1 Proof 1

for $n \in N : 1 + 2 + 4 + ... + 2^n = 2^{(n+1)} - 1$

2 Proof 2

For all positive integers $x, y : (x \mid y) \to (x \mid y^x)$.

3 Proof 3

Assuming you have two positive numbers a, b and the equation $a^2+2a = 4b^2+4b$ holds, prove that $a = 2b$.

4 Proof 4

For integers a,b, there are no integers s.t. $a^2 - 9b = 3$

5 Proof 5

If $x^2 - 8x + 11$ is even then x is odd

6 Proof 6

For any $n \in N \wedge n \geq 1$, $1 + 3 + 5 + 7 + ... + 2n - 1 = n^2$

7 Proof 7

Proof that $A \cup (A \cap B) =$ A for any sets A,B

8 Proof 8

Say $A[]B = \{x \mid x \in A \oplus x \in B\}$, show that $A[]B = (A - B) \cup (B - A)$

9 Proof 9

$$\forall n \geq 1, n \in N : \sum_{i=1}^{n} i(i+1) = \frac{n(n+1)(n+2)}{3}$$

10 Proof 10

We recursively define S. Say $(0,0) \in S$.
Recursion: $(m,n) \in S, \rightarrow (m+2, n+3) \in S$.
There are no other elements in S.
Prove that $(m,n) \in S \rightarrow 5 \mid (m+n)$

11 Proof 11

For any set A,B,C: prove that $(A \cup B) - C = (A - C) \cup (B - C)$

12 Proof 12

For integers x,y,z,n prove that $x^n + y^n = z^n$ has no solutions for n greater than 2

13 Proof 13

Define set S like this: $1 \in S$,
$x \in S \rightarrow x + 3 \in S$,
$2 \mid x \in S \rightarrow \frac{x}{2} \in S$
And nothing else.
Proof $k \in S \rightarrow 3 \nmid k$

14 Proof 14

$a \in S$,
$x \in S \rightarrow xb \in S$,
$x \in S \rightarrow abxa \in S$,
$x, y \in S \rightarrow xya \in S$
There are no other elements in S.
Prove that the number of a is odd in every string

15 Proof 15

Let A be the set of all bitstrings of form $0^n 1^n$ with $n \in N$,
Let B be the recursively defined set $01 \in B$,
$w \in B \rightarrow 0w1 \in B$
There are no other elements in B.
prove A=B

16 Proof 16

for all $n \in N, 3 \mid 5^{2n} - 1$

17 Proof 17

$A \cap B \subseteq A \subseteq A \cup B$ for any sets A,B

18 Proof 18

for all natural numbers $n \geq 1$

$$(\sum_{i=1}^{n} i)^2 = \sum_{i=1}^{n} i^3$$

(HH 4.2b)

19 Proof 19

x is odd iff $\mid x \mid$ is odd for any integer x.

20 Proof 20

suppose x and y have opposite parity, xy should be even, with $x, y \in Z$