1. Given real numbers $x, a, b$ with $x \geq a \geq b \geq 0$, show that
\[
\sqrt{x + b} - \sqrt{x - a} \geq \sqrt{x + a} - \sqrt{x - b}
\]

2. In the figure, we see three lines through a common point $P$. These are cut by the two lines $a$ and $b$ as shown, creating four triangular regions, labeled 1, 2, 3 and 4 in the diagram. If the areas of regions 1 and 4 are equal and the areas of regions 2 and 3 are equal, prove that lines $a$ and $b$ are parallel.

3. Let $S$ be a set of positive integers containing 1, 2, 3 and 4. Suppose that for every subset of $S$ consisting of four distinct integers, the sum of that subset is also a member of $S$. Prove that 1000 is a member of $S$.

4. Find all positive integers $n$ such that $n^2 + 3n + 1$ is a multiple of $3n + 10$.

5. Find all real numbers $x$ such that
\[
\sqrt{x + 4} - \sqrt{x} = 1
\]