Solid geometry

Basic terms from solid geometry

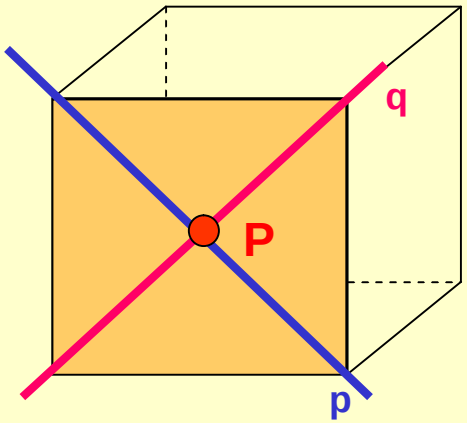
A *line* is given by 2 different points.

A plane is given by:

- three different noncolinear points
- two parallel lines
- a line and a different point
- two intersecting lines

Line – line intersection

A) line – line intersection of lines p, q

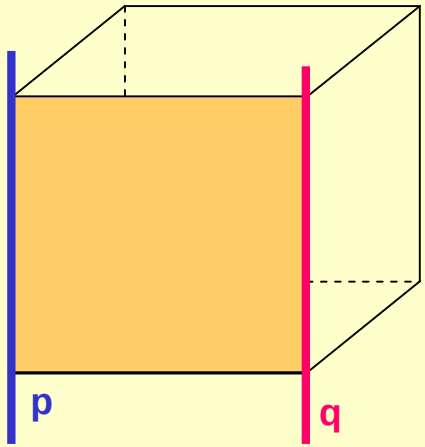


Lie on the same plane

Have a common point P

Intersecting lines

$p \nparallel q$

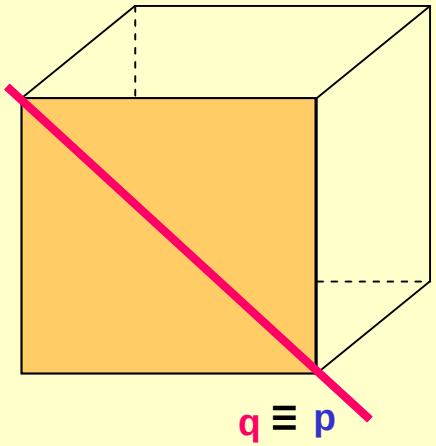


Lie on the same plane

Do not have a common point

Parallel lines

$p \parallel q$

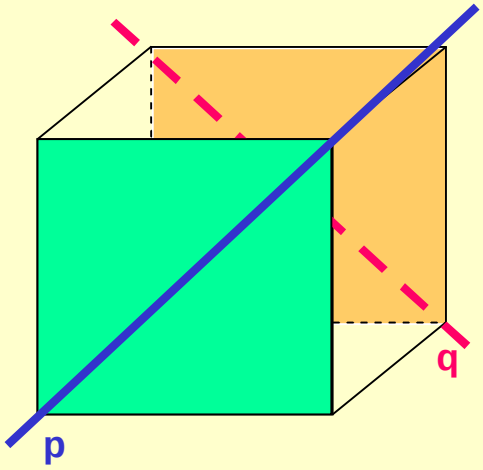


Lie on the same plane

Have common points (at least two)

