PA – MDC GRADE 4

Farmer Fred's Fields

NUMBER & OPERATIONS FRACTIONS

This lesson is intended to help students to use fractional parts of a whole, properties of shapes, congruency, and computation using fractions and money.

Problem Solving Formative Assessment Lesson

This lesson is adapted from New York City Department of Education and Fraction Equivalences Elementary Pilot, and revised by the PA-MDC Writing Committee.

MATHEMATICS design collaborative

With Sincere thanks and appreciation for the effort and work of the Members of the PA- MDC Writing Committee and for the unwavering support from their home districts: Camp Hill School District, Cumberland Valley School District, Lower Dauphin School District and Shippensburg School District.

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NUMBER & OPERATIONS FRACTIONS

Farmer Fred's Fields

This Formative Assessment Lesson in problem solving is used following an instruction unit's completion. The task should be implemented a few weeks after the unit to assess if students apply the skills / standards that have been addressed. The teacher should seek out multiple representative ways to complete the problem and share the thinking of their students to broaden insight into approaching problem solving.

Mathematical Goals: Students have to determine fair value for and the worth of each field, to determine fair value and worth, students must be able to recognize that the hexagon-shaped fields, the trapezoid –shaped fields, etc. are congruent. This lesson is intended to measure student understanding of:

- Fractional parts of a whole
- The properties of shapes
- Congruency
- Computation using fractions and money to make a fair determination of value and worth

Common Core Standards: This lesson involves a range of mathematical content from standards, with emphasis on:

4.NF.2 Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <.

4.NF.3 c Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.

4.NF.3 d Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

4.NF.4 c Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem.

4.G.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

The lesson also relates to **all** of the ***Standards for Mathematical Practice***, with a particular emphasis on:

MP.1 – Make sense of problems and persevere in solving them.
MP.3 – Construct viable arguments and critique the reasoning of others.
MP.6 – Attend to precision.
MP.7 – Look for and make use of structure.

PA Core Standards:
CC2.1.4.C.1 Extend the understanding of fractions to show equivalence and ordering.
CC2.1.4.C.2 Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
CC.2.3.4.A.2 Classify two-dimensional figures by properties of their lines and angles.

Introduction: This lesson is structured in the following way:

- Before the first lesson, students tackle the problem individually. You review their work and write questions to help students improve their solutions.
- At the beginning of the lesson, students respond to your questions. They then work collaboratively in pair/groups to produce a better solution improving on their original responses
- Then in small groups students evaluate and comment on sample solutions, followed by a whole-class discussion about the work.
- Finally, in a follow-up lesson students review and evaluate their work on the problem.

Time Needed – Estimated 80 – 105 minutes
Timings are approximate; exact timings will depend on your students.

- Pre-Assessment: 10 – 15 minutes
- Whole Class Introduction 15 minutes
- Collaborative Activity 30 – 40 minutes
- Collaborative Error Analysis: 10 - 15 minutes
- Whole Class Discussion 10 – 15 minutes
- Reflection: 5 minutes or if short on time, assign for homework

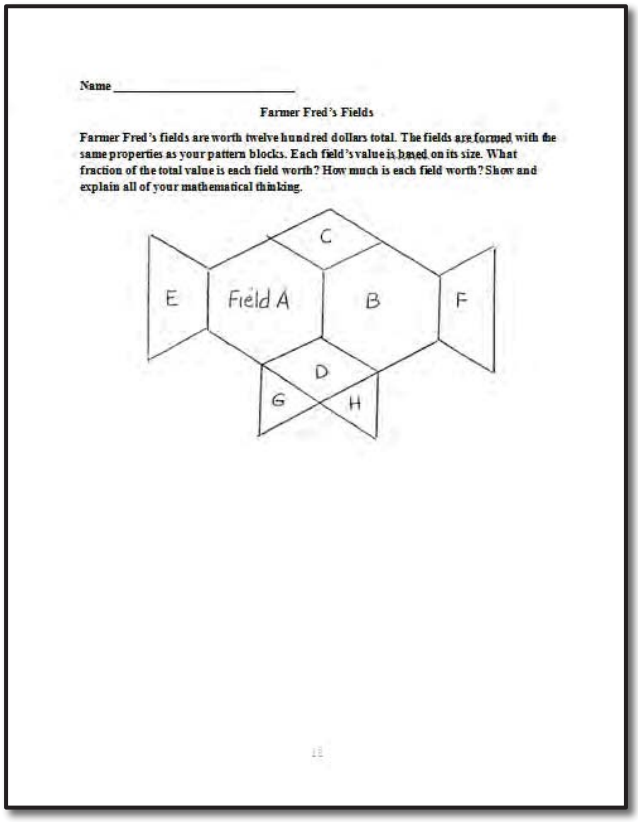
Materials Required:

- Each individual student will need a copy of the pre-assessment sheet *Farmer Fred's Fields* (Manipulatives table should be available for pre-assessment)
- Pattern blocks: hexagons, rhombi, trapezoids and triangles
- Transparency sheet (insert blank copy of Farmer Fred's Fields), white boards, wipe off markers
- Chart paper, pencils, pens, rulers

Before the Lesson

Pre-Assessment Task: Farmer Fred's Fields (*10 – 15 minutes*)

Have the students do this task in class a day or more before the Formative Assessment Lesson. This will give you an opportunity to assess the work and to find out the kinds of difficulties students have with it. Then you will be able to target your help more effectively in the follow-up lesson.



Name _____

Farmer Fred's Fields

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.

Give each student a copy of pre-assessment task*: Farmer Fred's Fields*

Introduce the task briefly help the class to understand the problem and its context.

