**THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF VISUAL COMPUTING**

**ASSIGNMENT 3**

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**Exercise 3.1:**

1. The diagram corresponding to the given problem:

*O*

*y*

*x*

*q* (*y* = 2)

*g1*

*p* (*y* = 1)

*g1’*

*-x0* = -2

*x0* =2

Point *p* is at (0, *yp*) and point *q* is at (-*x0*:*yq*:1). The observer O is at (-*x0*:0:1). As is evident from the figure, since O*q* || y-axis, it will not have any projection on the y-axis

For the line segment *pq:*

* Slope *m* = =
* The intercept *y0 = yp*
* The normal to the line segment *pq* will be along the line segment with slope . Passing through O, the equation of the line will be

Applying the perspective transformation on the representations of *pq*:

* *g’1*=
* *g’1* =

Applying the perspective transformation to the line *g1* for the input values *yp* = 1, *yq* = 2, *xo* = 2, we get,

*m* =

*g1’* =

The equation of *g1’* will be . Since point *p* lies on the projection line, it is unchanged after transformation and *g1’* will pass through *p*. However, since the point *q* does not have any projection on the *y*-axis, it will be transformed to the point at infinity.

*q’ =* , which indicates a point at infinity.

1. The point at infinity for *g1* will be the transformed point *q’*, since point *q* is the image of that point on *g1*. The point in homogeneous coordinates is ().
2. The vanishing point for *g1’* will be point *q*, since *q’* is at infinity.

**Exercise 3.2:**

Total derivative of at a point is given by:

**Exercise 3.3:**

At extrema positions,

The extremum points are

To find the saddle points and the local extrema, we have to perform the second-derivative test: