PERANGKAT PEMBELAJARAN KHUSUS

COURSE : SOLID GEOMETRY

SOLID GEOMETRY LEARNING USING DISCUSSION METHOD

1. SYLLABUS
2. LESSON PLAN
3. MEDIA : STUDENT WORKSHEET
   (MATERIAL AND STUDENT ACTIVITY)

BY :
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YOGYAKARTA STATE UNIVERSITY

MATHEMATICS AND NATURAL SCIENCE FACULTY

MATHEMATICS EDUCATION DEPARTMENT
2010

SYLLABUS

Faculty : MIPA
Study Program : Mathematics Education
Course & Code : Solid Geometry/MAA310
Credit Hours : 3 credits
Semester : 3
Prerequisites & Code : Plane Geometry/MAA205
Lecturer : Himmawati P.L, M.Si.

FRM/FMIPA/065-00
5 September 2008

I. COURSE DESCRIPTION

The study of Solid Geometry includes space geometry : basic geometry objects and their relations in space, oblique projection, perpendicular, angle, distance, prism, cylinder, cone, sphere, cross section, polyhedron

II. COURSE BASED COMPETENCY

The students will be able to explain concepts and properties of space figures, and use them to solve problems either in mathematics or in other courses.

III. ACTIVITY PLAN

Meeting	Based Competency	Main Materials	Lecturer Strategy	References
1	Preliminary		Discussion	A, C, D
2	Introduction	Basic geometry objects and their relations	Discussion	A, C, D
3	Extending plane geometry into solid geometry	Extending plane geometry into solid geometry	Discussion & presentation	B
4	Oblique Projection	Geometric constructions	Discussion & presentation	A, C, D
5	Oblique Projection	Oblique projection	Discussion & presentation	A, C, D
6	Pencil of planes and dihedral angle	Pencil of planes and dihedral angle	Discussion & presentation	A, C, D
7	Angle	Angle formed by two geometric object	Discussion & presentation	A, C, D
8	Angle	Angle formed by two geometric object	Discussion & presentation	A, C, D
9	perpendicular	Line perpendicular to plane	Discussion & presentation	A, C, D
10	perpendicular	Line perpendicular to	Discussion &	A, C, D

		plane	presentation	
11	Distance	Distance of two geometric object	Discussion & presentation	A, C, D
12	Distance	Distance of two geometric object	Discussion & presentation	A, C, D
13	Prism	Definition, kind, elements of prism	Discussion & presentation	A, C, D
14	Prism	Lateral area and volume of prism	Discussion & presentation	A, C, D
15	pyramid	Definition, kind, elements of pyramid	Discussion & presentation	A, C, D
16	Pyramid	Lateral area and volume of pyramid	Discussion & presentation	A, C, D
17	MIDTERM			
18	Cylinder	Definition and its properties	Discussion & presentation	A, C, D
19	Cylinder	Definition and its properties	Discussion & presentation	A, C, D
20	Cone	Definition and its properties	Discussion & presentation	A, C, D
21	Cone	Definition and its properties	Discussion & presentation	A, C, D
22	Cone	Conic sections	Discussion & presentation	A, C, D
23	Sphere	Definition and its properties	Discussion & presentation	A, C, D
24	Sphere	Sphere section	Discussion & presentation	A, C, D
25	Sphere	Area and volume	Discussion & presentation	A, C, D
26	Cross section	Cross section	Discussion & presentation	A, C, D
27	Cross section	Cross section	Discussion & presentation	A, C, D
28	polyhedron	Definition and polyhedron's type	Discussion & presentation	A, C, D
29	polyhedron	Polyhedron's net	Discussion & presentation	A, C, D
30	Regular polyhedron	Definition, its type, and its net	Discussion & presentation	A, C, D
31	Regular polyhedron	Net of regular polyhedron	Discussion & presentation	A, C, D
32	MIDTERM			

IV. REFERENCES

A. J.M. Aarts. 2008. Plane and solid geometry. Springer Science: New York
B. Rich, Barnett & Thomas, Christopher. 2009. Schaum Outline Series : Geometry. McGraw Hill : New York.
C. Wentworth, G and Eugene Smith, D. Solid Geometry. Ginn and Company
D. Woodruff, BW and Eugene Smith, D. New Plane and Solid Geometry. Ginn and Company

V. EVALUATION

No.	Component	Weight (%)
1.	Tasks	10
2.	Quiz	10
3.	Presentation	10
4.	Performance in the class	10
5.	Midterm	25
6.	Final Test	35
Total		100%

LESSON PLAN

1. Faculty /Study Program : MIPA/Mathematics Education
2. Subject & Code : Solid Geometry/MAA 310
3. The number of credit : 3
4. Semester and Duration : 3, 1x100 minutes
5. Based Competency : Understand concepts of basic geometry objects
6. Achievement Indicator :
   - Student can explain the undefined terms and other basic geometry objects.
   - Student can explain the relation between undefined terms.
7. Material : Basic geometry objects and their relations
8. Lecture Activity : 2

Step Component	Activity	Duration	Method	Media	References
Introduction	1. Motivating the students by showing the problems in daily life related to geometry objects. 2. Stating the competency that the students have to attain and its indicators.	3’ 2’	Discussion in group, Discussion in class	LCD, Student’s worksheet	A B C
Main Activities	1. The teacher explains the material 2. The students work in a group to discuss undefined terms and their relations 3. Some groups give questions to other groups and some others give some comment or answers, and the teacher acts as a moderator.	15’ 30’ 35’			
Closing Activity	Conclude the discussion	10’			
Further Activities	Invite the students to ask and give the task	5’			

9. Evaluation

The evaluation is performed based on the student activities in discussion, doing exercise.