> *Spend fifteen minutes on your own, answering these questions. Don't worry if you can't figure it out. There will be a lesson on this material later that will help you improve your work. Your goal is to be able to answer these questions with confidence by the end of that lesson.*

It is important that students answer the question without assistance, as far as possible.

If students are struggling to get started, ask them questions that help them understand what is required, but do not do the task for them and be conscientious to not lead or provide the thinking for your students.

Assessing Students' Responses

Collect student responses to the task. Make some notes on what their work reveals about their current levels of understanding. The purpose of this is to forewarn you of the issues that will arise during the lesson, so that you may prepare carefully.

We suggest that you do not score students' work. The research shows that this is counterproductive, as it encourages students to compare scores, and distracts their attention from how they may improve their mathematics.

Instead, help students to make further progress by asking questions that focus attention on aspects of their work. Some suggestions for these are given on the next page. These have been drawn from common difficulties anticipated.

We suggest that you write your own lists of questions, based on your students' work. It is recommended that you either:

- Write one or two questions on each student's work
- Give each student a printed version of your list of questions and highlight the questions for each individual student

If you do not have time to do this, select a few questions that will be of help to the majority of students. These can be written on the board when you return the work to the students at the start of the lesson.

Common Issues	**Suggested Questions and Prompts**
No strategy is chosen, or a strategy is chosen that will not lead to a solution. Student has difficulty getting started or is disorganized in his/her approach.	• What steps do I need to take to make sense of this problem? • What are you being asked to solve? • How can you organize your thinking based on what is being asked?
Student does not apply understanding of fractional equivalence or ordering to the problem/shapes.	• How can I combine shapes to find the area of the new shape? • How can I group shapes to identify their similarities?
No written justification Represents the fractional comparisons but does not make the connection to the value of the land.	• Does your answer make sense? Explain your mathematical thinking with mathematical language. • Can you write the decimal numbers in money notation to match your fractional expression?
The student applies value but does not address the fraction of the total value each field is worth. Student miscalculates the monetary value of the fields.	• Is each field of equal size? If not, can you identify it with a fraction name? • Can you provide a total value of all fields ➢ using decimals to define the value of each field? ➢ using percentages to define the value of each field? • Can you provide a number sentence that proves your answer correctly matches the total?

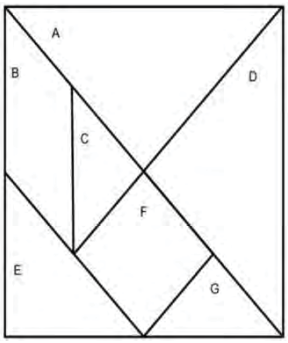
The student does not attempt a mathematical representation.	• How do I know that each value represents a combined total of the given value of land?
The student answers completely and expertly.	• Prove them with the Extension Activity (instructions below and resource workshop found on page 13)

Please use the blanks to add your class misconceptions and directed questions

Extension Activity

Provided to students who expertly answer the pre-assessment, this activity can be distributed to groups that finish the Collaborative activity early. This activity uses percentages and decimals to define the value of each field. This provides a total value of all the fields (decimals/cents).
***Resource Worksheet for this activity is found on page 13**

Use Tangram puzzles if you have them, or use scissors to cut the square unit provided into 7 pieces for students. Create a square unit from all seven pieces.



What fractional part of the whole square is it?

- Large right triangle (A,D)
- Square (F)
- Small right triangles: (C,G)
- Medium right triangle: (E)
- Parallelogram (B)

If a large right triangle is chosen to be 1 Unit in an area, how do the other pieces correspond?

Suggested Lesson Outline

Whole Class Introduction (*10 - 15 minutes*)

Of the pattern blocks, only the following are needed for this activity:

- Yellow hexagons
- Red trapezoids
- Blue rhombi
- Green triangles

Students should have their White Boards/Markers

Hold up each pattern block and have students name shapes through choral response.

You could also use overhead pattern blocks or a doc camera and lay shapes side by side as you ask questions and have students respond on white board. Students may also lay out the pattern pieces side by side for a visual representation.

Ask these questions:

1. The green triangle is what fraction of the blue rhombus? **(1/2)**

2. The red trapezoid is what fraction of the yellow hexagon? **(1/2)**

3. How can both be equivalent to 1/2? **(Fraction is relative to the whole)**

4. The green triangle is what fraction of the yellow hexagon? **(1/6)**

5. What pattern block represents 1/6 when two yellow hexagons are used as the whole? **(Blue rhombus) (…again, it shows the fraction is relative to the whole unit)**

Then ask:

Using your white boards and pattern blocks, I want you to create a piece of art that consists of six shapes.

Pause here for a few minutes to allow them to create with their shapes

If I tell you I want to know how much that piece of art costs and I know the value of a hexagon is $12.00, Show me how you know the value of your artwork.

The Hexagon value of $12.00 makes the value of the Trapezoid $6.00; Rhombus $4.00; Triangle $2.00

While students are working, walk the room observing and listening so you can choose 2 or 3 students to share the value of their art work.

Review Individual Solutions to the Task

Teacher:

Recall the task we worked on previously involving pattern blocks. What was the task? What were you asked to do?

The student comments should recall finding the value of Farmer Fred's fields.

Return your students' work on Farmer Fred's Fields.

Re--read both the problem and the solution.

If you have not added questions to students' work, write a short list of your most common questions on the board. Students can then select a few questions appropriate to their own work and begin answering them. Draw students' attention to the questions you have written.

