Indicator 4 Class Notes by Mrs. Joshi

Dividing Fractions

4. Interpret and compute quotients of fractions using visual models and equations to represent problems.
a. Use quotients of fractions to analyze and solve problems.

2.5 Lesson

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Key Vocabulary
reciprocals, *p. 72*

Two numbers whose product is 1 are **reciprocals**. To write a reciprocal of a number, write the number as a fraction. Then invert the fraction.

The Meaning of a Word • Invert

When you **invert** a glass, you turn it over.

EXAMPLE 1 Writing Reciprocals

Study Tip
When any number is multiplied by 0, the product is 0. So, the number 0 does not have a reciprocal.

	Original Number	*Fraction*	*Reciprocal*	*Check*
a.	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{5}{3}$	$\frac{3}{5} \times \frac{5}{3} = 1$
b.	$\frac{9}{5}$	$\frac{9}{5}$	$\frac{5}{9}$	$\frac{9}{5} \times \frac{5}{9} = 1$
c.	2	$\frac{2}{1}$	$\frac{1}{2}$	$\frac{2}{1} \times \frac{1}{2} = 1$

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Key Idea

Dividing Fractions

Words To divide a number by a fraction, multiply the number by the reciprocal of the fraction.

Numbers $\frac{1}{5} \div \frac{3}{4} = \frac{1}{5} \times \frac{4}{3}$

Algebra $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$, where b, c, and $d \neq 0$

EXAMPLE 2 Dividing a Fraction by a Fraction

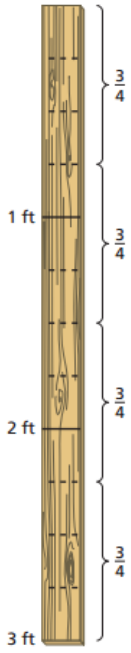
Find $\frac{1}{6} \div \frac{2}{3}$.

$\frac{1}{6} \div \frac{2}{3} = \frac{1}{6} \times \frac{3}{2}$ Multiply by the reciprocal of $\frac{2}{3}$, which is $\frac{3}{2}$.

$= \frac{1 \times \cancel{3}^{1}}{\cancel{6}^{2} \times 2}$ Multiply fractions. Divide out the common factor 3.

$= \frac{1}{4}$ Simplify.

EXAMPLE 3 Dividing a Whole Number by a Fraction



A piece of wood is 3 feet long. How many $\frac{3}{4}$-foot pieces can be cut from the piece of wood?

Method 1: Draw a diagram. Mark each foot on the diagram. Then divide each foot into $\frac{1}{4}$-foot sections.

Count the number of $\frac{3}{4}$-foot pieces of wood. There are four.

∴ So, four $\frac{3}{4}$-foot pieces can be cut from the piece of wood.

Method 2: Divide 3 by $\frac{3}{4}$ to find the number of $\frac{3}{4}$-foot pieces.

$3 \div \frac{3}{4} = 3 \times \frac{4}{3}$ Multiply by the reciprocal of $\frac{3}{4}$, which is $\frac{4}{3}$.

$= \frac{\cancel{3}^{1} \times 4}{\cancel{3}_{1}}$ Multiply. Divide out the common factor 3.

$= 4$ Simplify.

∴ So, four $\frac{3}{4}$-foot pieces can be cut from the piece of wood.

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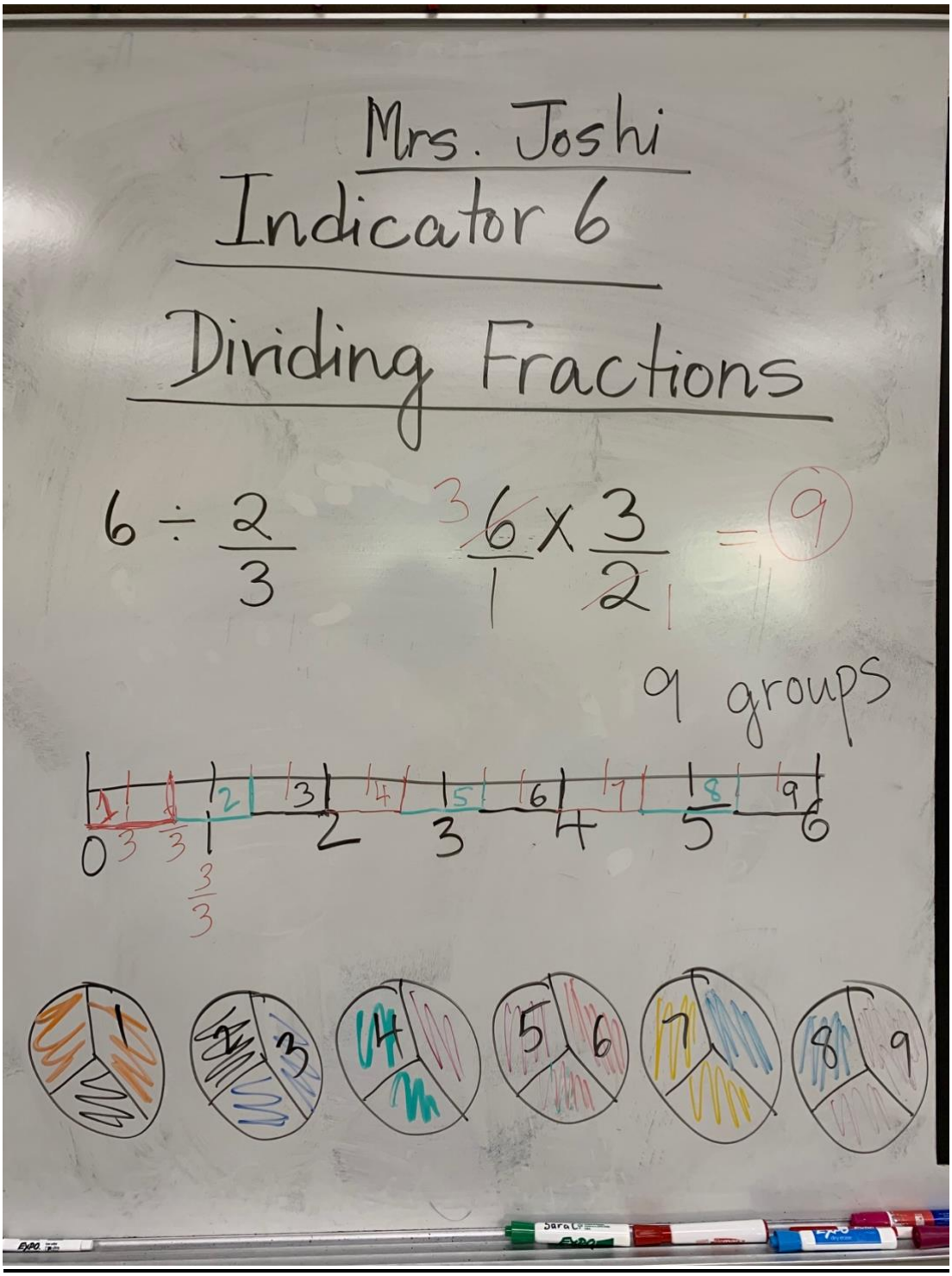
Visual Models of Dividing Fractions



