ST Math Immersion

Grade 5 Problem Solving - Answer Key

Week 1

G5_Journal_W1_D1

How does the feedback in the puzzle help you figure out how to solve the puzzle? Give an example.

Student explanations will vary.

Look for student answers to:

- *What happens when the student clicks on the screen?*
- *What feedback does the game give you?*
- *When does JiJi "Go?"*
- *What happens when JiJi gets an answer right?*
- *What happens when JiJi gets an answer wrong?*

G5_Journal_W1_D2

What strategies did you use to determine how to solve puzzles in ST Math?

Student explanations will vary.

Look for:

- *How did student thinking change as the result of puzzle feedback?*
- *How did the visuals support student understanding?*
- *What new knowledge or mathematical understandings did the student come away with?*

G5_POD_W1_D3

Trisha was in charge of making a sign for each ¼ mile distance for a 2-mile race. She marked the distances in decimals. What numbers did Trisha write on her signs?

0.25, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2 *or*

0.25, 0.50, 0.75, 1.00, 1.25, 1.50, 1.75, 2.00

G5_Journal_W1_D3

On a number line, how can you compare fractions and decimals? How do you know if a fraction and a decimal are equivalent on a number line?

Student explanations will vary.

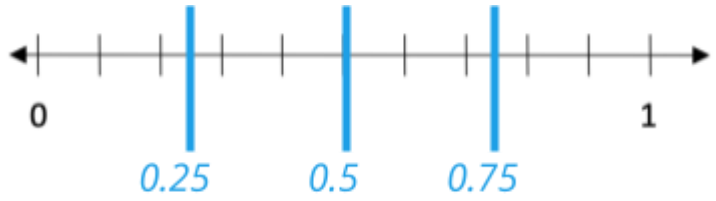
Look for:

- *Numbers on a number line will be organized from least to greatest, with smaller numbers towards the left and larger numbers toward the right.*
- *Intervals on the number line can be represented by both fractions and decimals. (ex. $\frac{1}{4}$ and 0.25)*

- *Equivalent fractions and decimals are represented by the same place on a number line.*

G5_POD_W1_D4 (Have students refer to Week 1 Day 3 POD.)

Trisha's coach gave her this number line to record her distances for the first mile. Mark and label the quarter-mile distances shown on her signs. If needed, you can draw the number line larger below.



G5_Journal_W1_D4

Explain how you would place $\frac{3}{5}$ on a number line partitioned into tenths.

Student explanations will vary.

Look for:

- $\frac{2}{10}$ *is equivalent to* $\frac{1}{5}$.
- $\frac{3}{5}$ *represents three groups of* $\frac{1}{5}$.
- $\frac{3}{5}$ *is the same as* $\frac{6}{10}$.
- $\frac{3}{5}$ *would be placed at the sixth tick mark on a number line partitioned into tenths.*

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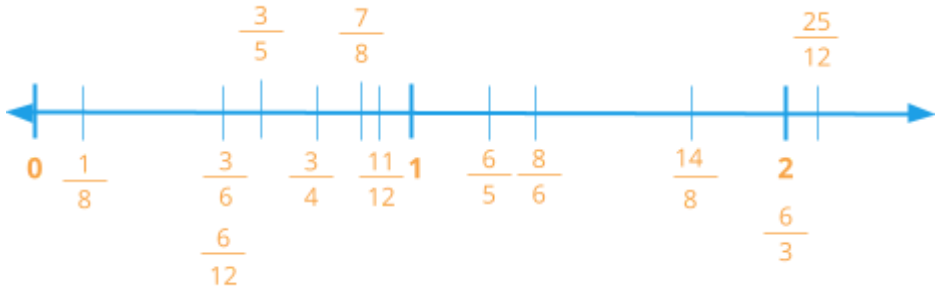
Week 2

G5_Task_W2_D1

Using Benchmark and Equivalent Fractions to Estimate Location on a Number Line

Cut out the fractions. Create a number line using all of these fractions. Be as exact as possible.

Record your number line (be as accurate as possible). Select three of the fractions you placed on the number line and explain how you and your partner determined where to place these fractions on the number line. Challenge yourself.



Student explanations will vary.

