Warmup 5/(The smallest # of sides a polygon can have)

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Below are some rules/patterns that do NOT have to do with consecutive sums. For each one, try to figure out how to put the rule/pattern into words. (It's harder than it seems, but you will have to do this for the project!)

1) $11 \cdot 1 = 11$
$11 \cdot 2 = 22$
$11 \cdot 3 = 33$
$11 \cdot 4 = 44$
$11 \cdot 5 = 55$
$11 \cdot 6 = 66$
$11 \cdot 7 = 77$
$11 \cdot 8 = 88$
$11 \cdot 9 = 99$

2) $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ $\frac{1}{5} - \frac{1}{6} = \frac{1}{30}$

$\frac{1}{9} - \frac{1}{10} = \frac{1}{90}$ $\frac{1}{15} - \frac{1}{16} = \frac{1}{240}$

3) $9 + 9 = 18$
$99 + 99 = 198$
$999 + 999 = 1998$
$9999 + 9999 = 19998$
$99999 + 99999 = 199998$

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$11 \cdot 2 = 22$
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"If you multiply 11 by a 1-digit number, you get a 2-digit number, where both digits are the number you multiplied by."

2) $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ $\quad \frac{1}{5} - \frac{1}{6} = \frac{1}{30}$
$\frac{1}{9} - \frac{1}{10} = \frac{1}{90}$ $\quad \frac{1}{15} - \frac{1}{16} = \frac{1}{240}$

"If you subtract 2 fractions with 1 in the numerator and consecutive numbers in the denominators, the difference will be a fraction with 1 in the numerator and the product of the denominators in the denominator."

3) $9 + 9 = 18$
$99 + 99 = 198$
$999 + 999 = 1998$
$9999 + 9999 = 19998$
$99999 + 99999 = 199998$

"If you add a number where all the digits are 9 with itself, you will get a sum whose first digit is a 1, last digit is an 8, and all middle digits are 9's. The number of 9's is 1 less than the number of 9's in each addend."

Another pattern…

$$1 \cdot 1 = 1$$
$$11 \cdot 11 = 121$$
$$111 \cdot 111 = 12321$$
$$1111 \cdot 1111 = 1234321$$
$$11111 \cdot 11111 = 123454321$$
$$111111 \cdot 111111 = 12345654321$$
$$1111111 \cdot 1111111 = 1234567654321$$

Discuss out loud: How would you word THIS one???

"If you multiply a number where all the digits are 1 by itself, you will get a number whose digits start with 1 and go consecutively up to the number of digits in each factor and then back down to 1"

TURN IN Week 7 Warmups

- **MAKE SURE YOUR NAME IS ON IT!**

Consecutive Sums Project (Day 2)

- Your group should be deciding on some **rules** that you figured out. You should be able to explain the rule in words.

- Example that isn't true, but gives an idea of what a rule could look like:
  - *"When you add 6 consecutive numbers together, the sum is always 30."*

- A **bad** example of a rule: *"It goes up by 3"*
  - Why is this bad?

“It goes up by 3”

- **WHAT goes up by 3? (The sums)**
- **Better word for “goes up” = increase**
- **And most importantly: WHEN do they increase by 3???**

- **“When you add _____, the sums increase by 3”**

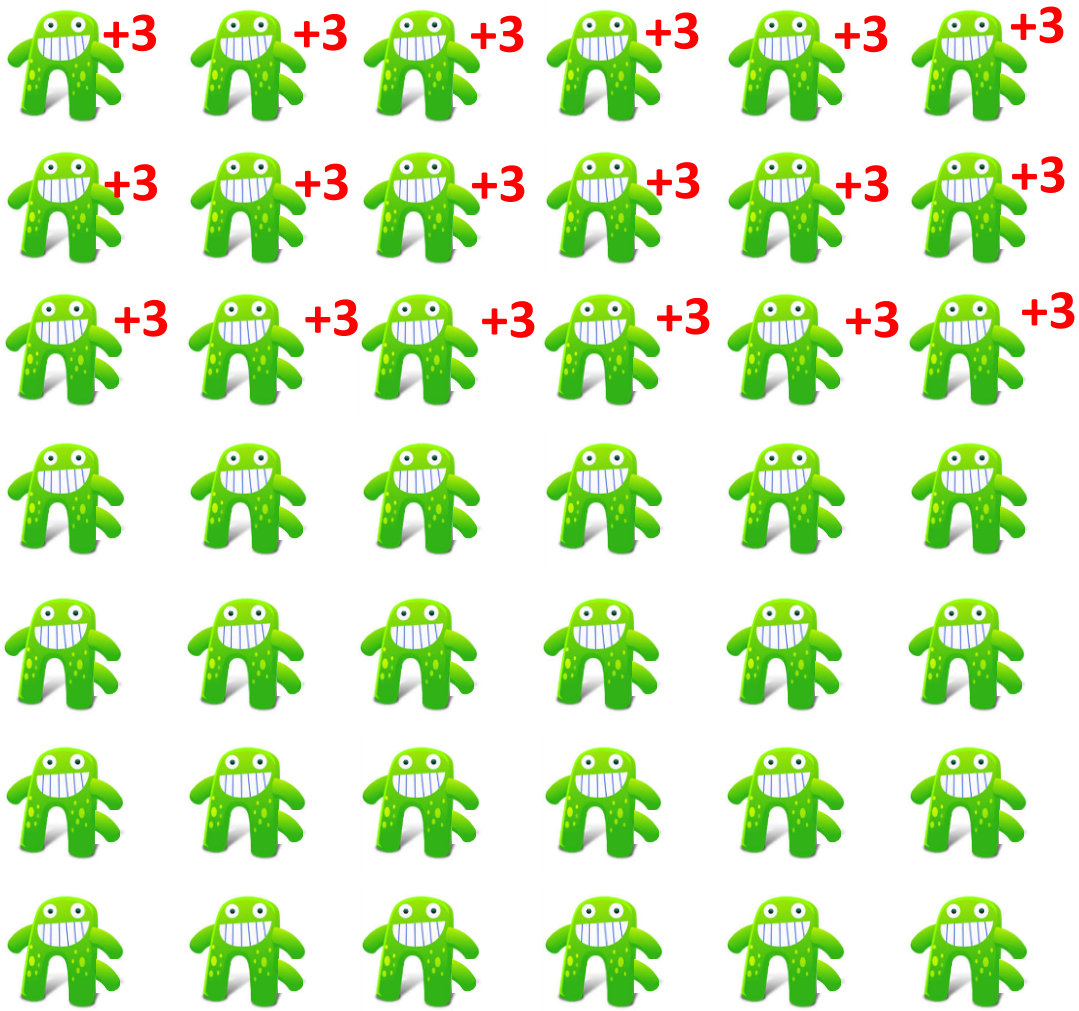
How could you make this rule better?