I have read your solutions and I have some questions about your work. I would like you to work on your own to reflect on those questions and to improve upon your answer

Give them no more than five minutes.

Some students may have the enrichment activity attached to their pre-assessment. They may use this time to re-read their pre-assessment and start on the enrichment activity. When students move to collaborative lesson, they may partner with other students who have the enrichment activity.

Collaborative Activity: Producing a Joint Solution (*30 to 40 minutes*)

Organize the class into pairs ahead of time, organizing students into groups of two using the pre-assessment task to sort students. Keep like levels as partners, deliberately pairing the students in homogenous groups of two, determined from the pre-assessment, so that students are paired by similar misconceptions but perhaps different approaches to the problem.

Grouping students who have taken different approaches and different mathematical reasoning may lead to discussions that are more profitable.

Lesson activity time is dependent upon the level of understanding of your students.

Planning a Joint Solution

Display the Joint Solution Procedure as a slide, or copy and distribute it as a handout prepared for students to follow (shown below, with a printable full-page of the procedure on page 16). The pairs of students can use this to guide group expectations.

Planning a Joint Solution

1. **Take turns to explain your original method. How do you think your work could be improved having considered my feedback?**
2. **Listen carefully to each other and ask questions if you don't understand.**
3. **Once you understand each other's work agree together in your group on the best approach for completing the problem.**
4. **Make sure that everyone in the group can explain the reason for your chosen method.**
5. **Outline on your large sheet of paper the approach you are going to use.**

Teacher:

> *You each have your own, individual solution. You have been thinking about how you might improve your response. I want you to share your work with your partner and share your ideas for improving it. Listen carefully to each other and ask questions if you don't understand or agree.*
>
> *Can you make suggestions to create a better, richer solution?*

Allow 10-15 minutes for pair discussion, then pair two groups together making a group of four.

Allow 15 - 20 minutes for groups of 4 to share ideas and write their response on chart paper to create posters.

> *Each group of four determines a plan to display the best solution in the most organized and complete way. Once you have evaluated the relative merits of each approach, agree on a strategy and then write your solution on a large sheet of chart paper.*

By carefully listening and watching students as they work together you will get a better idea of students' understanding, be in a better position to ask questions to help them progress, and in a whole-class discussion, be more purposeful in who you select to explain solutions.

Try to support students in their work without pushing them towards any particular solution method. One way to do this is to provide general or strategic rather than technical hints. Avoid simplifying the problem for pupils by breaking it down into steps. Instead, ask more strategic questions such as:

- What do you know?
- What are you trying to do?
- Don't ask for help too quickly. Try to think this out yourself. What have you tried so far?
- Re-read the problem. Look at the last two sentences.
- What makes you say that? Can you use math to justify your answer?

You may want to use the questions in the Common Issues table to support your questioning. If the whole class is struggling on the same issue, you could write one or two relevant questions on the board or hold a brief whole-class discussion.

Note different student approaches In particular, note whether students' original methods are the same or different. If they are different, how do they decide which method to use for their joint solution? What are their reasons for the choice of method?

Support Student Problem Solving

If students are struggling to produce a joint solution to the task, encourage them to identify the strengths and weaknesses of the methods employed in their individual responses. Can any of these methods be improved to produce a group solution that is better than the original individual response? Can they think of any other approaches to try?

Try not to make suggestions that move students towards a particular approach to the task. Instead, ask questions that help students to clarify their thinking.

For example, you may ask them to consider these questions:

- What have you done that you both [all] agree on?

- What else do you need to find? Have you used all the information given in the task?
- What do you now know that you didn't know before?
- Do your calculations make sense? What assumptions have you made?

You may also want to use some of the questions in the Common Issues table to support your questioning. The purpose of these questions is to help students to track and review their problem solving strategies. They should be encouraged to give reasons for the choices they have made.

Whole Class Discussion (*10-15 minutes*)

Once groups have completed their posters, display them at the front of the room. Hold a whole-class discussion on the methods used to produce a group solution. Ask two groups of students to describe the method used and the ways in which this method differs from their initial individual responses. Did the students check their work? If they did, what checking method did they use?

This is also a good time for your enrichment problem to be shared with the class. Select one group to share their results from the Tangram Activity.

Your job is to facilitate conversation. Promote questioning by the students to the presenters. Again, you may want to use the questions from the misconceptions and prompts.

Collaborative Analysis of Sample Responses to Discuss and Reflection (30 minutes)

Once students have had sufficient time to discuss some different approaches, distribute copies of the Student Responses to discuss within each group. The whole-class discussion held should help to inform your decision on whether or not to be selective about which sample responses students are given.

It may not be appropriate, or there may not be enough time, for all students to analyze all four sample responses. Each response highlights different misconceptions and so depending on the progress already made on the task, it may be appropriate to issue different sample responses to different groups. It would be important for all students to review the expert sample 4.

> *In your groups, you are now going to look at some students' work on the task you completed. Notice in which ways this work is similar to yours and in which ways it is different. You may write on the paper what this student did well, or what he/she could do to make their answer more complete. Share your findings with your group.*

This task gives students an opportunity to evaluate a variety of possible approaches to the task, without providing a complete solution strategy. Students should thoughtfully answer the questions below each piece of sample student work and be encouraged to think carefully about ways in which the work could be improved rather than focus on whether the student has neat handwriting.