Look for:

- *Benchmarks*
  - $\frac{1}{2} = \frac{3}{6} = \frac{3}{12}$
  - *2 wholes* = $\frac{6}{3}$
- *Common Numerator Comparison*
  - $\frac{3}{4} > \frac{3}{5} > \frac{3}{6}$
- *Pieces away from one whole:*
  - $\frac{11}{12} > \frac{7}{8} > \frac{3}{4}$
  - $\frac{25}{12}$ > *2 wholes*
  - $\frac{6}{5} = 1\frac{1}{5}$, $\frac{8}{6} = 1\frac{1}{3}$, $1\frac{1}{5} < 1\frac{1}{3}$
  - *6/5 = 1 ⅕ , 8/6 = 1 ⅓ , 1 ⅕ < 1 ⅓*

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Grade 5 Problem Solving - Answer Key

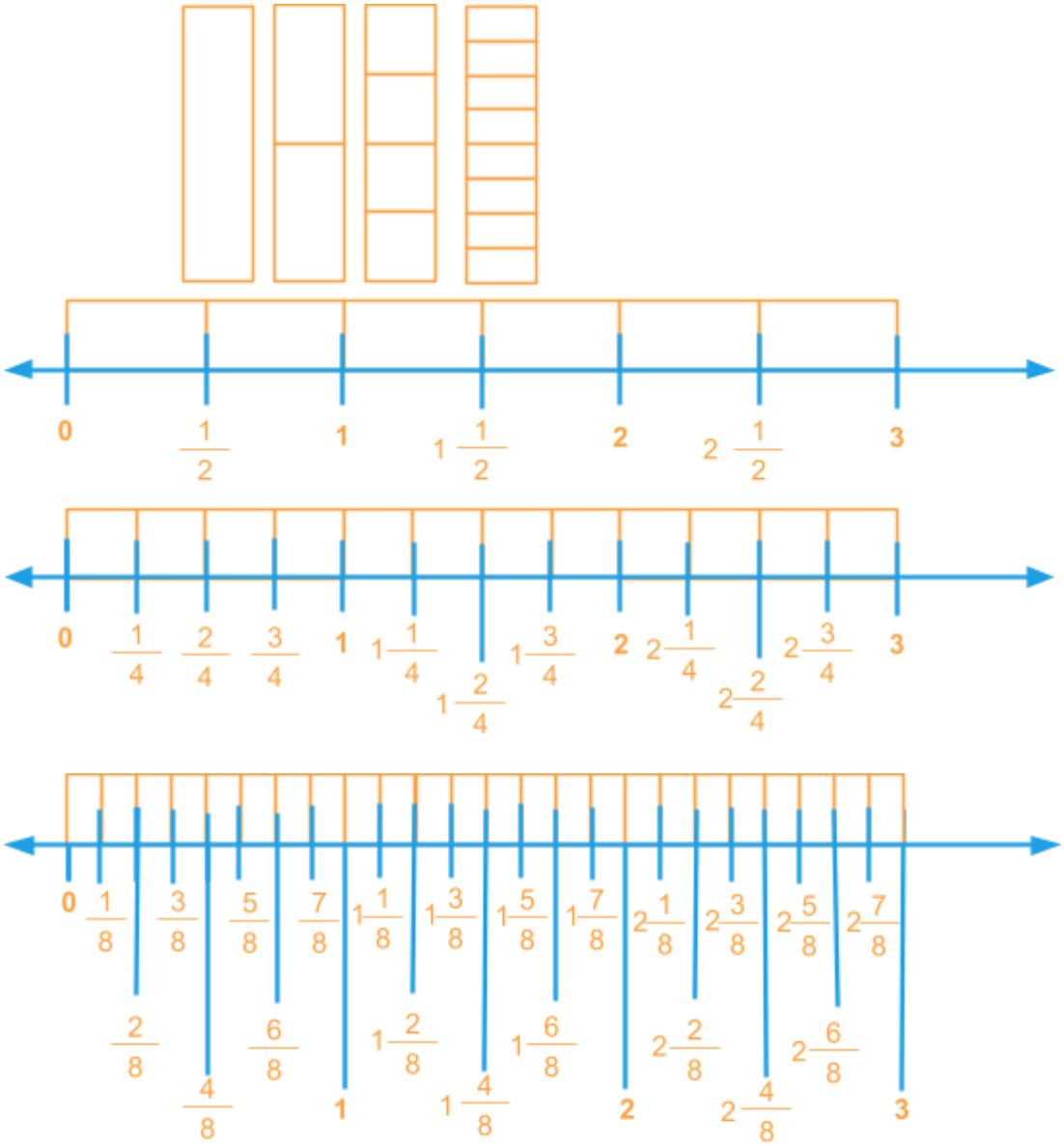
G5_Task_W2_D2

Partner A: Create a bar model of fractions that include halves, fourths, and eighths.
Partner B: Create a bar model of fractions that include thirds, sixths, and twelfths.

- You may use Cuisenaire rods, connecting cubes or paper strips to create your bar model, but you must both use the same manipulative and have the same size one whole.
- Use your bar model to build a number line. Include your fractions and whole numbers up to 3.
- Partners compare your two number lines.

Write 3 comparison statements.

Sample Work (Partner A):



G5_Task_W2_D2 (continued)

Note: Number line model may show all fraction quantities (halves, fourths, and eighths) on the same number line.

