PRIME, EMIRP, and Armstrong Numbers

Project for the Curious

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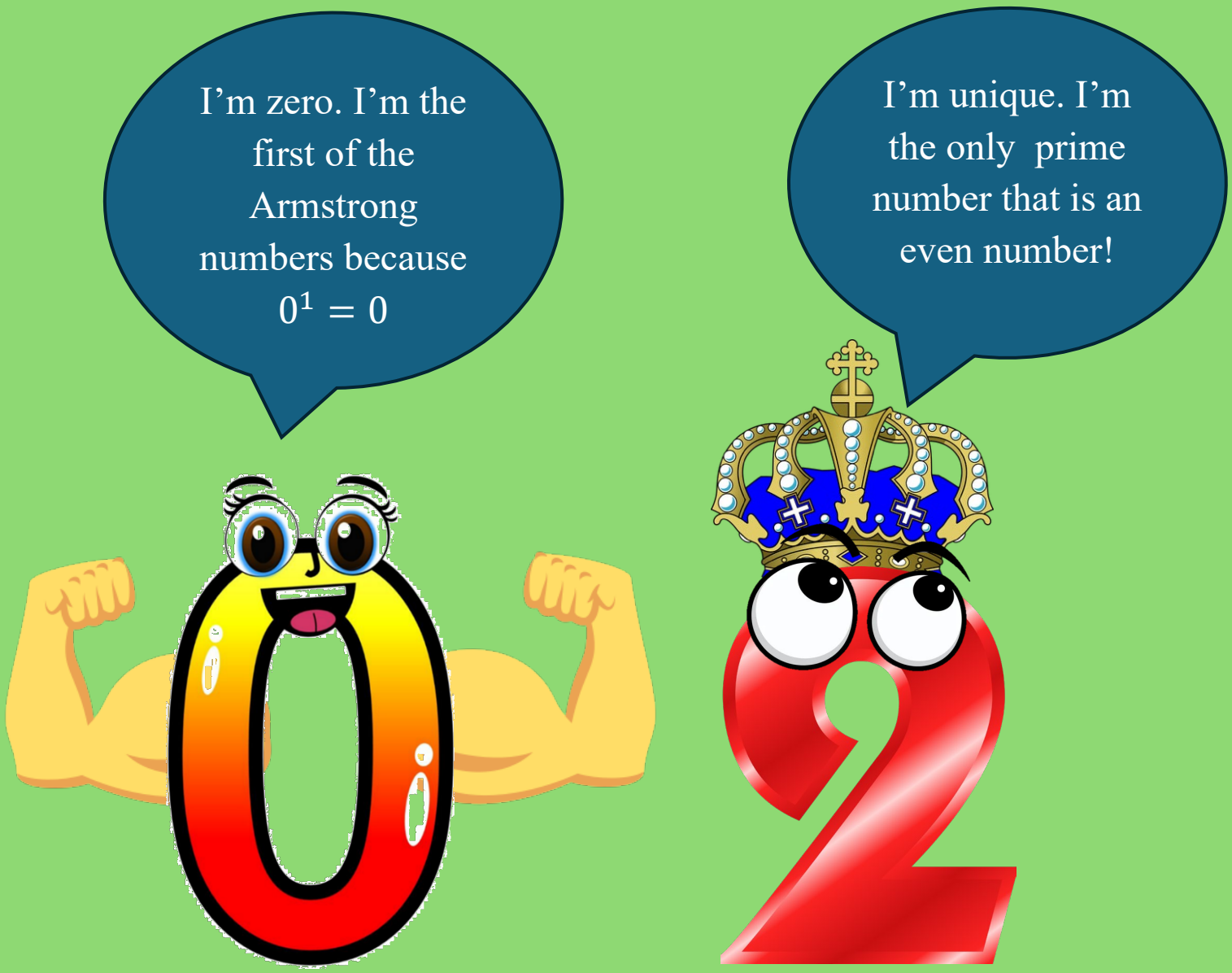
This excerpt explores two Goldbach Conjectures



PRIME, EMIRP, and Armstrong Numbers

Throughout history, mathematicians have explored a variety of types of numbers and relationships among those numbers.
Explorations took place as early as in the 200BCs.
More recently, an exploration took place in 1985.

Check out these explorations.

You will need:

- **Pencil**
- **Calculator**
- **Partner**

II-A. Goldbach Strong Conjecture

In 1742, Christian Goldbach, a Russian mathematician, proposed the relationship (to his friend Leonard Euler) that every number greater than 2 can be formed by adding two PRIME numbers.

Test Goldbach's Strong Conjecture.

