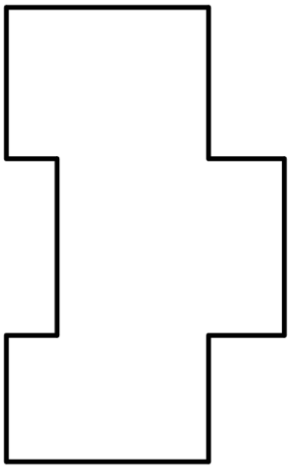
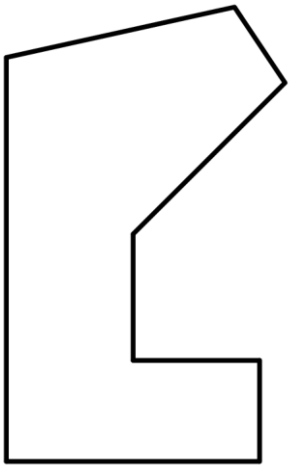
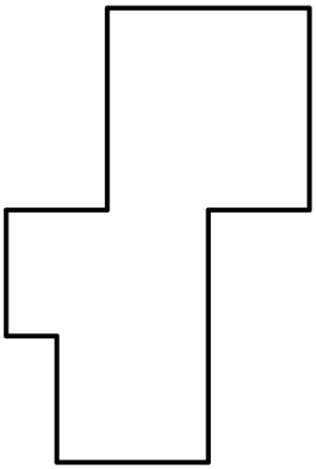
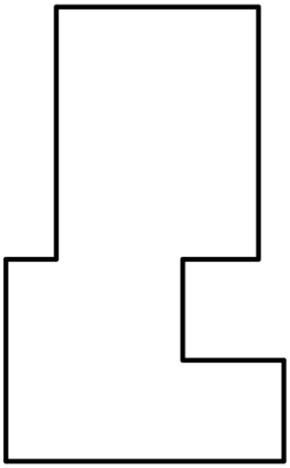
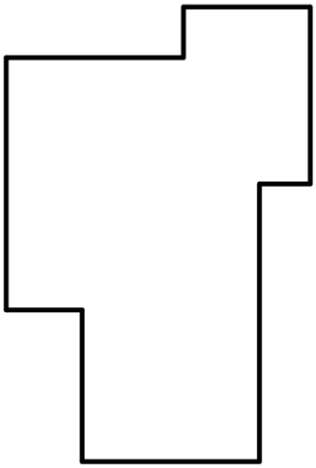
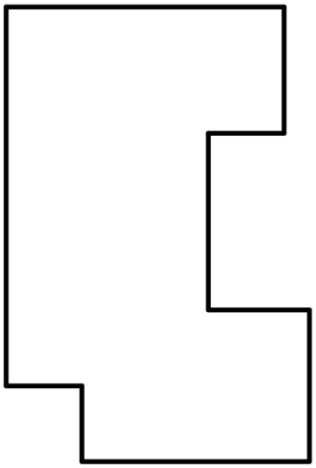
10 	**11** 	**12** 
13 	**14** 	**15** 
16 	**17** 	**18** 

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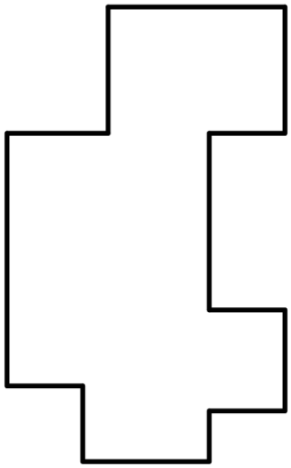
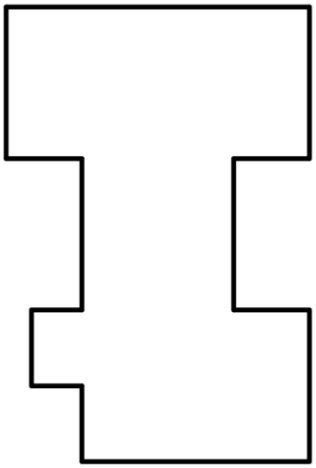
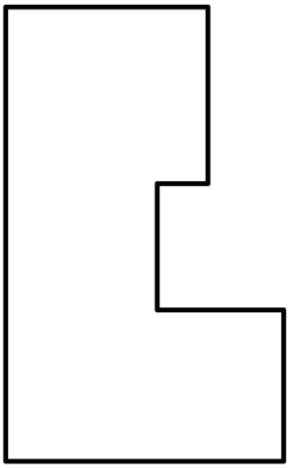
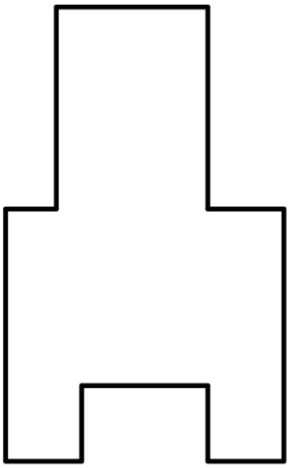
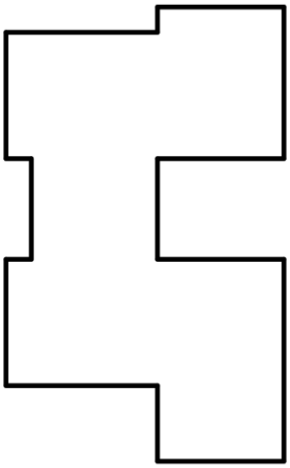
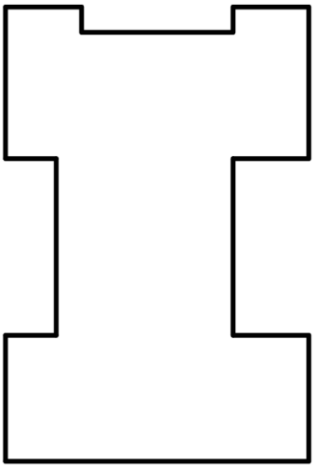
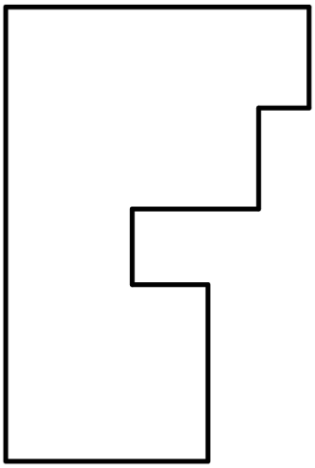
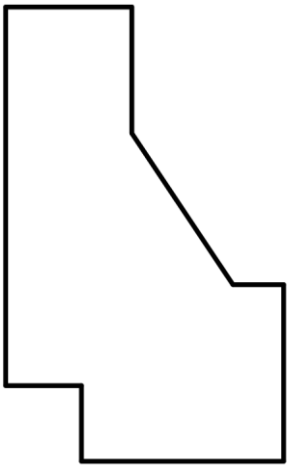
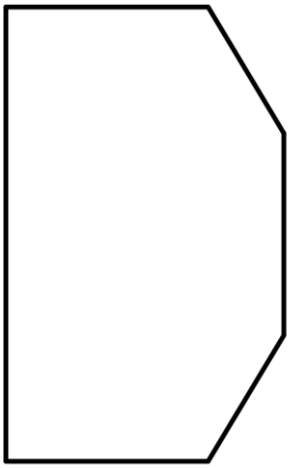
19 	**20** 	**21** 
22 	**23** 	**24** 
25 	**26** 	**27** 

3. METHODICAL GUIDELINES TO CREATION OF INTERSECTING LINES OF THE ROOF SLOPES

When making drawings of low-rise buildings, building reconstruction projects, it is necessary to construct the intersection of the roof slopes. Buildings are not always rectangular in plan. The tasks given in these methodical guidelines develop space imagination, create understanding of constructions, allow to evaluate creation accuracy when using computer-aided engineering systems (for example as the drainage system is designed, to check availability of valley gutters, etc.).

3.1. CREATION OF INTERSECTING LINES OF SLOPES OF ROOF IN THE FORM OF RECTANGLE ON THE PLAN

Consider the creation of the roof which slopes have equal biases θ (fig. 2, *a, c*).

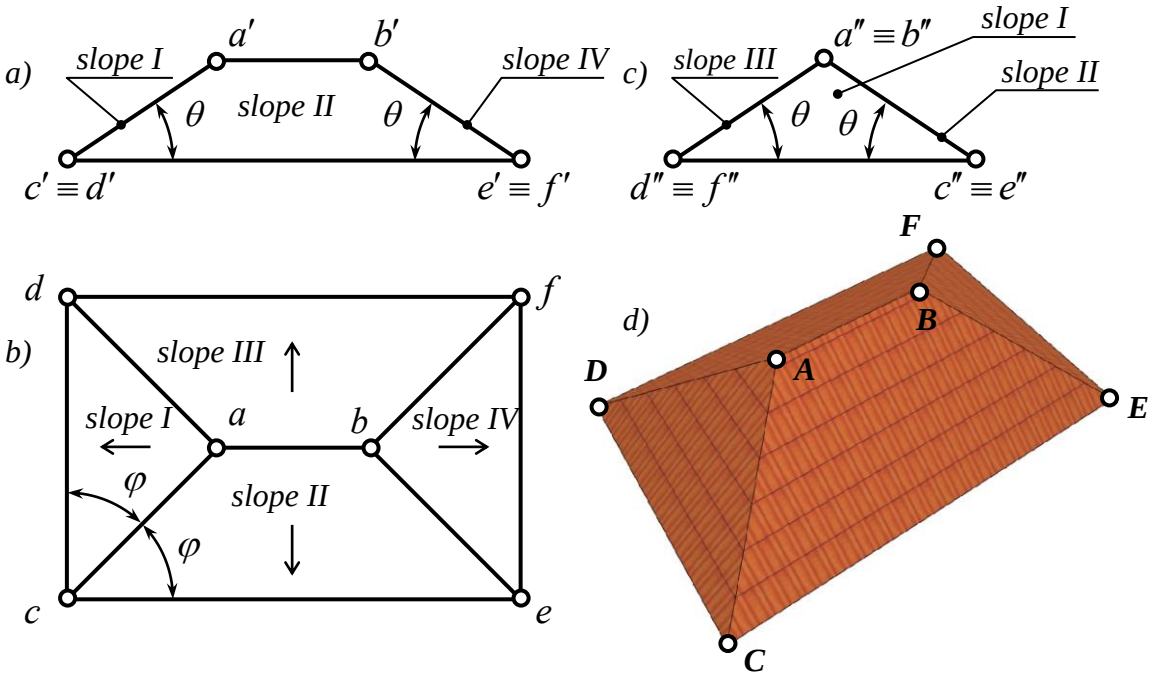


Fig. 2. Projections *(a, b, c)* and a view of the roof in prospect *(e)* of a rectangular building: *a* – frontal; *b* – horizontal; c – profile projections

If the overhangs of the slopes are placed on the same horizontal level (on the conditional horizontal plane *CDFE* (fig. 2)), then the following rules apply when constructing the lines of intersection of the roof slopes:

The 1st rule. The horizontal projection of intersecting line of adjacent slopes is bisector, formed by traces of slopes on the conditional horizontal plane (the bisectrix is constructed of point of intersection of traces).

For example, in figure 2, the horizontal projection of intersecting line of two slopes (I and II) is DCE corner CA bisectrix (fig. 2, d) formed on the conditional horizontal plane by traces of DC and CE of slopes I and II respectively.

The 2nd rule. If in some point on horizontal projection of roof projections of two edges of slopes are crossed, then through this point there passes also the projection of the third edge.

For example, in point A, the projections of the edges of three slopes converge (fig. 2, b).

The last rule is based on the postulate: the position of a point in space is determined by three planes intersecting along three straight lines that converge at one point (fig. 3). For example, in figure 3, the position of point A is given by three planes α, β, γ, which intersect along lines *l*, *m*, *n*, converging in point *A*.

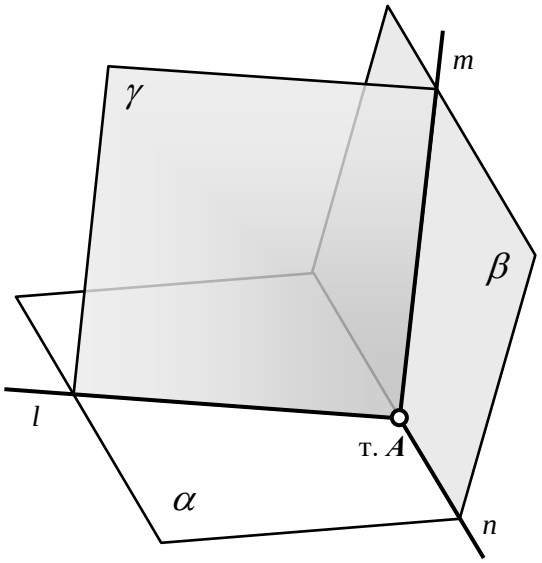


Fig. 3. The intersection of three planes in space determines the position of point A

Figure 4, a shows the initial data for constructing the line of intersection of four slopes of a rectangular roof. If slopes have identical biases and lines of overhang lie in one horizontal plane, then for creation on the plan of horizontal projections of intersecting lines of adjacent slopes to construct bisectrixes of internal corners enough (fig. 4, *b*). We shall construct horizontal edge (ridge) parallel to horizontal traces of slopes which are parallel (fig. 4, *c*). In figure 4, d, the roof top view is shown, shooters specified biases of slopes.