Student comparisons and observations will vary.
Look for:

- *Understanding of the relationship between a fraction's denominator and the number of pieces the whole is partitioned into in the bar and number line models.*
- *Student understanding of larger denominators yielding smaller sized pieces (bar model) or intervals (number line model)*
- *When the denominator is twice as large as the previous fraction, such as comparing fourths and eighths, there are two times as many pieces in the whole.*

Use your two number lines to compare these sets of numbers:

$\frac{5}{6} < \frac{7}{8}$

$\frac{6}{8} = \frac{9}{12}$

$\frac{9}{6} > \frac{6}{4}$

Combine the two number lines. Find a point that has a number labeled in thirds and also fourths. Explain why that same point can be named as thirds and fourths.

Students answers will vary.

Look for:

- *Thirds and fourths can both be used to name wholes. The only thing different about their respective wholes is the number of pieces they are broken into (3 for thirds, or 4 for fourths).*

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Grade 5 Problem Solving - Answer Key

G5_POD_W2_D3

Darla wanted to make 2 gallons of punch to take to the school picnic. She found a recipe that called for $\frac{3}{4}$ gal of fruit punch, 2 quarts of orange juice, $\frac{3}{8}$ gal of 7UP, and $\frac{1}{2}$ gal of water. If Darla makes this recipe, will she have as much punch as she wants? Justify your solution.

Yes, Darla will have more than 2 gallons of punch to take to the school picnic.

Possible Student Strategies

$\frac{3}{4}$ gallon = 3 quarts (Fruit Punch)

2 quarts (Orange Juice)

$\frac{1}{2}$ gallon = 2 quarts (Water)

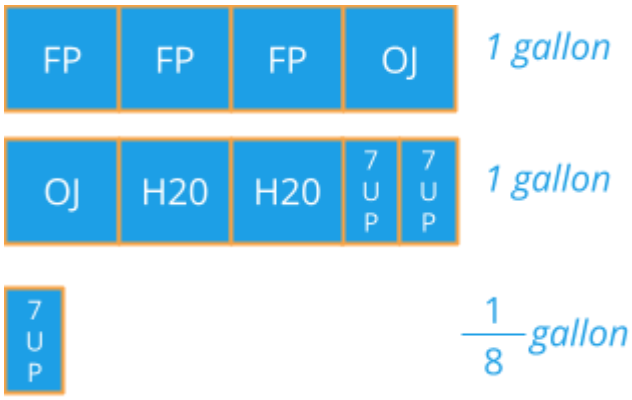
$\frac{3}{8}$ gallon = 1 $\frac{1}{2}$ quarts (7UP)

3 + 2 + 2 + 1 ½ = 8 $\frac{1}{2}$ quarts altogether

Quarts in one gallon = 4

Quarts in two gallons = 8

8 $\frac{1}{2}$ > 8



G5_Journal_W2_D3

Halley solved this subtraction problem: $\frac{7}{8} - \frac{1}{2} = \frac{6}{6}$. Compare the fractions in the equation to help explain why Halley's solution is not reasonable.

Student explanations will vary.

Look for:

- *$\frac{7}{8}$ is less than one whole. $\frac{6}{6}$, Halley's solution, is equivalent to one whole. When $\frac{1}{2}$ is taken away from $\frac{7}{8}$, the solution will be even less than $\frac{7}{8}$, which is already less than one whole.*

G5_POD_W2_D4

Kevin filled 4 glasses with different amounts of water so they would make different sounds when he rubbed his finger along the rim. Glass A held $\frac{5}{8}$ cup of water, glass B held $\frac{3}{4}$ cup of water, glass C held $\frac{3}{6}$ cup of water, glass D held & $\frac{2}{6}$ cup of water. How much water did Kevin use?

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Grade 5 Problem Solving - Answer Key

G5_POD_W2_D3 (continued)

How much water could he put in a fifth glass if he had 3 cups of water?

Kevin used $2\frac{5}{24}$ ***cups of water.***

Glass 5 can hold $\frac{19}{24}$ ***cup of water.***

Student strategies will vary.

Possible Student Strategies

Establishing Common Denominators	*Using ½ as a benchmark*
$\frac{3}{4}=\frac{6}{8}$ *(B)* $\frac{5}{8}$ *(A)* + $\frac{6}{8}$*(B)*= $\frac{11}{8}=\frac{33}{24}$ $\frac{3}{6}$*(C)* + $\frac{2}{6}$ *(D)* = $\frac{5}{6}=\frac{20}{24}$ *33 + 20 =* $\frac{53}{24}$ $\frac{53}{24}$ *=* $2\frac{5}{24}$	$\frac{5}{8}=\frac{1}{2}+\frac{1}{8}$ $\frac{3}{4}=\frac{1}{2}+\frac{1}{4}$ $\frac{3}{6}=\frac{1}{2}$ $\frac{2}{6}=\frac{1}{2}-\frac{1}{6}$ $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$ *= 2 wholes* $\frac{1}{8}+\frac{1}{4}=\frac{3}{8}$ $\frac{3}{8}-\frac{1}{6}=\frac{9}{24}-\frac{4}{24}$ $\frac{9}{24}-\frac{4}{24}=\frac{5}{24}$ *2 wholes and* $\frac{5}{24}$

G5_Journal_W2_D4

Bart solved this addition problem:

$\frac{1}{2}+\frac{3}{8}=\frac{4}{10}$. Use equivalent fractions to explain to Bart that his solution is not reasonable.

