Problems

1. Given that $x^x = 3$, determine the value of $x^{\left(x^{x+1}\right)}$.

2. If we have two positive integers a and b such that $ab + 1$ is square, is it always possible to find a positive integer c for which $ac + 1$ and $bc + 1$ are both square?

3. Given is a group of n people, some pairs are friends and some are not. It is known that amongst any three of these people, there is at least one pair who are not friends. What is the maximum number of pairs of friends amongst these n people?

4. Let $ABCD$ be a square. Determine all possible locations of a point P such that:

    - P lies inside square $ABCD$, and

    - $\angle APB + \angle CPD = 180°$.

5. Let a, b, n and m be positive integers, with $n > 1$. Show that $a^n + b^n = 2^m$ implies $a = b$.

6. There are 30 distinct rays coming out of the origin. For each pair of rays consider the smaller of the two angles between them (the one smaller than or equal to $180°$). What is the maximum possible number of obtuse angles amongst these?