Name _____

Farmer Fred's Fields

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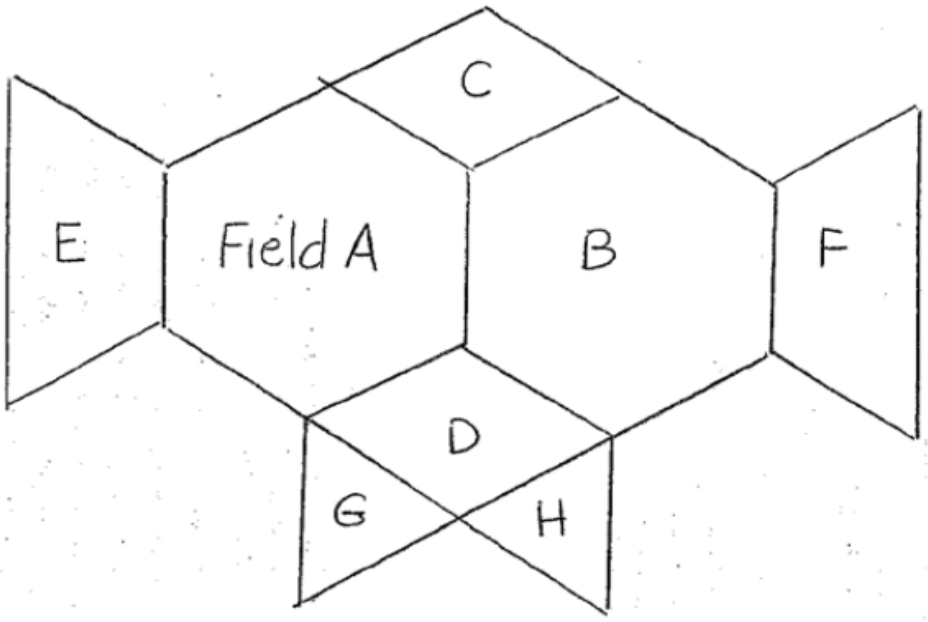


Extension Activity Resource

Use Tangram puzzles if you have them or use scissors to cut the square unit provided into 7 pieces for students.

Have students receiving this begin work while others reflect on the original Farmer Franks' Fields. When Collaborative Activity begins have them team up to work together on solutions. Have one of the groups present as the final group in whole class discussion.

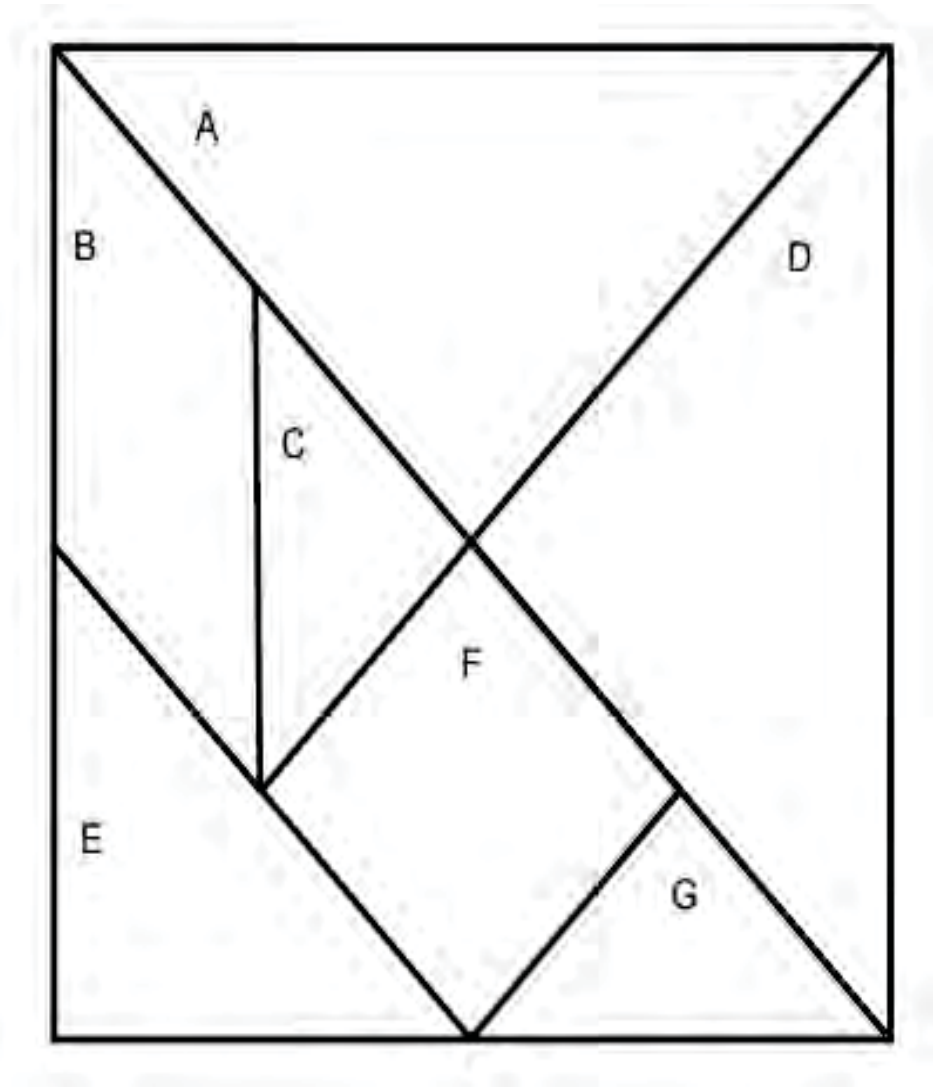
Cut along this line

Create a square unit from all seven pieces.

What fractional part of the whole square is it?