Student explanations will vary.

Look for:

- $\frac{1}{2}=\frac{5}{10}$.
- $\frac{5}{10}>\frac{4}{10}$, *so* $\frac{1}{2}+\frac{3}{8}>\frac{4}{10}$

ST Math Immersion

Grade 5 Problem Solving - Answer Key

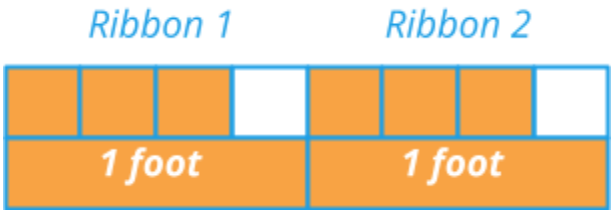
Week 3

G5_Task_W3_D1

A: Ribbon at Jones' Ribbon Shop is sold in various lengths. Rebecca bought two pieces of red ribbon to make hair bows. She selected the red ribbon from the bin with lengths of $\frac{3}{4}$ foot. How much ribbon did Rebecca buy? Compare your problem with your partner's problem.

Rebecca bought 1 $\frac{1}{2}$ ft of ribbon.

Possible Student Strategy:



$\frac{3}{4} + \frac{3}{4} = \frac{6}{4}$

$\frac{6}{4} = 1\frac{2}{4}$ *or* $1\frac{1}{2}$ *ft.*

B: Ribbon at Jones' Ribbon Shop is sold in various lengths. Chris bought a piece of ribbon that was 2 feet long. He used ¾ of the ribbon. What length of ribbon did he use? Compare your problem with your partner's problem.

Chris used 1 $\frac{1}{2}$ ft of ribbon.

Possible Student Strategy:

$\frac{1}{4}$ *of 2 feet is* $\frac{1}{2}$ *ft.*

$\frac{3}{4}$ *of 2 feet is* $1\frac{1}{2}$ *ft.*

Student explanations will vary.

Look for:

- *The same solution derived from two different representations.*

ST Math Immersion

Grade 5 Problem Solving - Answer Key

G5_Task_W3_D2

A: Janet discovered that the distance to the park and back to her house is ¾ mile. She ran to the park and back home 5 times. How far did she run? • Compare your problem with your partner's problem.

Janet ran 3 $\frac{3}{4}$ miles.

B: Bailey lives 5 miles from the park. She decided to run to the park. She got $\frac{3}{4}$ of the way there, stopped and called her mother to pick her up. How far did Bailey run? • Compare your problem with your partner's problem.

Bailey ran 3 $\frac{3}{4}$ miles.

Possible Student Strategies:

<table>
<tr>
<td>Janet

$\frac{3}{4}$ represents the distance to the park and back each time.

5 represents the number of laps Janet completed.</td>
<td>Repeated Addition
$\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}$</td>
<td>Multiplication of Fractions

$\frac{3}{4} \times 5 = \frac{15}{4}$
$\frac{15}{4} = 3\frac{3}{4}$</td>
<td>Grouping $\frac{3}{4}$ into 1 ½

$\frac{3}{4}+\frac{3}{4} = 1\frac{1}{2}$ mi (2 laps)
$1\frac{1}{2}+1\frac{1}{2} = 3$ mi (4 laps)
$3+\frac{3}{4} = 3\frac{3}{4}$ miles (5 laps)</td>
</tr>
<tr>
<td>Bailey

$\frac{3}{4}$ represents what fraction of the whole distance Bailey ran before stopping.

5 represents the intended whole distance of the run.</td>
<td colspan="2">$\frac{3}{4}$ of 5

5 miles split into four equal sections makes each section $1\frac{1}{4}$ miles.

$1\frac{1}{4}+1\frac{1}{4}+1\frac{1}{4} = 3\frac{3}{4}$</td>
<td>Benchmarks

$\frac{1}{2}$ of 5 is is $2\frac{1}{2}$
$\frac{1}{2}$ of $2\frac{1}{2}$ is $1\frac{1}{4}$
$\frac{1}{4}$ of 5 is $1\frac{1}{4}$
$2\frac{1}{2}+1\frac{1}{4}$</td>
</tr>
</table>

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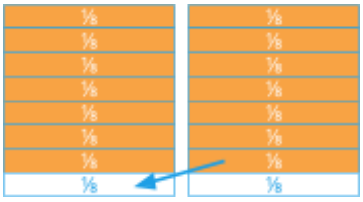
Grade 5 Problem Solving - Answer Key

G5_POD_W3_D3

James built a launchpad for his Lego space ship. The pad was 2 feet by $\frac{7}{8}$ foot. What was the area of James' launchpad?