Example of exercises :

1. Mention the relations of point and line on a plane
2. Investigate the relation of points, lines, and planes on space
3. Draw the cube ABCD.EFGH. Then determine the relation of
   a. Point A and line AD
   b. Point A and line BD
   c. Point E and plane BFHD
   d. Line FG and plane EFGH
   e. Line HD and plane ACGE

10. References

A. J.M. Aarts. 2008. Plane and solid geometry. Springer Science: New York

B. Wentworth, G and Eugene Smith, D. Solid Geometry. Ginn and Company

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Yogyakarta, September 2010
Lecturer

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YOGYAKARTA STATE UNIVERSITY

MATHEMATICS AND NATURAL SCIENCES FACULTY

MATHEMATICS EDUCATION STUDY PROGRAM

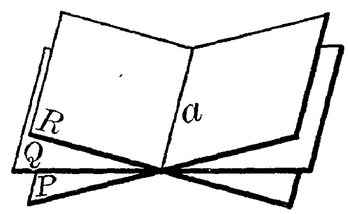
STUDENT'S WORKSHEET

TOPIC 2
BASIC GEOMETRY OBJECTS
(POINTS, LINES, AND PLANES IN SPACE)

A. MAIN MATERIAL

Discuss the material with your group

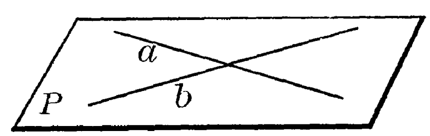
In plane geometry we deal with figures lying in a flat surface, studying their properties and relation and measuring the figures. In solid geometry we shall deal with figures not only of two dimensions but of three dimensions, also studying their properties and relations and measuring the figures.



A surface such that a straight line joining any two of its points lies wholly in the surface is called a **plane**. A plane is understood to be indefinite in extent, but it is conveniently represented by a rectangle seen obliquely. A plane may be designated by a capital letter or Greek letter written within the parallelogram.

Proportions.

A line joining any two points in a plane lies wholly in the plane



Through a given line an indefinite number of planes may be passed

Two intersecting lines determine a plane.

A plane is said to be determined by certain lines or points if it contains the given lines or points, and no other plane can contain them. When we suppose a plane to be drawn to include the given lines or points, we are said to pass the plane through these lines or points. When a straight line is drawn from an external point to a plane, its point of contact with a plane is called its **foot**.

The line that contains all the points common to two planes is called their **intersection**.

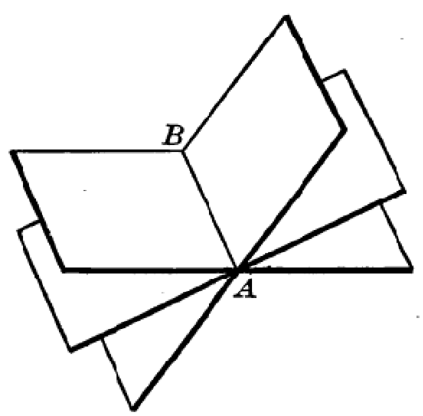
Theorem. Through any three non-collinear points there is a plane.

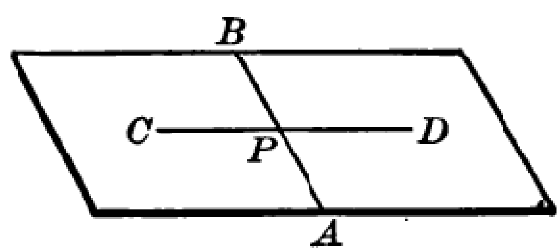
Theorem. Through any three non-collinear points there is exactly one plane.

Theorem. For every point P and every line m there is exactly one line through P and parallel to m.

Postulate. One plane, and only one, can be passed through two given intersecting straight lines.

For it is apparent from the first figure that a plane may be made to turn about any single straight line AB, thus assuming different positions. But if CD intersects AB at P, as in second figure, then when the plane through AB turns it includes C, it must include D, since it includes two points, C and P of the line. If it turns any more, it will no longer contain C.





Corollary

A straight line and a point not in the line determine a plane.

Three points not in a straight line determined a plane.

Two parallel lines determine a plane.

