Grade 6 Fraction Tasks and Extensions Beyond

Empowering Learners: Students apply their fraction knowledge across all content domains in middle school and in all conceptual categories in high school.

For each task, you will find:

Task Description: How does the task represent grade-level understanding?
Standard(s) alignment: To which standard(s) does the task align?
Source: From what source did the task come?
Students show what they know: Examples of student work or thinking that can be helpful within a larger formative assessment process and/or help illuminate different ways that students view a task.
Fostering agency, identity, and belonging: Questions designed to help position students as intellectual leaders, to help students know that the knowledge they are bringing to any particular task counts, and to reflect ideas, grounded in learning rather than correctness, of a mathematical community. Note: some of these questions are generic and can be used to help educators understand what knowledge a student is bringing to the particular task.

Standards addressed: (in order of appearance in the tasks below)

- 6.NS.C
- 6.NS.C.7.a
- 6.RP.A.2
- 6.NS.A.1
- 6.EE.B.5
- Extensions beyond grade 6 standards

Additionally, you will find **Key Research** to support the learning and application of fractions beyond the elementary grades.

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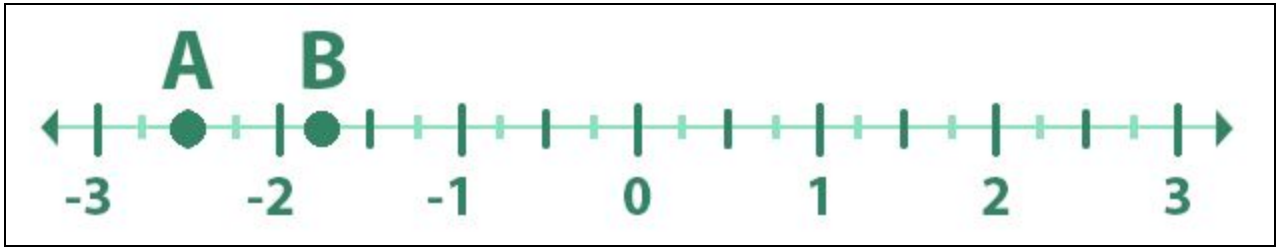
Entry Task: Numbers less than zero

This task is designed to have students leverage their understanding of fractions as numbers developed across grades 3-5 and expand their known number system to now include rational numbers.

Teacher: "This year we are going to introduce numbers that are less than zero. Why do you think we need to have numbers less than zero?"

Study the number line shown. Based on what you observe, what numbers do you think are at points A and B? How would you write them?



Standard(s) Alignment: 6.NS.C
Source: Created by Student Achievement Partners

Students Show What They Know	**Fostering Identity, Agency, and Belonging**
Video to Come! .	• What are some things you can say for sure about the points A and B on the number line? • Do you think there is a "right" answer to this problem? Why or why not? • Can you think of anything you might be able to do to label the points A and B more accurately?

Resources

- Explore the full grade 6 Number System domain on the Coherence Map.
- Progressions, the complete video collection used throughout the grade-level materials highlighting important features of teaching and understanding fractions across grades 3 through 5.

Task: Fractions on the number line

This task allows students to use their prior grades 3-5 learning on partitioning a whole on the number line to locate fractions greater than one to now include rational numbers less than one.

a.

Find and label the numbers $\frac{4}{3}$, $\frac{5}{4}$, $-\frac{2}{3}$, and $-\frac{3}{4}$ on the number line.

b.

For each of the following, state which inequality is true. Use the number line diagram to help explain your answers.

i.

Is $\frac{4}{3} > \frac{5}{4}$, or is $\frac{4}{3} < \frac{5}{4}$?

ii.