James' launchpad was 1 $\frac{3}{4}$ square feet.

Possible Student Strategies

Array Model	*Repeated Addition*	*Multiplication*
	$\frac{7}{8} + \frac{7}{8} = \frac{14}{8}$ $\frac{14}{8} = 1\frac{6}{8}$ $1\frac{6}{8} = 1\frac{3}{4}$	$\frac{7}{8} \times 2 = \frac{14}{8}$ $\frac{14}{8} = 1\frac{6}{8}$ $1\frac{6}{8} = 1\frac{3}{4}$

G5_Journal_W3_D3

Explain how to find the product of a whole number times a unit fraction. How is this the same as multiplying a whole number by a whole number?

Student explanations will vary.

Look for:

- *Connections to repeated addition*
  - *"3 x 5 is the same as three groups of five, or 5 + 5 + 5. 3 x $\frac{1}{4}$ is the same as three groups of one-fourth, or $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$."*
- *Students may connect using repeated addition to multiply a whole number by a whole number, to using repeated addition to multiply a whole number by a unit fraction.*

ST Math Immersion

Grade 5 Problem Solving - Answer Key

G5_POD_W3_D4

LeVonne tiled her bedroom with carpet squares. Her bedroom is 12 tiles by 16 tiles. The carpet tiles she used were $\frac{3}{4}$ ft. by $\frac{3}{4}$ ft. What is the area of LeVonne's bedroom?

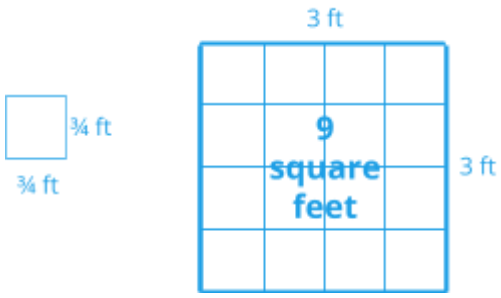
LeVonne's bedroom is 108 square feet.

Student strategies will vary.

Look fors:

- *Each tile is $\frac{9}{16}$ square feet.*
- *Every 16 tiles is 9 square feet.*
- *There are 192 total tiles.*

Possible Student Strategy



A row of 4, $\frac{3}{4}$ - foot tiles has a length of 3 feet.

A 4x4 array of $\frac{3}{4}$ - foot tiles will have dimensions of 3 feet by 3 feet, or 9 square feet in area.

12 x 16 small tiles = 3 x 4 large, 9 sqft groups.

9 sq feet x 12 tiles = 108 square feet

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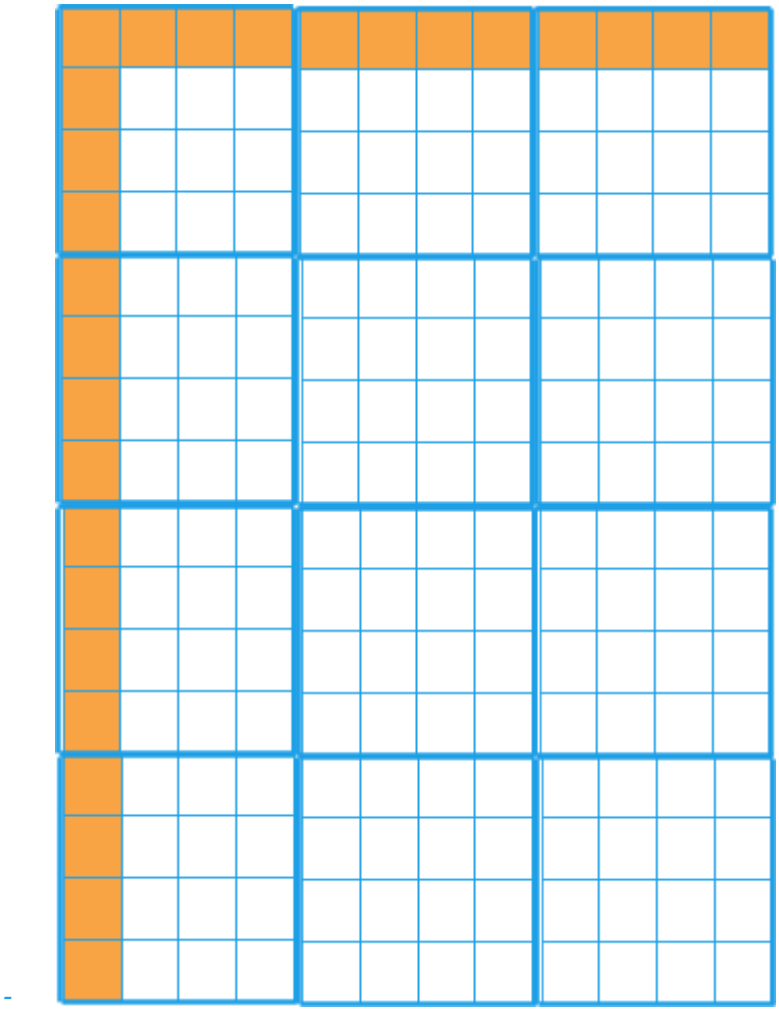
Grade 5 Problem Solving - Answer Key