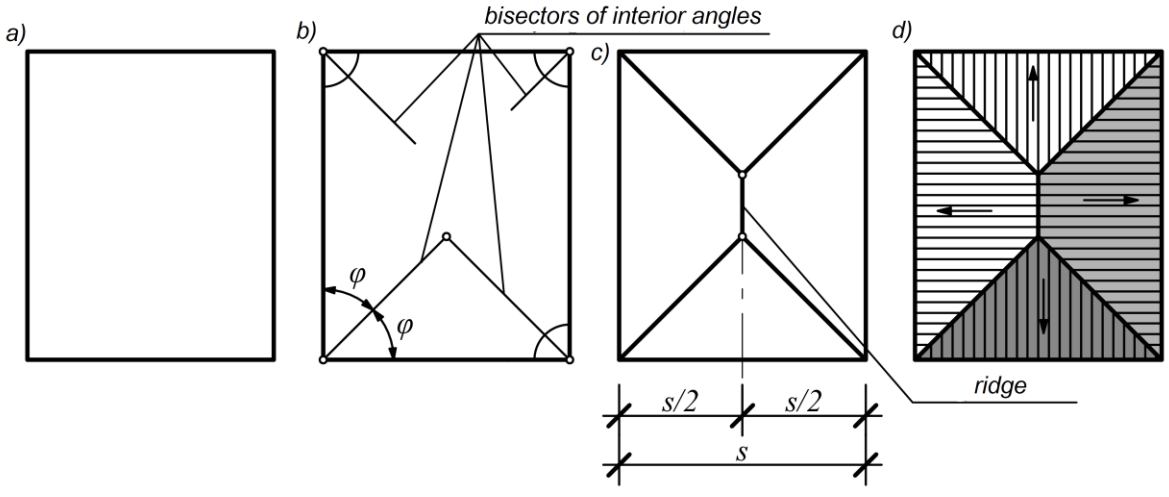


Fig. 4. Construction of intersecting lines of the roof slopes of a rectangular shape in plan

If the overhangs of the roof slopes form a square on the plan, then the intersection lines of the adjacent slopes intersect at the highest point of the roof (p. *A*) (fig. 5).

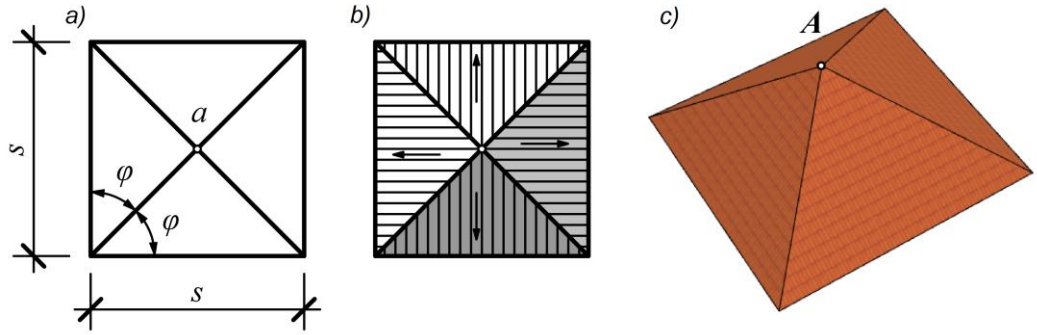


Fig. 5. Lines of intersection of the square in the plan of the roof

3.2. INTERSECTION OF THE ROOF SLOPES WHICH FORM IN THE PLAN IS FORMED BY THE CROSSED RECTANGLES

Let's consider creation of projections of slopes of the roof having the form of two crossed rectangles in the plan (fig. 6, *a*). The protruding part is wider than the main part of the building.

We begin creation with the plan. Let's continue lines of the contour of the roof so that two rectangles were formed (fig. 6, *b*). For definition of horizontal projections of intersecting lines of slopes of roof, we will construct bisectrixes of internal and outside corners at first for the main part of roof (fig. 6, *c*). After that, we define for the projecting part (fig. 6, *d*). In the middle of the main part of the building we will carry out horizontal edge of *AB* (ridge) parallel to horizontal traces of slopes of roof (fig. 6, *c*). Similarly, we define the ridge *CE* of the projecting part of the building (fig. 6, *d*).

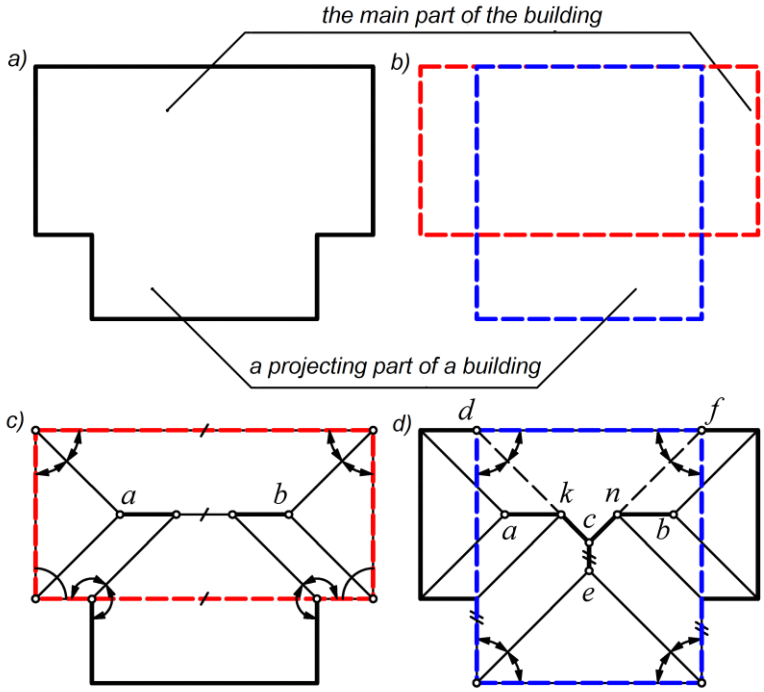


Fig. 6. Sequence of creation of horizontal projections of intersecting lines of slopes of roof

In Figure 6, d, the non-existent slope of the DCF, indicated by dashed lines, coincides with the slope of the main part of the building. Therefore, segments DC and FC should be drawn only on the sections KC and NC, which are the lines of intersection of the roof slopes.

Figure 7 shows the horizontal and frontal projection of the roof, its view from above and in perspective.

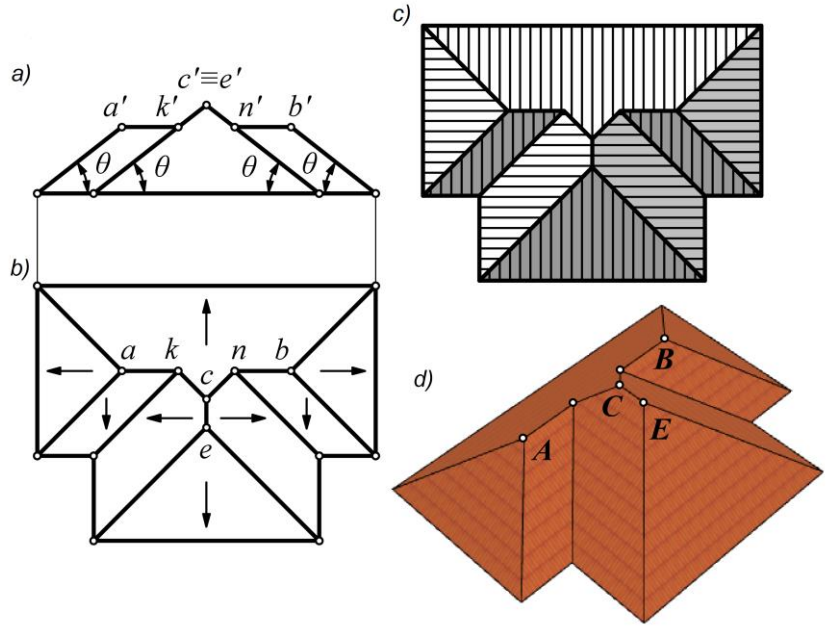


Fig. 7. Projections (*a*, *b*), top view (*c*) and perspective (*d*) of the roof:
a, b – frontal and horizontal projections, respectively

If the protruding part of the building has a smaller width than the main (or equal to it) construction is carried out in the same way (see fig. 8).

In figure 8, the section BC of the straight line AC and the ridge DB lie in the plane of slope I, and the edge KD lies in the plane of slope II, so they are depicted by a dashed line. Similarly, in figure 8, b, the edges KD and ND of the non-existent slope KDN lie in the plane of slope II, and in figure 8, the edge AB lies in the plane of slope I, and the edge AC lies in the plane of slope II.

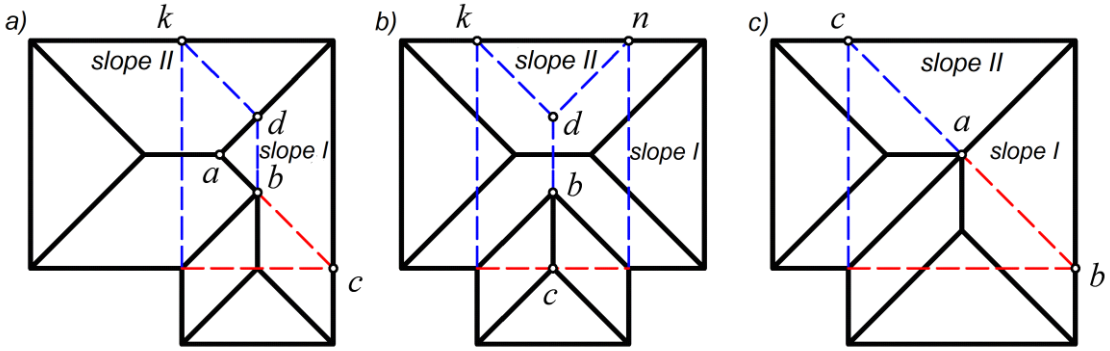


Fig. 8. Creation of horizontal projections of intersecting lines of slopes of roof

When constructing the intersection of the roof slopes in the above way, dividing the roof plan into intersecting rectangles, care should be taken to correctly organize the drainage from the roof.

Example 1. Figure 9 a shows the initial data for constructing the cross section of the roof slopes on the plan. We divide the roof plan into two rectangles and build horizontal projections of the intersecting lines of the roof slopes, drawing the bisectors of the internal corners and ridges (fig. 9, b, c). Figure 9, d shows the construction of the bisectors of the outer corners of the roof. At this stage of creation two versions of solutions of slopes shown in figure 9, d are possible, one of which is inadmissible. For final creation we will allocate joint part of two rectangles of roof (fig. 9, e). The horizontal edge (ridge) of the joint part of the plan (in figure 9, e highlighted by a thick line) is always placed *across the longitudinal sides of the rectangle* highlighted in the figure by a dashed line. This design solution of the roof slopes provides drainage in this part of the roof (fig. 10, a). If the horizontal edge (ridge) is placed along the longitudinal sides of the selected rectangle, then a longitudinal hollow (horizontal valley) is formed (fig. 10, b), which is unacceptable due to the threat of wetting the structure, accumulation of precipitation in the form of snow, etc.

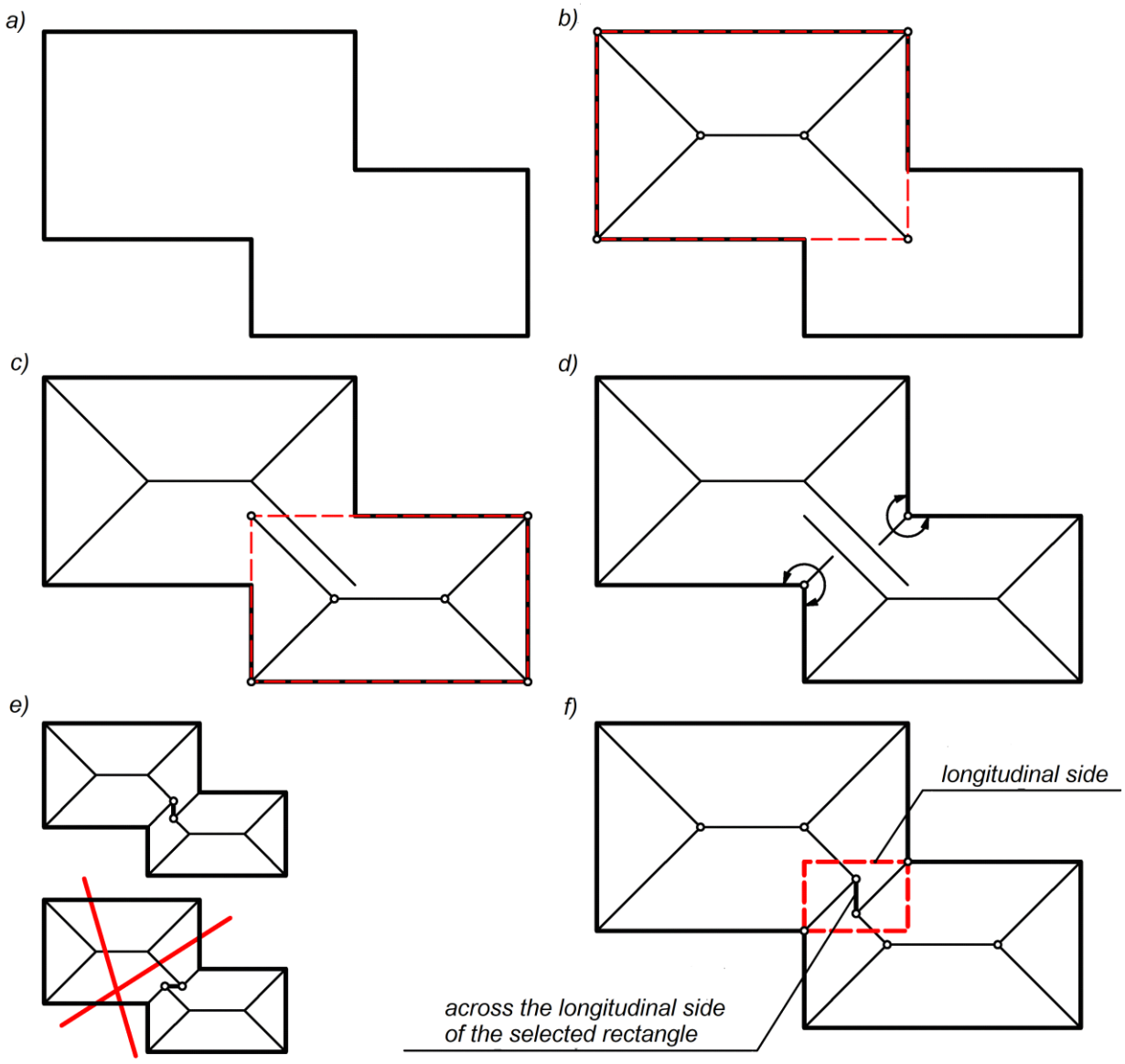


Fig. 9. Sequence of construction of horizontal projections of intersecting lines of roof slopes

