CSE 409: Class Test 1

Time: 30 min

Name: **Student ID:**

1. Given a point P(1,2,3) and a line L=(1,1,1)+t(1,2,3). Prove that P is not on L. Let Q be the point on L that is closest to P. Determine Q. [Mark: 5]

2. Prove the formula of reflection: $\bar{r} = \bar{a} - 2\,(\bar{a}.\,\hat{n})\,\hat{n}$. Here, $\bar{a}$ is the incident ray, $\hat{n}$ is normal to the reflection surface and $\bar{r}$ is the reflected ray. [Mark: 5]

3. Area(rectangle A)=10. Transformation matrix M is applied on A. What would be its new area? [Mark: 2]

$$M=\begin{bmatrix}2 & 0 & 0\\ 0 & 3 & 0\\ 0 & 0 & 1\end{bmatrix}$$

4. [2D problem] Determine with proof whether a shearing transformation along the X axis and a shearing transformation along Y axis are commutative or not. [Mark: 3]

5. [2D problem] You want to transform the points A(0,0), B(a,0), C(a,a), and D(0,a) to A'(a,0), B'(0,a), C'(-a,0), and D'(0,-a) respectively by performing one scaling, one translation, and one rotation operation (not necessarily in the given order). Write down the corresponding composite transformation matrix. You don't need to multiply the three matrices. Use homogeneous coordinates. [Mark: 5]