

# Rich Questions to Support All Learners

Marian Small  
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## Suppose I ask

- ▶ There were 24 kids in the class.
- ▶ Each one paid \$15 for the field trip.
- ▶ How much was collected?
- ▶ Explain your thinking.



## The problem is...

- ▶ For some kids these numbers are too much and they are excluded.
- ▶ For some kids, this is not much of a problem.
- ▶ So how do we change it up to be more useful to more kids?



## Maybe

- ▶ There were more than 15 kids in a class.
- ▶ Each one paid MORE THAN an \$10 but LESS THAN \$25 for the field trip.
- ▶ How much are you sure is TOO LOW?
- ▶ How much is TOO HIGH?
- ▶ How much might have been collected?
- ▶ Explain your thinking.

## What is great about this is...

- ▶ That kids can pick numbers they can be successful with, but see that the process is the same no matter what.
- ▶ Even the too low and too high estimates leave a lot of latitude for all students.
- ▶ But really strong students are likely to pick tighter “too low” or “too high” estimates to challenge themselves.



# Agenda

- ▶ Why use open questions?
- ▶ Open questions in number, pattern and relations



## Math is tricky

- ▶ We learned math believing that all kids need to be doing the same skill on the same day, when we know this is unrealistic.
- ▶ But we didn't see options.



## Open questions

- ▶ Provide a viable option for differentiation.
- ▶ One question can meet the needs of many learners because the question is not overly tight and so benefits a broader range of students.



## A good open question

- ▶ engenders thinking, not repetition.
- ▶ focuses on important math.
- ▶ allows entry to all learners.
- ▶ leads to rich mathematical conversation.
- ▶ extends strong learners and
- ▶ provides LOTS of assessment for learning info.



## Where they belong in a lesson

- ▶ A minds-on open question is not a long activity, but engenders discussion that will put students in the right frame of mind for the action task.



## Where they belong in a lesson

- ▶ An open action question can be a “main” activity.



## Where they belong in a lesson

- ▶ An open question might suit consolidation if its focus is to bring out the important math.



Look at these samples

*Some fractions are more than one half.  
They are pretty close to one half, though.*



## What would you expect from

- ▶ A grade 4? Grade 5? Grade 6 student?
- ▶ Is it appropriate for all of them?



Grade 4



### Fraction Focus Task

*Some fractions are more than one half.  
They are pretty close to one half, though.*

Show three or four possible fractions.

$$\frac{1}{3} \quad \frac{1}{4} \quad \frac{1}{5}$$



Tell how you know they are right.

I know I am right because the lower number has more and I put more than  $\frac{1}{2}$ , I put  $\frac{1}{3}$ ,  $\frac{1}{4}$  and  $\frac{1}{5}$ .

### Fraction Focus Task

*Some fractions are more than one half.  
They are pretty close to one half, though.*

Show three or four possible fractions.

$$\frac{509}{1000} \quad \frac{6}{10} \quad \frac{12}{20} \quad \frac{51}{100}$$

Tell how you know they are right.

I know it's right because a half of 10 is 5  
 $+1 = \frac{6}{10}$ ,

Next a half of 20 is 10 but I did 2 more  $\frac{12}{20}$

Then a half of 100 is 50 but...  $+1 = \frac{51}{100}$

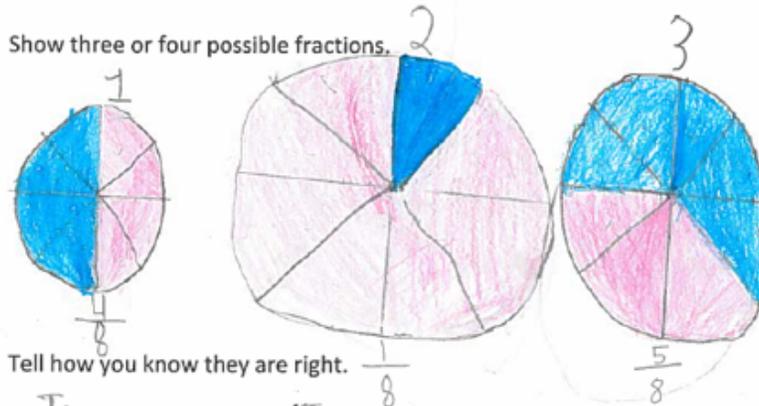
lastly a half of 1000 is 500 then add +

$$\frac{509}{1000}$$

## Fraction Focus Task

Some fractions are more than one half.  
They are pretty close to one half, though.