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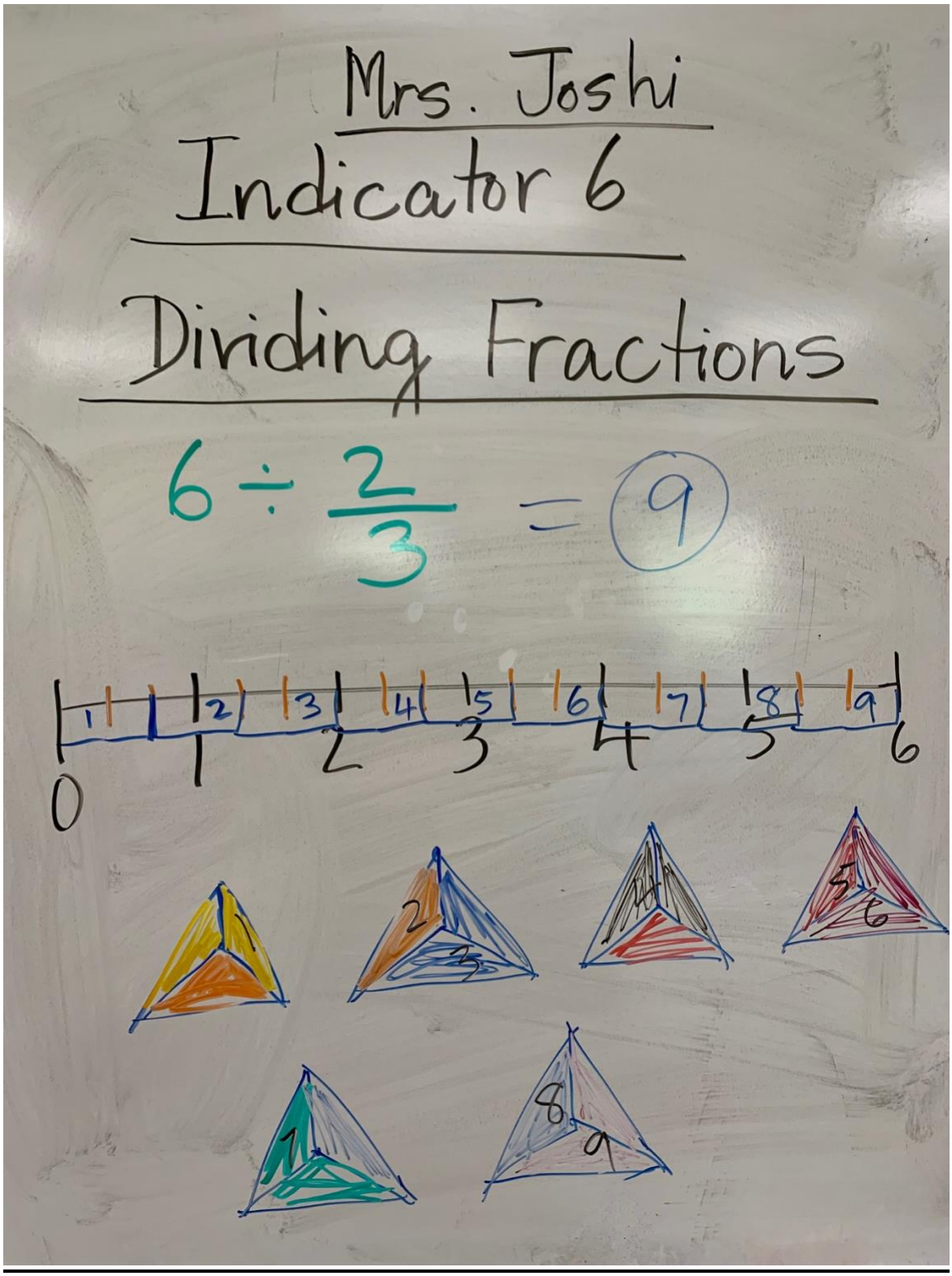

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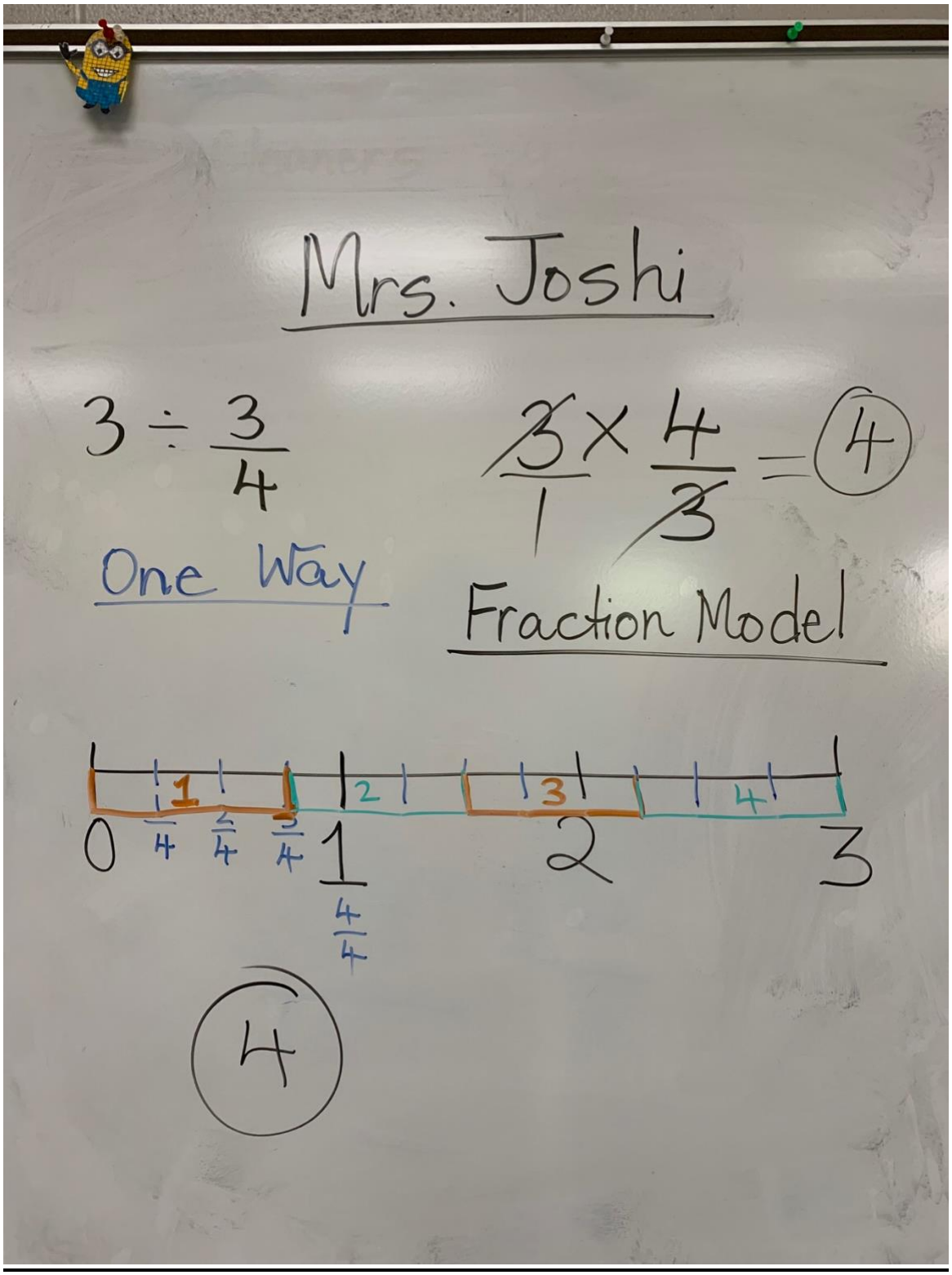

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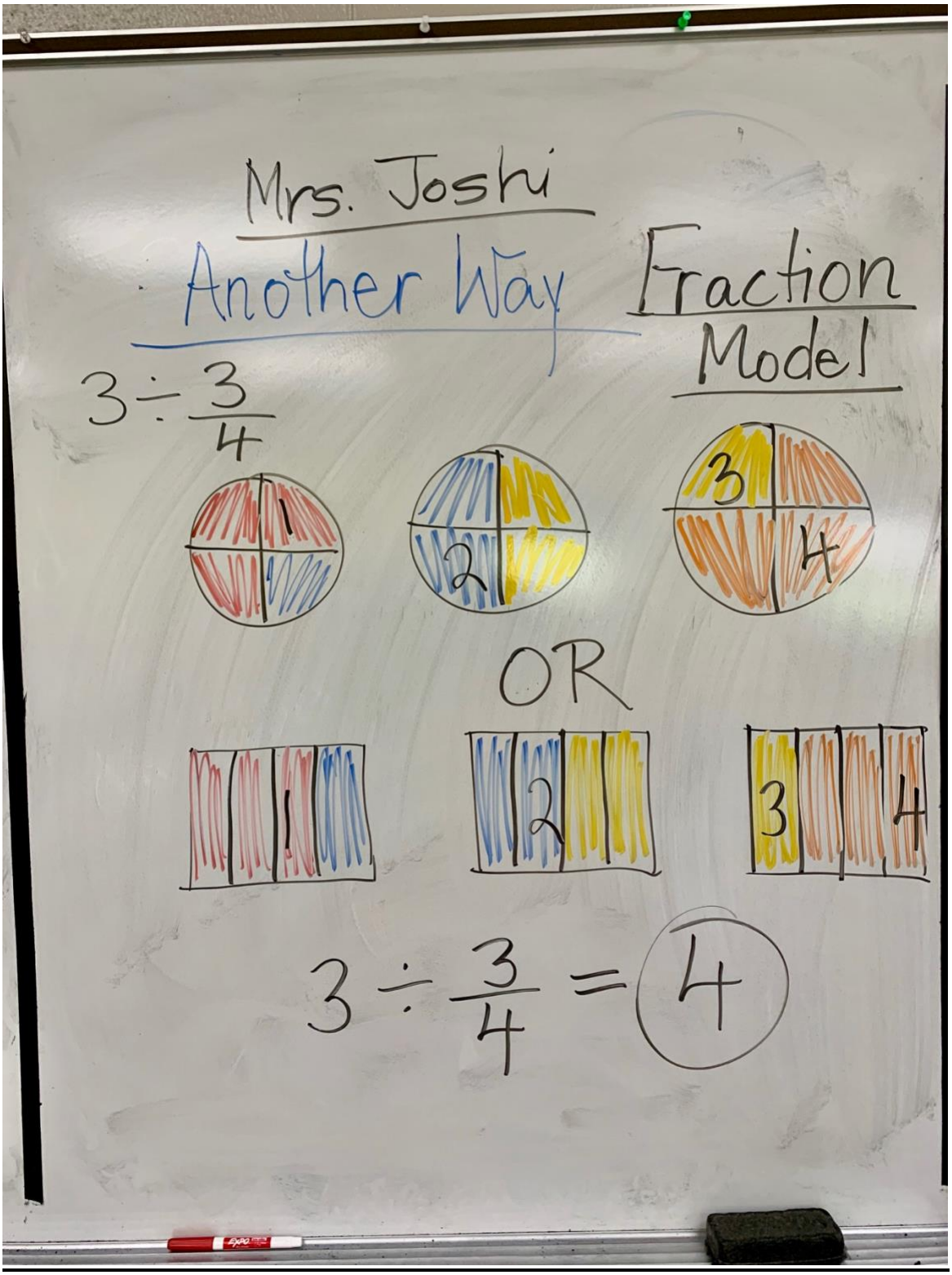

