

# Step by Step Guide: Finding Reciprocals of Real Numbers Using Division

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## Grade 10 Mathematics | 40-Minute Lesson

### Before Class Begins

#### Preparation Checklist:

- Arrange students into groups of 5
- Prepare paper/whiteboards for each group
- Have calculators available for verification
- Prepare exit tickets for distribution
- Set timer for phase transitions
- Write the key formula on the board (covered until Phase 2): Reciprocal of  $x = 1/x = 1 \div x$

### PHASE 1: Problem-Solving and Discovery (15 Minutes)

#### Opening (2 minutes)

[SAY]:

*"Good morning/afternoon, class! Today we're going to discover something very useful about numbers—how to find their reciprocals using division. By the end of this lesson, you'll be able to find the reciprocal of any real number."*

[SAY]:

*"Here's our key question: How do we use real numbers in day-to-day activities? Keep this in mind as we work."*

#### Anchor Activity Introduction (2 minutes)

[ASK]:

*"Before we start, can someone tell me—what do you think a reciprocal might be?"*

[WAIT for responses, acknowledge all attempts]

[SAY]:

*"Great ideas! Let's discover what reciprocals are through an activity."*

### **Group Work Instructions (1 minute)**

**[SAY - Read slowly and clearly]:**

*"In your groups of 5, I want you to:*

*Step 1: Write numbers from 2 to 15 in ascending order. Call this the First List.*

*Step 2: Write the same numbers in descending order (15 to 2). Call this the Second List.*

*Step 3: Create fractions using the first number from each list. For example:  $\frac{2}{15}$ ,  $\frac{3}{14}$ , and so on.*

*Step 4: For each fraction, try to find its reciprocal using division.*

*Step 5: Pick 3 whole numbers from 2-15 and find their reciprocals using division.*

*You have 10 minutes. Begin!"*

### **Circulation and Probing (8 minutes)**

**[DO]:** Walk around the room, observing each group's progress.

**[ASK probing questions as you circulate]:**

- "How did you find the reciprocal of that fraction?"
- "What happens when you multiply a number by its reciprocal?"
- "Can you check if your answer is correct?"
- "What do you notice about the reciprocal of  $\frac{2}{15}$  compared to  $\frac{15}{2}$ ?"
- "What would happen if you tried to find the reciprocal of zero?"

**[OBSERVE]:** Note which groups understand that reciprocal means "flip" the fraction. Watch for confusion about dividing by fractions.

**[TIME CHECK]:** At 8 minutes, announce: "Two more minutes to finalize your work!"

### **Group Sharing (2 minutes)**

**[SAY]:**

*"Time's up! Let's hear from some groups. [Group name], how did you find the reciprocal of  $\frac{2}{15}$ ?"*

**[LISTEN, then ask]:**

*"[Group name], what did you get when you found the reciprocal of 5 using division?"*

**[TRANSITION]:**

*"Excellent work! Now let's formalize what you've discovered."*

## PHASE 2: Structured Instruction (10 Minutes)

### Defining Reciprocals (4 minutes)

**[SAY]:**

*"Let me give you the formal definition of a reciprocal."*

**[WRITE on board]:**

**Reciprocal:** The reciprocal of a number  $x$  is  $1/x$ . When you multiply a number by its reciprocal, the result is always 1.

**[WRITE]:**  $x \times (1/x) = 1$

**[SAY]:**

*"To find the reciprocal of any number using division, we simply divide 1 by that number:  $1 \div x$ "*

**[ASK]:**

*"What is the reciprocal of 2?"*

**[Expected answer]:** "1/2 or 0.5"

**[SAY]:**

*"Exactly!  $1 \div 2 = 0.5$ . And let's verify:  $2 \times 0.5 = 1$ . It works!"*

### Working Through Examples (4 minutes)

**[SAY while writing]:**

*"Let me show you some examples:*

*Example 1: Reciprocal of 5*

$$1 \div 5 = 0.2$$

$$\text{Check: } 5 \times 0.2 = 1 \quad \checkmark$$

*Example 2: Reciprocal of  $-3$*

$$1 \div (-3) = -0.333... \text{ or } -0.\overline{3}$$

$$\text{Check: } -3 \times (-0.333...) = 1 \quad \checkmark$$

*Example 3: Reciprocal of 0.25*

$$1 \div 0.25 = 4$$

$$\text{Check: } 0.25 \times 4 = 1 \quad \checkmark$$

### Addressing Zero (2 minutes)

**[ASK]:**

*"What about zero? What is the reciprocal of zero?"*

**[WAIT for responses]**

**[SAY]:**

*"Zero has NO reciprocal! Why? Because  $1 \div 0$  is undefined. You cannot divide by zero. This is a very important exception to remember."*