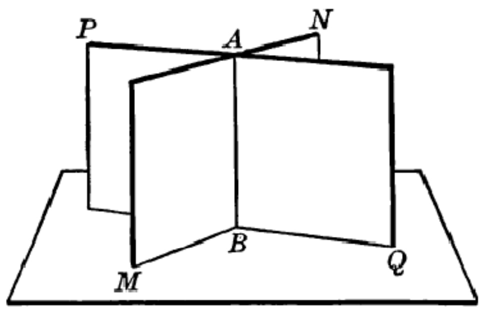
Definition. We say that a line m and a plane α are **parallel** if either m lies in α or m and α have no point in common. If the line m and the plane α are not parallel, we say that they intersect each other.

Since there is exactly one line through any two distinct points, a line m and a plane α that intersect have exactly one point in common. We call this point the intersection point of m and α.

Definition. We say that two planes α and β are **parallel** if either α = β or α and β have no point in common. If the planes α and β are not parallel, we say that they intersect each other. We indicate that two planes α and β are parallel by writing α//β.

Theorem

If two planes cut each other, their intersection is a straight line.

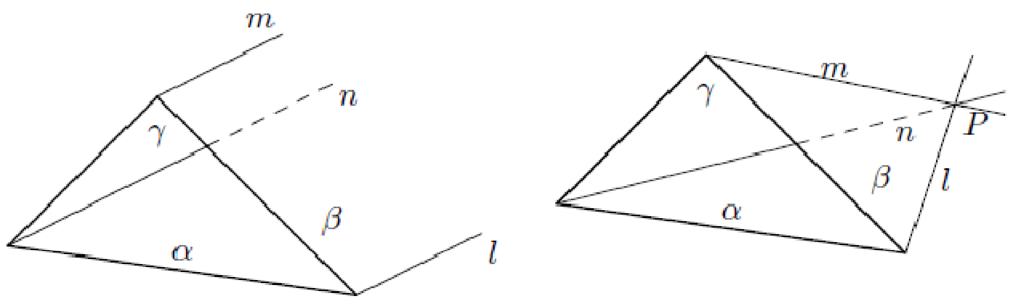


Proof

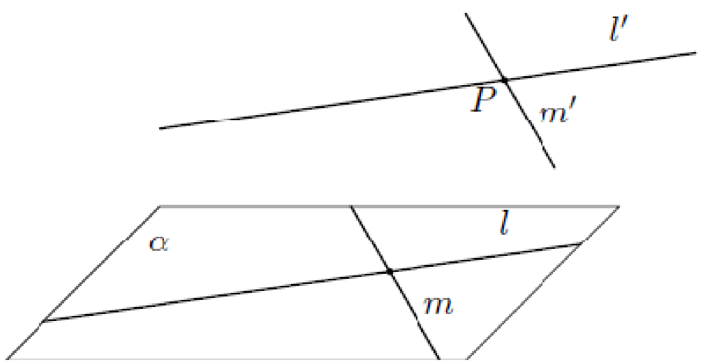
Given MN and PQ, two planes which cut each other. Let A and B be two points common to the two planes. Draw a straight line through the points A and B. then the straight line AB lies in both planes (for it has two points in each plane).

No point not in the line AB can be in both planes, for one plane, and only one, can contain a straight line and a point without the line. Therefore the straight line trough A and B contains all the points common to the two planes, and is consequently the intersection of the planes.

Theorem (Three-planes theorem). We are given three planes α, β, and γ such that any two intersect each other. Let l be the intersection line of α and β, m that of β and γ, and n that of γ and α. The intersection lines l, m, and n either are parallel to one another or meet at a single point.



Theorem. For every point P and every plane α there is exactly one plane through P and parallel to α.



In plane geometry two positions of straight lines with respect to each other play an important role: parallel and perpendicular. This is also the case in solid geometry. We have already talked about parallel lines. We now turn our attention to perpendicular lines.

Definition. Let l and m be lines, and let C_ be an arbitrary point in space. By Theorem, there are unique lines l’ and m’ through C_ that are parallel to l and m, respectively. We say that l and m are perpendicular to each other if l’⊥ m’. We indicate this by writing l⊥m. If l⊥m and l and m do not intersect, we also say that the lines are perpendicular skew lines.

B. STUDENT’S ACTIVITY

Answer these questions, work in group

1. Mention the relations of point and line on a plane
2. Investigate the relation of points, lines, and planes on space

3. Draw the cube ABCD.EFGH. Then determine the relation of
    a. Point A and line AD
    b. Point A and line BD
    c. Point E and plane BFHD
    d. Line FG and plane EFGH
    e. Line HD and plane ACGE
    f. Line GC and plane ABD
    g. Line AB and line BC
    h. Line AF and line DG
    i. Line AE and line BC
    j. Plane ABCD and plane BCGF
    k. Plane ADHE and BCGF

4. A circle and a plane have two common points. May we assert that the circle is contained in this plane?
5. Three points of a circle lie on a plane. May we assert that the circle is contained in the plane?
6. Two planes have three common points not lying in a straight line. How are these planes situated?
7. How many planes can be drawn through:
    (a) one point;
    (b) two points;
    (c) three points not in a straight line;
    (d) four points each three of which are not in a straight line?
8. A spherical surface and a straight line have two common points. Do other points of the line belong to this surface?