1. Recal that for $p, q \in \mathbb{H}$, we define $\langle p, q \rangle = \mathrm{Re}(p\overline{q})$, where $\mathrm{Re}(q)$ is the real part of q.

a) Suppose $s \in \mathbb{H}$. Show that for all $p, q \in \mathbb{H}$, $\langle ps, qs \rangle = |s|^2 \langle p, q \rangle$.

b) Show that for all $p, q \in \mathbb{H}$, $\langle \overline{p}, \overline{q} \rangle = \langle p, q \rangle$.

c) Suppose $s \in \mathbb{H}$. Show that for all $p, q \in \mathbb{H}$, $\langle sp, sq \rangle = |s|^2 \langle p, q \rangle$.

d) Suppose $u \in \mathbb{H}$ and $u \neq 0$. Show that conjugation by u takes the real quaternions to themselves.

e) Conclude quickly that if $u \in \mathbb{H}$ and $u \neq 0$, then conjugation by u takes the imaginary quaternions to themselves.

2. 2.1.1

3. 2.1.2

4. 2.2.1

5. 2.2.2

6. 2.2.5

7. Extra Credit: 2.2.3