Coincident lines

$p \equiv q$



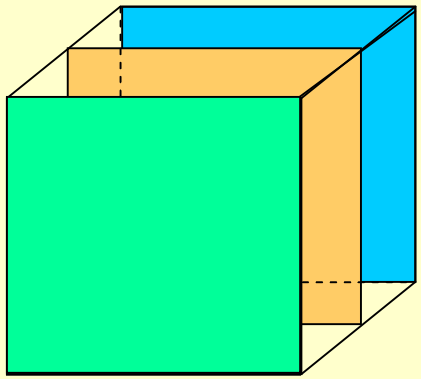
Do not lie on the same plane

Do not have common points

Skew lines

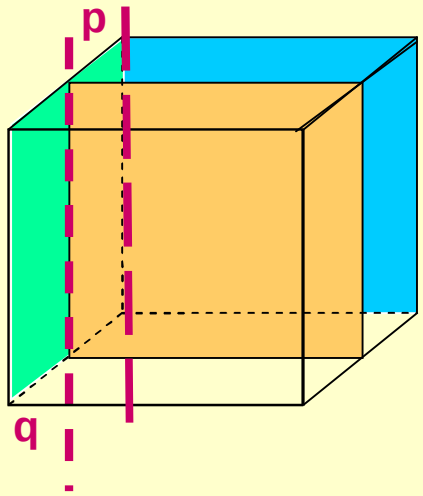
$p \not\subset q$

C1) Plane – plane intersection of planes α, β, γ

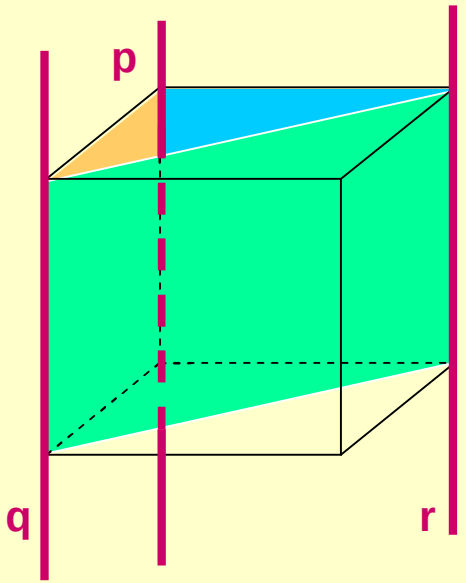


Do not have common points

Intersecting planes
α ∥ β ∥ γ



Intersecting planes
α ∥ β ⋕ γ

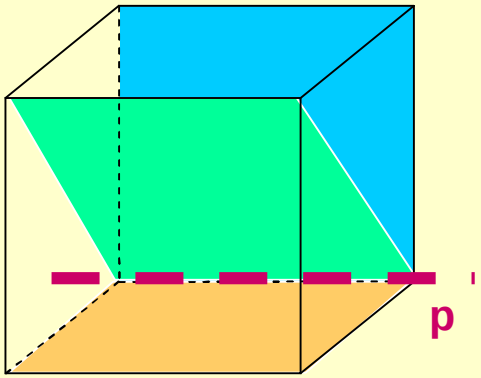


Intersecting planes
α ⋕ β ⋕ γ

Have many common points

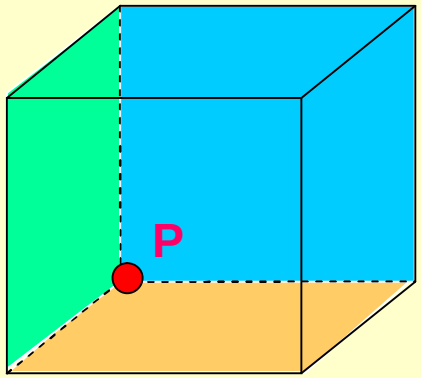
Coincident planes
α ≡ β ≡ γ

C2) Plane – plane intersection α, β, γ



Have a
common line (p)

Intersecting planes
α ⋕ β ⋕ γ



Have a
common point P

Intersecting planes
α ⋕ β ⋕ γ

Collinearity

If two straight-lines are parallel to the same straight-line than they are parallel.

If two planes are parallel to the same plane than they are parallel.

If one from two parallel straight-lines is parallel to plane than second straight-line is parallel to plane too.

If a straight-line is parallel to one from two parallel planes than straight-line is parallel to second plane too.

If a plane contents two intersecting straight-lines those are parallel to other plane than these planes are parallel.

SOLID SECTIONS

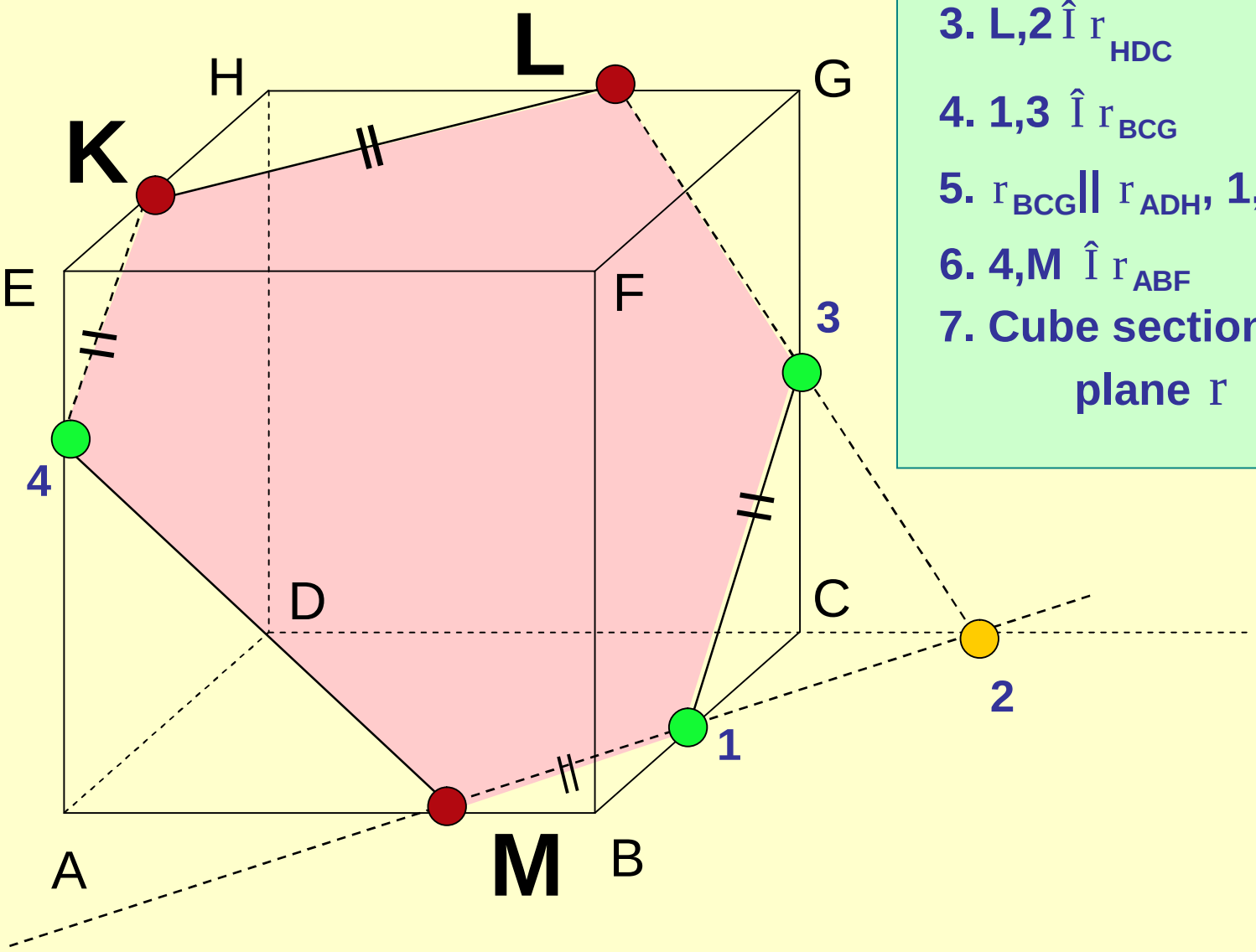
Section of a solid with a plane is an intersection of this solid with that plane. It is a plane shape and its border is an intersection of the solid edge with the section plane.

CUBE SECTION

Rule:

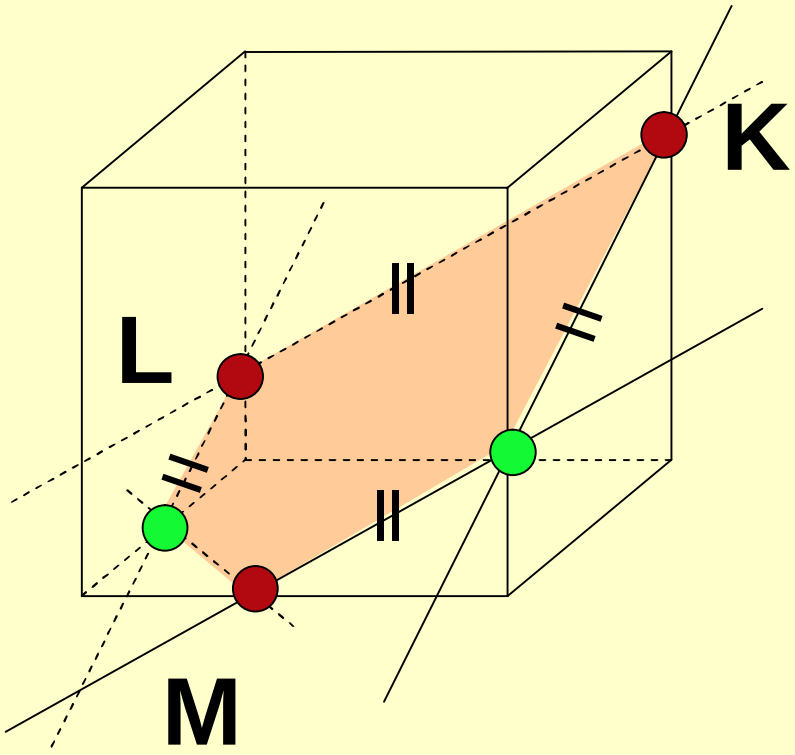
A plane intersects two other parallel planes in two parallel lines.

