1 Background

In the scientific computation, it is common to express surfaces as collections of polygons. In systems with many objects moving about, it is important to detect when surfaces touch and intersect.

2 The problem

Given infinite plane of the form \( ax + by + cz = d \), and a parallelogram with vertices given by the position vectors \( \mathbf{r}_0, \mathbf{r}_0 + \mathbf{v}_1 \) and \( \mathbf{r}_0 + \mathbf{v}_1 + \mathbf{v}_2 \) where \( \mathbf{r}_0 \) points toward one corner of the parallelogram and \( \mathbf{v}_1 \) and \( \mathbf{v}_2 \) point along two distinct edges, design an algorithm to determine the line segment corresponding to the intersection of the parallelogram and the plane. Note, it is possible that they do not intersect at all, that the intersection is a point, or that the intersection is a line segment.

You should implement your algorithm in Maple as a procedure which accepts \( a, b, c, d, \mathbf{r}_0, \mathbf{v}_1 \) and \( \mathbf{v}_2 \) as inputs in that order. The output should be a parametric equation for the line segment in form of a list \([\mathbf{p}_0 + \mathbf{v}t, t_0, t_1]\) where the first element of the list is a parametric equation for the line and \( t_0 \leq t \leq t_1 \) is the parameter range for \( t \) corresponding to the line segment.