Show three or four possible fractions.



Tell how you know they are right.

I'm Not to sure if they are  
right because I'm just  
putting down what I learned  
last year so I'm not to sure

but I tries my best  
but I don't know if I  
did it right. But I think  
the 3rd one is right because  
it has more than one half  
and close to one half.

Grade 5



## Fraction Focus Task

*Some fractions are more than one half.  
They are pretty close to one half, though.*

Show three or four possible fractions.

$\frac{2}{3}$      $\frac{5}{6}$      $\frac{7}{8}$

Tell how you know they are right.

☺ This shows three spaces, and i'm saying that it is 2 out of 3. So I fill in 2. ☺ and leave one blank.

⊕ Now, this shows six blank spaces, and since it's 5 out of 6 I fill in 5. ⊕ And leave one blank, cause it's  $\frac{5}{6}$ .

⊕ And finally we have 7 out of 8. So we colour in 7 of those 8 spaces. ⊕ And leave one blank.

## Fraction Focus Task

Some fractions are more than one half.  
They are pretty close to one half, though.

Show three or four possible fractions.

①  $\frac{4}{6}$

③  $\frac{3}{4}$

②  $\frac{11}{20}$

④  $\frac{22}{42}$

Tell how you know they are right.

"For number 1, I know they're right because, in the title it says "they are close to one half"; so I decided to do it one above the  $\frac{1}{2}$  mark. It also says in the title that "Some fractions are more than one half so I was able to do it."

## Fraction Focus Task

*Some fractions are more than one half.  
They are pretty close to one half, though.*

Show three or four possible fractions.

|                   |
|-------------------|
| 1. $\frac{3}{4}$  |
| 2. $\frac{4}{6}$  |
| 3. $\frac{7}{12}$ |
| 4. $\frac{6}{10}$ |

Tell how you know they are right.

1.  $\frac{3}{4}$  

2.  $\frac{4}{6}$  

3.  $\frac{7}{12}$  

4.  $\frac{6}{10}$  

} you just need to take away one to get a half



Grade 6



### Fraction Focus Task

Some fractions are more than one half.  
They are pretty close to one half, though.

Show three or four possible fractions.

$$\frac{5001}{10000} \quad \frac{501}{1000} \quad \frac{51}{100}$$
$$\frac{501}{100}$$

Tell how you know they are right.

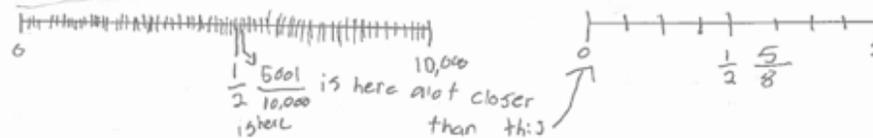
I know how these numbers are close to  $\frac{1}{2}$  because the higher the number the closer it is to  $\frac{1}{2}$  like...

Exp

$$\frac{5001}{10,000} \text{ would be more } \frac{6}{10} \text{ or } \frac{5}{8}$$

closer than.

Imagine if this number line was divided into 10,000 little pieces.