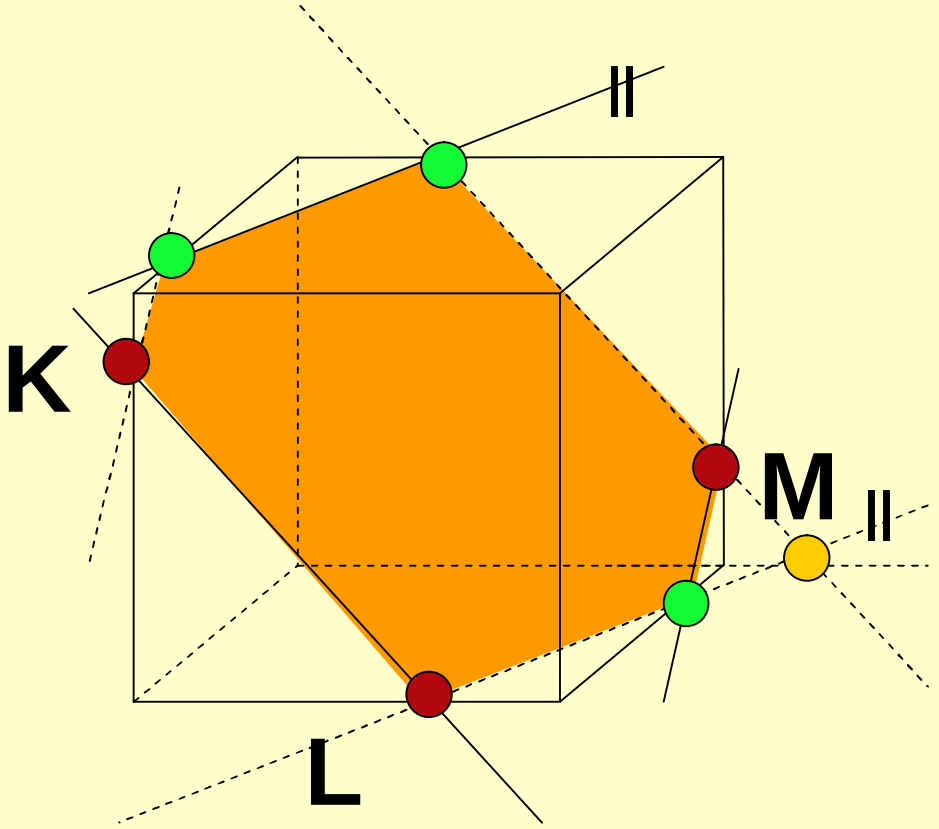
CUBE SECTION:

