Hi Nrich Team,

I am Preethi Rao. I am one of the facilitators at **'Ganit Kreeda', Vichar Vatika, India**. I worked collaboratively with a group of students from 4th grade to 7th grade, online, on **"KEEP IT SIMPLE".** The names of the students are:

Anirved Mahanta, Aarya Kathe, Abheer Deo, Ashaman Singh, Dia Ramalingam, Mihika Kothari, Reyansh Sethumadhavan, Dhanwin, Darsh Rathi, Shiva N Pant, Siddhanth Adahavan, Sunil Patil

Children observed that:

1. Can you describe Charlie's rule? - One of the addends' denominators must be a product of the other addend's denominator and the sum's denominator.

2. Are all his examples correct? - No, the second one and the fourth one are not correct.

3. What do you notice about the sums that are correct? - The addends' denominator and the given sum's denominator are consecutive numbers.

4.Find some other correct examples..

$\frac{1}{5} = \frac{1}{6} + \frac{1}{30}$

$\frac{1}{6} = \frac{1}{7} + \frac{1}{42}$

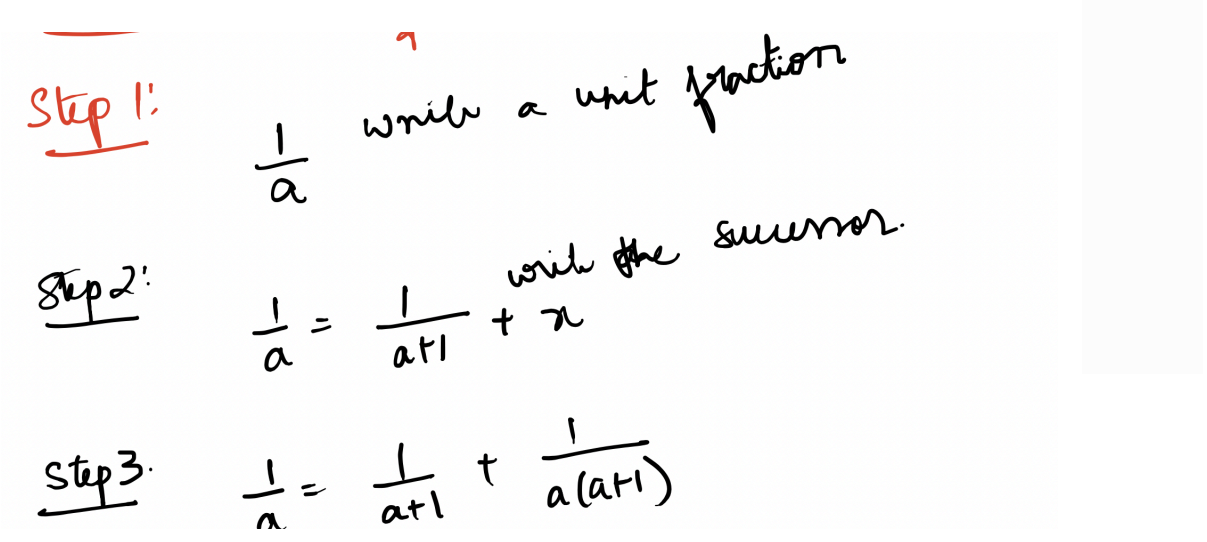
5. How would you explain to Charlie how to generate lots of correct examples? - Take two consecutive numbers and multiply them together. Ex. 7 x 8 = 56.

Write the consecutive numbers and the product as unit fractions.

Write the sum of the two smaller fractions as the sum of the biggest fraction.

I.e 1/7 = ⅛ + 1/56

Most of the children generalised the above as:



6. Charlie tried to do the same with ⅛. Can you finish Charlie's calculations to see which ones work?

1/8=1/9+1/72

1/8=1/10+1/40

1/8=1/11+3/88 (Does not work)

7. Can all unit fractions be made in more than one way like this? - Yes.

8. Choose different unit fractions of your own to test out your theories.

1. 1/9 = 1/10 + 1/90
2. 1/9 = 1/11 + 2/99 (Does not work)
3. 1/9 = 1/12 + 1/36

Arya observed that Charlie's technique worked only if the difference between the denominators of the first addend and the sum divides their product.

1/9 = 1/10 + 1/90 works because (10 - 9) divides 10*9. The quotient (10*9 / 1 = 90) is the denominator of the other addend.

1/9 = 1/12 + 1/36 works because (12 - 9) divides 12*9. The quotient (12*9 / 3 = 36) is the denominator of the other addend.

1/9 = 1/11 + 2/99 does not work (11-9) does not divide 11*9

9. **Charlie tried to do the same with 1/8. Can you finish Charlie's calculations to see which ones work?**

1. 1/8=1/9+1/72
2. 1/8=1/10+1/40
3. 1/8=1/11+3/88 (Does not work)

1/8=1/9+1/72 works because (9-8) divides 9*8. The quotient (9*8 / 1 = 72) is the denominator of the other addend.

1/8=1/10+1/40 works because (10-8) divides 10*8. The quotient (10*8 / 2 = 40) is the denominator of the other addend.

1/8=1/11+3/88 does not work because (11-8) does not divide 11*8.

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USING EQUIVALENT FRACTIONS

Reyansh and Anirved came up with this method. They figured out that if we get the largest unit fraction less than the given unit fraction,w e can express it as a sum.

HOW TO FIND THE LARGEST UNIT FRACTION THAT IS LESS THAN THE GIVEN FRACTION?

Step 1: Find equivalent fraction for the given fraction such that you can manipulate the numerator into being a factor of the denominator.

23/35 = 46/70

Step 2: Split the 46 into 35+11

46/70 = 35/70 + 11/70

35/70 is nothing but ½ and that is the largest unit fraction less than 23/35

Therefore 23/35 = ½ + 11/70

= ½ + 10/70 + 1/70

= ½ + 1/7 + 1/70

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Anirved came up with all possible solutions for expressing unit fractions as sum of other unit fractions.

a. ½=⅓+⅙

b. ⅓=¼+1/12

⅓=⅕+1/15+1/15

c. ¼=⅕+1/20

¼=⅙+1/12

¼=1/7+1/14+1/28

h. 1/9=1/10+1/90

1/9=1/11+1/99+1/99

1/9=1/12+1/36

1/9=1/13+1/30+1/1,170

1/9=1/14+1/26+1/819

1/9=1/15+1/45+1/45

1/9=1/16+1/24+1/144

1/9=1/17+1/20+1/510+1/3,060

d. ⅕=⅙+1/30

⅕=1/7+1/35+1/35

⅕=⅛+1/20+1/40

⅕=1/9+1/12+1/180

e. ⅙=1/7+1/42

⅙=⅛+1/24

⅙=1/9+1/18

⅙=1/10+1/15

⅙=1/11+1/22+1/33

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i. 1/10=1/11+1/110

1/10=1/12+1/60

1/10=1/13+1/65+1/130

1/10=1/14+1/35

1/10=1/15+1/30

1/10=1/16+1/40+1/80

1/10=1/16+1/32+1/160

1/10=1/17+1/34+1/85