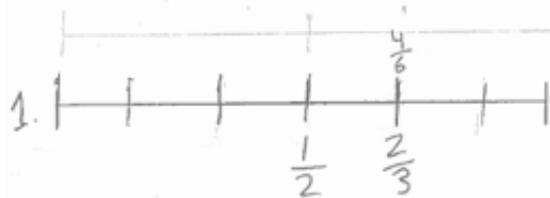


## Fraction Focus Task

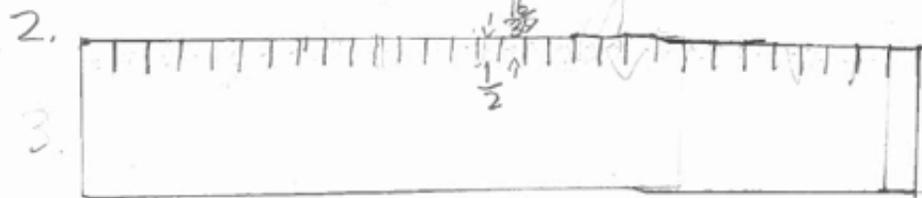
Some fractions are more than one half.  
They are pretty close to one half, though.

Show three or four possible fractions.

~~$\frac{6}{10}$~~   ~~$\frac{3}{5}$~~   ~~$\frac{2}{3}$~~



Tell how you know they are right.



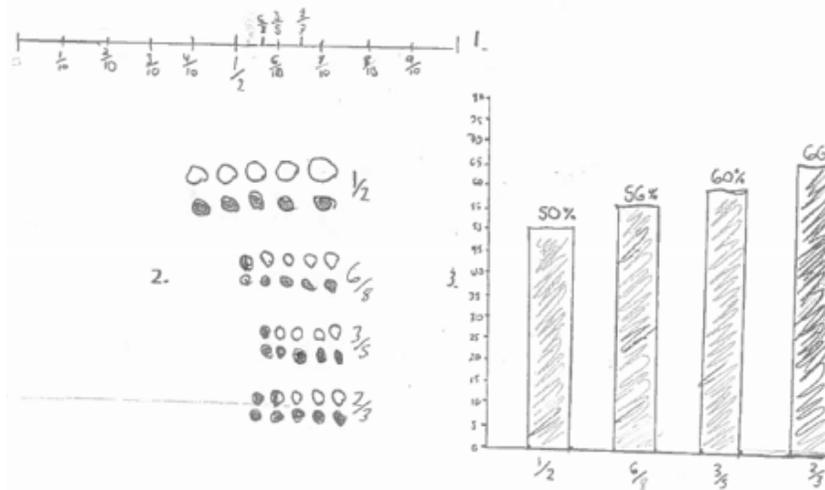
## Fraction Focus Task

*Some fractions are more than one half.  
They are pretty close to one half, though.*

Show three or four possible fractions.

$$\frac{3}{5} \quad \frac{6}{8} \quad \frac{2}{3}$$

Tell how you know they are right.



# Open questions in number or pattern and relations



## Grade K or 1 Minds ON

→  Stand on a number on a number line. Name two numbers that come before your number. Name two numbers that come after your number.

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## Grade K or 1 Minds ON

 There are 10 people in a room, and there are more boys than girls in the room. How many of each might there be?



## Grade K or 1 Minds ON

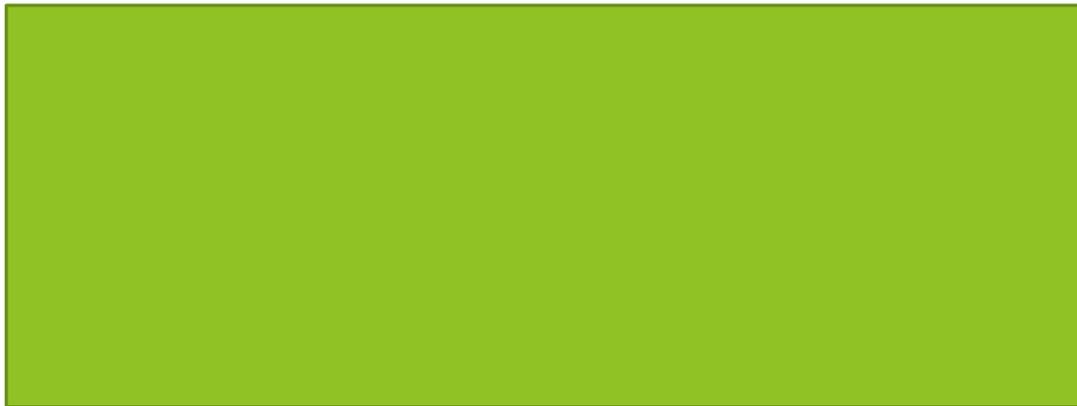
**Q** Choose numbers to put in the blanks to make the statement true:

\_\_\_\_\_ is a lot closer to \_\_\_\_\_ than to \_\_\_\_\_.