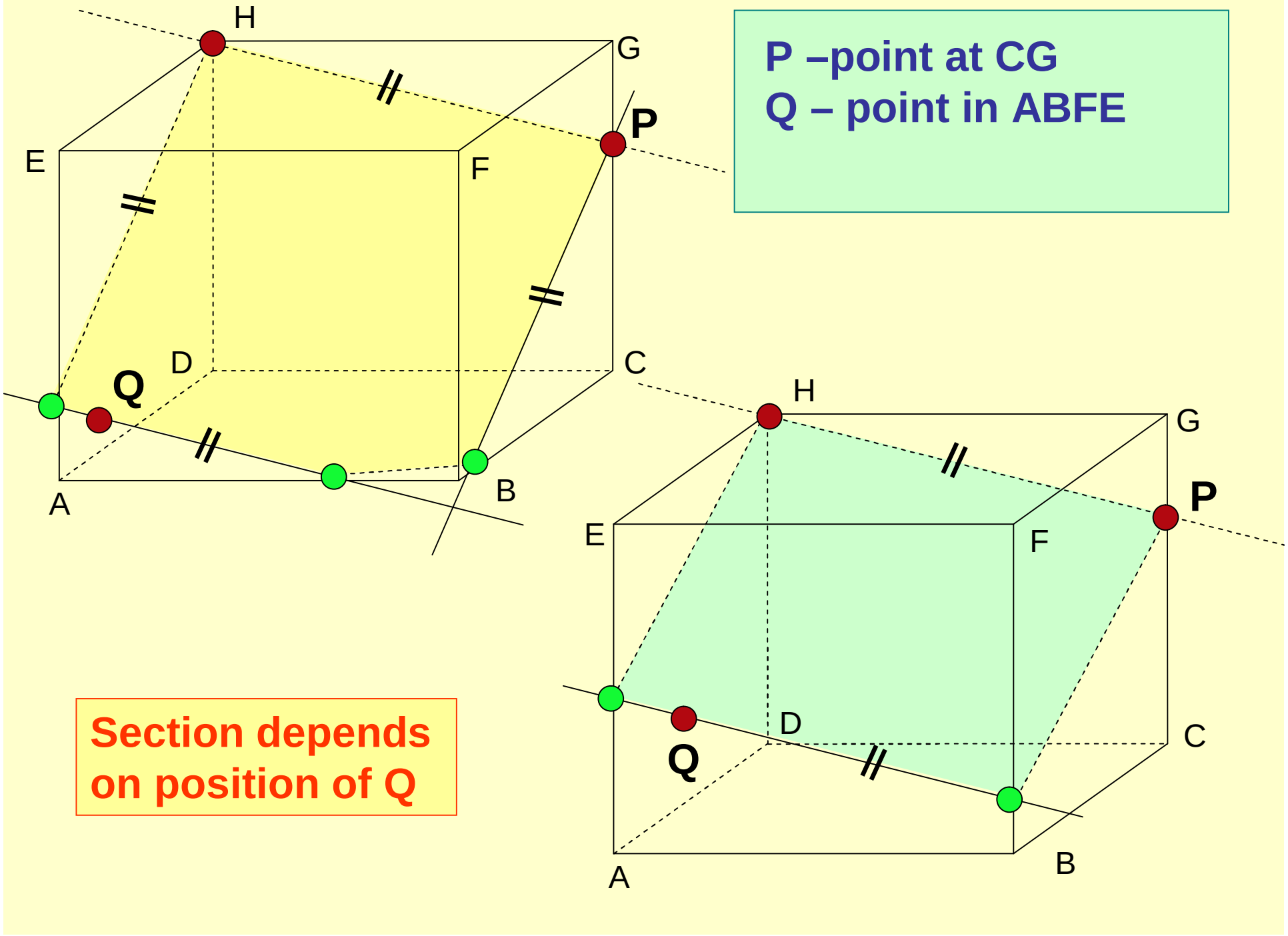


1. K,L $\hat{I}$ r_{EFG}
2. M $\hat{I}$ r_{ABC}, $r_{EFG} \| r_{ABC}$
3. L,2 $\hat{I}$ r_{HDC}
4. 1,3 $\hat{I}$ r_{BCG}
5. $r_{BCG} \| r_{ADH}$, 1,3 $\|$ K,
6. 4,M $\hat{I}$ r_{ABF}
7. Cube section with plane r

Cube section with plane KLM






H
G
E
F
P
D
C
Q
A
B
P –point at CG
Q – point in ABFE
Section depends on position of Q

PYRAMID SECTION

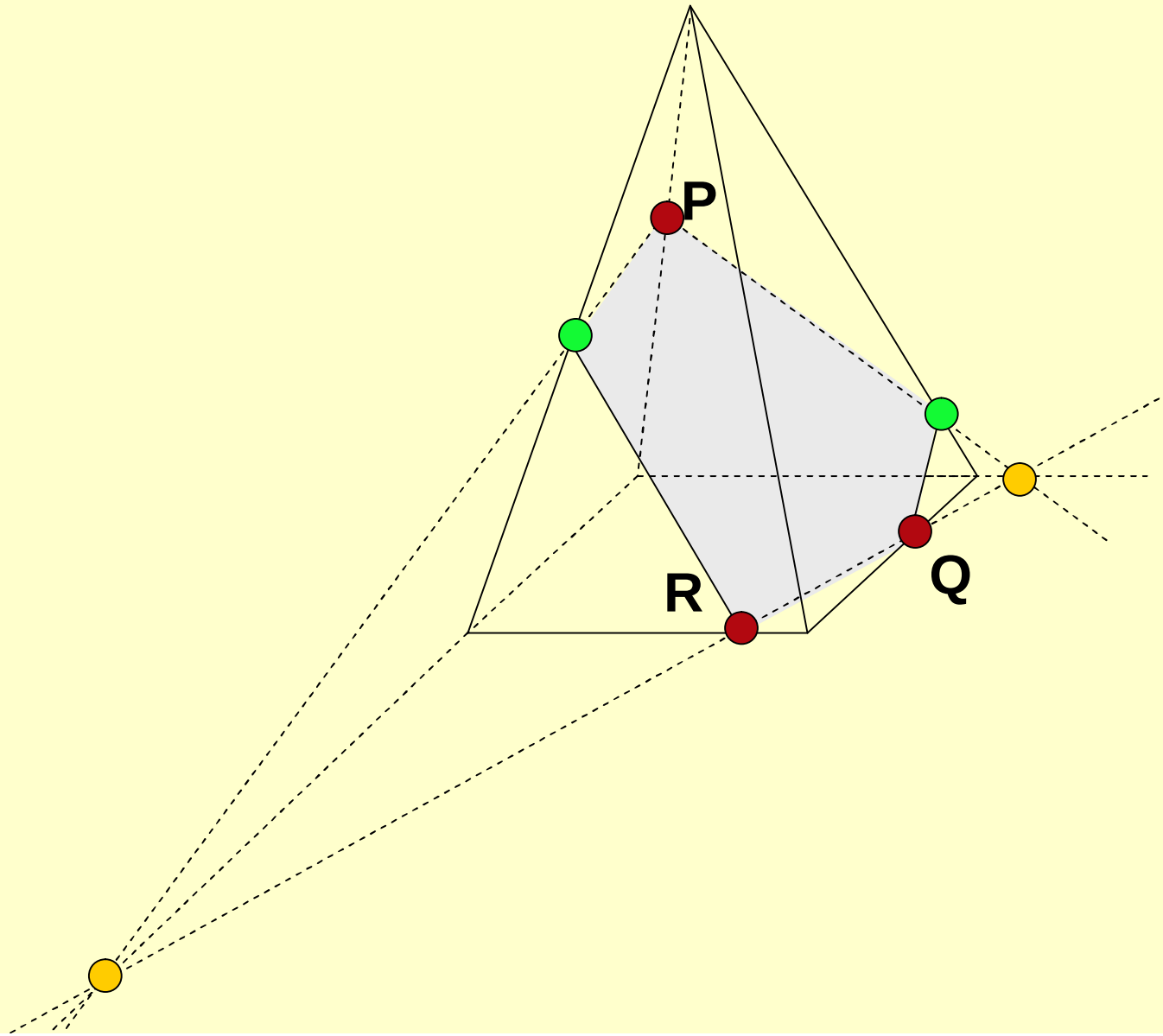
Pyramid is a solid, which has one significant face – its bottom base, and one significant vertex – the main vertex V. All the remaining faces of the pyramid are triangles, which are called side faces.