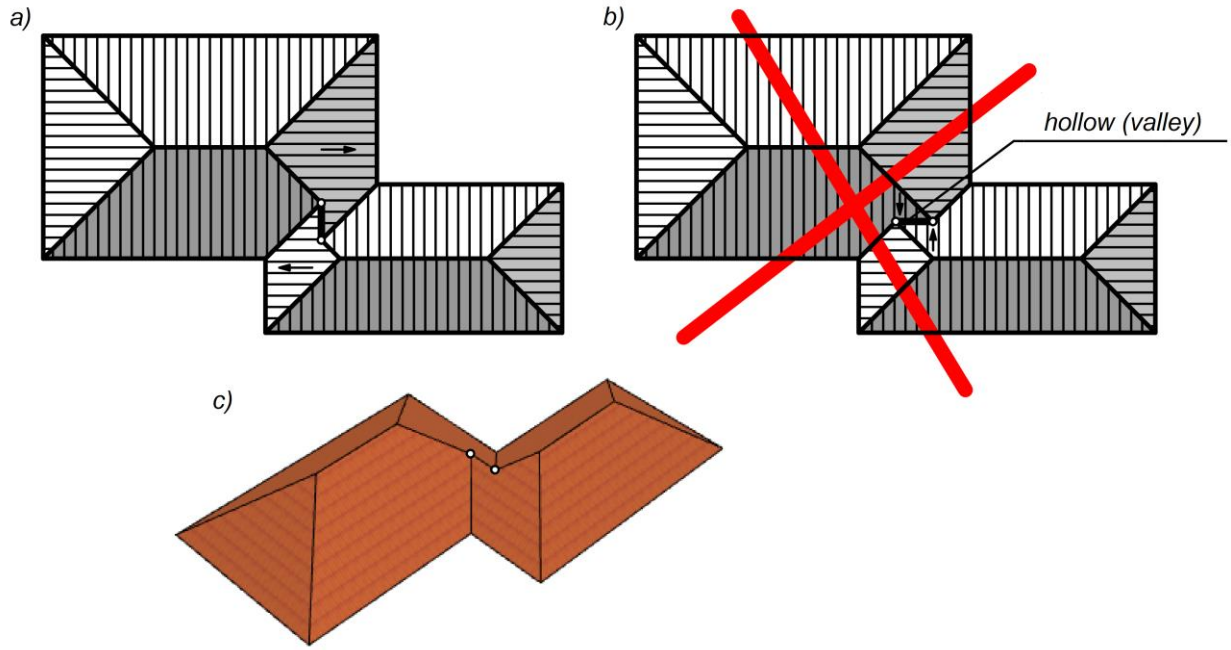


Fig 10. Placement of horizontal edge (ridge) in the general part of the plan of roof: correct (*a – the top view; c – in perspective*) and inadmissible (*b*)

Example 2. Build the intersection of the roof slopes, the plan of which is shown in figure 11, a.

In figure 11 the sequence of creation of horizontal projections of intersecting lines of slopes of roof is shown by one of ways at which step by step define the general edges of the crossed slopes.

In figure 11, b, after numbering the slopes, we build the bisectors of the inner and outer corners of the roof in the plan, which are horizontal projections of the intersection of the adjacent roof slopes.

In figure 11, a horizontal edge (ridge) of the intersection of slopes I and VII is constructed, the traces of which are parallel. To determine the line of intersection of slopes II and VII on the plan (fig. 11, d), the traces of the slopes are continued to the intersection. From the point of intersection, construct the bisector of the angle formed by the traces of the slopes, and indicate only the section of the edge common to slopes II and VII. The intersection of slopes III and VII is shown in figure 11, d. The traces of the slopes are parallel, so the slopes intersect along a line parallel to the traces, forming a ridge. To determine the line of intersection of slopes III and VI (fig. 11, e), the traces of the slopes are continued on the plan to the intersection. Build bisector along which the horizontal projection of the edge, common for slopes, is placed of point of intersection. Figure 11. g shows a plan projection of the common edge of slopes III and V, the traces of which are parallel. The completed roof plan is shown in figure 11, h.

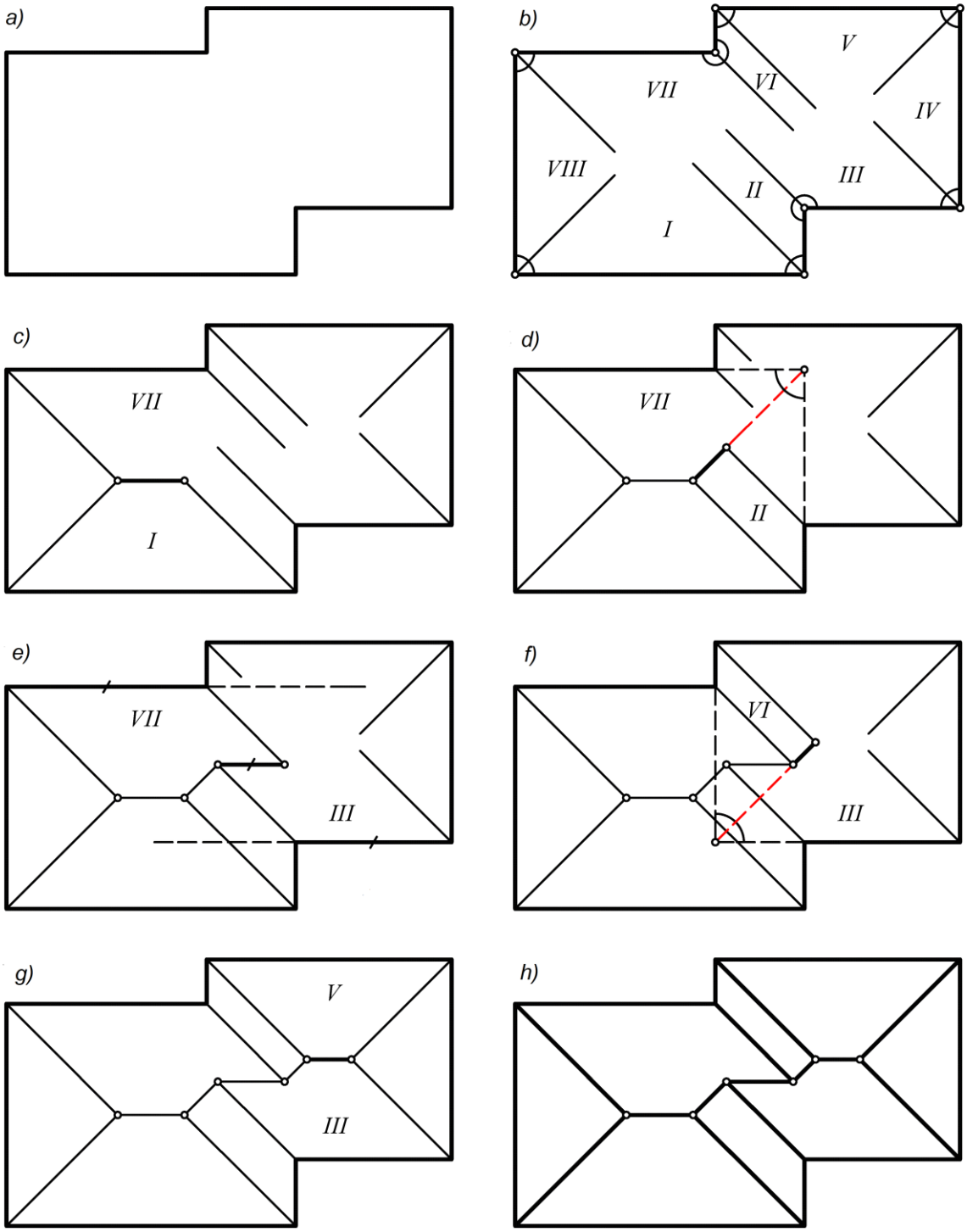


Fig. 11. Creation of horizontal projections of intersecting lines of slopes of roof

Figure 12 shows the sequence of construction of the lines of intersection of the slopes of the same roof in a different way. Having carried out bisectrixes of internal and outside corners on the plan, we shall construct horizontal edges (ridges) for two rectangular parts of roof (fig. 12, a). On the plan for two rectangular parts of the roof, we highlight the *common* rectangular part outlined by a dashed line in figure 12, b. Let's construct in the middle AB ridge across the longitudinal parties of the allocated rectangular part of the roof (fig. 12, b). Considering the rule that if in some point on horizontal projection of roof projections of two edges of slopes are crossed, then

through this point there passes also the projection of the third edge, we will connect the corresponding points of horizontal edges (ridges) (fig. 12, c), having completed creation. The top view of the roof is shown in figure 12, d.

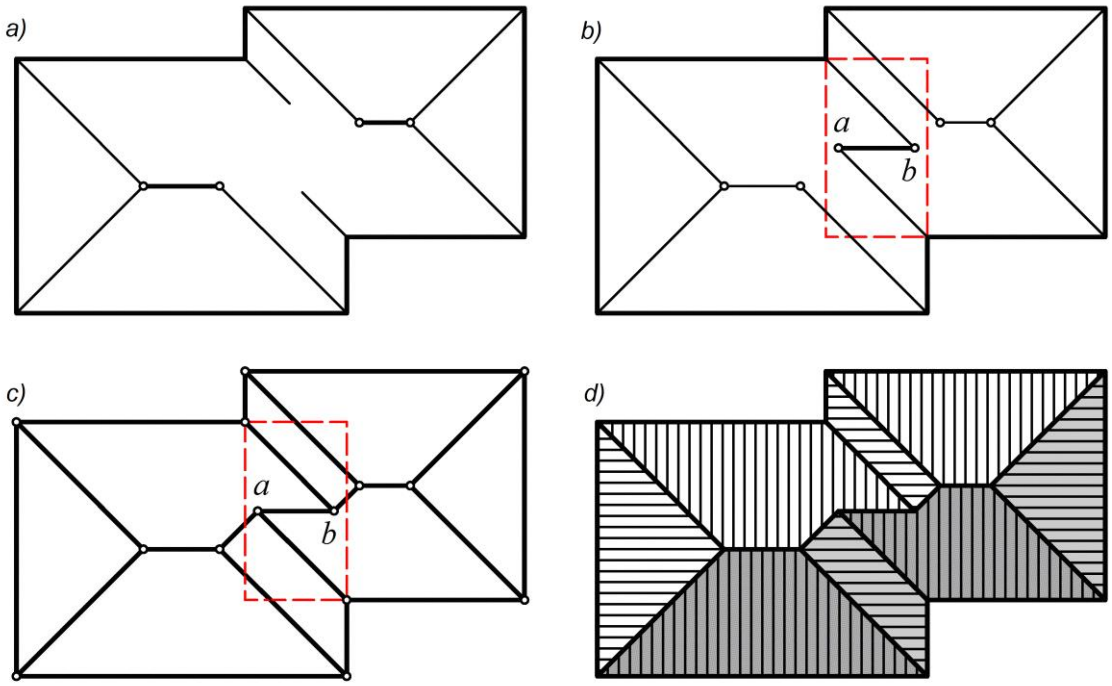


Fig. 12. Construction of horizontal projections of intersecting lines of roof slopes

To determine the location of the edge AB on the roof plan, it is also possible to highlight the conventional main part of the roof (shown by a dashed line in fig. 13) and construct a horizontal edge KN (segments KA and BN lie in the plane of slopes VII and III, respectively, so they are not depicted) .

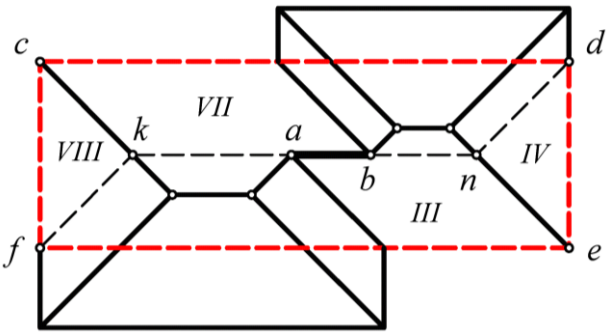


Fig. 13. Construction of the edge AB

Figures 14-16 show the intersection of the slopes of individual symmetrical roofs of buildings, the shape of which in the plan is formed by intersecting squares.