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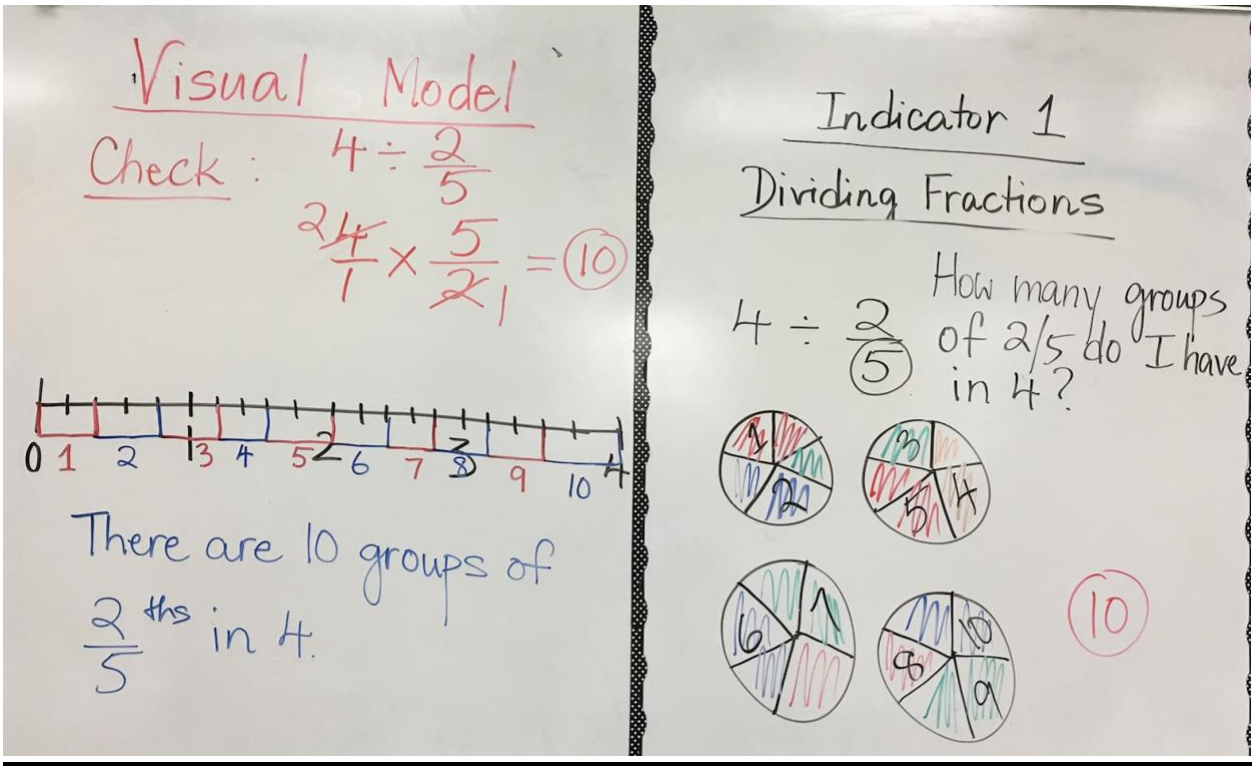

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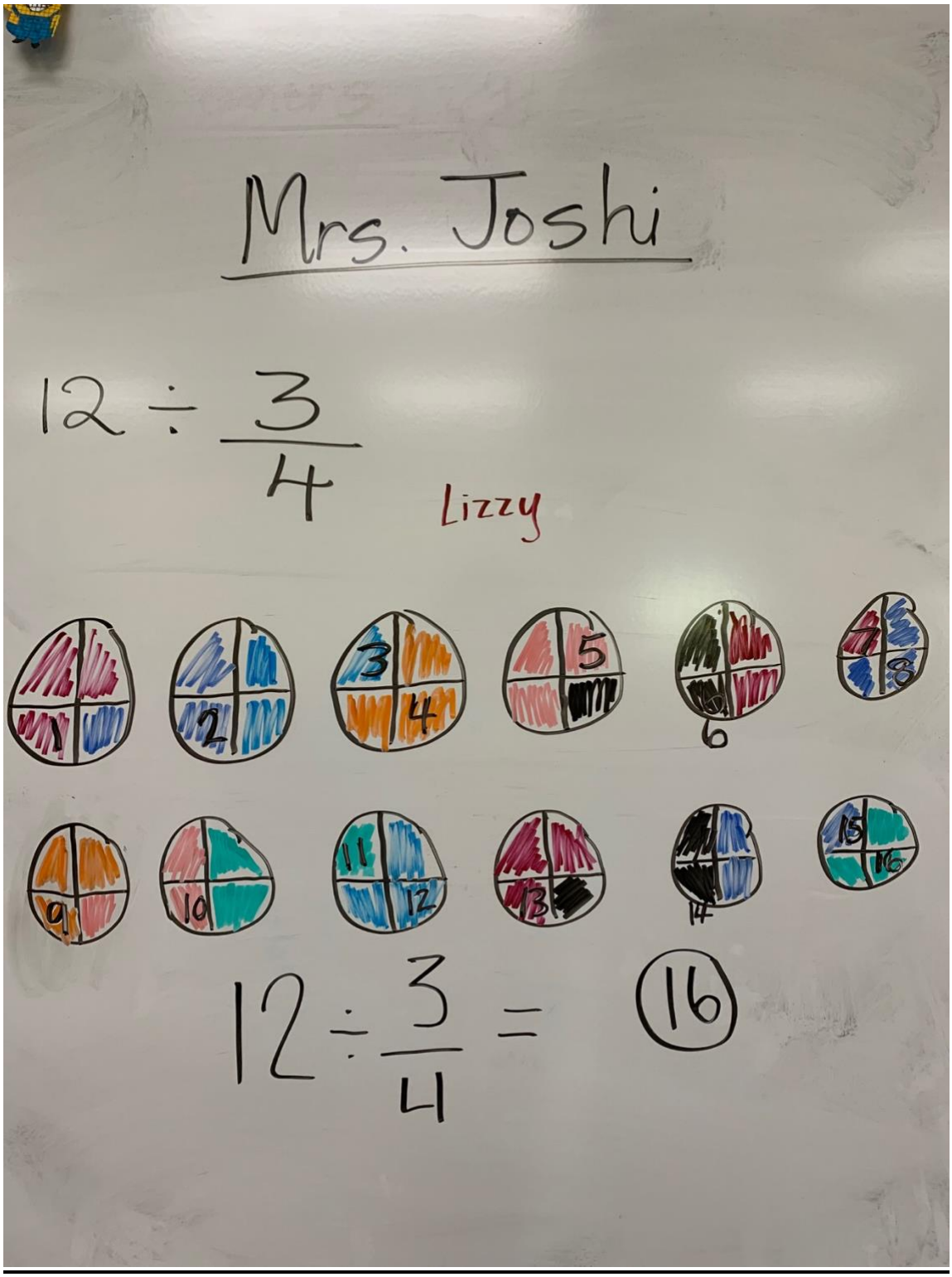