Bottom face and vertex V play an important role in pyramid sections. We usually construct the sections in the following way:

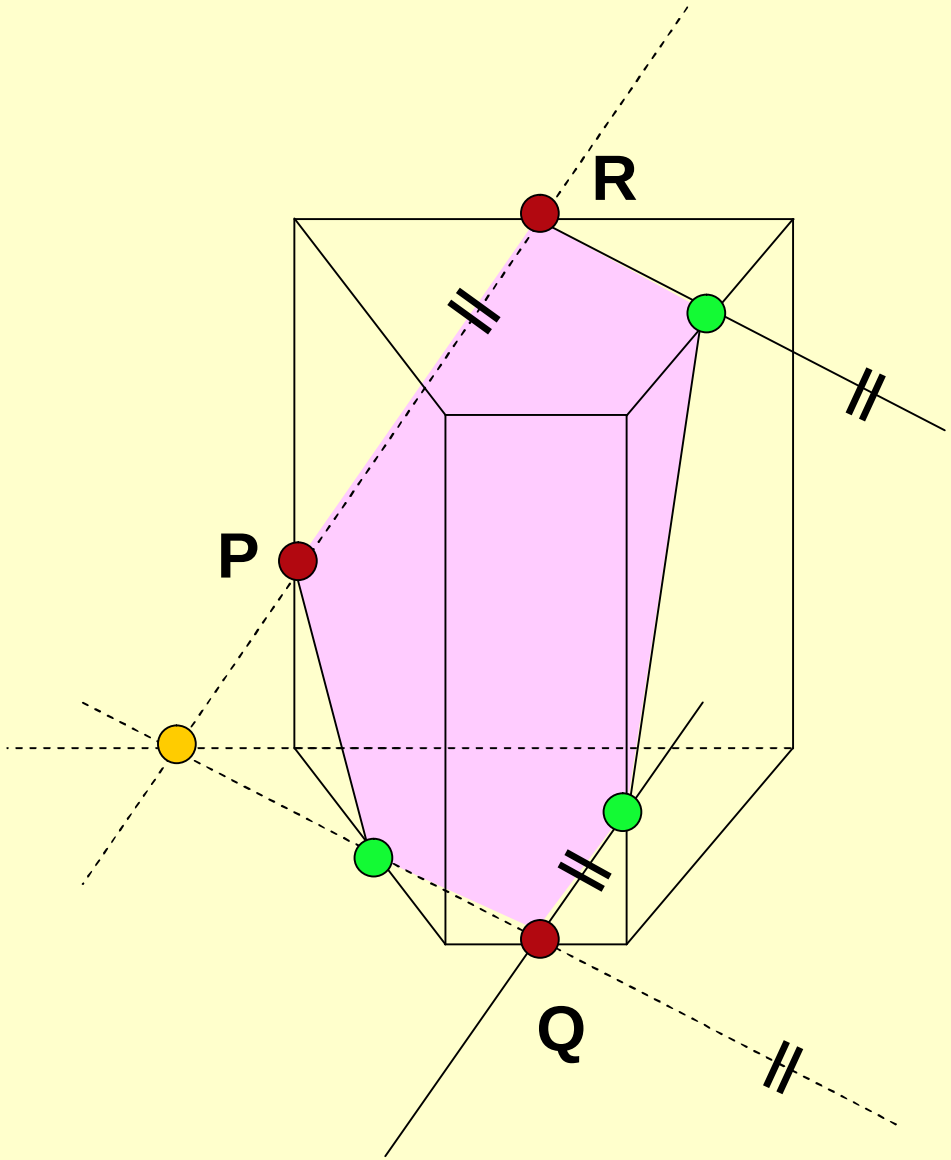
We always consider three planes: section plane, bottom

face and some side face. We start with that side face, where some point of the section plane lies. Similarly we proceed when constructing sections of a prism.