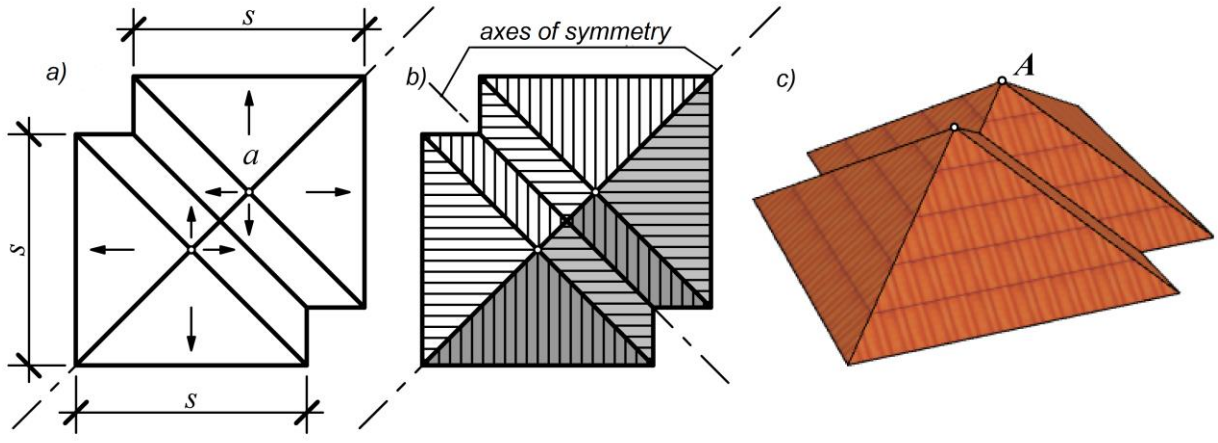


Fig. 14. Crossing of slopes of roof of the symmetric building

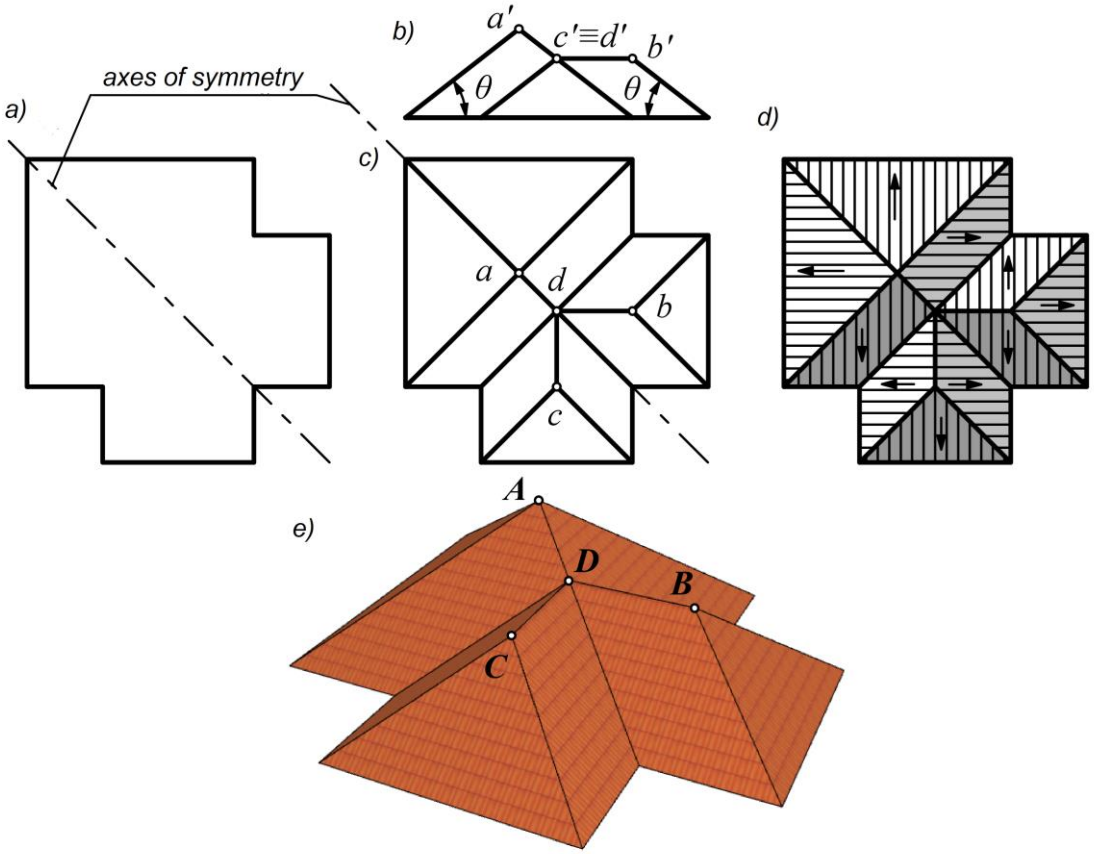


Fig. 15. The roof of a symmetrical building: a – initial data; b and c – frontal and horizontal projections, respectively; d - top view; d - perspective

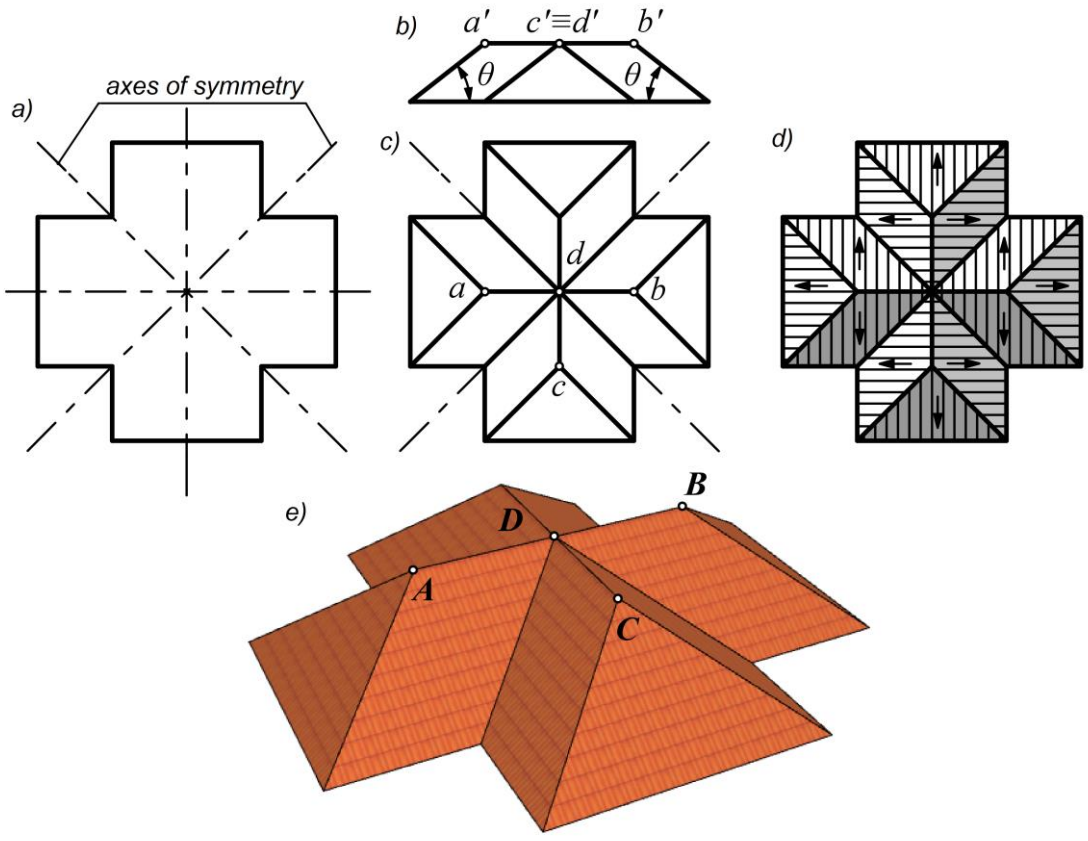


Fig. 16. The roof of a symmetrical building: a – initial data; b and c – frontal and horizontal projections, respectively; d - top view; d - perspective

Figure 17 shows examples of the roofs of buildings with a complex shape formed by rectangles, and the roof slopes have the same slope, and the overhang lines of the slopes are in the same horizontal plane. These tasks can be used for self-preparation: on the contour of the roof chosen in the drawing to construct in plan of the line of crossing of slopes and the roof facade.

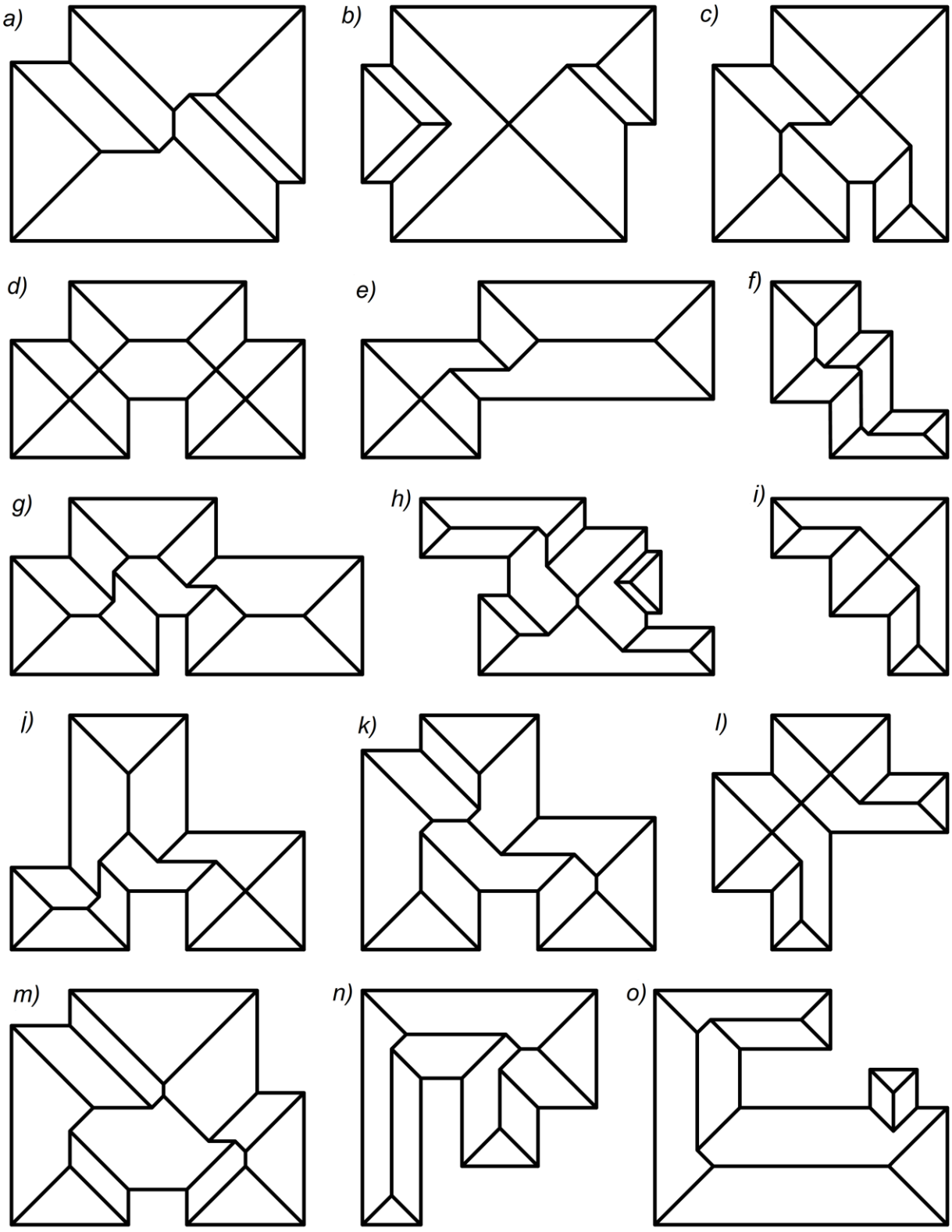


Fig. 17. Examples of roofs of buildings with a complex shape in plan

3.3. INTERSECTION OF THE ROOF SLOPES WHICH FORM IN THE PLAN REPRESENTS REGULAR POLYGON

Determination of the projections of the lines of intersection of the roof slopes of the building, which has a shape in the plan of a regular polygon, begins with the construction of the bisectors of its internal angles on the plan. Along the bisectors, projections of the lines of intersection of adjacent roof slopes are built, which intersect at the point p. O, which is the center of the circle inscribed in the polygon. Figure 18 shows the construction of lines of intersection of roof slopes, the basis of which are regular polygons.