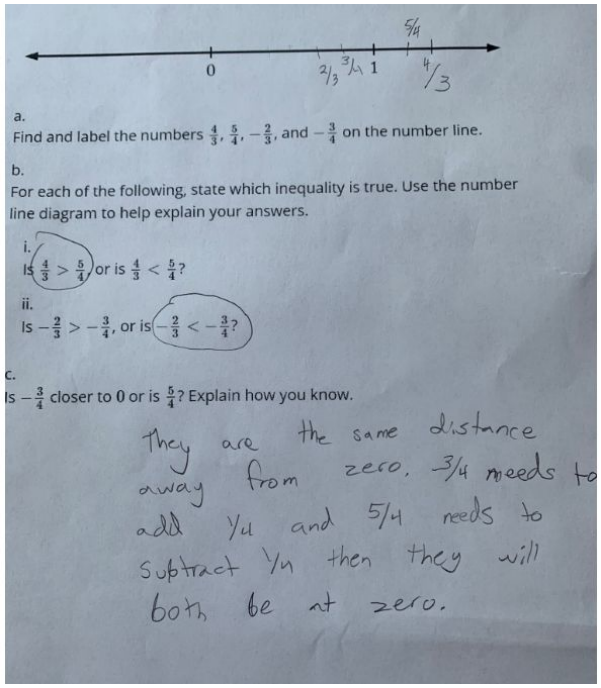
Is $-\frac{2}{3} > -\frac{3}{4}$, or is $-\frac{2}{3} < -\frac{3}{4}$?

c.

Is $-\frac{3}{4}$ closer to 0 or is $\frac{5}{4}$? Explain how you know.

Standard(s) Alignment: 6.NS.C.7.a
Source: Illustrative Mathematics

Students Show What They Know



While the student recognizes that thirds are bigger than fourths they are not familiarized with the negative symbol (-) and do correctly mark -⅔ and -¾ on the number line, impacting their responses to problems ii and c. This task provides insight into what students understand about positioning fractions in relation to positive whole numbers and also to integers.

Fostering Identity, Agency, and Belonging

- What can you tell me about the four fractions?
- Explain your thinking to a partner, a small group, or the class.
- How does this task relate to tasks that you completed in previous grades?
- (For students who have incorrectly labeled the fractions less than 1): What does the symbol (-) mean in front of the fraction ⅔?

Resources

- Preparing for Algebra by Building Fraction Sense, article that describes a series of activities with a paper bar.

Task: Unusual units

This task has several fairly straightforward albeit unusual unit rate problems (pumpkins per hippo and goats per pizza), with answers that are fractions. Educators can reinforce some of the key takeaways from earlier grades by asking students to consider the magnitude of their answers (e.g., what does 5/3 pumpkins per hippo actually mean?)

a.
Hippos sometimes get to eat pumpkins as a special treat.

If 3 hippos eat 5 pumpkins, how many pumpkins per hippo is that?

b.
Lindy made 24 jelly-bread sandwiches with a 16-ounce jar of jelly. How many ounces of jelly per sandwich is that?

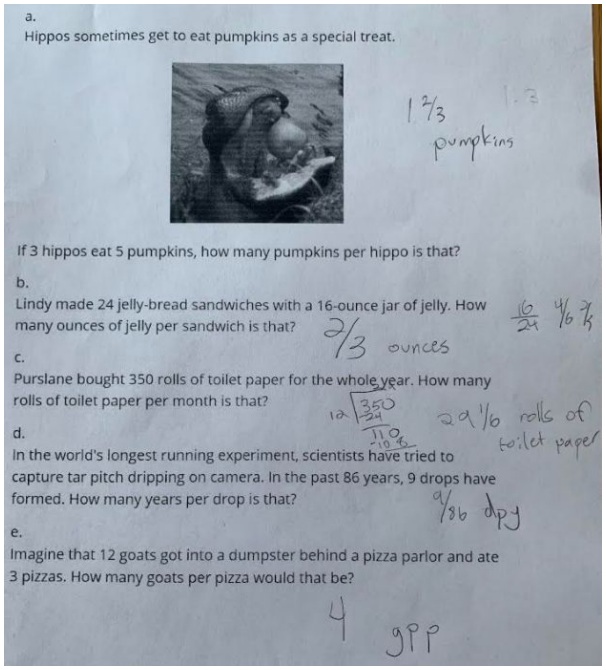
c.
Purslane bought 350 rolls of toilet paper for the whole year. How many rolls of toilet paper per month is that?

d.
In the world's longest running experiment, scientists have tried to capture tar pitch dripping on camera. In the past 86 years, 9 drops have formed. How many years per drop is that?

e.
Imagine that 12 goats got into a dumpster behind a pizza parlor and ate 3 pizzas. How many goats per pizza would that be?

