## Assignment 9

## Oral question

1. $5.5 / 12$

## Question to be answered in writing

1. Let $a, b, c, d$ be real numbers, such that $a d-b c \neq 0$. Using that

$$
\frac{a z+b}{c z+d}= \begin{cases}\frac{a}{c}+\frac{b-a d / c}{c z+d} & \text { if } c \neq 0, \text { and } \\ \frac{a z+b}{d} & \text { if } c=0\end{cases}
$$

show that every fractional linear transformation of the above form arises as a combination of horizontal translations $z \mapsto z+b$, dilations $z \mapsto a z$ and "reflected inversions" $z \mapsto 1 / z$. Conclude that fractional linear transformations preserve angles and the cross-ratio.