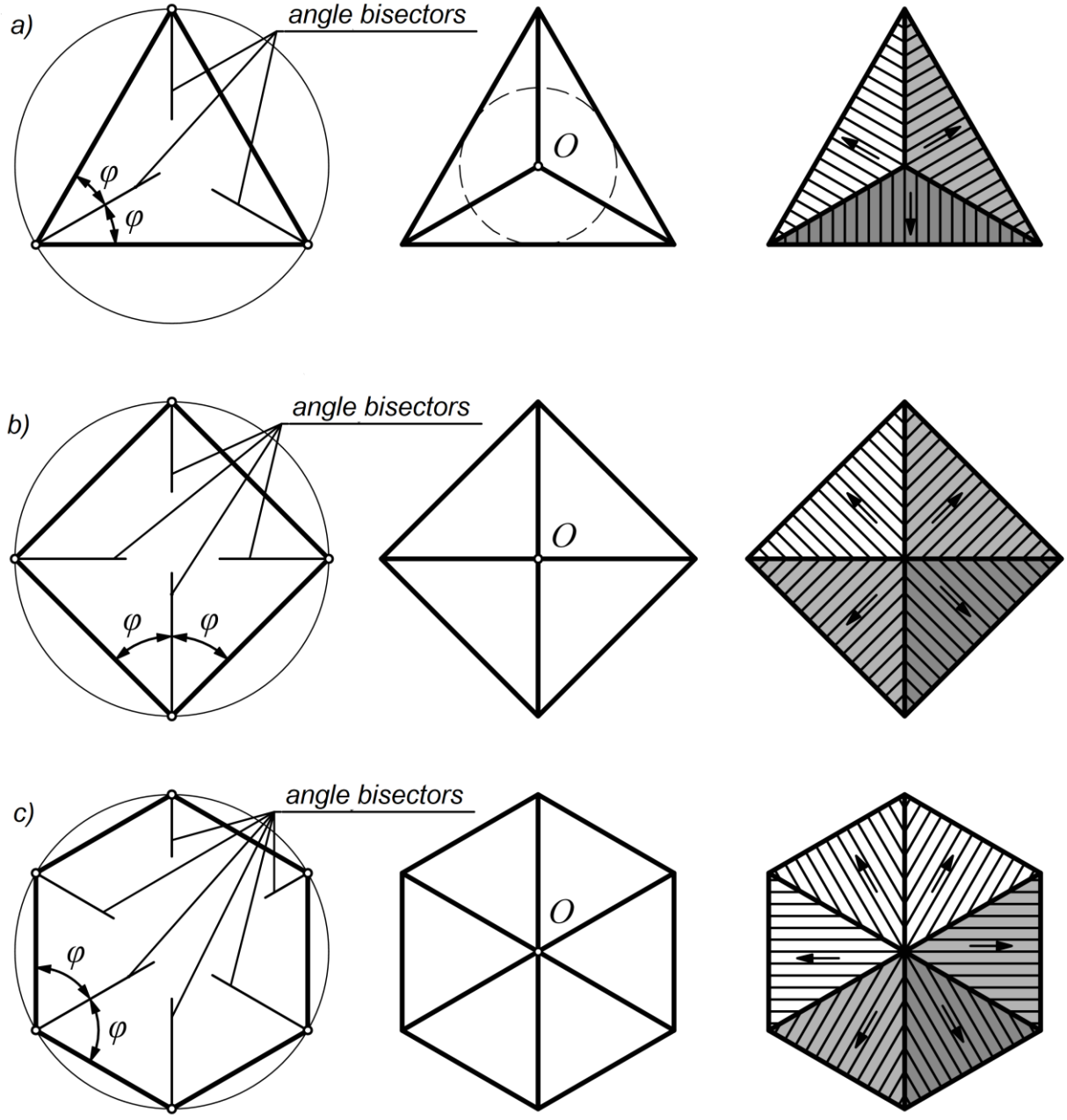


Fig. 18. The sequence of determining the projections of the lines of intersections of the roof slopes of the building, which has the form in the plan of a regular polygon:
a – triangle; b – quadrangle; c – a hexagon

3.4. INTERSECTION OF THE ROOF SLOPES IN THE FORM OF TRIANGLE ON THE PLAN

For a roof that has a triangular shape in plan, it is sufficient to construct the bisectors of the inner angles of the triangle to determine the projection lines of the intersection of the slopes on the plan. Along the bisectors to point A (see fig. 19), horizontal projections of the intersecting lines of the roof slopes are made.

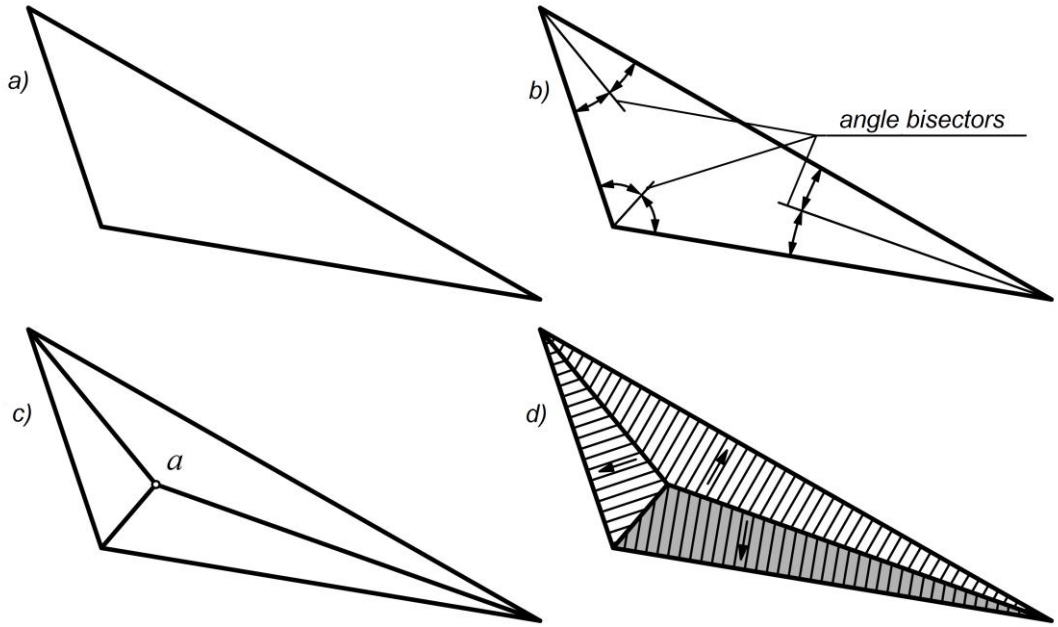


Fig. 19. Construction of projections of slope intersection lines for a triangular-shaped roof

3.5. INTERSECTION OF THE ROOF SLOPES OF COMPLEX FORM ON THE PLAN

If the traces of the roof slopes on the plan are not parallel, then the construction of the horizontal projection of the line of intersection of the slopes takes place in the following sequence (fig. 20):

– continue the horizontal tracks AB and CD of slopes I and II on the plan to the point of their intersection (point F), from which the bisector FK of the formed angle AFD is constructed (see fig. 20, b);

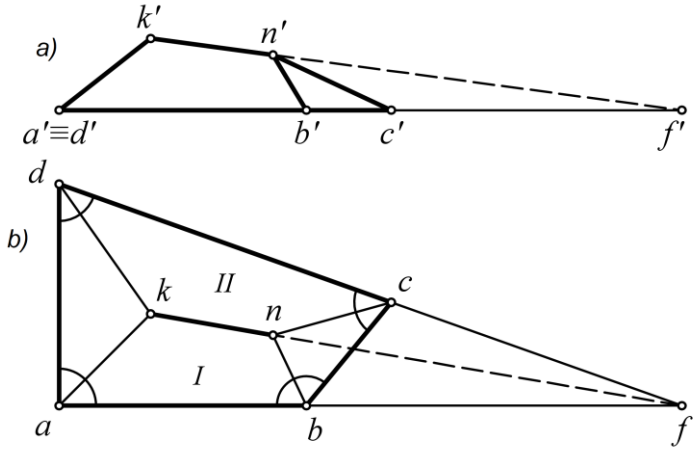


Fig. 20. Construction of the line of intersection of slopes, the traces of which are not parallel

– along bisectrix on the plan build intersecting line of slopes on which direct the edge of KN (ridge), general for two slopes. Let's notice that KF ridge on frontal projection does not hold horizontal position any more (fig. 20, a);

– define other intersecting lines of slopes, having constructed bisectrixes of corners.

Example 1. Construct the intersecting lines of the slopes of the roof, which has a complex shape in plan, shown in figure 21, a.

The sequence of construction of horizontal projections of the lines of intersection of the roof slopes on the plan is shown in figure 21.

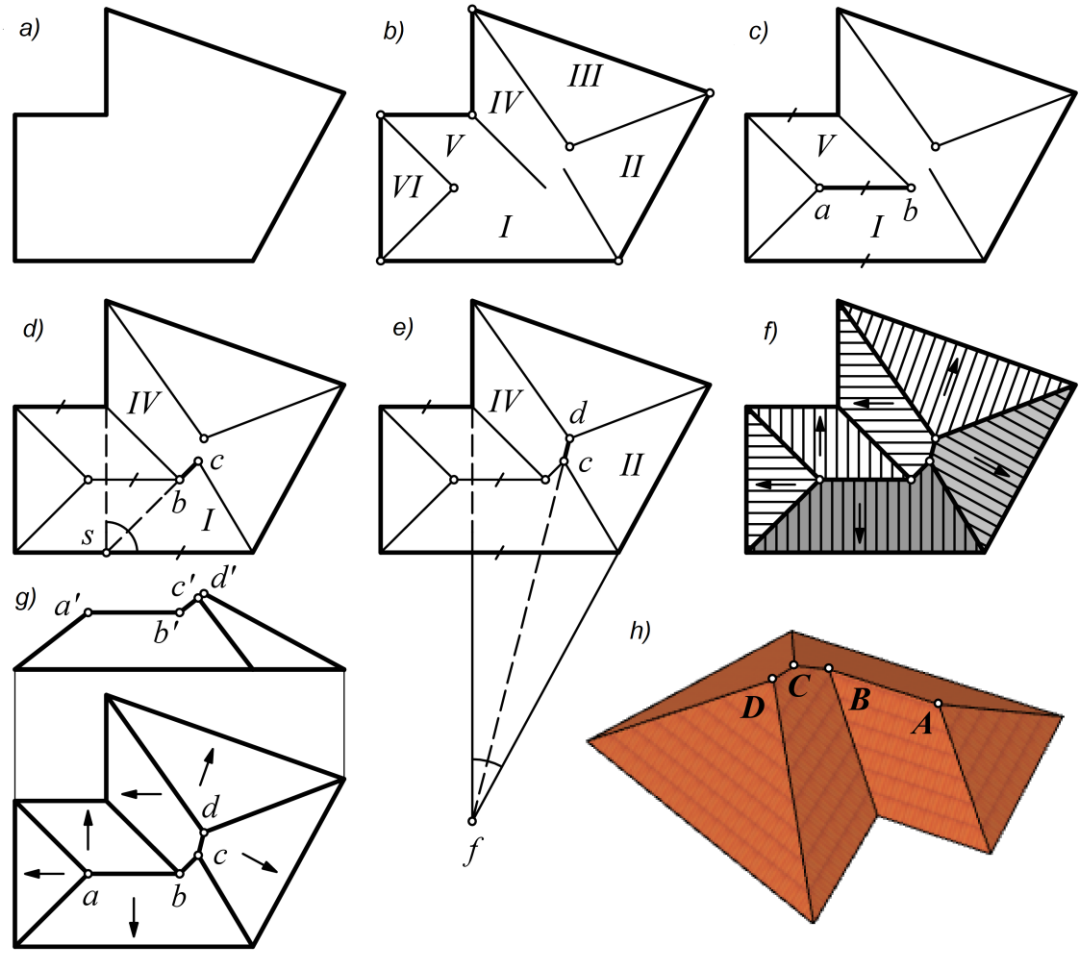


Fig. 21. Construction of roof plan (*a-f*), roof facade and plan (*g*) and perspective view of the roof (*h*)

At the first stage, we build on the plan the bisectors of the inner and outer corners of the roof, along which we make horizontal projections of the lines of intersection of adjacent slopes (fig. 21, b). Let's number roof slopes. As the traces of the slopes I and V are parallel, the line of intersection of the slopes AB runs in the middle, parallel to the traces (fig. 21, c). To determine the horizontal projection of the line of intersection of slopes I and IV, let's continue the horizontal traces of the slopes to their intersection at point S. Let's construct the bisector of the angle S formed by the traces of the slopes, along which we shall draw the edge BC common to slopes I and IV on the plan (fig. 21, d).

Similarly, to build a common edge DC of slopes II and IV, we continue the traces of the slopes to the intersection at point F (fig. 21, e). Having constructed the bisector of the angle F, we determine the horizontal projection of the intersection line DC of the II and IV roof slopes. The final construction of the facade and roof plan is shown in figure 21, g; the perspective view of the roof is shown in figure 21, h.

Example 2. To construct intersecting lines of slopes of the roof having the same form in the plan as in figure 22, a.