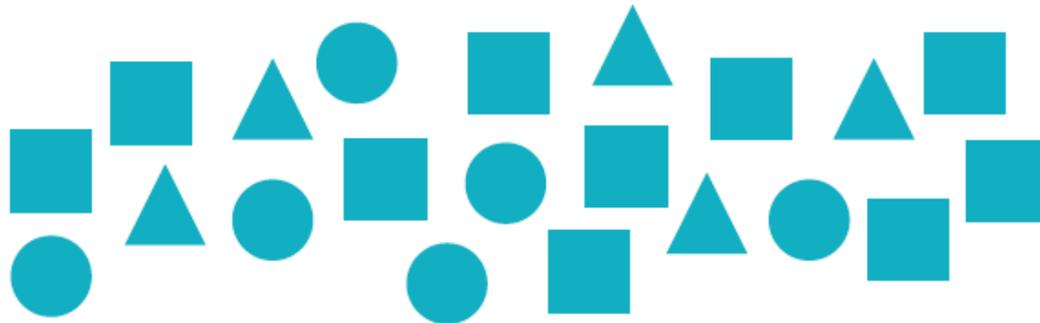
K or 1

 What are some storybooks you know that have patterns?



K or 1

**Q** How could you arrange some or all of these shapes to make a pattern?



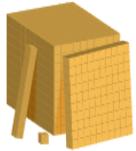
## Grade 2 Main Problem



Show an amount of money using six coins.  
How else could you show this amount?  
Repeat for two other amounts.

A large, solid green rectangular area intended for students to write their answers to the problem.

## Grade 2 Main Problem



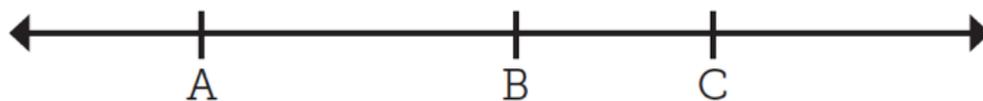
Break the number 48 up to show each of the following things about it

Show each thing using a number line or base ten blocks.

- a) It is even.
- b) It is between 40 and 50.
- c) It can be broken up into three groups.
- d) It has 4 groups of 10 and some leftovers.

## Grade 2 Main Problem

→→→→→ **Q** Choose three numbers less than 100 to put at points A, B, and C on the number line below. Explain why those numbers make sense. Repeat with other numbers.



## Grade 2 pattern and algebra

 Use emoticons to design a repeating pattern that changes in two ways. Describe your pattern.



## Grade 3 Consolidate

**Q** Start at 100 and skip count forward by 2s.  
Start at 100 and skip count forward by 5s.  
Name some numbers you say for 2s that you don't say for 5s.  
Name some numbers you say for 5s that you don't say for 2s.  
Name some numbers you say for both 2s and 5s.

## Grade 3 Consolidate

**Q** A number that includes the digits 2 and 5 is greater than a number that includes the digits 7 and 8. How is that possible? The numbers can have two or three digits.

## Grade 3 Consolidate

**Q** The answer to a subtraction question is one less than the answer to  $300 - 155$ . What might the subtraction question be?

**SAMPLE RESPONSE**

$299 - 155$  OR  $300 - 156$  OR  $244 - 100$

## Grade 3 consolidate

**Q** A shrinking number pattern has a number in the 20s as the fifth term. What might the pattern be? Think of lots of possibilities.

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## Grade 3 consolidate



Create a growing pattern. Represent it on grid paper using a bar graph. How does the graph help you see what makes the pattern a pattern?



Grade 4 minds on

 Which fraction do you think does not belong:  $\frac{3}{10}$ ,  $\frac{3}{3}$ ,  $\frac{1}{8}$ , or  $\frac{2}{3}$ ? Why?