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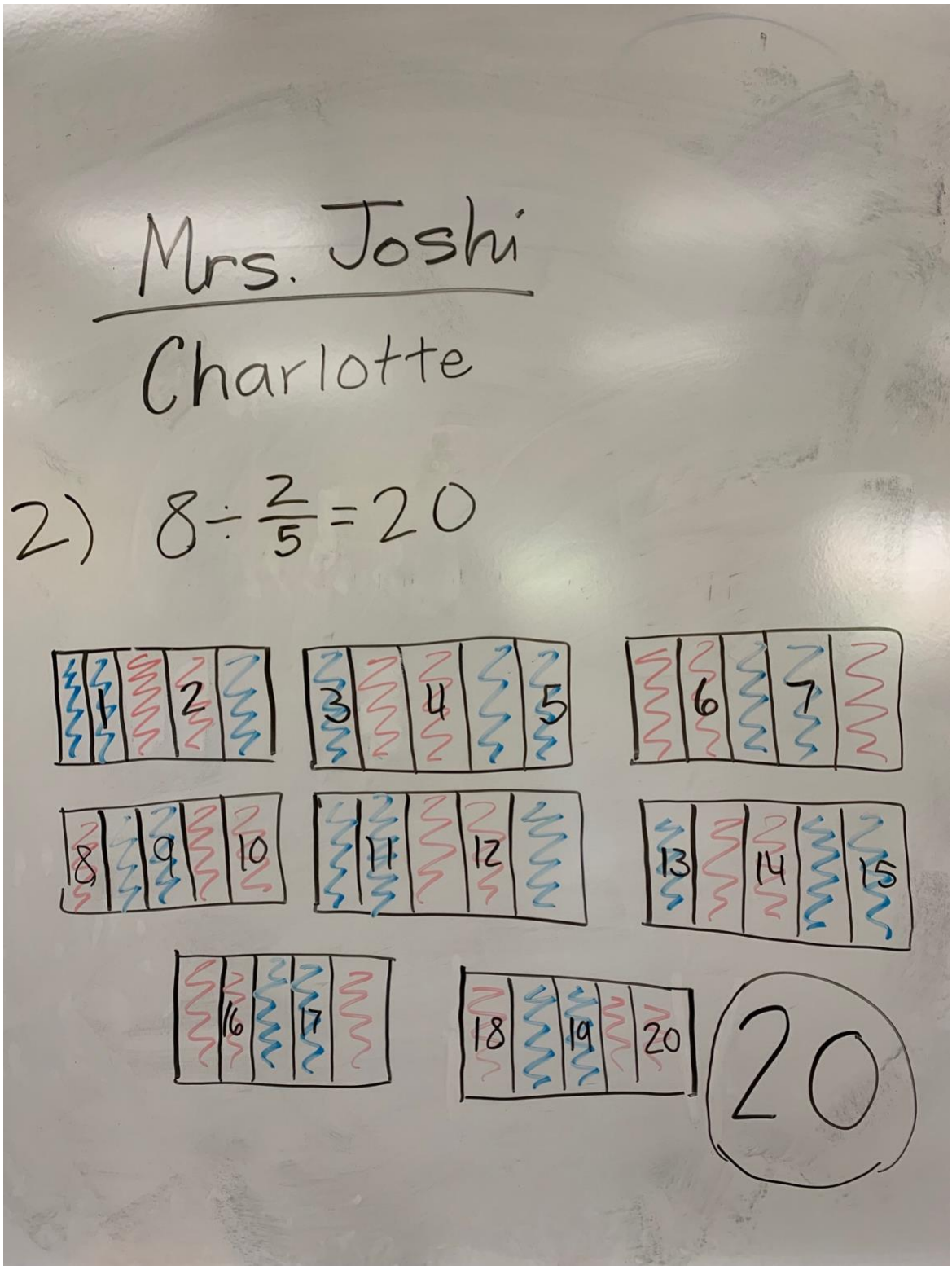

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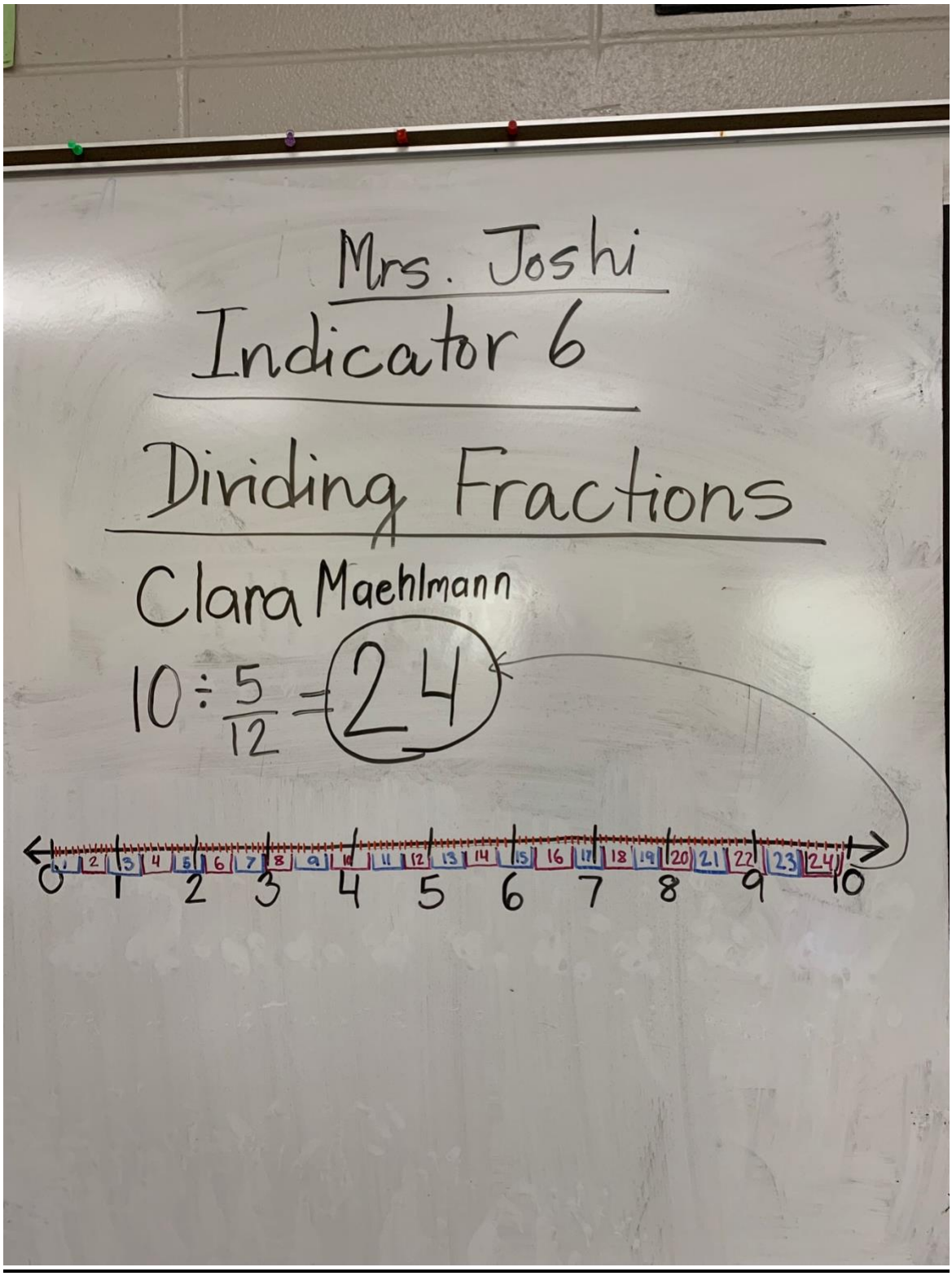

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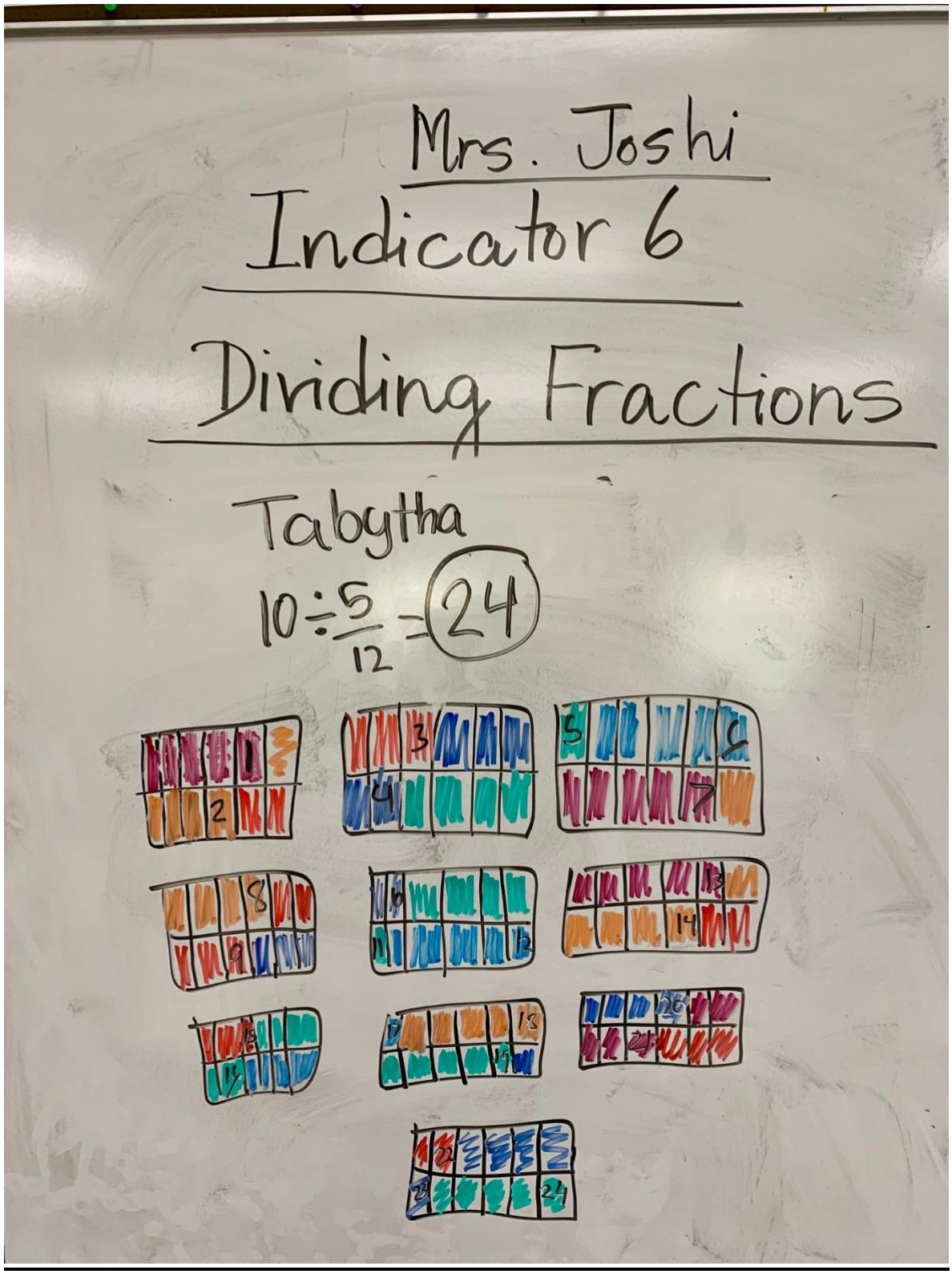