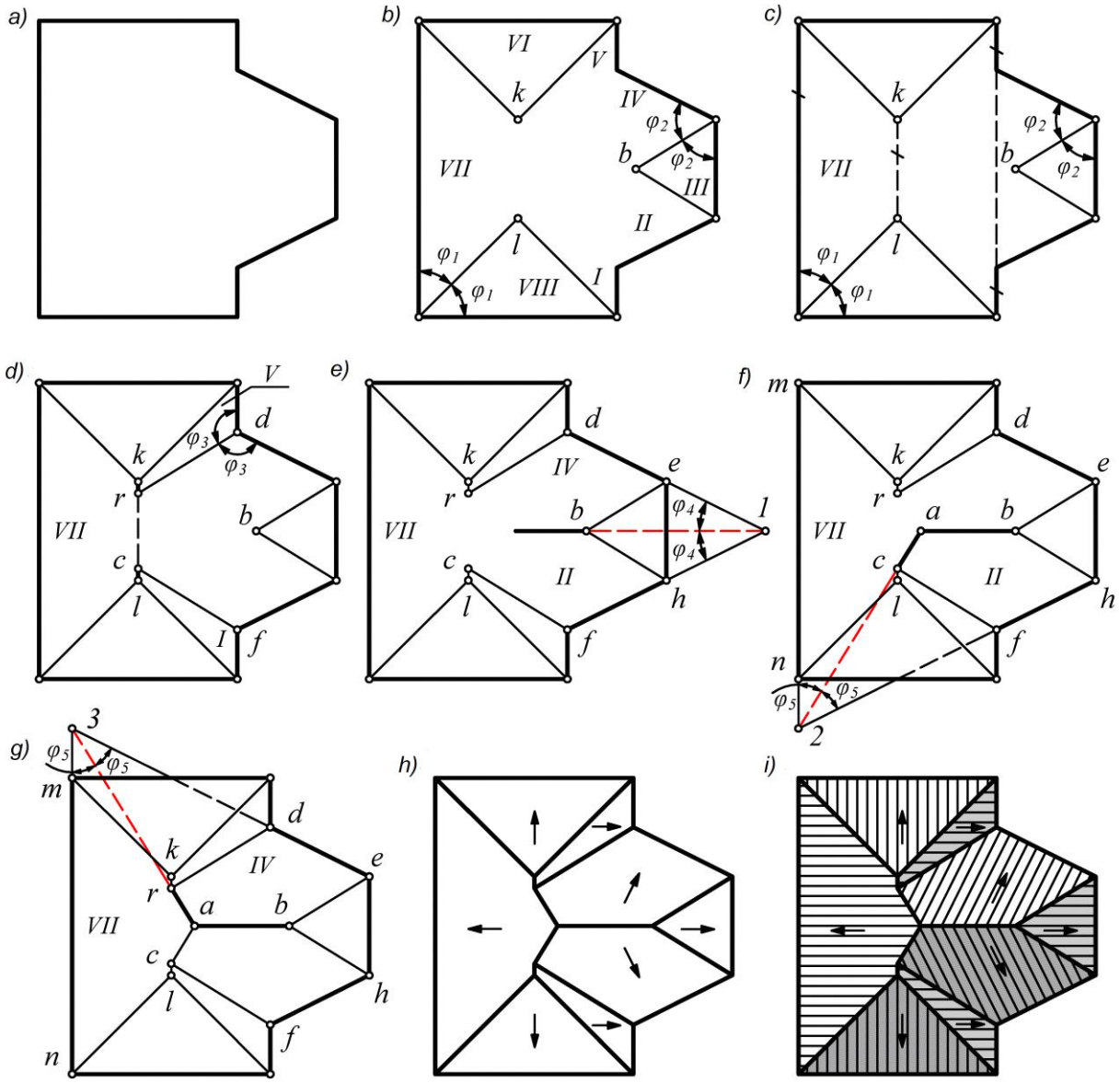


Fig. 22. Stages of construction of intersecting lines of roof slopes

If the overhangs of the slopes belong to the conditional horizontal plane, then the construction of horizontal projections of the lines of intersections of the roof slopes takes place in the following sequence:

1. Let's build on the plan the bisectors of the internal angles, along which the horizontal projections of the lines of intersection of the roof slopes pass (fig. 22, b). The edges of the slopes at the intersection form points B, L and K. For convenience, we number the roof slopes;

2. Let's construct horizontal edge of LK (ridge) in the middle of rectangular part of roof (fig. 22, c), parallel to traces of slopes;

3. Let's construct the bisectors of the external angles from points F and D to the intersection with edge LK (fig. 22, d). Edge LC is a horizontal projection of the line of intersection of slopes I and VII, and edge KR is a horizontal projection of the line of intersection of slopes V and VII on the roof plan;

4. Let's build a horizontal projection of the line of intersection of slopes II and IV of the roof. Next, we shall continue the traces of the slopes DE and FH on the plan. We will draw the bisector B1 of the angle D1F through the point of intersection, point 1 (fig. 22, e). The common edge of slopes II and IV runs along the bisector on the plan;

5. To determine the projection of the line of intersection of slopes II and VII, we shall continue the traces of MN and HF slopes to the intersection at point 2 (fig. 22, f). Through point 2, we construct the bisector C2 of the angle M2H. Bisectors C2 and B1 in the plan belong to the same plane (slope II) and intersect at point A. Edge SA is the intersection of slopes II and VII (fig. 22, f).

6. Similarly, after continuing the traces of slopes IV and VII, determine the position of point 3 and, having built the bisector A3 of the angle N3E, build the line of intersection of the slopes - edge RA (fig. 22, g).

Figure 22, h shows the final construction of the roof plan, and figure 22, i shows the top view of the roof.

Figure 23 shows three roof projections (horizontal, frontal, and profile) and a perspective view of the roof (figure 23, d).

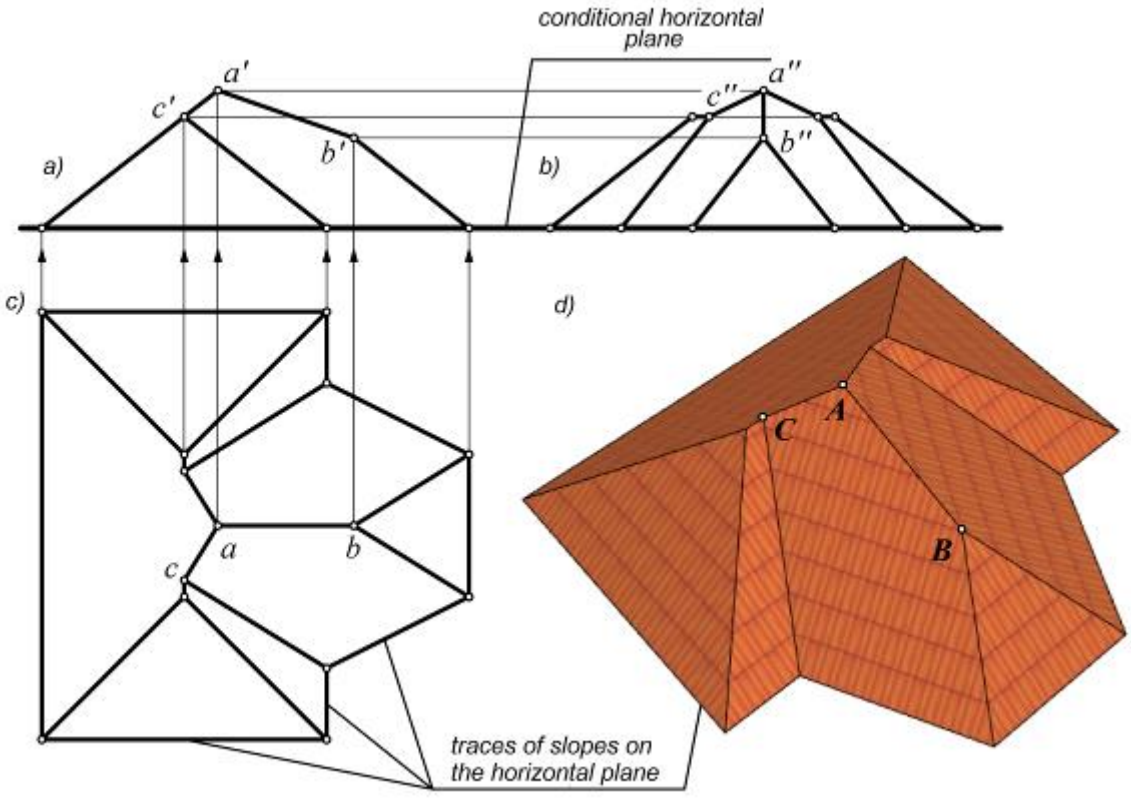


Fig. 23. Projections (*a, b, c*) and the view of the roof in perspective (*d*):
a – frontal; b – profile; c – horizontal projection

Example 3. To construct the intersecting lines of the roof slopes, the shape of which is shown in the plan in fig. 24, a.

As the roof of the building is symmetric, it is enough to construct intersecting lines of one half which slopes we shall number (fig. 24, b). To determine the horizontal projections of the lines of intersection of adjacent slopes, it is enough to construct the bisectors of the inner and outer corners of the roof on the plan (fig. 24, b).

Construction on the plan of the horizontal projection of the line of intersection of the opposite slopes is carried out as follows:

– if the traces of the slopes are parallel, then the projection of the common horizontal edge (ridge) of the slopes is parallel to their traces and is located in the middle between them. For example, the edge AB of slopes I and VI is parallel to the traces of the slopes (fig. 24, c). The horizontal projection of the line of intersection of slopes III and V in figure 24, f is constructed in the same way;

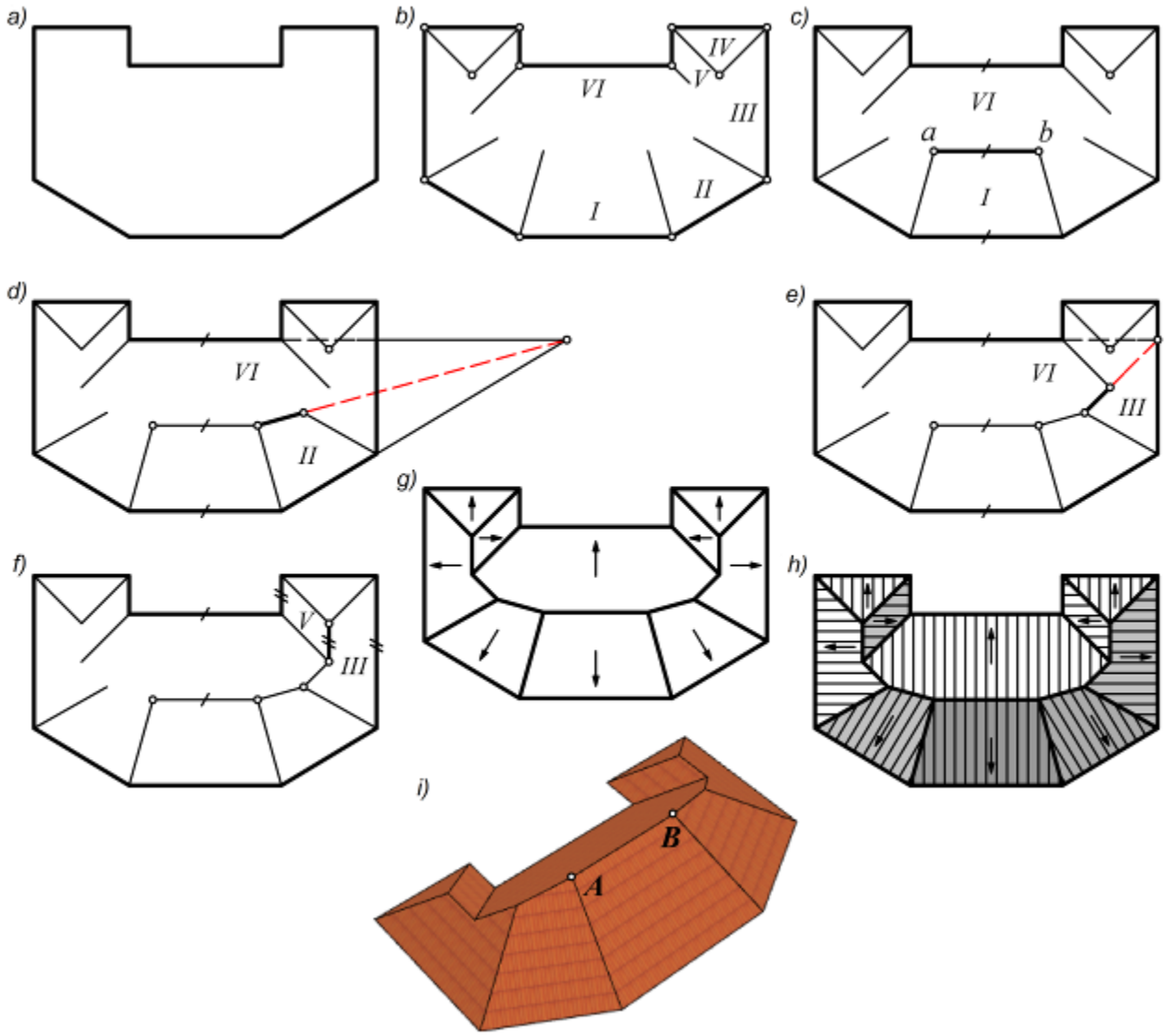


Fig. 24. Step-by-step construction of the roof plan and the view of the roof in perspective

– if the traces of the roof slopes are not parallel, then they build the bisector of the angle formed on the plan by the intersection of the continuations of the traces. Along the bisector, build a horizontal projection of the line of intersection of the slopes (common edge, ridge).

For example, in figure 24, d to determine the location of the common edge of slopes II and VI on the plan, continue their traces to the point of intersection, from which the angle bisector is constructed. The section of the bisector common to slopes II and VI is the horizontal projection of the line of intersection of the slopes. To construct the line of intersection of slopes III and VI (fig. 24, e), continue the trace of slope VI to the intersection with the trace of slope III. A bisector is built from the top of the formed angle, along which runs the horizontal projection of the edge common to the slopes (fig. 24, e).

The completed construction of the roof plan is shown in figure 24, g. The top view of the roof is shown in figure 24, h, and in figure 24, i – in perspective.

Example 4. Construct the intersecting lines of the roof slopes, the shape of which is shown in the plan in fig. 25, a.

