THE PUZZLE VAULT
1. Four areas
1. Four Areas
2. Digit sums
2. **Digit Sums**

- Take any positive whole number $n$. 
2. Digit sums

- Take any positive whole number $n$.
- Prove there exists a multiple of $n$ whose digit sum is odd.
3. The Superfrog
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- Starts at zero.
3. **THE SUPERFROG**

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- Every second the frog jumps $n$ to the right.
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- Every second the frog jumps $n$ to the right.
- After one second we decide we want to catch him.
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- Every second the frog jumps \( n \) to the right.
- After one second we decide we want to catch him.
- Every second (starting from 1 second) we check a number.
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- Every second the frog jumps \( n \) to the right.
- After one second we decide we want to catch him.
- Every second (starting from 1 second) we check a number.
- We don’t know what \( n \) is.
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- Every second the frog jumps $n$ to the right.
- After one second we decide we want to catch him.
- Every second (starting from 1 second) we check a number.
- We don’t know what $n$ is.
- Find a strategy that guarantees capture.
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- What if the frog picks the direction?
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- After one second we decide we want to catch him.
- Every second (starting from 1 second) we check a number.
- We don’t know what \( n \) is.
- Find a strategy that guarantees capture.
- What if the frog picks the direction?
- What if the frog picks the starting number?
4. **Odd Factors**
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- 4
4. Odd factors

- 4
- (5)
- (6)
- (7)
- (8)
4. Odd factors

- 4
- (5) 5
- (6) 3
- (7) 7
- (8) 1
4. Odd factors

- 4
- (5)  5
- (6)  3
- (7)  7
- (8)  1

\[ 16 = 4^2 \]
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Let \( n \) be a positive whole number, and consider the largest odd factors of \( n+1, n+2, n+3, \ldots, 2n \).
4. Odd factors

Let $n$ be a positive whole number, and consider the largest odd factors of $n+1$, $n+2$, $n+3$, ..., $2n$.

Prove that their sum is $n^2$. 
Links
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