- **“If you multiply anything by ten, it always ends in zero.”**
- **“It” → “the product”**
- **This is technically not true!**
- **If you multiply <u>any whole number</u> by ten, the product will always end in zero.**
- **Tips for writing rules**
  - **Use mathematical vocabulary**
  - **USE PRECISE LANGUAGE!!!**

Escape Problem

- 42 Creatures, 180 arms
- **Strategy: Guess & Check**
- **21 of each:** $21 \cdot 6 + 21 \cdot 3 = 126 + 63 = 189$
  Too high! (need fewer zeebles)
- **20 Zeebles, 22 Quarks:** $20 \cdot 6 + 22 \cdot 3 = 120 + 66 = 186$
  Too high!
- **19 Zeebles, 23 Quarks:** $19 \cdot 6 + 23 \cdot 3 = 114 + 69 = 183$
  Too high!
- *****If we take out a Zeeble and add a Quark, we subtract three arms!*****
- **18 Zeebles, 24 Quarks:** $18 \cdot 6 + 24 \cdot 3 = 108 + 72 = 180$
  There it is!!!

Strategy: Draw a Picture



42 x 3 =
126 arms

(Need to add 3 18 times to get to 180)

Escape Problem

- 42 Creatures, 180 arms
- **Strategy: Start w/ all Quarks**
- **42 Quarks: $42 \cdot 3 = 126$ We need 54 more arms!**
- ***If we change a Quark into a Zeeble, we add three arms.**
- **$54 \div 3 = 18$. So, we need to change 18 of the Quarks into Zeebles.**
- **42 – 18 = 24 Quarks, 18 Zeebles**

Escape Problem

- 42 Creatures, 180 arms
- **Strategy: Start w/ all Zeebles**
- **42 Zeebles: $42 \cdot 6 = 252$ We have 72 arms too many!!!**
- ***If we change a Zeeble into a Quark, we subtract three arms.**
- **$72 \div 3 = 24$. So, we need to change 24 of the Zeebles into Quarks.**
- **42 – 24 = 18 Zeebles, 24 Quarks**

Escape Problem

- 42 Creatures, 180 arms
- **<u>Strategy: System of Equations</u>**
- **Creatures Equation:** **Q + Z = 42**
- **Arms Equation:** **3Q + 6Z = 180**

- **You can multiply the top equation by -3 to eliminate Q, or by -5 to eliminate Z.**

- **Or you could write the first equation as "Q = 42 – Z" and do substitution by plugging in "42 – Z" for "Q"**

Your goal for today:

- Continue to explore/figure out some rules and patterns

- You will likely stay on your own paper for today, but if your group feels like you are already ready for the poster, you may start on your poster today.

- **Q:** How many rules do I need?
- **A:** There is no set amount. Last year one of the best posters had only two rules, but they were <u>really good</u>.

What should we put on our poster?

- Title: “Consecutive Sums: Our Discoveries”
- Everybody’s name
- The rules/patterns themselves. **Think carefully about how to word them well!!!**
- For each pattern or rule, put some examples that show how it works
- GOING ABOVE AND BEYOND: write an explanation of **why** the rule works
- You can also put a rule that you thought was true but later realized was false, and explain how you discovered it was false.

- **YOUR POSTER SHOULD BE NEAT AND ORGANIZED!!!**
- **Use COLOR effectively!!!**