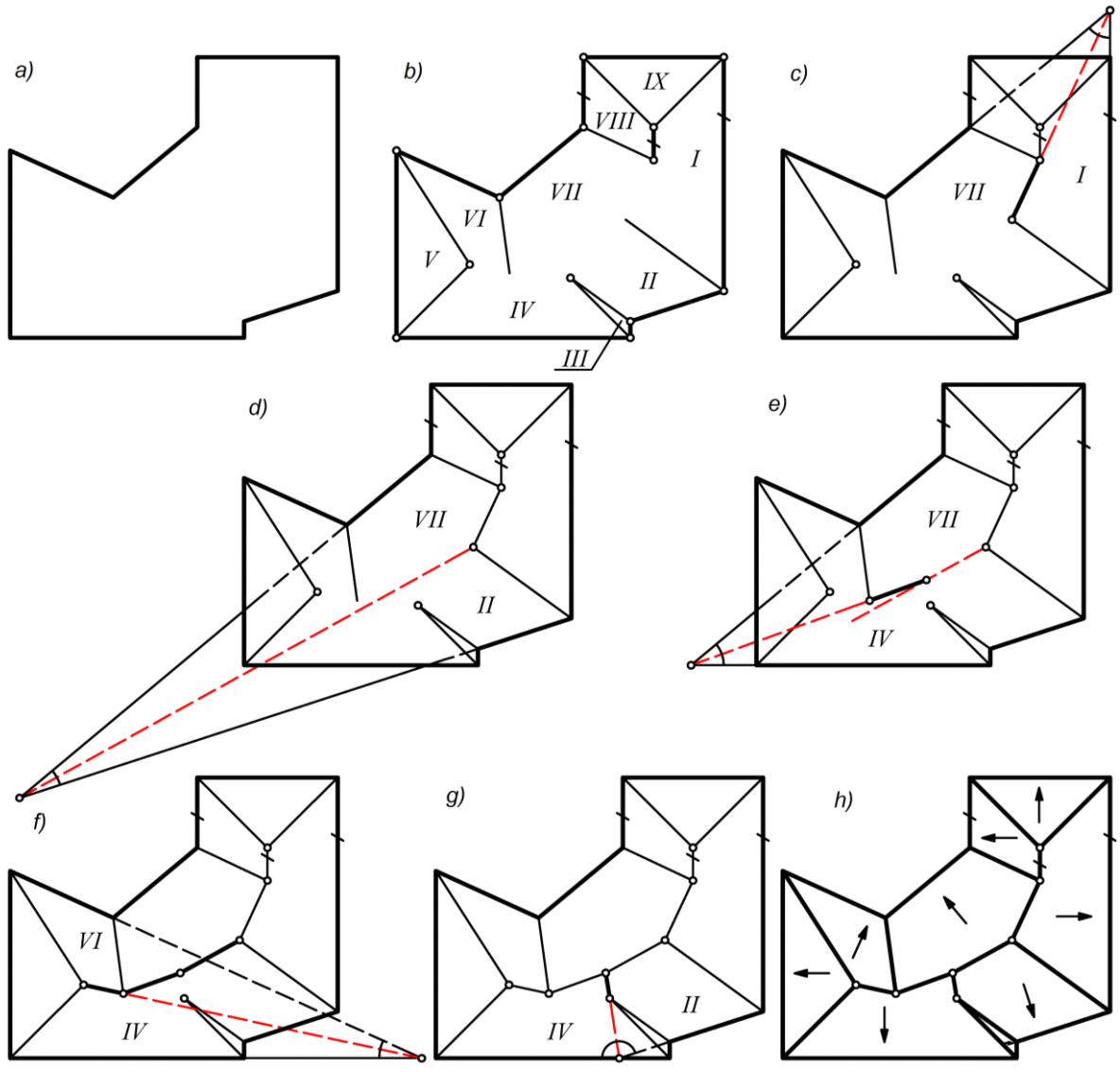


Fig. 25. The sequence of the construction of the lines of intersection of the roof slopes of complex form on the plan

The sequence of construction of horizontal projections of lines of intersection of roof slopes on the plan is shown in figure 25.

To determine the horizontal projections of the intersecting lines of adjacent slopes, we shall construct the bisectors of the inner and outer corners on the plan (fig. 25, b). Let's number roof slopes near each of their traces.

Roof slope IX is adjacent to slopes I and VIII (fig. 25, b). Let's construct along the bisectors their common edges intersecting at point A. From point A, we draw a common edge for slopes I and VIII, the traces of which are parallel (fig. 25, b).

To determine the horizontal projection of the line of intersection of slopes I and VII (fig. 25, c), we continue the traces of the slopes to the intersection. From their point of intersection, we construct an angle bisector, along which the common edge for slopes I and VII is located, shown in figure 25, c.

To determine the line of intersection of slopes II and VII on the plan, we first construct the bisector of the angle formed by the continuation of the traces of slopes II and VII (fig. 25, d), and then - the bisector from the point of intersection of the continuations of the traces of slopes IV and VII (fig. 25, e). The bisectors intersect at point D (fig. 26, 25, e), which belongs to three slopes: II, IV and VII.

The horizontal projections of the intersection lines of slopes IV and VI (fig. 25, f) and II and IV (fig. 25, g) of the roof are determined on the plan by constructing bisectors from the intersection points of the continuations of the corresponding traces of the slopes.

Figure 25, h shows the completed roof plan. Figure 26, a shows the plan and facades of the roof, figure 26, c shows the top view of the roof, and figure 26, b shows the perspective view.

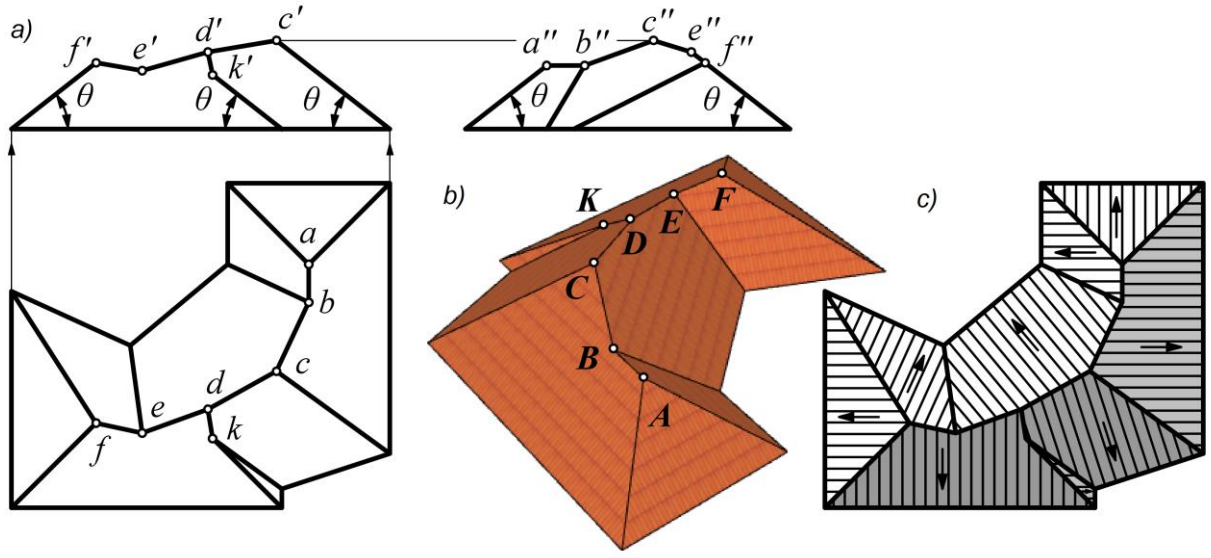


Fig. 26. Projections of the roof (*a*), perspective view of the roof (*b*) and top view (*c*)

3.6. INTERSECTION OF THE ROOF SLOPES OF THE BUILDING WITH THE INNER COURTYARD

Figure 27, a shows a plan of the outline of the roof of the building with an inner courtyard. The construction of the projections of the intersecting lines of the roof slopes is carried out in stages. To determine the horizontal projections of the lines of intersection of adjacent roof slopes, we shall construct the bisectors of the inner and outer corners of the roof on the plan (fig. 27, b). Horizontal projections of intersecting lines of adjacent slopes pass along the angle bisectors.

The horizontal projection of the line of intersection of slopes I and V, the traces of which are parallel on the conventional horizontal plane, is parallel to the traces and equidistant from them. This is the ridge of the roof (fig. 27, c).

To determine the horizontal projection of the line of intersection of slopes I and VI, the traces of these slopes are continued on the plan to the intersection (fig. 27, d). From the point of intersection, we construct the bisector of the formed angle (see fig. 27, d) and draw the edge that is common to the given slopes.

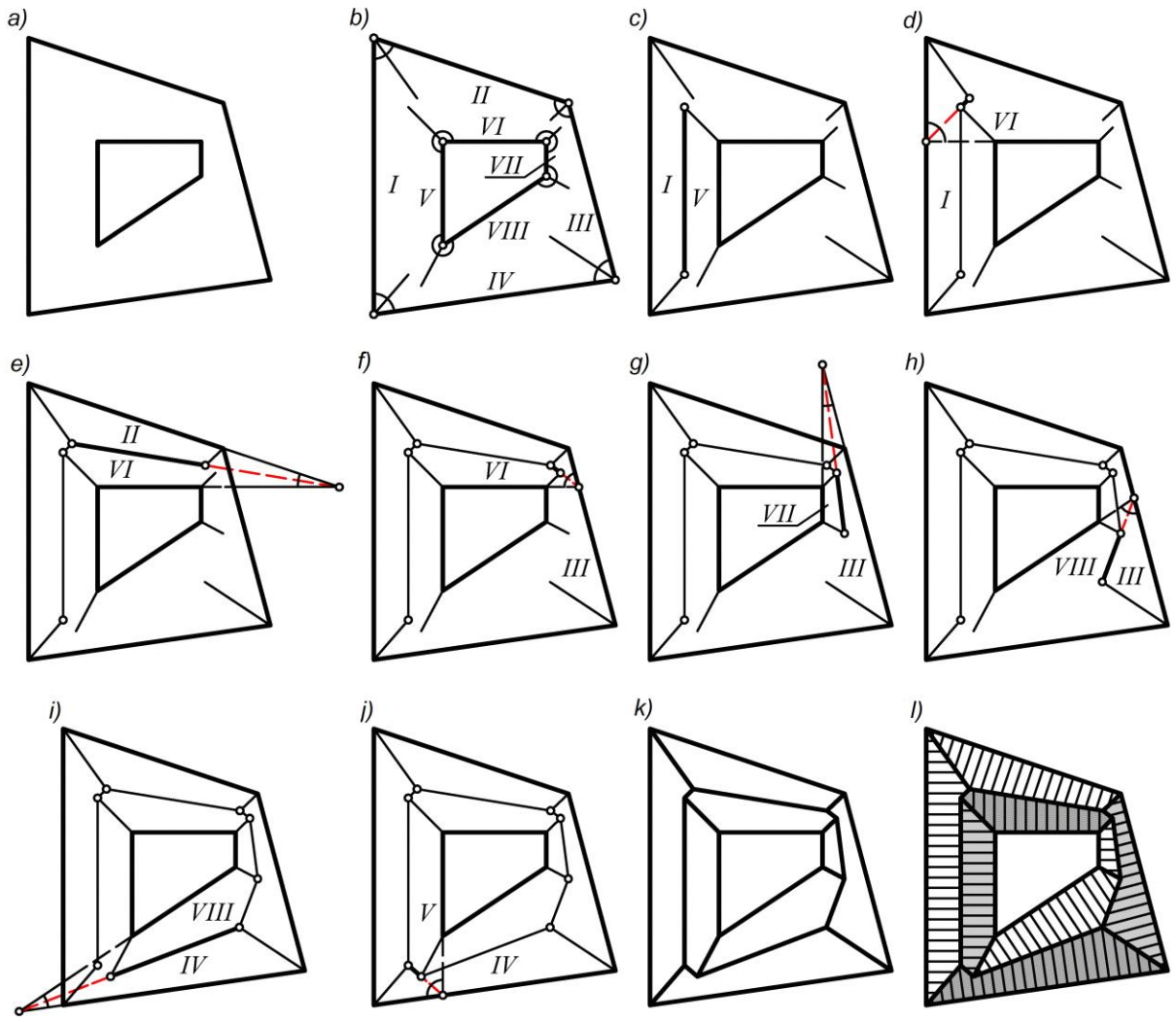


Fig. 27. Step-by-step construction of projections of the intersection lines of the roof slopes of the building with an inner courtyard

The common edge of slopes II and VI is determined in the same way: continue the traces of the slopes to the intersection (see fig. 27, e); from the point of intersection, a bisector of the formed angle is built, along which the horizontal projection of the line of intersection of the slopes II and VI of the roof is placed.

Horizontal projections of intersecting lines of other slopes are built similarly (see figures 27, f-l): on the plan, it is estimated which slopes (in pairs) can intersect; continuing their traces, determine the point of intersection; the bisector of the formed angle is constructed from the point of intersection; the common edge of intersecting slopes is drawn along the bisector.

Figure 28, b shows the construction of horizontal projections of the lines of intersection of the roof slopes of the building with the inner courtyard. On the basis of the horizontal projection, a frontal projection of the roof is built (fig. 28, a). In fig. 28, c shows the roof of the building in perspective.