G5_Journal_W3_D4

When you multiply a whole number greater than zero by a fraction between zero and one, what do you know about the size of the product compared to the whole number factor? Explain why that would happen.

The size of the product will be smaller than the whole number.

Student explanations will vary.

Look for:

- *A fractional portion of a whole will be less than the whole itself.*
- *Multiple groups of a fraction will be less than multiple groups of a whole.*

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Grade 5 Problem Solving - Answer Key

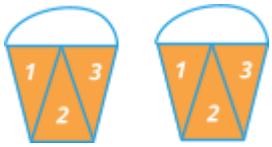
Week 4

G5_POD_W4_D1

Bill, Jack, and Jill took a total of 2 pails of water up the hill. If they each carried the same amount of water, how much water did each friend carry? Prove that the total amount of water they carried equals two pails of water.

Each friend took $\frac{2}{3}$ of a pail of water up the hill.

Possible Student Strategies

2 pails, each divided into thirds	*Non-anticipatory sharing*	*2 divided by 3*
	$\frac{1}{2}\ \frac{1}{2}\ \frac{1}{2}$ $\frac{1}{6}\ \frac{1}{6}\ \frac{1}{6}$ $\frac{1}{2}+\frac{1}{6}=\frac{3}{6}+\frac{1}{6}$ $\frac{4}{6}=\frac{2}{3}$	$\frac{2}{3}$

G5_Journal_W4_D1

Explain how a fraction can be interpreted as division of the numerator by the denominator.

Student explanations will vary.

Sample Student Explanation:

Fractions help us make sense of real life situations, like when it comes to sharing. If a group of 3 friends were to split one cookie, they must divide or cut up the cookie to have an equal amount ($\frac{1}{3}$ + $\frac{1}{3}$+ $\frac{1}{3}$).The number of cookies becomes your numerator that you are sharing or dividing with 3 people (your denominator).

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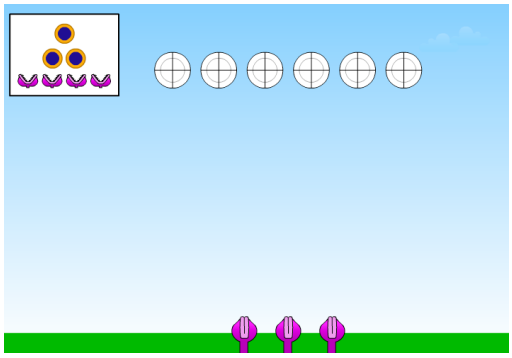
Grade 5 Problem Solving - Answer Key

G5_POD_W4_D2

1.



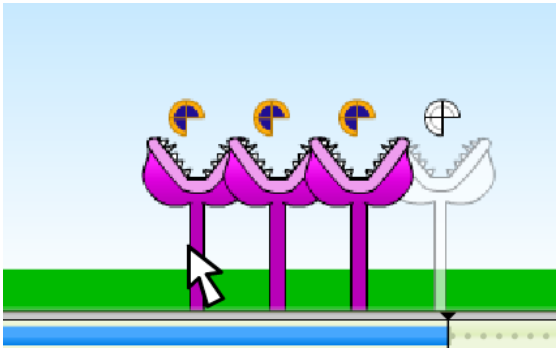
How many pies will these 3 monsters eat?

In this puzzle, 4 fruit monsters eat every 3 whole pies. Each monster eats $\frac{3}{4}$ of a pie. With 3 monsters, they would eat $\frac{3}{4}$ + $\frac{3}{4}$ + $\frac{3}{4}$ or $2\ \frac{1}{4}$ pies.

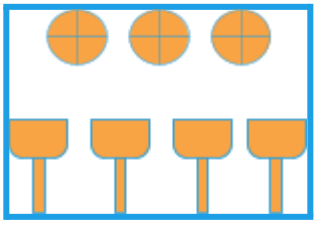
Write an equation to show how you could solve this problem.

$$\frac{3}{4} + \frac{3}{4} + \frac{3}{4} = 2\ \frac{1}{4}$$

2.



What would the rate card (upper left corner) for this puzzle look like? Prove your claim.