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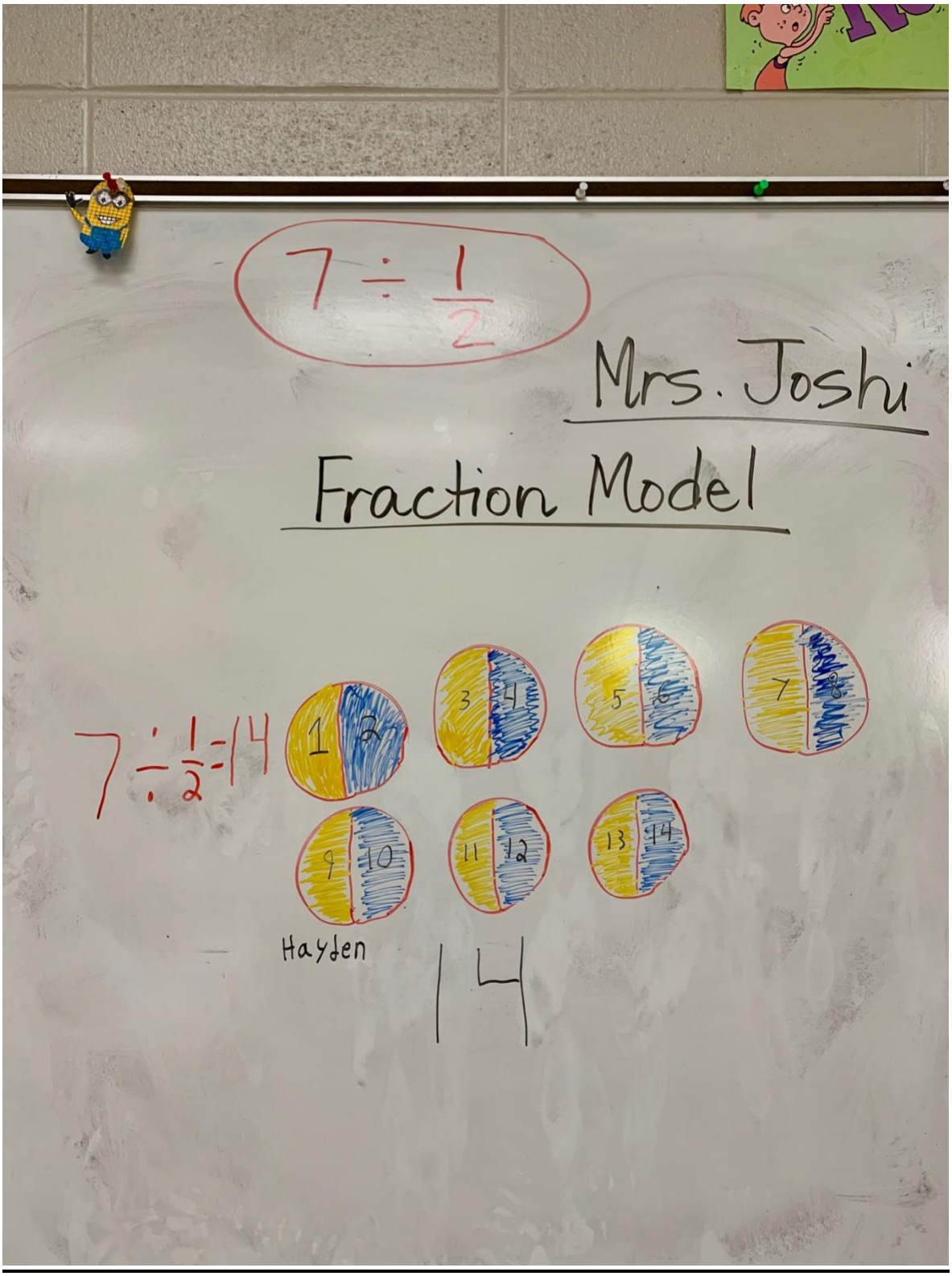

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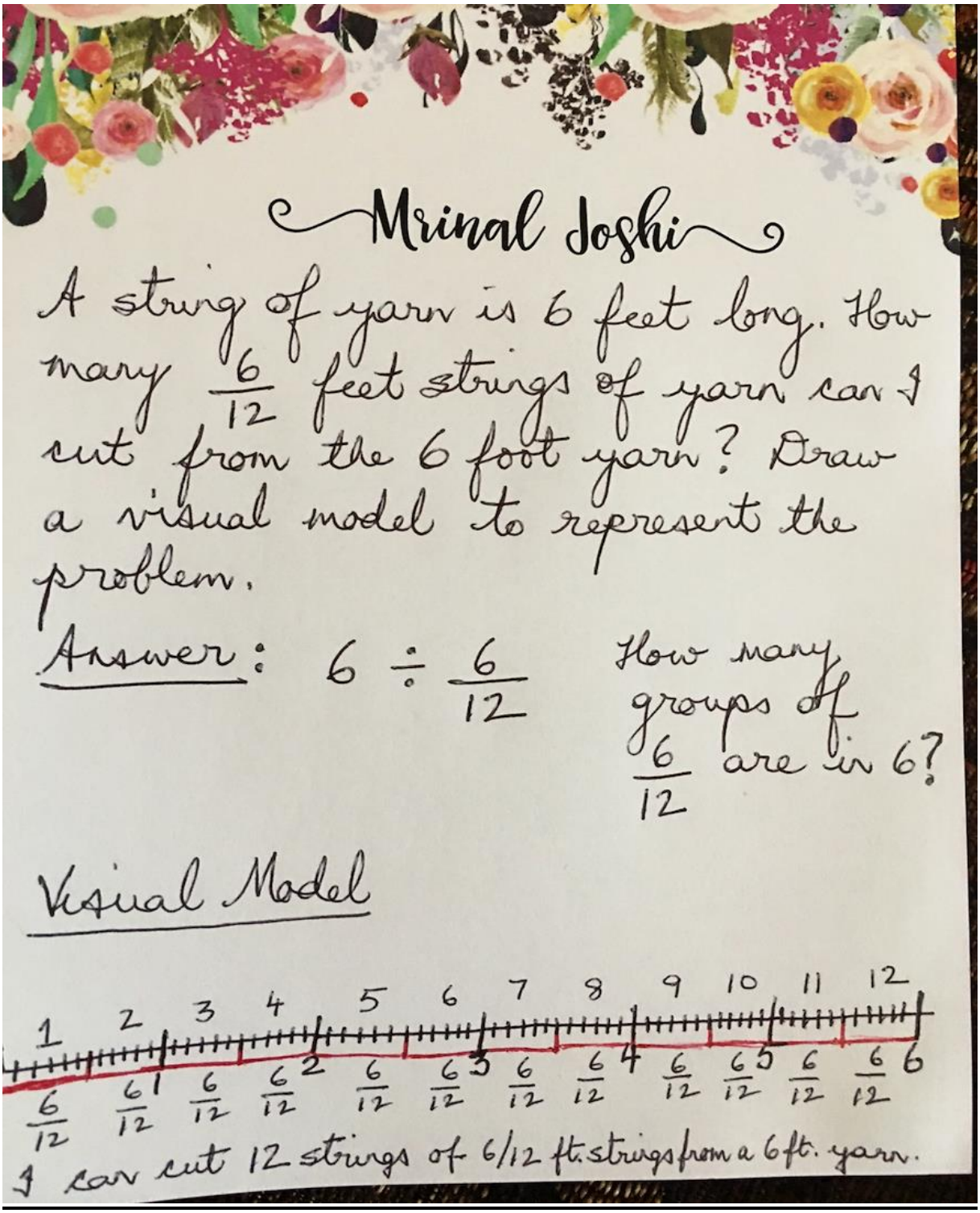

