N1a Collatz MacIntyre

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1. $a_{i+1} = \begin{cases} \text{-a}_i/2 & \text{if } a_i \text{ is even} \\ 3\text{*a}_i + 1 & \text{if } a_i \text{ is odd} \end{cases}$
   Start with Positive Integer. Seems to loop and reach 1 no matter the integer.

2. $a_{i+1} = \begin{cases} \text{a}_i/2 & \text{if } a_i \text{ is even} \\ (3\text{*a}_i + 1)/2 & \text{if } a_i \text{ is odd} \end{cases}$
   Start with Positive Integer. Seems to loop and reach 1 no matter the integer.

3. $a_{i+1} = \begin{cases} (\text{a}_i + 2)/2 & \text{if } a_i \text{ is even} \\ 3\text{*a}_i + 1 & \text{if } a_i \text{ is odd} \end{cases}$
   Start with Positive Integer. Seems to loop one of the following loops:[6, 4, 3, 10, 6], [40, 21, 64, 33, 100, 51, 154, 78, 40], [22, 12, 7, 22], or if $a_0 = 2$ [2, 2, 2].

Proof for 1: That all positive integers work, while domain is all real numbers.
Basis Step:

Case 1:(even) Let n = a_i , and n = 2
P(2) = 2/2 = 1 (odd)

Case 2: (odd) Let n = 1
P(1) = 3*1 + 1 = 4 (Even)
Therefore, even integers create an odd integer, while odd integers create an even integer.

Induction: Now let n = k + 1

Case 1: (even) k + 1 = (-k + 1) / 2 while k is even (2q)
= (-2q + 1) / 2, which is within the domain. So n + 1 will work in this scenario. (result odd)

Case 2: (odd) k + 1 = (3 * (k+1) + 1), k = 3q+1
= 9q + 6
= 3 (3q + 2) which is even and withen domain.

Therefore, both cases work and rebound back and forth from even and odd. Hence, Because n + 1 is true, by mathematical induction, a_0 is true for all Z^+

Note: With this being said, I am not quite sure how to show that this will eventually come back to 1 and loop as my program has shown.

Note: Also not sure if this proof by mathematical induction is cmpletely correct or the right way to go about this.