Sample student explanation:

Each fruit monster is seen eating $\frac{3}{4}$. *Together, three fruit monsters eats* $2\ \frac{1}{4}$ *pies. With one more fruit monster, four monsters will eat 3 whole pies.*

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Grade 5 Problem Solving - Answer Key

G5_Journal_W4_D2

Write a division story problem with the answer of $\frac{2}{3}$.

Student explanations will vary.

Look for:

- *Two wholes shared three ways*
    - *Example: If there are 2 cookies left in the pantry and 3 people are hungry, how much does each person get?*

G5_POD_W4_D3

Ibrahim did $\frac{1}{5}$ of his homework problems on his bus ride home. He completed 3 problems. How many problems did Ibrahim have for homework?

Ibrahim had 15 problems for homework.

Possible Student Strategies

Reasoning Up

$\frac{1}{5}$ = *3 problems*

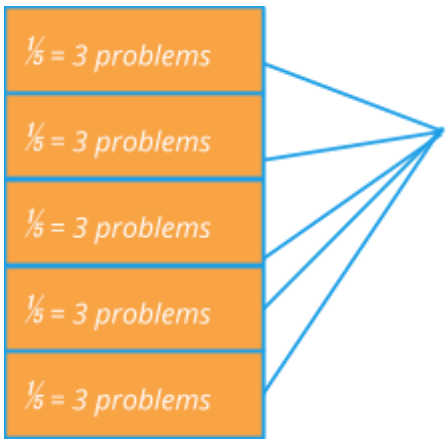
$\frac{2}{5} = \frac{1}{5} + \frac{1}{5}$ = *6 problems*

$\frac{3}{5}$ = *9 problems*

$\frac{4}{5}$ = *12 problems*

$\frac{5}{5}$ = *15 problems*

Visual Model



G5_Journal_W4_D3

When you divide a whole number by a fraction, explain why you multiply the denominator of the fraction times the whole number. What happens to the numerator?

Student explanations will vary.

Look for:

- *The denominator of the fraction tells us how many pieces are in its whole.*
- *By multiplying the denominator of the fraction times the whole number, the whole is then broken into the same number of pieces.*
- *The numerator of the fraction identifies the number of pieces in a group. From the whole number, now in pieces of the fraction's size, the numerator is divided to make groups of the fraction amount.*
    - *Example:*

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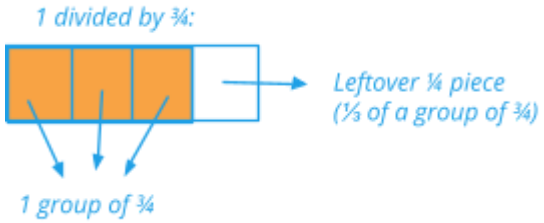


The whole is broken into fourths to easily remove a group of $\frac{3}{4}$.

1 x 4 = 4

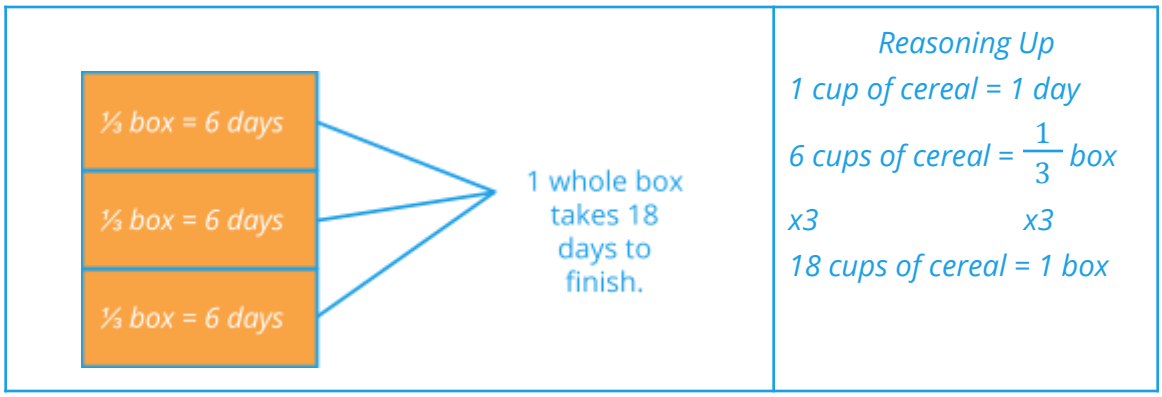
4 ÷3 = 1 group and $\frac{1}{3}$ of the next group (1 $\frac{1}{3}$).

G5_POD_W4_D4

Mylo eats a cup of cereal a day. He ate ⅓ of a box in 6 days. How many cups of cereal were in the full box?

There were 18 cups of cereal in the full box.

Possible Student Strategies



G5_Journal_W4_D4

Explain why you can serve 8 people, if you have 2 pans of lasagna and divide each pan into fourths. Write an equation for this problem.

Student explanations will vary.