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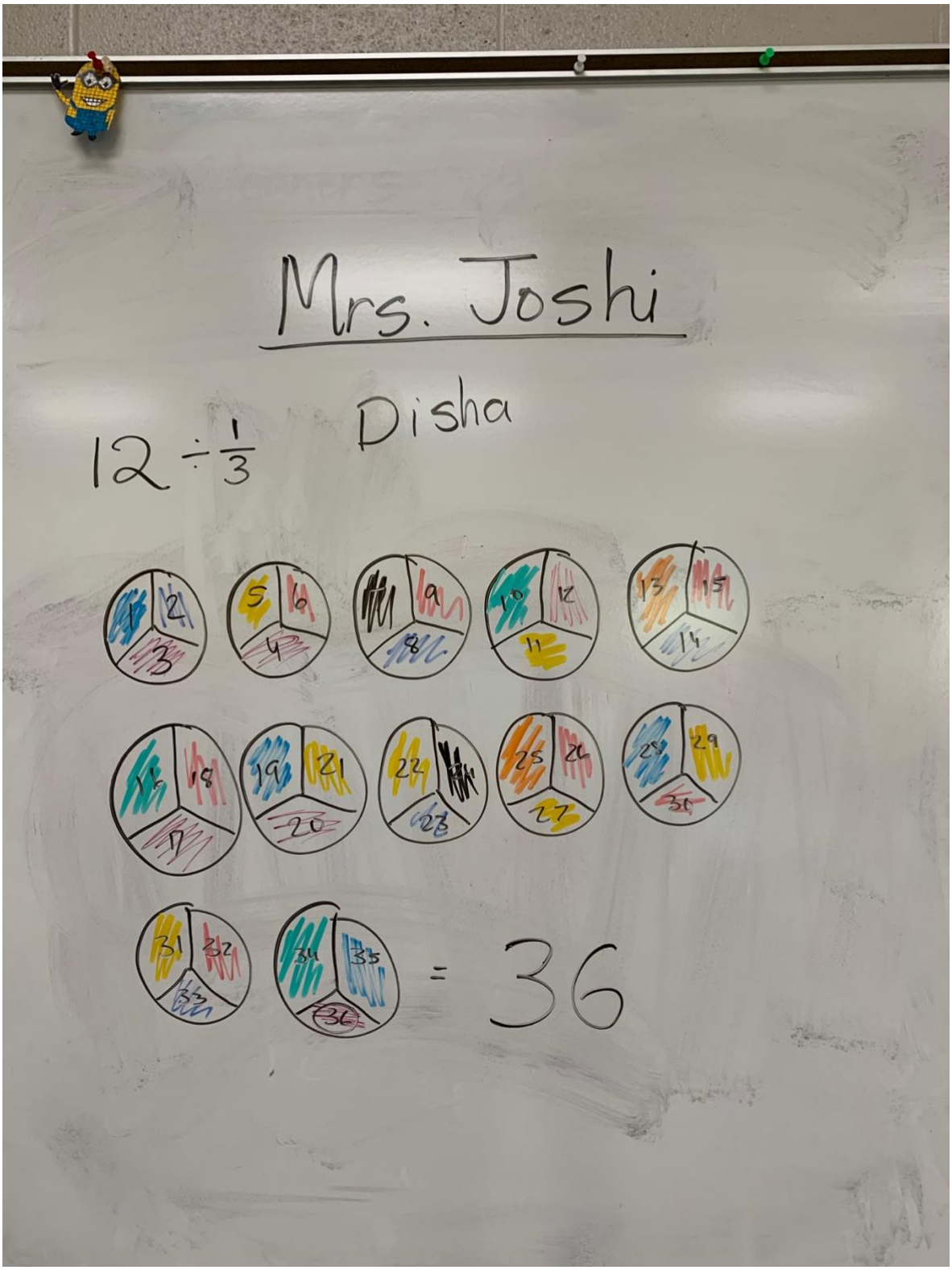

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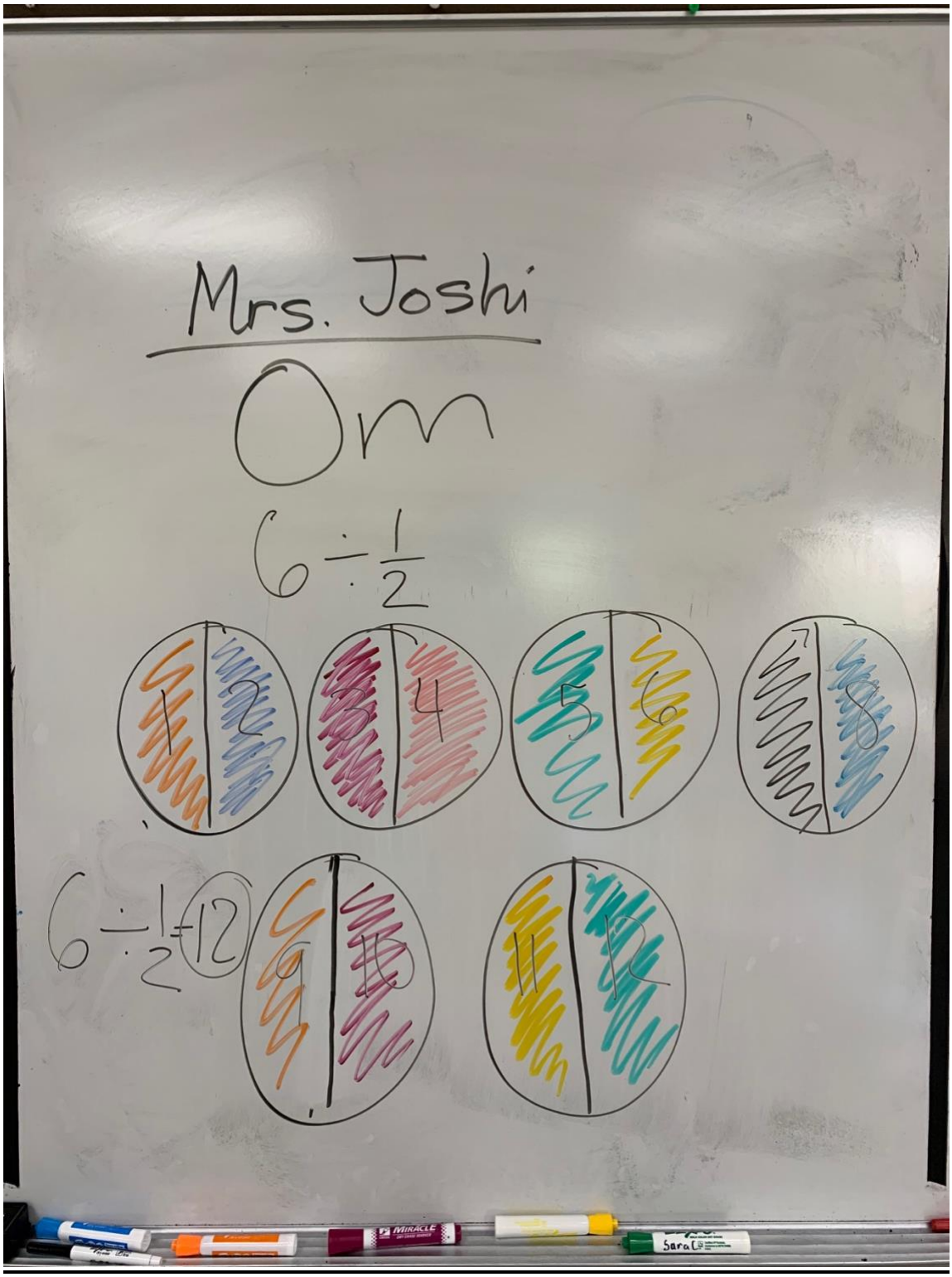