- Large right triangle
- Square
- Small right triangles
- Medium right triangle:
- Parallelogram

If a large right triangle is chosen to be 1 unit in area, how do the other pieces correspond?

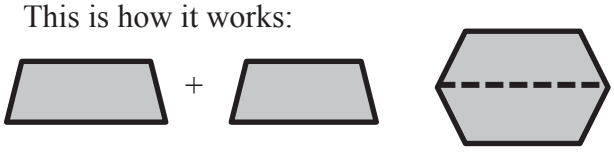


ANSWER KEY

Farmer Fred: Number & Operations Fractions

FIELD	FRACTION	WORK	FIELD VALUE
A	**1 Whole (4/4 or 6/6)**		**$300.00**
B	**1 Whole**		**$300.00**
C	**1/3**		**$100.00**
D	**1/3**		**$100.00**
E	**1/2**		**$150.00**
F	**1/2**		**$150.00**
G	**1/6**		**$50.00**
H	**1/6**		**$50.00**

This is how it works:



Students identify the shapes that are equivalent…i.e.:

- Two trapezoids equal one hexagon
- Two triangles make a rhombus

Possible Solutions:

1. Student comes to conclusion that the diagram really has 4 hexagons so…$1200/4 + $300 per hexagon so he breaks the other numbers down by how many pieces form the hexagon (denominators of 2, 3, 6) and divides by $300.00

2. The student demonstrates correct reasoning of the underlying mathematical concepts in the problem.
3. The student applies understanding of fractional parts of a whole. The student determines that all the field shapes can form four hexagons and divides 1200 by 4 for a quotient of 300.
4. The student divides 300 by the denominators 3, 6, and 2 to find the remaining worth of the trapezoid, rhombus and triangle shaped fields. The student draws in the line of symmetry, compares fractions to decimals and percentages, and uses the concept of area to determine why a field cannot be shaped as a square in this problem.
5. Student verifies her/his answer by dividing 1200 by 24 (triangles) and finds the correct worth of the fields.
6. The student correctly uses the mathematical terms from the problem: worth, fractions, and values.
7. The student also correctly uses the terms: equivalent, trapezoids, hexagon, triangles, rhombus, shapes, denominators, whole line of symmetry, percentages, decimals, and sixths.
8. The student correctly uses the mathematical notation 6/6, 1/3, 1/2, 1/6, 24/6, 2/2, 3/3, 24/6, 100%, 50%, 1.00, .5, .50, $300.00, $100.00, $150.00, $50.00.

Extension Activity
ANSWER KEY

Large Triangle – 1/4

Square – 1/8

Small right triangle – 1/16 (each)

Medium right triangle – 1/8

Parallelogram – 1/8

Add to the Activity: Changing the entire unit is interesting. For example, if a large right triangle is chosen and announced to be 1 unit in area, the other pieces correspond.

Square – 1/2

Small right triangle – 1/4 (each)

Parallelogram – 1/2

Medium right Triangle – 1/2

Planning a Joint Solution

1. **Take turns to explain your original method and how you think your work could be improved having considered my feedback.**

2. **Listen carefully to each other and ask questions if you don't understand.**

3. **Once you understand each other's work agree together in your group on the best approach for completing the problem.**

4. **Make sure that everyone in the group can explain the reason for your chosen method.**

5. **Outline on your large sheet of paper the approach you are going to use.**

Grade 5 Math:

FARMER FRED'S FIELDS

ANNOTATED STUDENT WORK

This section contains samples of real student work. The work shows examples of student understandings and misunderstandings of the task. Your students will do an error analysis and make suggestions that would rectify misconceptions they find.

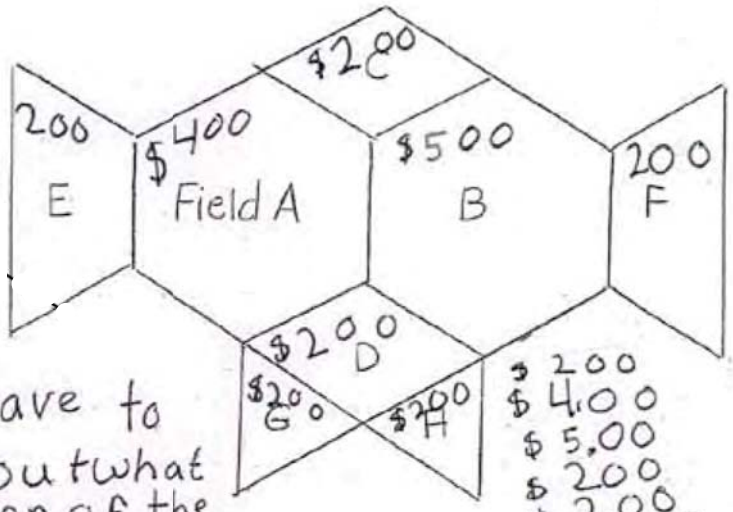
Grade 4 Math: Farmer Fred

Grade 4

Name_____

Farmer Fred

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.



