AMP(2)-Lab02 – Parameters

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# Learning objectives

By the end of this lab you should be able to (pen and paper):

* Use the parametric equations of functions and curves
* Handle the straight line by its parametric equation, vector equation or cartesian equation.
* Determine the intersection between two straight lines
* Handle the plane by its parametric equation, vector equation or cartesian equation.
* Determine the intersection between two planes
* Determine the intersection between different objects (line, plane, sphere, …)
* Convert between the vector equation, the parametric equation and the cartesian equation of an object

We advise you to **make your own summary of topics** which are new to you.

# Exercises

Dependent of the lab session you may work individually or teamed. In either case make sure that throughout the course of this lab, you re-save sufficiently your solution file on your local machine as

**1DAExx-0y-name1**(+name2+name3).GGB given **xx**=groupcode, **0y**=labindex

## Exercise1 : directionvector of a line

Determine by pen and paper if the lines through AB and CD are parallel

A (2, 1, -1) to B (-1, 2, -5)

C (4, -1, -3) to D (7, -2, 1)

A picture containing text, device, meter

Description automatically generated

Check your solution in geogebra.

## Exercise2 : intersecting or parallel lines

Are the line r through the points A (-8; 2; -4) and B (-3; 4; -1) and the line s with equation

parallel, intersecting or not? If applicable, also determine their intersection.

Check your solution in geogebra.

## Exercise 3 : point on a line

Given A (2; 4; 2) and B (1; -4; 0) and line r

Determine C on r taking into account that you need in the triangle ABC an angle of 90° in C. [2 solutions : C1 (5,-1,3) and C2(1/2, 7/2, 3)]

Check your solution in geogebra.

## Exercise 4 : equations of a polygon

Consider the position vectors and . A polygon of a 3D object is composed by the origin, and the position vectors v and w.

* Determine a parametric and a cartesian equation of the polygon.
* Calculate a normal vector for this polygon

## Exercise 5 : equation of a plane through a point

Determine a parameter equation of the plane vp through P (3;6,2) and parallel to the plane vO through the origin, A (1; 2; 3) and B (4; 2; 1).

In addition, determine the cartesian equation of the plane vp and determine whether point A (44; 16; -7) is in the plane or not.

Check your solution in geogebra.

## Exercise 6 : orthogonal projection

Determine the orthogonal projection Q from the point P(-5,0,8) on the plane α : 2x + 2 y + -z + 9 = 0 , and the perpendicular distance to the plane [Solution = Q(-3, 2, 7) Distance = 3]

Check your solution in geogebra.

## Exercise 7 : non-orthogonal projection



In the image the vector r is

Determine the parameter equation of Ks // r through the point P (0,0,4). Determine the projection in the XY-plane from the point P parallel with the direction vector

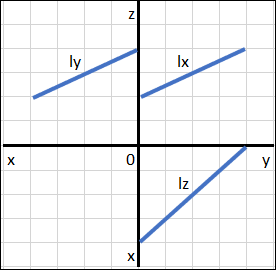
Check your solution in geogebra.

## Exercise 8 : intersection between line and sphere

Determine the intersectionpoints of the line through A(1,2,3) and B (5,0,6) and the sphere with Centerpoint (1,2,3) and radius sqrt(58)

Check your solution in geogebra.

## Exercise 9 : orthogonal projections

From the line l, The 3 projections on the corresponding planes are visualized. What is the parameter equation of the line?

# References

## Animation maths – Lannoo – Ivo De Pauw & Bieke Masselis

Leerboek ruimtemeetkunde – die Keure

Raytracing : <http://web.cse.ohio-state.edu/~shen.94/681/Site/Slides_files/basic_algo.pdf>