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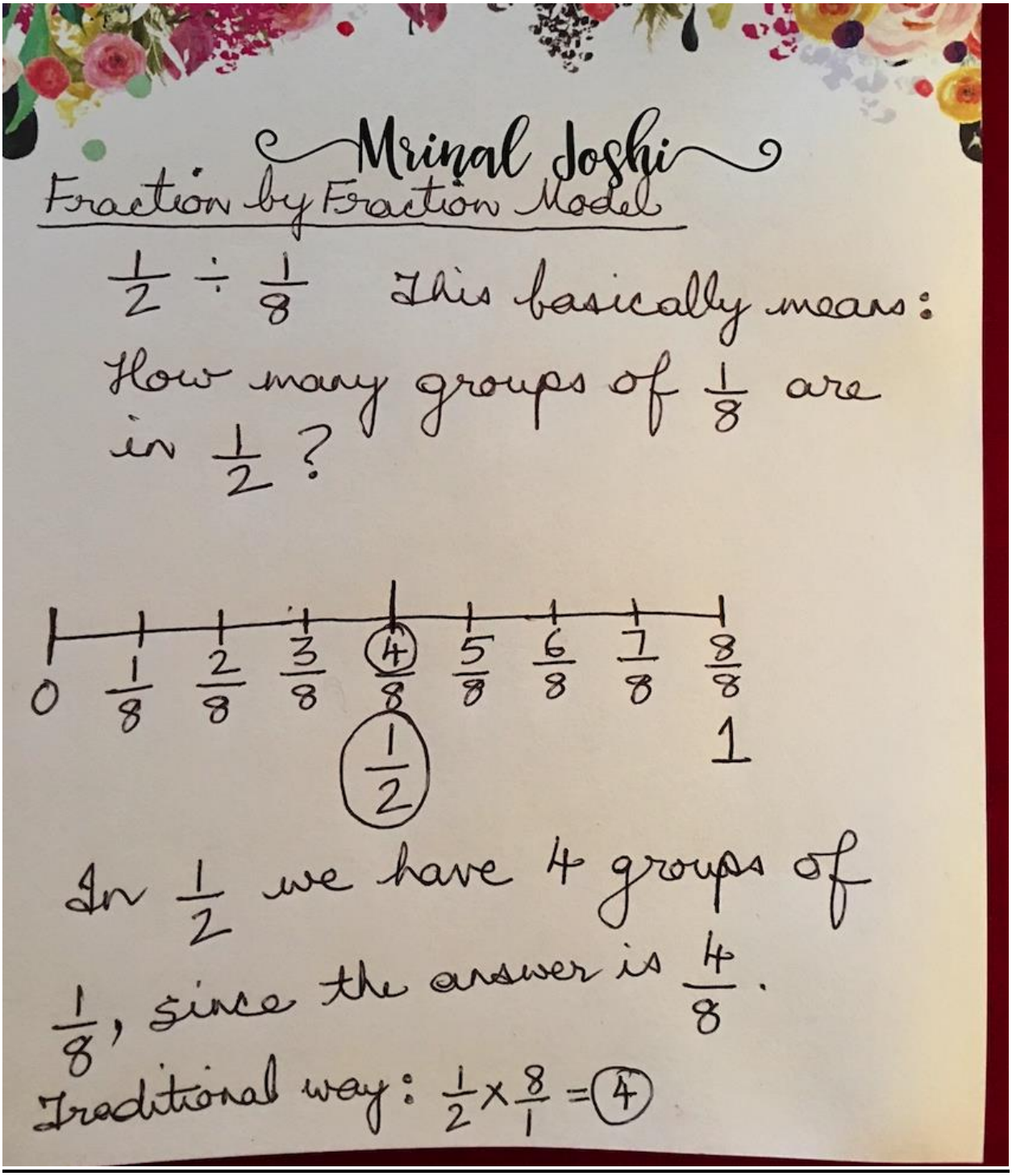

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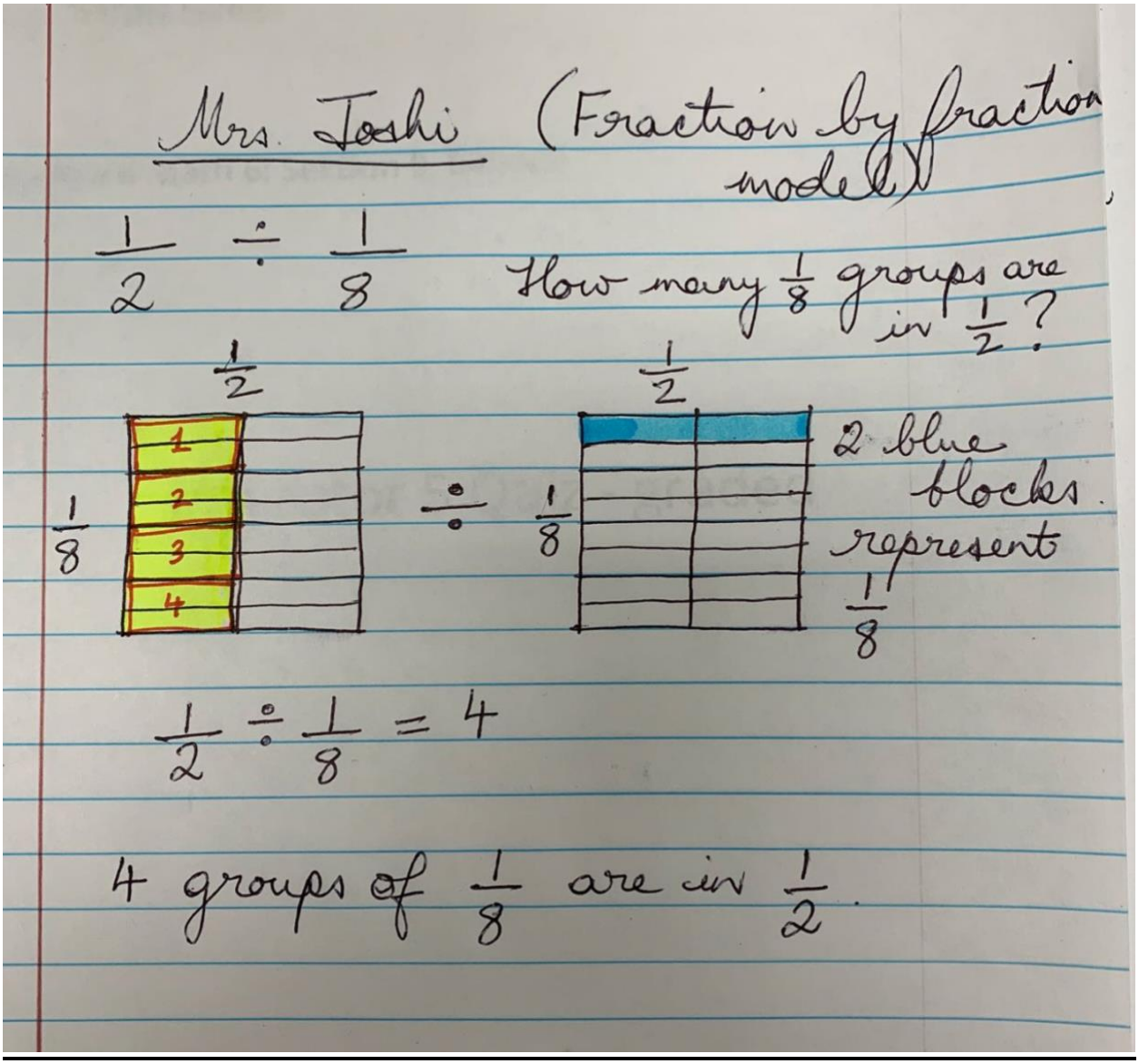

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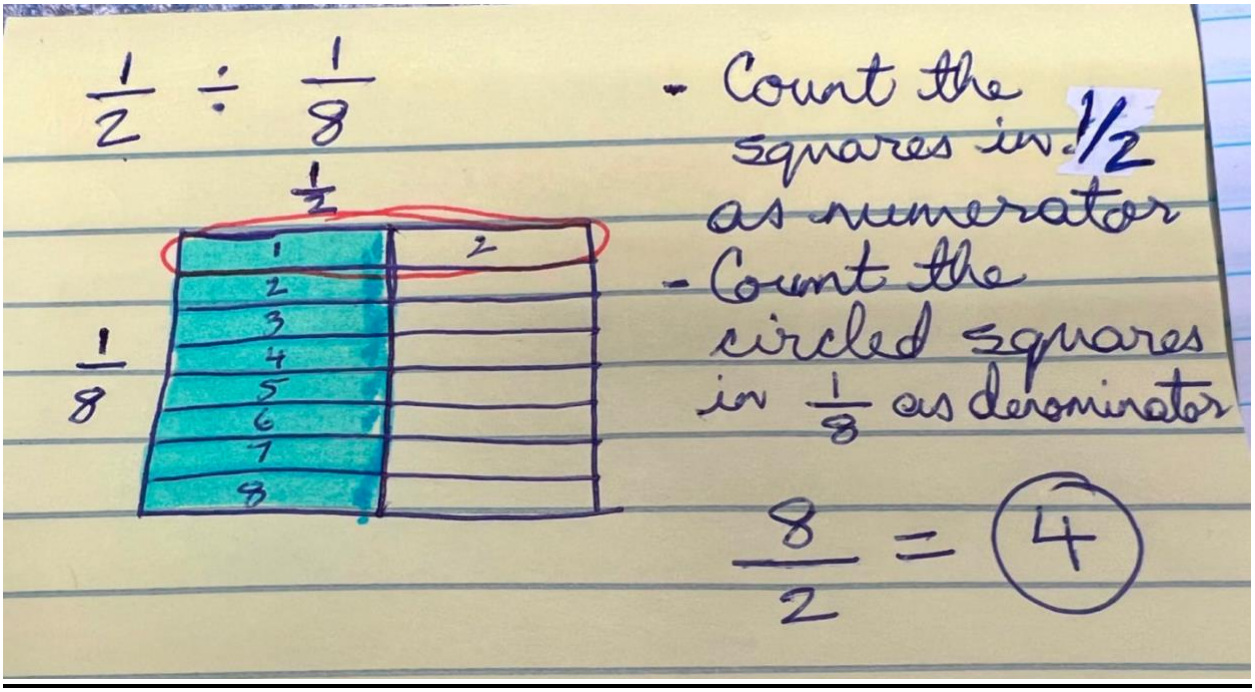