## Grade 4 Minds On

**\$** **Q** You represent an amount of money with 28 coins, including 13 quarters. How many other coins (not 28) might you have used to represent that same amount? Explain.

## Or you could ask

**Q**

Fill in the blanks to make this sentence true:  
\_\_\_\_\_ is a little less than double \_\_\_\_\_.

**SAMPLE RESPONSE**

4 and 3 **OR** 19 and 10 **OR**  $\frac{9}{10}$  and  $\frac{1}{2}$

# Grade 4 Pattern

**Q** Describe three growing patterns in the multiplication table. Explain each pattern.

| × | 0 | 1 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
|---|---|---|----|----|----|----|----|----|----|----|
| 0 | 0 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 1 | 0 | 1 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 2 | 0 | 2 | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 3 | 0 | 3 | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
| 4 | 0 | 4 | 8  | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 5 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| 6 | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |
| 7 | 0 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 |
| 8 | 0 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 |
| 9 | 0 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 |

# Grade 4 Relations

**Q** You figured out the missing number in a multiplication equation, and you thought it was really easy. What might the equation be, and why did you think it would be really easy?



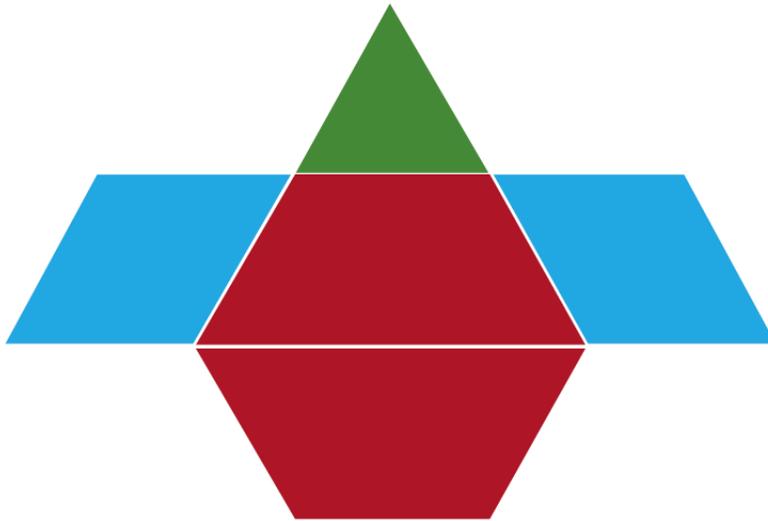
## Grade 5 action

**Q** Think of five-digit numbers where the sum of the digits is 24. List 10 or more possible numbers. Order them from least to greatest.

## Grade 5 Action



Q Name three improper fractions that you see in the diagram below. Tell where you see them. Tell what mixed number each fraction represents. Do you think it is easier to see the number as a mixed number or as an improper fraction? Why?



## Grade 5 Action

**Q** The 30th term in a growing number pattern is the same as the 15th term in another growing number pattern. What could the two patterns be?



## Or you could ask

**\$** **Q** You bought something and paid the clerk \$50. You got two bills and four coins in change. How much money might you have spent? Think of two or more possibilities. Explain your answer.

# Grade 6 consolidation questions



You could ask



**Q** Describe two big numbers that are easy to compare. Tell why it's easy to compare them.



## You could ask

**Q** Do you think that the ratios 5:2 and 24:10 are more alike than the ratios 5:2 and 20:17? Explain.

You could ask



Q

Is it true that knowing 75% of a number also tells you 10% of a number?

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## Grade 6 consolidation

**Q** A growing pattern grows quickly. The points form a straight line on a graph. What might the pattern be?



## Grade 6 main pr

**Q** Suppose  $4 \times \square = \triangle$ .  
What other equations  
relating  $\square$  and  $\triangle$  must  
also be true?

### SAMPLE RESPONSE

$$8 \times \square = 2 \times \triangle$$

$$\triangle \div 4 = \square$$

$$\triangle \div \square = 4$$

## Strategies You Can Use

- ▶ Start with the answer. Students create the question.



