1. A, B, C, A', B', C' are six points on a circle such that the chords \( AA', BB', CC' \) meet in a point. Prove that

\[
AB \cdot B'C' \cdot C'A = A'B' \cdot BC \cdot C'A.
\]

Is it true, conversely, that if A, B, C, A', B', C' are six points on a circle satisfying (*) then AA', BB', CC' are concurrent? Justify your answer.

2. Find, with proof, the number of different (i.e. non-congruent) triangles with sides of integer length whose perimeter is 1986 units.

3. Find, with proof, the largest real number \( k \) with the following property:

Whenever \( a, b, h \) are constants such that

\[
ax^2 + 2hx + b > 0
\]

for all real numbers \( x \), then

\[
a(x^2+y^2) + b(z^2+1) + h[xz+y+k(x-zy)] > 0
\]

for all real numbers \( x, y, z \).

4. Solve the equations

\[
x^2 + (y-z)^2 = a^2,
y^2 + (z-x)^2 = b^2,
z^2 + (x-y)^2 = c^2
\]

for \( x, y, z \), where \( a, b, c \) are given.

5. A sequence of polynomials \( P_m(x,y) \), \( m = 0, 1, 2, \ldots \) in \( x \) and \( y \) is defined by \( P_0(x,y) = 1 \) and

\[
P_m(x,y) = (x+y)(y+1)P_{m-1}(x,y+1) - y^2P_{m-1}(x,y)
\]

for \( m>0 \). Prove that each \( P_m(x,y) \) is symmetric, i.e. \( P_m(x,y) = P_m(y,x) \).

6. Show that the sequence of integers \( [n/2] \), \( n=1,2, \ldots \) contains an infinite number of integer powers of 2. Here \( [x] \) denotes the integer part of \( x \); for example \( [3.2] = [4.242\ldots] = 4 \).