**[TRANSITION]:**

*"Now let's practice finding reciprocals!"*

### PHASE 3: Practice and Application (15 Minutes)

#### Direct Calculation (5 minutes)

**[SAY]:**

*"Let's find some reciprocals together. Tell me the reciprocal and how you found it."*

**[ASK]:** "What is the reciprocal of 256?"

**[Expected answer]:** " $1 \div 256 = 0.00390625$ "

**[ASK]:** "What is the reciprocal of 4.2?"

**[Expected answer]:** " $1 \div 4.2 = 0.2381$  (to 4 decimal places)"

**[ASK]:** "What is the reciprocal of  $\frac{3}{5}$ ?"

**[Expected answer]:** " $1 \div (\frac{3}{5}) = \frac{5}{3}$  or about 1.667"

**[ASK]:** "What is the reciprocal of  $-8$ ?"

**[Expected answer]:** " $1 \div (-8) = -0.125$ "

#### Word Problems (7 minutes)

**[SAY]:**

*"Now let's apply reciprocals to real-world problems. Work with your partner on this one."*

**[READ the problem]:**

*"A cyclist covers a distance of 12 km in 1 hour. Using division to find reciprocals, determine the time taken to cover 1 km at the same speed."*

**[GIVE 3 minutes, then solve together]:**

*"Speed = 12 km per hour. To find time for 1 km, we need the reciprocal of 12.*

*$1 \div 12 = 0.0833...$  hours, or about 5 minutes.*

*So it takes  $1/12$  of an hour to cover 1 km."*

### **Quick Practice (3 minutes)**

**[SAY]:**

*"Quick check: If a machine produces  $5/8$  of a widget per minute, how many minutes to produce 1 widget?"*

**[WAIT, then reveal]:**

*"We need the reciprocal of  $5/8$ , which is  $8/5 = 1.6$  minutes per widget."*

**[TRANSITION]:**

*"Now I want to see what each of you has learned."*

## **PHASE 4: Assessment / Exit Ticket**

### **Exit Ticket Distribution (1 minute)**

**[SAY]:**

*"Please clear your desks. I'm handing out an exit ticket. Work independently and silently."*

**[DISTRIBUTE exit tickets]**

### **Independent Work (5 minutes)**

**[DISPLAY questions]:**

*"Question 1: If the reciprocal of  $x$  is  $1/6$ , find the value of  $x$ .*

*Question 2: Movin covers  $1/x$  km from home to school. If the distance is 0.2 km, find  $x$ ."*

**[SAY]:**

*"You have 5 minutes. Begin."*

## Collection and Closure (2 minutes)

**[SAY]:**

*"Time's up. Please pass your exit tickets forward."*

**[COLLECT all tickets]**

**[SAY]:**

*"Today you learned to find reciprocals of real numbers using division. Remember: the reciprocal of  $x$  is  $1 \div x$ , and when you multiply a number by its reciprocal, you always get 1."*

**[ASK]:**

*"Returning to our key question: How do we use real numbers in day-to-day activities? Can anyone give an example where reciprocals are useful?"*

**[ACCEPT 2-3 responses - examples: calculating rates, speed/time problems, cooking conversions]**

**[SAY]:**

*"Great work today! For homework, find the reciprocals of 5 different numbers and verify each by multiplication."*

## Differentiation Notes

**For Struggling Learners:**

- Provide a step-by-step guide for finding reciprocals
- Use calculators to verify division
- Start with simple whole numbers before decimals and fractions
- Work directly with this group during anchor activity

**For Advanced Learners:**

**[GIVE these extension problems]:**

- A factory machine produces  $\frac{5}{8}$  of a widget every minute. How long to produce 40 widgets?
- A typist types  $\frac{4}{7}$  of a page in 8 minutes. How long to type 25 pages?
- Create your own real-world problem involving reciprocals.

## Answer Key

### Exit Ticket Answers:

**Question 1:** If the reciprocal of  $x$  is  $1/6$ , then  $x = 6$ .

**Question 2:** If  $1/x = 0.2$ , then  $x = 1 \div 0.2 = 5$ .

### Extension Problem Solutions:

**Factory machine:** Rate =  $5/8$  widget/min. Time for 1 widget =  $8/5$  min. Time for 40 widgets =  $40 \times 8/5 = 64$  minutes.

**Typist:** Rate =  $(4/7)/8 = 4/56 = 1/14$  page/min. Time for 1 page = 14 min. Time for 25 pages =  $25 \times 14 = 350$  minutes.

## Post-Lesson Reflection Prompts

- 1. What went well?** Which activities generated the most engagement?
- 2. What would I change?** Were the time allocations appropriate?
- 3. Student Understanding:** What did the exit tickets reveal?
- 4. Next Steps:** Which students need additional support?