Standard(s) Alignment: 6.RP.A.2
Source: Illustrative Mathematics

Students Show What They Know



In this task, students are to find unit rates in context that are less familiar. The student work shows a clear understanding of units even with answering drops per year instead of years per drop for *d*.

Fostering Identity, Agency, and Belonging

- What do we know about unit rates? Are there any common ones that come to mind?
- How could you represent (select one) problem?
- Is there one answer that you are most sure of? If so, which one and why?
- Explain how you approached these different problems.

Resources

- Grades 6-7 Ratios and Proportional Relationships progressions document with further explanation of the standards and examples included.
- Grade 6.RP.A.2 example tasks and assessment items highlighted on the Coherence Map.
- Grade 6 Ratios and Rates Mini-Assessment, multiple problems to assess students ability to use ratio reasoning to solve problems.

Task: Division number sentence

This task is aligned to a standard that represents the culmination of multiple years of performing mathematical operations on fractions. It can extend students grade 5 work on fraction multiplication as a way to introduce division of a fraction by a fraction in grade 6.

Standard(s) Alignment: 6.NS.A.1
Source: Illustrative Mathematics

Task

Solve each problem using pictures and using a number sentence involving division.

a. How many fives are in 15?

b. How many halves are in 3?

c. How many sixths are in 4?

d. How many two-thirds are in 2?

e. How many three-fourths are in 2?

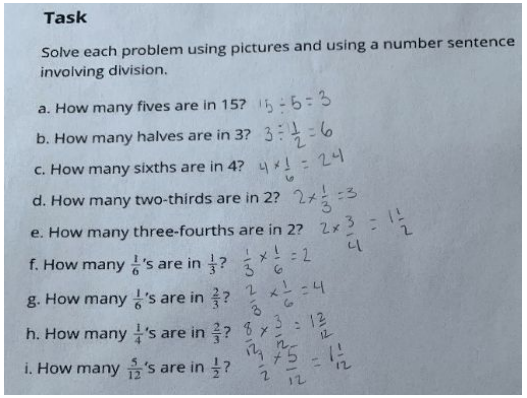
f. How many $\frac{1}{6}$'s are in $\frac{1}{3}$?

g. How many $\frac{1}{6}$'s are in $\frac{2}{3}$?

h. How many $\frac{1}{4}$'s are in $\frac{2}{3}$?

i. How many $\frac{5}{12}$'s are in $\frac{1}{2}$?

Students Show What They Know



The problems in this task progress in complexity and perhaps if the student had solved the problems using pictures they would have recognized the division of fractions beyond *a* and *b*. Showing a visual model helps connect the division algorithm to the question and helps develop an understanding of when division results in a larger quotient.

Fostering Identity, Agency, and Belonging

- How can you visually represent the problems?
- How do the visuals you've drawn relate to the number sentences?
- What's similar about these problems? What's different? How might that difference impact the quotients?
- What do you think would happen to the quotient if the dividend were all 1? What if they were less than one?

Resources

- Standing in Line, an additional task to support instruction.
- Grade 6 Number System Mini-Assessment, geared toward the procedural aspects of the domain, this mini-assessment provides problems to see progress toward expected computation skills.

Task: Make use of structure

This task allows students to reason about the meaning of equations and the solution of an equation, and gives them an opportunity to make connections with operations with fractions and decimals. The computation in the equations is meant to be doable quickly or even solved mentally.