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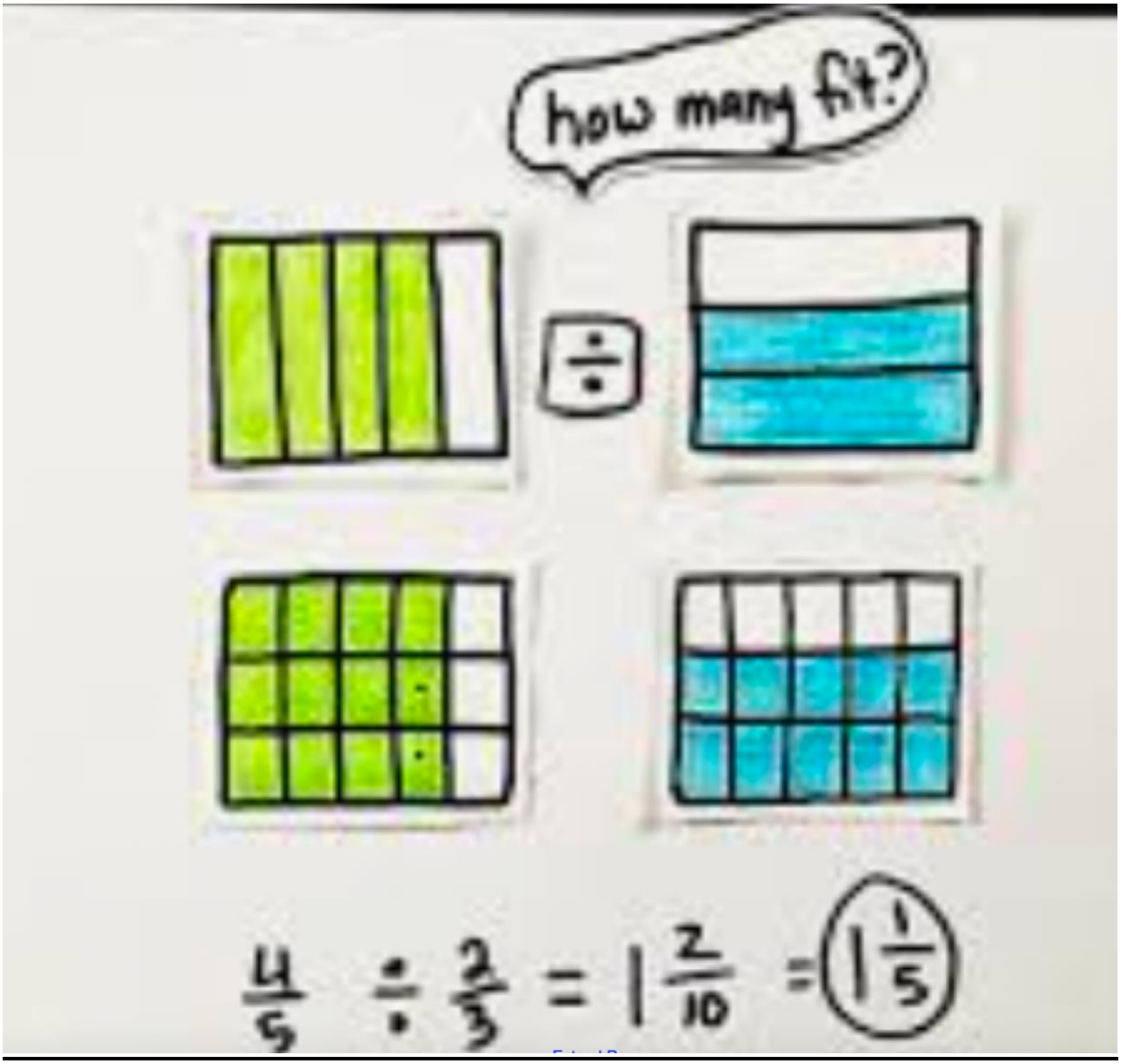

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EXAMPLE 4 Evaluating an Algebraic Expression

Evaluate $a \div b$ when $a = \frac{4}{5}$ and $b = 2$.

$a \div b = \frac{4}{5} \div 2$ Substitute $\frac{4}{5}$ for a and 2 for b.

$= \frac{4}{5} \times \frac{1}{2}$ Multiply by the reciprocal of 2, which is $\frac{1}{2}$.

$= \frac{\overset{2}{\cancel{4}} \times 1}{5 \times \underset{1}{\cancel{2}}}$ Multiply fractions. Divide out the common factor 2.

$= \frac{2}{5}$ Simplify.

EXAMPLE 5 Using Order of Operations

Evaluate $\frac{3}{8} + \frac{5}{6} \div 5$.

$\frac{3}{8} + \frac{5}{6} \div 5 = \frac{3}{8} + \frac{5}{6} \times \frac{1}{5}$ Multiply by the reciprocal of 5, which is $\frac{1}{5}$.

$= \frac{3}{8} + \frac{\overset{1}{\cancel{5}} \times 1}{6 \times \underset{1}{\cancel{5}}}$ Multiply $\frac{5}{6}$ and $\frac{1}{5}$. Divide out the common factor 5.

$= \frac{3}{8} + \frac{1}{6}$ Simplify.

$= \frac{9}{24} + \frac{4}{24}$ Rewrite fractions using the LCD 24.

$= \frac{13}{24}$ Add.

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2.6 Lesson

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Key Idea

Dividing Mixed Numbers

Write each mixed number as an improper fraction. Then divide as you would with proper fractions.

EXAMPLE 1 Dividing a Mixed Number by a Fraction

Find $4\frac{1}{2} \div \frac{3}{8}$. **Estimate $5 \div \frac{1}{2} = 10$**

$4\frac{1}{2} \div \frac{3}{8} = \frac{9}{2} \div \frac{3}{8}$ Write $4\frac{1}{2}$ as the improper fraction $\frac{9}{2}$.

$= \frac{9}{2} \times \frac{8}{3}$ Multiply by the reciprocal of $\frac{3}{8}$, which is $\frac{8}{3}$.

$= \frac{\overset{3}{\cancel{9}} \times \overset{4}{\cancel{8}}}{\underset{1}{\cancel{2}} \times \underset{1}{\cancel{3}}}$ Multiply fractions. Divide out common factors.

$= 12$ Simplify.

∴ So, the quotient is 12. **Reasonable? $12 \approx 10$** ✓

EXAMPLE 2 Dividing Mixed Numbers

Find $3\frac{5}{6} \div 1\frac{2}{3}$. **Estimate $4 \div 2 = 2$**

$3\frac{5}{6} \div 1\frac{2}{3} = \frac{23}{6} \div \frac{5}{3}$ Write each mixed number as an improper fraction.

$= \frac{23}{6} \times \frac{3}{5}$ Multiply by the reciprocal of $\frac{5}{3}$, which is $\frac{3}{5}$.

$= \frac{23 \times \overset{1}{\cancel{3}}}{\underset{2}{\cancel{6}} \times 5}$ Multiply fractions. Divide out common factors.

$= \frac{23}{10}$, or $2\frac{3}{10}$ Simplify.

∴ So, the quotient is $2\frac{3}{10}$. **Reasonable? $2\frac{3}{10} \approx 2$** ✓

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EXAMPLE 3 Using Order of Operations

Evaluate $5\frac{1}{4} \div 1\frac{1}{8} - \frac{2}{3}$.

Remember

Be sure to check your answers whenever possible. In Example 3, you can use estimation to check that your answer is reasonable.

$5\frac{1}{4} \div 1\frac{1}{8} - \frac{2}{3}$

$\approx 5 \div 1 - 1$

$= 5 - 1$

$= 4$ ✓

$5\frac{1}{4} \div 1\frac{1}{8} - \frac{2}{3} = \frac{21}{4} \div \frac{9}{8} - \frac{2}{3}$ Write each mixed number as an improper fraction.

$= \frac{21}{4} \times \frac{8}{9} - \frac{2}{3}$ Multiply by the reciprocal of $\frac{9}{8}$, which is $\frac{8}{9}$.

$= \frac{{}^{7}\cancel{21} \times {}^{2}\cancel{8}}{{}_{1}\cancel{4} \times {}_{3}\cancel{9}} - \frac{2}{3}$ Multiply $\frac{21}{4}$ and $\frac{8}{9}$. Divide out common factors.

$= \frac{14}{3} - \frac{2}{3}$ Simplify.

$= \frac{12}{3}$, or 4 Subtract.

EXAMPLE 4 Real-Life Application

One serving of tortilla soup is $1\frac{2}{3}$ cups. A restaurant cook makes 50 cups of soup. Is there enough to serve 35 people? Explain.

Divide 50 by $1\frac{2}{3}$ to find the number of available servings.

$50 \div 1\frac{2}{3} = \frac{50}{1} \div \frac{5}{3}$ Rewrite each number as an improper fraction.

$= \frac{50}{1} \cdot \frac{3}{5}$ Multiply by the reciprocal of $\frac{5}{3}$, which is $\frac{3}{5}$.

$= \frac{{}^{10}\cancel{50} \cdot 3}{1 \cdot {}_{1}\cancel{5}}$ Multiply fractions. Divide out common factors.

$= 30$ Simplify.

∴ No. Because 30 is less than 35, there is not enough soup to serve 35 people.