Leadership

AGA

2

Handout

Imagine Learning IMK12 for School & District Leaders

2.1 Review vs Warm-up Roleplay

Directions: Role-play each scenario with a partner. One partner takes on the role of the teacher, and the other partner acts as the student.

Scene 1

Gradual Release

Warm-up: Solve each equation.

$$\frac{x}{2} = \frac{3}{4}$$

Teacher: Ok. Let's do some math to solve this equation! Think about the cross-multiplying method that we reviewed last week! I'll help you with the first one. Can anyone tell me what I get when I multiply x and 4?

Student 1: $4x$!

Teacher: (while annotating the slide on the board) Great! Now, what about 3 times 2?

Student 2: Six!

Teacher: Of course it is! Now I have an easier equation to solve: $4x = 6$. Good work! And to solve this, I divide 4 on both sides. That gives me $x = \frac{6}{4}$ which simplifies to $x = \frac{3}{2}$.

Problem-based

Solve each equation mentally:

$$\frac{x}{2} = \frac{3}{4}$$

Teacher: Please take 30 seconds of quiet thinking time to find the value of this expression. Give me a thumbs-up when you have an answer and are ready to discuss your strategy.

Teacher: What's the value of x?

Student 1: 1.5

Student 2: $\frac{3}{2}$

Teacher: So far we have heard 1.5 and $\frac{3}{2}$. Did anyone get a different value? (after a moment) I invite you to share your strategy.

Student 1: Since we have two fractions that are equal, I noticed that since 2 is half of 4, x must be half of 3, which is 1.5.

Teacher: (annotated on the board as Student 1 spoke) Thank you for sharing that! Does anyone else want to share a strategy?

Student 2: And I did the same thing, I just wrote my answer as a fraction. $\frac{3}{2}$ and 1.5 are equivalent.

Student 3: I did it a different way but got the same answer. I wanted both fractions to have the same denominator, so I multiplied the left side of the equation by $\frac{2}{2}$. That gave me $\frac{2x}{4} = \frac{3}{4}$. Then, since the denominators were equal, I knew the numerators had to be equal, so I set $2x = 3$. When I solve that I get $\frac{3}{2}$.

Scene 2

Gradual Release

Warm-up: Solve each equation.

$$\frac{3}{x} = \frac{1}{6}$$

Teacher: Let's look at another one! This one's actually a little bit easier, so you can do this one without my help! Just use the same strategies we did together on the first problem. When you get an answer, tell your partner!

Student 1 : (to a partner) I got 18. You only had to do one step. When you cross multiply, you get $1x = 18$, which is the same thing as $x = 18$.

Teacher: I heard Student 1 say 18! That's right! Who else got 18? Great work, you've been working on this strategy all year.

Teacher: I saw some students with $1x = 18$. Remember, that one just goes away…you don't need it! Great job, everyone!

Problem-based

Solve each equation mentally:

$$\frac{x}{2} = \frac{3}{4}$$

$$\frac{3}{x} = \frac{1}{6}$$

Teacher: Let's look at another one. When you have the value and a strategy, put your thumb up. (Thumbs go up at different times during a one minute quiet thinking time.)

Teacher: Student 4?

Student 4: I got 18.

Teacher: Did anyone get a different number? (waits) Student 4, tell us about your strategy.

Student 4: I did the kind of same thing Student 1 did for the first one. I noticed that these fractions were equal. I see that the numerator on the left is three times larger than the numerator on the right. That same relationship must be true of the denominators as well, so I multiplied 6 and 3 to get 18 for x.

Student 5: Me too!

Teacher: That makes sense. Who thought about it in a different way?

Student 6: I tried to get a common denominator, but the x made it tricky so I got stuck.

Teacher: Can you tell us how you started?

Student 6: I thought maybe it would be $6x$, because that's what I get when I multiply x and 6?

Student 7: That's right! Then, I had to multiply the fraction on the left by $\frac{6}{6}$ and the fraction on the right by $\frac{x}{x}$. When I did that, I ignored the denominators and noticed that the equation simplified to $18 = x$!

Teacher: (annotates the work on the board) Ahh. Interesting. Thank you for sharing that!

Scene 3

Gradual Release

Warm-up: Solve each equation.

$$\frac{1}{4} = \frac{1}{x^2}$$

Teacher: Ok you are ready to do this on your own! Don't let that exponent scare you! Remember your friendly cross-multiplication.

Teacher: (after 2 minutes) Okay, who can show us how to do this one?

Student 1: I can! (student walks to the board and talks as he writes) One times x-squared equals 1 times 4. (On the board is his equation: $1x^2 = 1(4).$) "This simplifies to x-squared = 4, and the square root of 4 is 2. So I got 2!

Teacher: Close! Who can help Student 1?

Student 3: I think I remember that the square root always has 2 answers, a positive and a negative. So I think it should be 2 and -2.

Teacher: That's right. Don't worry, Student 1, I make mistakes like that all the time. Thank you for sharing your process.

Teacher: There is one more problem , but we are out of time. So we will save that one for homework!

Warm-up: Solve each equation.

$$\frac{2}{x} = \frac{x}{8}$$

Problem-based

Solve each equation mentally:

$$\frac{x}{2} = \frac{3}{4}$$

$$\frac{3}{x} = \frac{1}{6}$$

$$\frac{1}{4} = \frac{1}{x^2}$$

Teacher: We are nearly out of time so this will probably be the last one! Put your thumb up when you have an answer and a strategy. (Thumbs go up at different times during a one minute quiet thinking time.)

Teacher: Ok. What's the value?

Many Students: 2

Student 3: I got 2 answers. I also got -2.

Teacher: (writes 2 and -2 on the board). Ok. Let's talk strategies! Student 3, tell us about your thinking!

Student 3: I used a different approach than what I did last time. These two fractions have the same numerator. So, if the fractions are equal, the denominators must be equivalent. So I solved $4 = x^2$ by taking the square root of both sides. I know that when I take the square root of 4, I get both 2 and -2, because $2^2 = 4$ and $(-2)^2 = 4$.

Teacher: Ahh. I see (annotating the strategy on the board). Did anyone else do that? (a few students nodded yes)

Student 4: I didn't. (Teacher annotates as Student 4 explains.) I read it as *one over four equals one over something*. The only thing that would make that true is four, and two squared is four. It seemed really easy but now I realize I forgot negative two.

Teacher: I appreciate how you were willing to share *and* listen and think about other people's strategies. This work will help us later with more complex rational equations.

Solve each equation mentally:

$\frac{x}{2} = \frac{3}{4}$

$\frac{3}{x} = \frac{1}{6}$

$\frac{1}{4} = \frac{1}{x^2}$

$\frac{2}{x} = \frac{x}{8}$

Discuss: How did it feel as the teacher? How did it feel as the student(s)?

2.2 Warm-up Teaching Notes

Directions: Independently read through the warm-up cards and teaching notes, noting anything that would be useful for teachers beginning implementation.

Learning Goal: Let's write and solve some more rational equations.

Pacing: 5 minutes for warm-up activity and synthesis

About the warm-up

- Warm-ups help students get ready for the day's lesson, or give students an opportunity to strengthen their number sense or procedural fluency.

Activity narrative

- In this warm-up, students have an opportunity to notice and make use of structure (MP7), because the skills they use to solve equations involving fractions also work to solve equations with more complex rational expressions.

Standards:

Building towards: HSA-REI.A

Solve each equation mentally:

$$\frac{x}{2} = \frac{3}{4}$$

Teaching notes

Instructional routine: Math Talk

Launch

- Display one problem.
- Give students quiet think time for each problem and ask them to give a signal when they have an answer and a strategy.
- Keep all problems displayed throughout the talk.
- Follow each problem with a whole-class discussion.

Student Response

- $x = \frac{3}{2}$

Activity Synthesis

- Ask students to share their strategies for each problem.
- Record and display their responses for all to see.
- To involved more students in the conversation, consider asking:

	○ Who can restate _____'s reasoning in a different way? ○ Did anyone have the same strategy but would explain it differently? ○ Did anyone solve the problem in a different way? ○ Does anyone want to add on to _____'s strategy? ○ Do you agree or disagree? Why? **Support for English Language Learners** ● Speaking: MLR8 Discussion Supports. Display sentence frames to support students when they explain their strategy. For example, "First, I _____ because ..." or "I noticed _____ so I ...". Some students may benefit from the opportunity to rehearse what they will say with a partner before they share with the whole class. *Design Principle(s): Optimize output (for explanation)* **Support for students with disabilities** ● *Representation: Internalize Comprehension.* To support working memory, provide students with sticky notes or mini whiteboards. ● *Supports accessibility for: Memory; Organization*
Solve each equation mentally: $\frac{x}{2} = \frac{3}{4}$ $\frac{3}{x} = \frac{1}{6}$	**Student response** ● $x = \frac{3}{2}$ ● $x = 18$

Solve each equation mentally:

$\frac{x}{2} = \frac{3}{4}$

$\frac{3}{x} = \frac{1}{6}$

$\frac{1}{4} = \frac{1}{x^2}$

Student response

- $x = \frac{3}{2}$
- $x = 18$
- $x = 2, \ -2$

Solve each equation mentally:

$\frac{x}{2} = \frac{3}{4}$

$\frac{3}{x} = \frac{1}{6}$

$\frac{1}{4} = \frac{1}{x^2}$

$\frac{2}{x} = \frac{x}{8}$

Student response

- $x = \frac{3}{2}$
- $x = 18$
- $x = 2, -2$
- $x = 4, -4$

Activity Synthesis

- Ask students to share their strategies for each problem.
- Record and display their responses for all to see.
- To involve more students in the conversation, consider asking:
  - "Who can restate ––––––––'s reasoning in a different way?"
  - "Did anyone have the same strategy but would explain it differently?"
  - "Did anyone solve the problem in a different way?"
  - "Does anyone want to add on to ––––––––'s strategy?"
  - "Do you agree or disagree? Why?"

2.3 Warm-up and Teaching Notes Discussion

Directions: Review the warm-up and teaching notes. With your team, discuss:

How do the teaching notes connect to the instructional rhythm and to the teachers in the roleplay?
What are student responsibilities during the warm-up?
How do the resources support shifts in instructional practice?