I have to find out what fraction of the total value is each field and how much is each field

$ 200
$ 400
$ 500
$ 200
$ 200
$1500

page 1 of 1

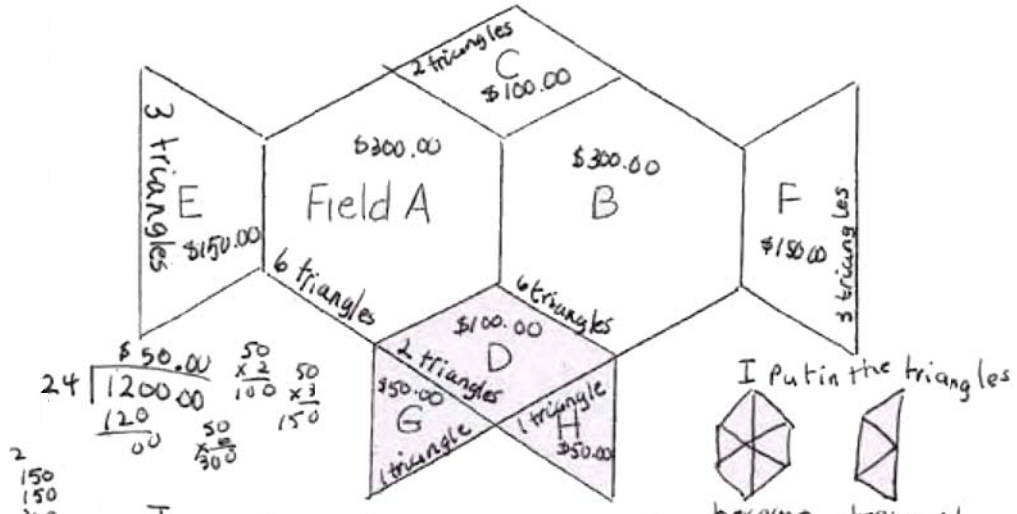
Grade 4 Math: Farmer Fred

Grade 4

Name_____

Farmer Fred

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.



$50.00
24 | 1200.00
120
00

50 x 2 = 100
50 x 3 = 150
50 x 6 = 300

2
150
150
300
300
100
100
50
+ 50
1200

I will draw a diagram I have to find out how much each field is worth So find how many triangles and divide into $1200.00 to get the answer.

I put in the triangles

hexagon trapezoid

rhombus triangle

Answer
Field EF $150.00
Field AB $300.00
Field CD $100.00
Field GH $50.00

page 1 of 1

Grade 4 Math: Farmer Fred

Student Response 3
page 1 of 2

Name_____

Farmer Fred

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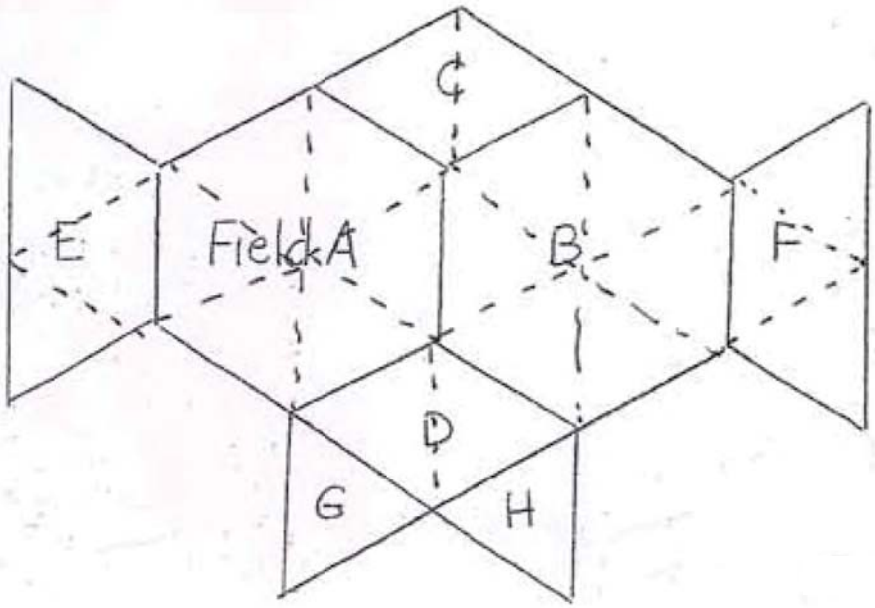


I will find out the fraction and how much value each field is. I have to find how many sixths there are. I will use pattern Blocks to figure it out and the diagram.

page 1 of 2

Grade 4 Math: Farmer Fred

$50.00
24 | $1200.00
-120
0
0

24
x5
120

50 50
x6 2
300 100

the fields

field	shape	value	fraction
A	hexagon	$300.00	1/1
B	hexagon	$300.00	1/1
C	rhombus	$100.00	1/3
D	rhombus	$100.00	1/3
E	trapezoid	$150.00	1/2
F	trapezoid	$150.00	1/2
G	triangle	$50.00	1/6
H	triangle	$50.00	1/6