For each of these even numbers, identify <u>all sets</u> of <u>two</u> PRIME Numbers that add to the even number.

4 = _____ + _____	**18 = _____ + _____**
6 = _____ + _____	**20 = _____ + _____**
8 = _____ + _____	**30 = _____ + _____**
10 = _____ + _____	**38 = _____ + _____**
12 = _____ + _____	**40 = _____ + _____**
14 = _____ + _____	**46 = _____ + _____**
16 = _____ + _____	**50 = _____ + _____**

II-B. The Goldbach Weak Conjecture

In 1742, Christian Goldbach, also proposed the relationship that every odd number greater than 5 can be formed by adding three PRIME numbers.

Test Goldbach's Weak Conjecture.

For each of these odd numbers, identify <u>all sets</u> of <u>three</u> PRIME Numbers that add to the odd number.

7 = _____ + _____ + _____

9 = _____ + _____ + _____

11 = _____ + _____ + _____

13 = _____ + _____ + _____

15 = _____ + _____ + _____

17 = _____ + _____ + _____

19 = _____ + _____ + _____

23 = _____ + _____ + _____

29 = _____ + _____ + _____

31 = _____ + _____ + _____

Solutions

II-A. Goldbach Strong Conjecture

For each of these even numbers, identify <u>all sets</u> of <u>two</u> PRIME Numbers that add to the even number.

<u>4</u> = 2 + 2

<u>6</u> = 3 + 3

<u>8</u> = 3 + 5

<u>10</u> = 3 + 7
= 5 + 5

<u>12</u> = 5 + 7

<u>14</u> = 3 + 11
= 7 + 7

<u>16</u> = 3 + 13
= 5 + 11

<u>18</u> = 5 + 13
= 7 + 11

<u>20</u> = 3 + 17
= 7 + 13

<u>30</u> = 7 + 23
= 11 + 19
= 13 + 17

<u>38</u> = 7 + 31
= 19 + 19

<u>40</u> = 3 + 37
= 11 + 29
= 17 + 23

<u>46</u> = 3 + 43
= 5 + 41
= 23 + 23

<u>50</u> = 3 + 47
= 7 + 43
= 13 + 37
= 19 + 31

Solutions

II-B. The Goldbach Weak Conjecture

For each of these odd numbers, identify <u>all sets</u> of <u>three</u> PRIME Numbers that add to the odd number.

<u>7</u> = 2 + 2 + 3

<u>9</u> = 2 + 2 + 5
=3 + 3 + 3

<u>11</u> = 2 + 2 + 7
= 3 + 3 + 5

<u>13</u> = 3 + 3 + 7
= 3 + 5 + 5

<u>15</u> = 2 + 2 + 11
= 3 + 5 + 7
= 5 + 5 + 5
= 2 + 2 +11

<u>17</u> = 2 + 2 + 13
= 3 + 3 + 11
= 5 + 5 + 7

<u>19</u> = 3 + 3 + 13
= 3 + 5 + 11
= 5 + 7 + 7

<u>23</u> = 2 + 2 + 19
= 3 + 3 + 17
= 3 + 7 + 13

<u>29</u> = 3 + 13 + 13
= 5 + 7 + 17
= 7 + 11 + 11

<u>31</u> = 3 + 5 + 23
= 3 + 11 + 17
= 5 + 7 + 19
= 7 + 11 + 13

AUTHOR BIOS

Carole Greenes, Ed.D. is Professor Emerita, Mathematics Education at Arizona State University and was Professor at Boston University. She has authored/co-authored more than 350 books for students and teachers; 82 articles; six mathematical musicals; and two histories of mathematics in story and song. Her 2021 - 2026 books/games include: *What's My Angle? Alge-Grid: What's the a?, Pattern Grid-unLocks, Play It Positively or Negatively!*, *Factor Max, Make It Proper, Shape Up, Function Frenzy, What's My Angle?*, *READY-X?*, SMARTY, and *PRIME,EMIRP, and Armstrong Numbers*, all available from the Center for Mathematics and Teaching. (cgreenes@asu.edu)

Tanner Wolfram has a J.D. from Georgetown University Law Center, and a B.S. in physics from Arizona State University. A native of Arizona, he has worked with Professor Greenes in multiple capacities for more than 10 years. During this time, he collaborated on three research projects developing Grades 5 – 12 students' and teachers' interests in a variety of STEM fields, and he co-authored 9 mathematics puzzle books. Tanner is interested in pursuing a career in transactional law, which involves doing the legal work for deals between large corporations. He will start his legal career at a law firm in Washington D.C. (twolfram@asu.edu).