For example..

- ▶ The answer is 200.
- ▶ What might the question have been?



# Alike and Different

- ▶ How are adding and multiplying alike? Different?
- ▶ How is adding decimals like adding whole numbers? How is it different?
- ▶ How are fractions and decimals alike? Different?



## Choose your own values

- ▶ Choose two different pairs of two-digit numbers.
- ▶ Multiply them different ways.
- ▶ Tell how you multiplied each pair and why you used different ways.



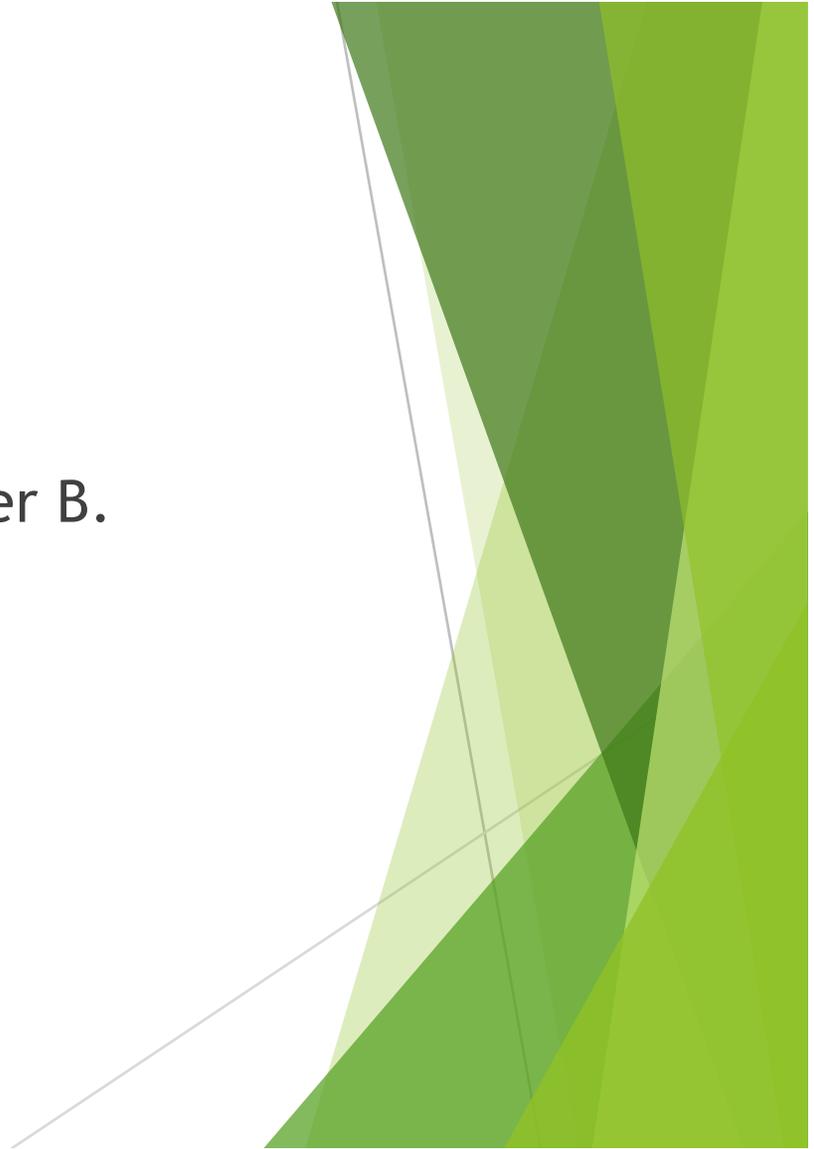
## Use “soft” words

- ▶ You add two decimal numbers and the answer is slightly less than 7.
- ▶ What might they be?



## Use “soft” words

- ▶ You divide number A by number B.
- ▶ The answer is a little more than number B.
- ▶ What could the numbers have been?



## Starting with a standard question and opening it up

- ▶ Now you start with a few standard number or pattern or relation questions and try to open them up to work for more students and to create richer conversations.





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