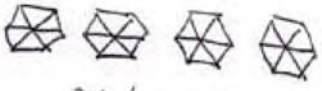
50
x3
150

600
200
300
+100
1200

answer 2

answer 1

Conections
I named the shapes
I see 24/6 equals 4 hexagons



24 triangles
is 4 hexagons

page 2 of 2

Grade 4 Math: Farmer Fred

Farmer Fred

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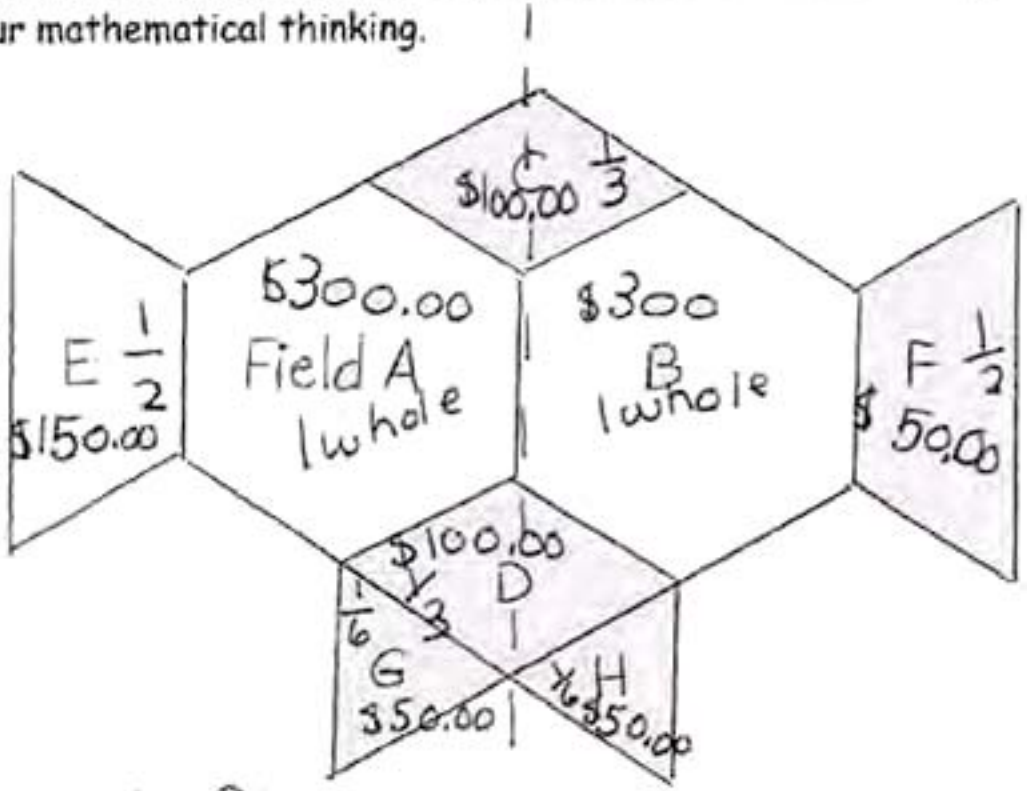
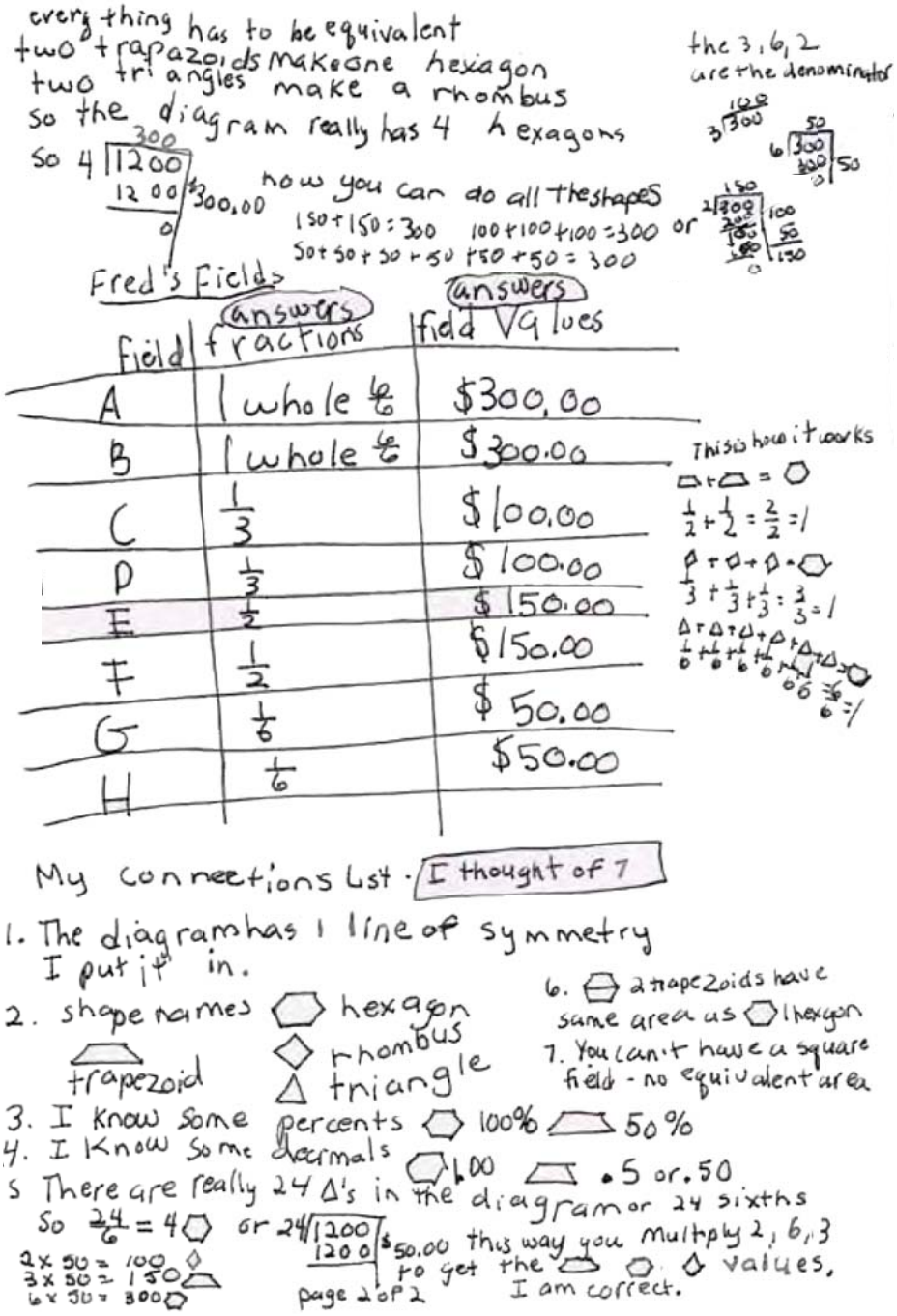


I have to figure out what the fields are worth and the fraction of the fields. You can't solve this problem IF you don't know fractions. I will make a table and write the answers on it.