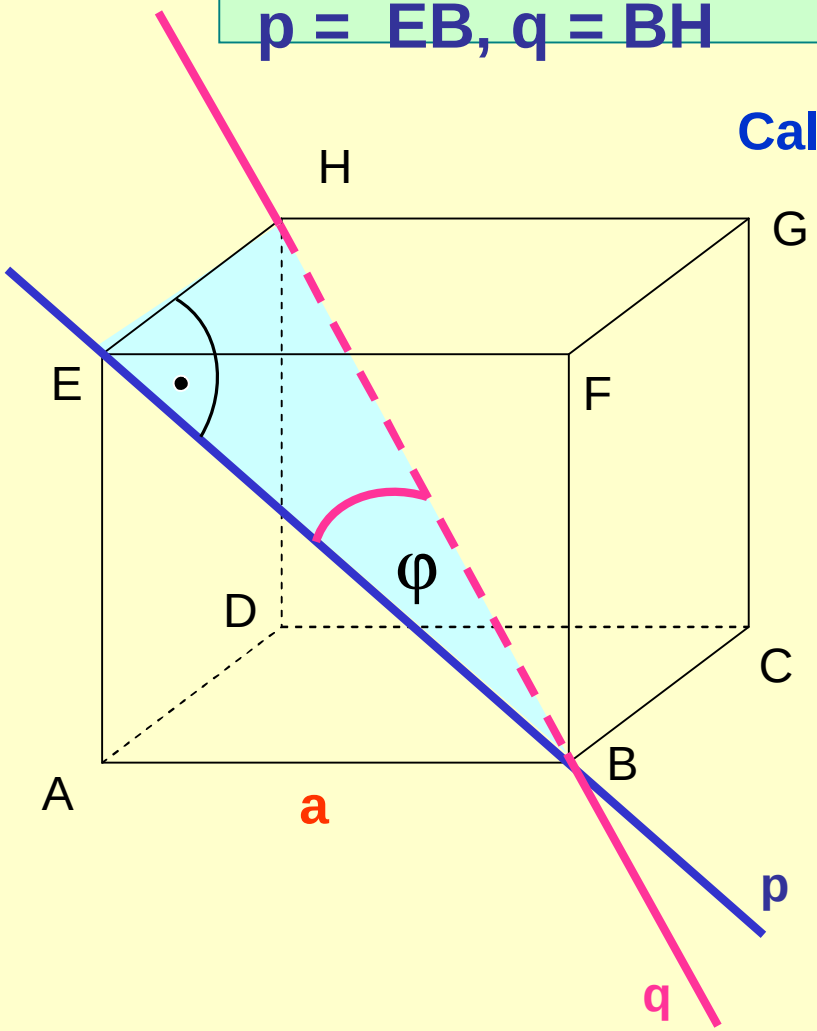
Pyramid section with the plane PQR



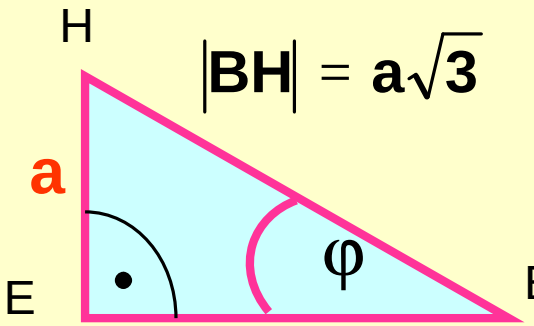
Polygon section with the plane PQR



A1 Calculate the angle of two lines $p = \overleftrightarrow{EB}$, $q = \overleftrightarrow{BH}$



Calculate the angle from the triangle EBH



$|BH| = a\sqrt{3}$ Internal diagonal

$|BE| = a\sqrt{2}$ Square diagonal

$$\mathrm{tg}\,\varphi = \frac{|EH|}{|EB|} = \frac{a}{a\sqrt{2}} = \frac{\sqrt{2}}{2}$$