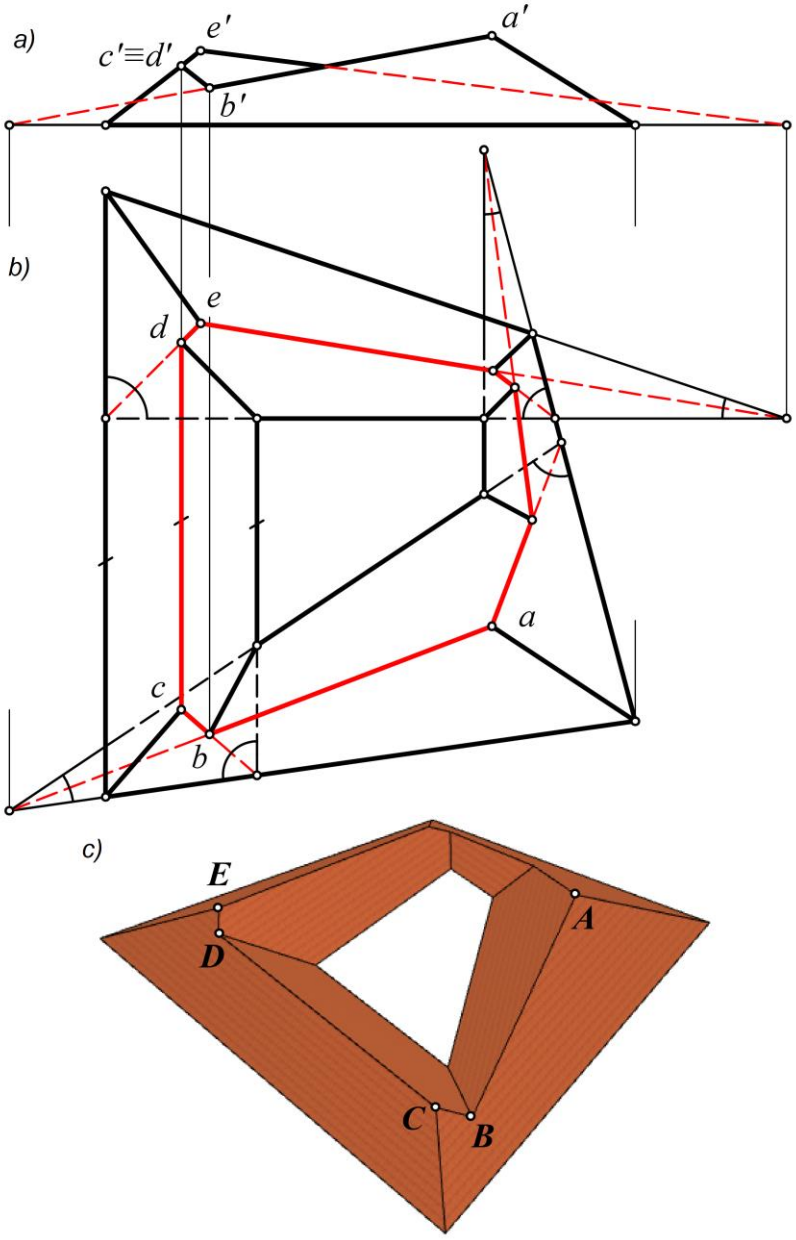


Fig. 28. Construction of intersecting lines of roof slopes (*a – frontal; b – horizontal projection*) and the view of the roof of the building with the inner courtyard in perspective (*c*)

Example. Construct the intersecting lines of the roof slopes of a complex building with an inner courtyard (see fig. 30, a.)

The construction of horizontal projections of the intersecting lines of the roof slopes of a complex building with an internal courtyard (fig. 29, 30) is carried out similarly: the roof slopes that may intersect are analyzed in pairs; look for the intersection of the traces of the first two selected roof slopes and draw the angle bisector from the point of their intersection; along the bisector, a common edge is built for the slopes – a projection of the line of intersection of the selected slopes; choose the next pair of slopes that can intersect and repeat the given construction algorithm. Figure 29 shows a top view and a frontal projection of the roof of the building with an internal courtyard, as well as a perspective view of the roof.

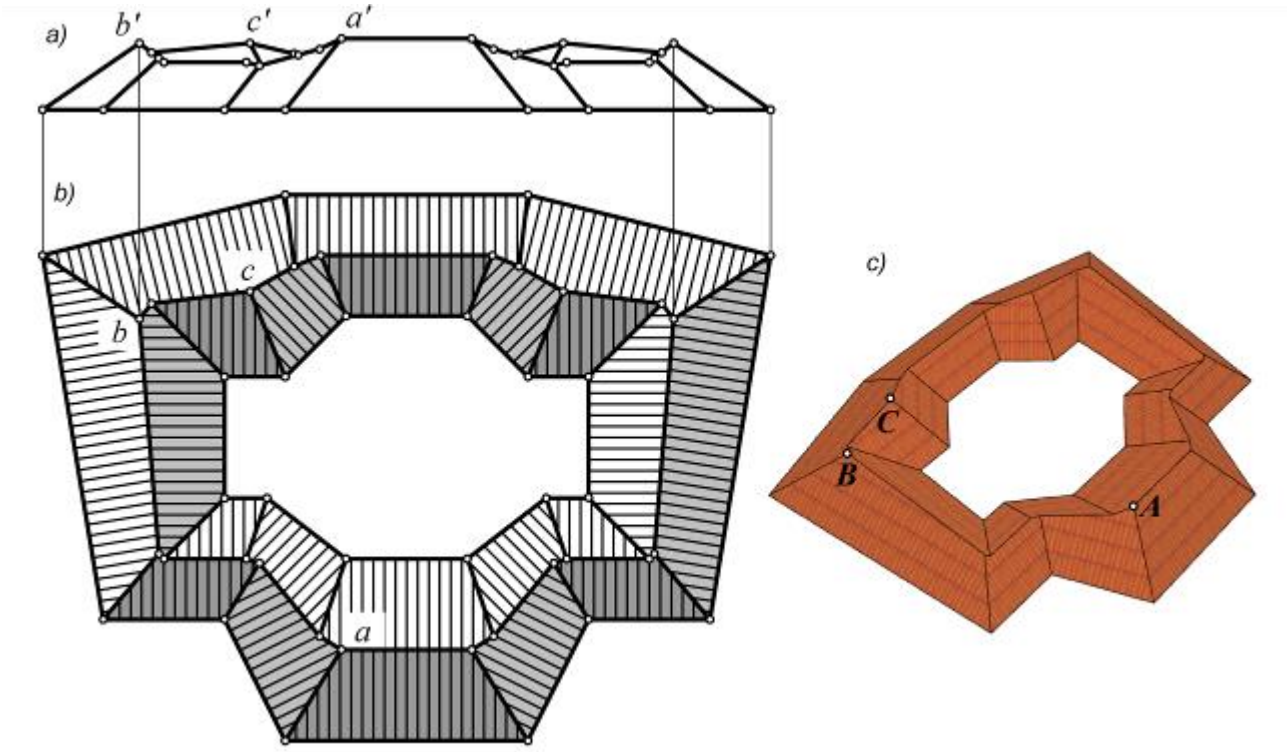


Fig. 29. Frontal projection (*a*), top view (*b*) and perspective (*c*) of the roof of a building with a complex outline with an inner courtyard

Bisectors of the inner and outer corners of the roof are drawn on the plan of the horizontal projections of the intersecting lines of the adjacent slopes of the roof of a complex-shaped building with an inner courtyard (fig. 30, b). The roof of the building is symmetrical in plan, which simplifies construction. For slopes I and VII (fig. 30, c) and slopes III and IX (fig. 30, g), common horizontal edges (ridges) are built, parallel to the traces of the slopes - horizontal projections of the lines of intersection of the roof slopes.

Construction on the plan of other intersecting lines of the roof slopes is carried out along the bisectors drawn from the top of the corners formed by the continuation of the horizontal traces of the slopes. The sequence of construction of the lines of intersection of the roof slopes is shown in figures 30, b-o.

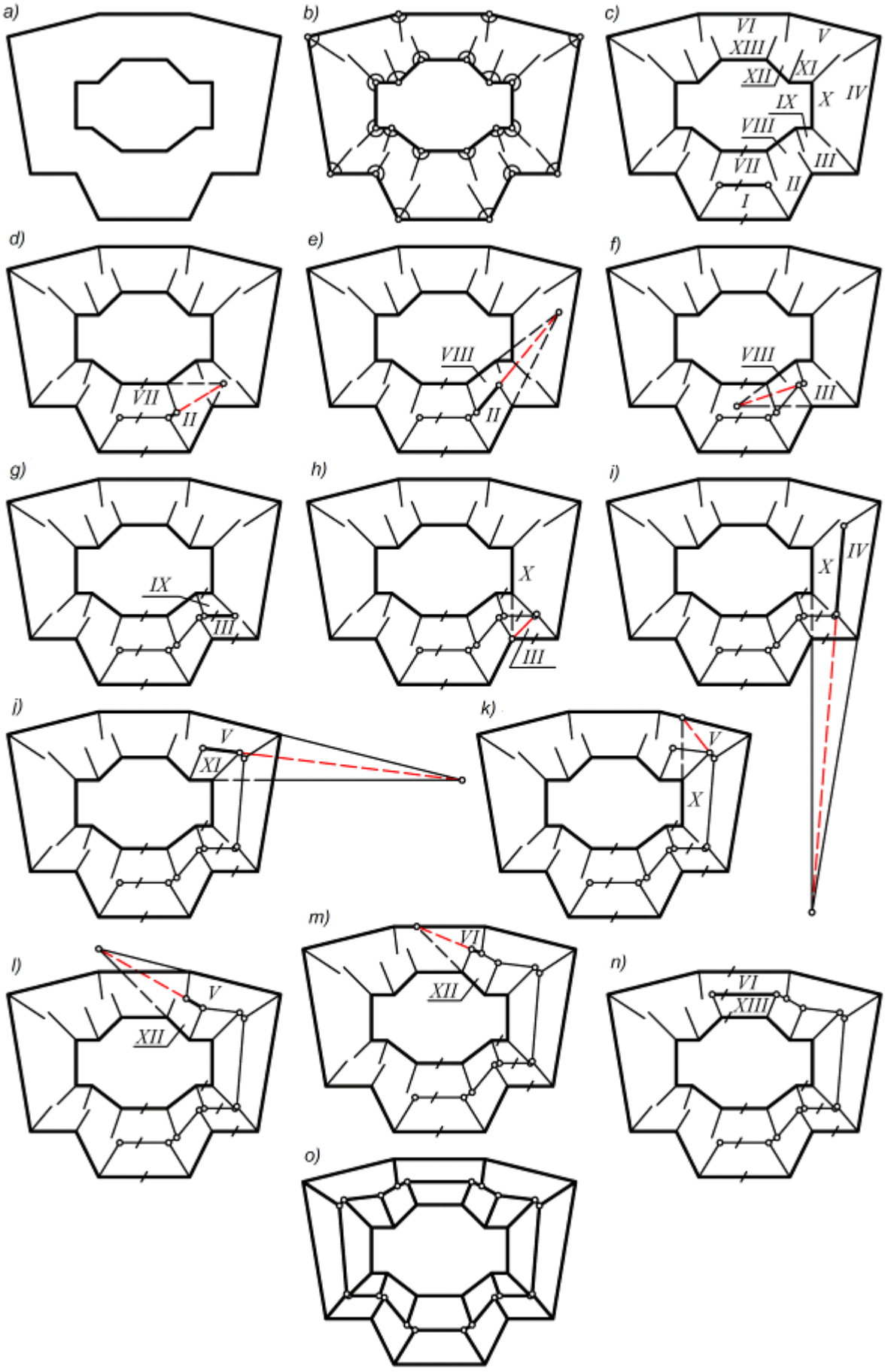


Fig. 30. Stages of construction of the intersection of the roof slopes of the building with the inner courtyard

Therefore, the construction on the plan of the horizontal lines of intersection of the slopes of the roof of the building, which has an arbitrary shape in the plan, is reduced to the construction of the bisectors of the angles formed by the continuation of the horizontal traces of the intersecting slopes. Along the bisectors of the angles (internal or external), horizontal projections of the common edges of the slopes, the intersection of which is being investigated, are placed. If the horizontal traces of the slopes on the plan are parallel, then the slopes intersect, forming the ridge of the roof (a horizontal common edge parallel to the traces of the slopes on the plan and equidistant from them).

Note that the given constructions of the lines of intersection of the roof slopes are purely geometric in nature and do not take into account constructive aspects. For example, the location of walls, columns on which roof structures can be supported, etc.

4. QUESTIONS FOR INDEPENDENT TRAINING

1. What are the acceptance restrictions when constructing the intersection of the roof slopes in relation to their slopes and placement of overhangs of the roof slopes?
2. What are the traces of slopes called?
3. How is the placement of the roof ridge relative to the traces of the slopes determined on the plan?
4. How is the projection of a common edge for adjacent roof slopes determined on the plan?
5. What are the basic rules of construction on the plan of the lines of intersection of the roof slopes?
6. If the traces of the slopes on the plan are not parallel, how do you build a horizontal projection of the line of intersection of the roof slopes?
7. What is the sequence of determining the projections of the intersection lines of the roof slopes on the plan?
8. Які способи побудови ліній перетину схилів даху Ви знаєте?
9. Why is the formation of horizontal valleys inadmissible when designing the shape of the roof?
10. How is the construction of the lines of intersection of the slopes of the roof, which has a shape in the plan of a regular polygon, simplified?

5. LITERATURE

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Information resources

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