

18. In Northern Germany one often sees church towers of a square profile with so called 'Rautendächer'. These roofs are formed by four rhombuses leaving on each of the four sides an isosceles triangle gable.

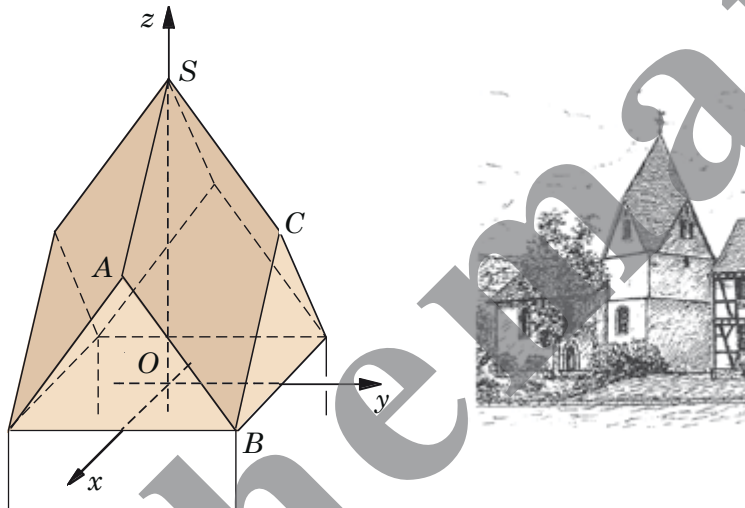
- a. Show that the total height of the roof (from the middle of the attic floor up to the top) is twice as high as the height of a gable.

The figure below shows an attic of a Rautendach in an appropriate coordinate system (the attic floor lies inside the xy -plane and the whole attic is symmetric with respect to the xz - and yz -plane). The square profile of the attic floor has a side length of 6m and the total height of the roof is 8m. Determine:

- b. the coordinates of the vertexes of the rhombus $ABCS$ (in m),
 c. the side length and the acute angle of the rhombus $ABCS$,
 d. the total surface area of the roof,
 e. the angle between two adjoining rhombuses of the roof.

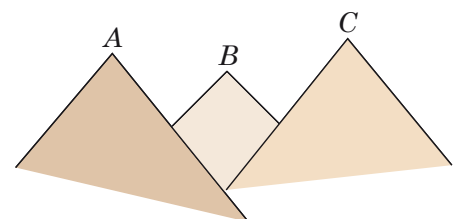
The substructure of the church tower is 32m high.

- f. What is the whole volume of our tower?



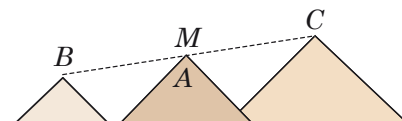
19. There are many mountains in Mountasian. For land surveying one assumes a not curved earth's surface and uses Cartesian coordinates x , y and z , where z describes the height over the sea level.

From the tourist place $T = (0/0/1)$ one can see the mountain peaks $A = (-3/4/6)$, $B = (0/10/9)$ and $C = (6/7/12)$ as shown aside.



panorama viewed from T

- a. Which beeline is longer AB or AC ?
 b. How high does one have to go up vertically with a hot-air ballon from T (in coordinate units) such that all three mountain peaks seem to be on a straight line?
 c. B is the peak of a vulcano which erupted years ago. The not too young natives of T know that before the eruption B looked from T as high as A . How much height did the vulcano lose during the eruption?
 d. From which point P on the sea level does one see the panorama aside, where A exactly conceals the real midpoint M of the line segment BC ?



panorama viewed from P