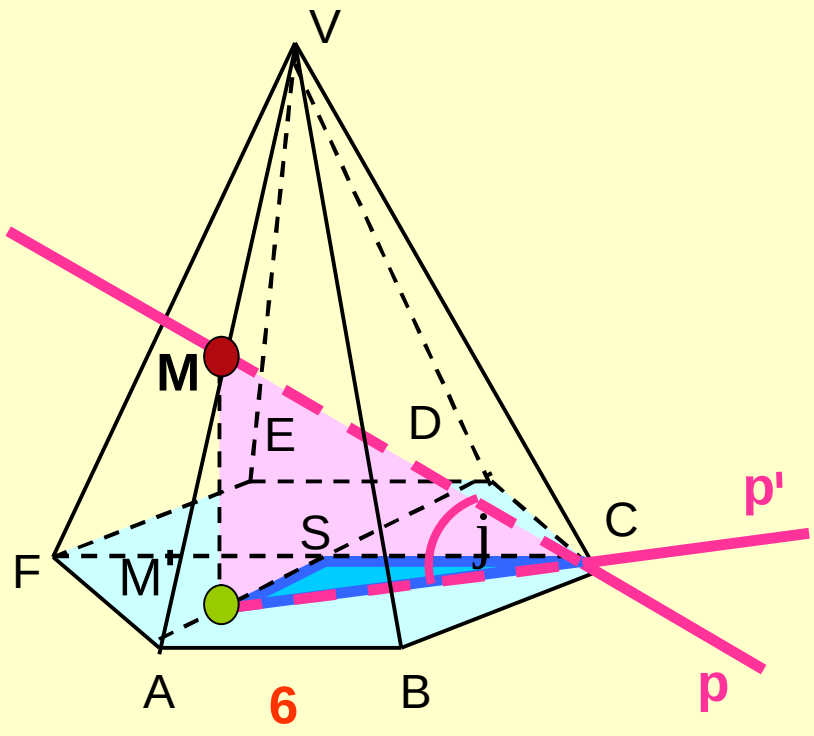
$$|\sphericalangle pq| = \varphi = 35°15'$$

Calculate the angle of the line p = $\overleftrightarrow{CM}$ with base plane

Hexagonal triangle

h = 10

M = centre AV

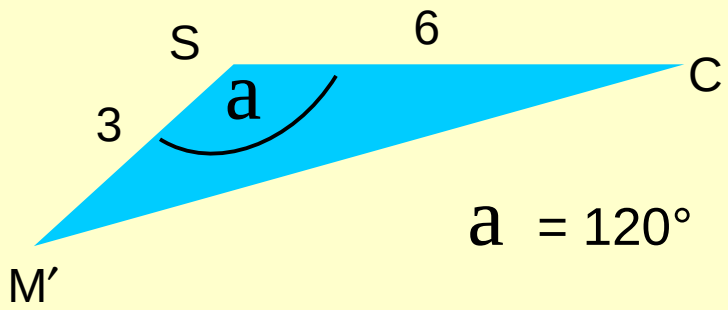


The angle from D M¢CM

|MM¢| = h/2 = 5

|M¢ C| calculate from D M¢CS

Cosine rule



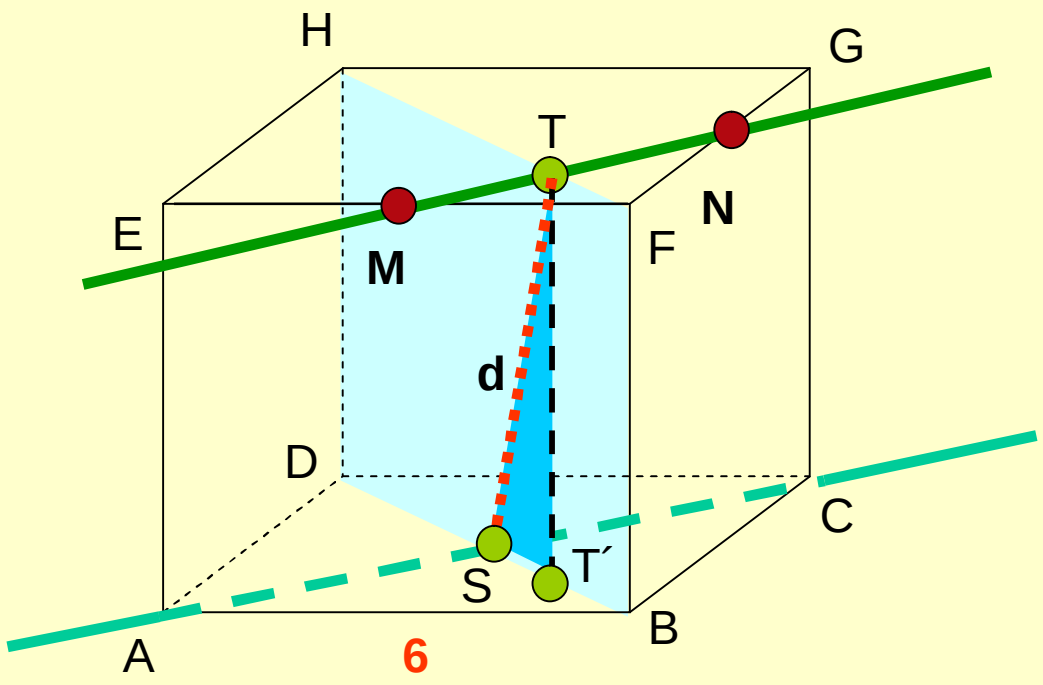
a = 120°

j = 32°12¢

B3 Distance from MN to AC

M = centre EF

N = centre FG



r_{BFH} is perpendicular to both lines

MN central diagonal ▱EFG

|FT| = |FH|. 1/4

|ST´| = |FT|

Pytagora`s rule ▱STT´

d = 6,36