Look for:

- 1 pan divided into fourths makes four equal pieces.
- 2 whole lasagna pies divided by 8 people = $\frac{1}{4}$. Each person will get $\frac{1}{4}$serving of total lasagna available.
- 2 pans, each divided into fourths will make 4 pieces of lasagna on each pan, serving 8 people altogether.

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Grade 5 Problem Solving - Answer Key

Repeated Subtraction

$8 - \frac{1}{4} = 7\frac{3}{4}$

$7\frac{3}{4} - \frac{1}{4} = 7\frac{2}{4}$

$7\frac{2}{4} - \frac{1}{4} = 7\frac{1}{4}$

$7\frac{1}{4} - \frac{1}{4} = 7$

$7 - \frac{1}{4} = 6\frac{3}{4}$

$6\frac{3}{4} - \frac{1}{4} = 6\frac{2}{4}$

$6\frac{2}{4} - \frac{1}{4} = 6\frac{1}{4}$

$6\frac{1}{4} - \frac{1}{4} = 6$

$6 - \frac{1}{4} = 5\frac{3}{4}$

$5\frac{3}{4} - \frac{1}{4} = 5\frac{2}{4}$

$5\frac{2}{4} - \frac{1}{4} = 5\frac{1}{4}$

$5\frac{1}{4} - \frac{1}{4} = 5$

$5 - \frac{1}{4} = 4\frac{3}{4}$

$4\frac{3}{4} - \frac{1}{4} = 4\frac{2}{4}$

$4\frac{2}{4} - \frac{1}{4} = 4\frac{1}{4}$

$4\frac{1}{4} - 4 = 4$

$4 - \frac{1}{4} = 3\frac{3}{4}$

$3\frac{3}{4} - \frac{1}{4} = 3\frac{2}{4}$

$3\frac{2}{4} - \frac{1}{4} = 3\frac{1}{4}$

$3\frac{1}{4} - \frac{1}{4} = 3$

$3 - \frac{1}{4} = 2\frac{3}{4}$

$2\frac{3}{4} - \frac{1}{4} = 2\frac{2}{4}$

$2\frac{2}{4} - \frac{1}{4} = 2\frac{1}{4}$

$2\frac{1}{4} - \frac{1}{4} = 2$

$2 - \frac{1}{4} = 1\frac{3}{4}$

$1\frac{3}{4} - \frac{1}{4} = 1\frac{2}{4}$

$1\frac{2}{4} - \frac{1}{4} = 1\frac{1}{4}$

$1\frac{1}{4} - \frac{1}{4} = 1$

$1 - \frac{1}{4} = \frac{3}{4}$

$\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$

$\frac{2}{4} - \frac{1}{4} = \frac{1}{4}$

$\frac{1}{4} - \frac{1}{4} = 0$

32 groups of $\frac{1}{4}$, or 32 meals, could be taken away from 8 pounds.

Grouping

$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$

4 meals for every 1 pound

4 meals x 8 pounds = 32 meals

Reasoning Up

$\frac{1}{4}$ *pound = 1 meal*

1 pound = 4 meals

8 pounds = 32 meals

ST Math Immersion

Grade 5 Problem Solving - Answer Key

G5_Journal_W5_D1

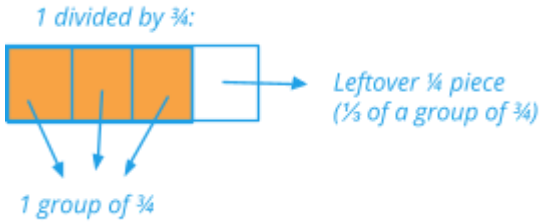
When you divide a whole number by a fraction less than 1, the answer is greater than the whole number you divided. Explain why that happens.

Student explanations will vary.

Look for:

- *A fraction divisor can tell us the size of a group. If the size of one group is less than one, there will be leftovers from each whole that can be used to make additional groups.*

Example:



G5_POD_W5_D2

The art teacher had 6 cups of sparkles for an art project. He gave each student in Ms. Clark's class $\frac{1}{3}$ of a cup of sparkles to use. How many students are there in Ms. Clark's class?

There are 18 students in Ms. Clark's class.

Possible Student Strategies

Repeated Addition	*Grouping*	*Reasoning Up*
$\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 cup $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 cup $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 cup $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 cup $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 cup $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 cup	$\frac{1}{3}$ *x 3 = 1 cup* *For every three students who received sparkles, the art teacher used one cup of sparkles.* *Since there were 6 cups of sparkles, 6 times as many students (3 x 6) were in the class.*	$1 \div \frac{1}{3} = 3$ $6 \div \frac{1}{3} = 18$

G5_Journal_W5_D2

$\frac{1}{8} \times 4 = \frac{1}{2}$ Write two division equations that would use these same three numbers.

$\frac{1}{2} \div 4 = \frac{1}{8}$

$\frac{1}{2} \div \frac{1}{8} = 4$