Think about what these equations mean, and find their solutions. Write a sentence explaining how you know your solution is correct.

a. $x + 6 = 10$

b. $1000 - y = 400$

c. $100 = m + 99$

d. $0.99 = 1 - t$

e. $3a = 300$

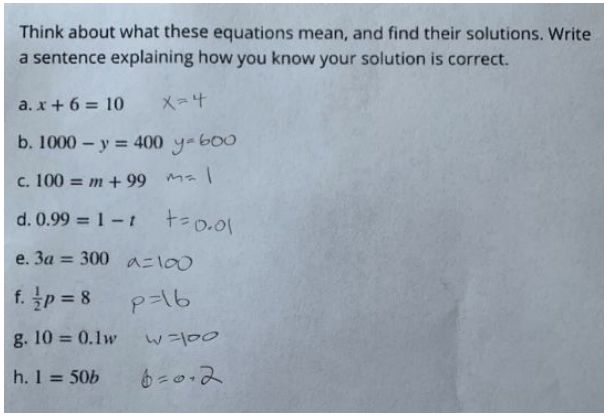
f. $\frac{1}{2}p = 8$

g. $10 = 0.1w$

h. $1 = 50b$

Standard(s) Alignment: 6.EE.B.5
Source: Illustrative Mathematics

Students Show What They Know



This task is meant to give students an opportunity to make connections with operations with fractions and decimals. The student appears to be able to do the calculations accurately in their head with the exception of *h*, where they incorrectly marked 1/5 or 0.2 instead of 1/50 or 0.02.

Fostering Identity, Agency, and Belonging

- Were these problems you solved on paper or in your head?
- Which problems seem more similar to the other problems on this page? Which problems seem more different? Why?
- Which problems do we think will give a solution less than one? Why?
- How does one of the factors impact the other factor?
- How does the product change when multiplying a fraction by a whole number? How do you know?

Resources

- Choosing Equations to Match Situations, a lesson activity to support instruction.

Extensions Beyond Grade 6	
While the formal study of fractions concludes in grade 6, student work with fractions does not come to an end. Fractions are now part of the number system that students work within, and fractions appear in nearly all future units of study throughout the rest of their school years. Here are some additional tasks that may provide insight into fraction connections in later grades. Within the links, you'll find further explanation and commentary.	
Grade 7	• 7.RP.A.1, Cooking with the Whole Cup: students work with unit rates and scale factors that are fractions in this step-by-step task. • 7.NS.A.1, Operations on the Number Line: students have an opportunity to show rational numbers on the number line. • 7.G.A.1, Floor Plan: students solve a scaling problem with fraction dimensions. • 7.SP.C.5, Prize Game, students can build understanding of probability as a chance event between 0 and 1 in this example task.
Grade 8	• 8.NS.A.1, Identifying Rational and Irrational Numbers: example task and assessment items that show and connect the procedural and conceptual components of this standard. • 8.EE.B.5, Coffee by the Pound: students solve for unit rate. • 8.F.B.4, Distance Across the Channel: students work through this real-life situation, with a high cognitive demand. • 8.G.B.7, Glasses: students work with volume and perform operations using fractions.
High School	• HS.A-SSE.B.3.c, Forms of Exponential Expressions: students have many opportunities to apply their foundational knowledge of fractions while solving systems of equations in this domain and conceptual category. • HS.M, What is Modeling?: a resource that provides insight into the real world of mathematics, which is full of fractions. Modeling problems often allow students to apply their knowledge of fractions in very relevant ways. • HS.S-ID.A.1-3, Haircut Costs: students interpret and represent data in a generally familiar context.

Key Research *What are some key findings that support the learning and application of fractions beyond the elementary grades?*
Developmental and Individual Differences in Understanding of Fractions – This research study demonstrates the imperative nature of understanding of fraction magnitude to performing with fraction arithmetic and succeeding in algebra. It defines fraction magnitude and names it as a particularly important aspect of conceptual understanding of fractions. It also pinpoints that the common challenge to understanding fractions as numbers is children applying whole-number reasoning and properties to fractions.
Improving At-risk Learners' Understanding of Fractions – This research study compares the impact of two conceptual interpretations of fractions, part-whole vs. measurement, on improving fraction understanding; its results make the case of emphasizing the measurement interpretation (often represented with number lines). It also describes an intervention with this conceptual interpretation, including the training of the teachers and the consideration of domain-general abilities (such as the role of language).
Units, a Unifying Idea in Measurement, Fractions, and Base Ten – This excerpt contextualizes the unit fraction within the prevailing concept of the unit as building blocks for a number and explains how the concept of the unit fraction allows for the arithmetic that follows.