Grade 4 Math: Farmer Fred



every thing has to be equivalent
two trapazoids make one hexagon
two triangles make a rhombus
so the diagram really has 4 hexagons
so 4 | 1200 → 300 | 12 00 | 0 → $300.00

now you can do all the shapes
150+150=300 100+100+100=300 or
50+50+50+50+50+50=300

the 3, 6, 2 are the denominator

3 | 300 → 100
6 | 300 → 50
2 | 300 → 150 | 150 | 0 → 100 | 50 | 150

Fred's Field

Field	answers fractions	answers field values
A	1 whole 6/6	$300.00
B	1 whole 6/6	$300.00
C	1/3	$100.00
D	1/3	$100.00
E	1/2	$150.00
F	1/2	$150.00
G	1/6	$ 50.00
H	1/6	$50.00

This is how it works
▱ + △ = ⬡
1/2 + 1/2 = 2/2 = 1
◇ + △ + △ = ⬡
1/3 + 1/3 + 1/3 = 3/3 = 1
△ + △ + △ + △ + △ + △ = ⬡
1/6 + 1/6 + 1/6 + 1/6 + 1/6 + 1/6 = 6/6 = 1

My connections list · I thought of 7

1. The diagram has 1 line of symmetry I put it in.
2. shape names ⬡ hexagon ◇ rhombus ▱ trapezoid △ triangle
3. I know some percents ⬡ 100% ▱ 50%
4. I know some decimals ⬡ 1.00 ▱ .5 or .50
5. There are really 24 △'s in the diagram or 24 sixths
   So 24/6 = 4⬡ or 24 | 1200 → 50.00 | 1200 | 0
   this way you multiply 2, 6, 3 to get the ▱ ⬡ ◇ values, I am correct.
6. ⬭ 2 trapezoids have same area as ⬡ 1 hexagon
7. You can't have a square field - no equivalent area

2 x 50 = 100 ◇
3 x 50 = 150 ▱
6 x 50 = 300 ⬡

page 2 of 2

Reflection: Farmer Fred's Fields

How Did You Do?

Name _____

Group _____

My answer was _____ because:

- ☐ **I remembered to state my answer clearly**
- ☐ **I remembered to provide an equation**
- ☐ **I remembered to explain my answer**

Using a Scale of 1 – 4 with 1 being "not so good" and 4 being, "we were awesome!"

How well did your group do the following?

Allow for conversation _____	**Respect each other _____**
Listen to each other _____	**Work as a team _____**

As a Group: Did your answer improve? Did it change? Explain

_____

_____

Reviewing the Sample Student Work we realized our answer was most like:

- ☐ **Student 1**
- ☐ **Student 2**
- ☐ **Student 3**
- ☐ **Student 4**

The best response was Student ____ because _____

_____

_____

_____

TEACHER NOTES

Grade 5 Math:

FARMER FRED'S FIELDS

ANNOTATED STUDENT WORK

This section contains annotated student work. The student work shows examples of student understandings and misunderstandings of the task with notations for the teacher.

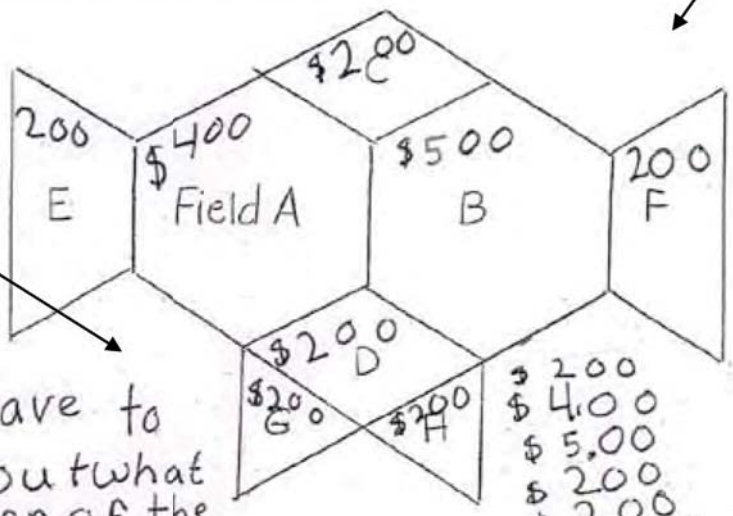
Grade 4 Math: Farmer Fred
Annotated Student Work

Grade 4

Name_____

Farmer Fred

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.



I have to find out what fraction of the total value is each field and how much is each field

$ 200
$ 400
$ 500
$ 200
$ 200
$1500

page 1 of 1

The student does not apply understanding of fraction equivalence and ordering (4NF 1, 2), and does not build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers (4NF 3, b, d).

The student is not able to discern that the problem requires an understanding of fractional parts to a whole and computation with money. The student does not indicate a fractional value for each field and the worth of each field is not correct.

The student applies the math term, total value, in the solution but not the stated word-fraction.

The student does not model with mathematics. The student only labels the one provided with incorrect monetary amounts for each field and does not construct her/his own diagram or table to construct a viable argument.

The student is not able to search for the regularity and trends embedded in the problem.

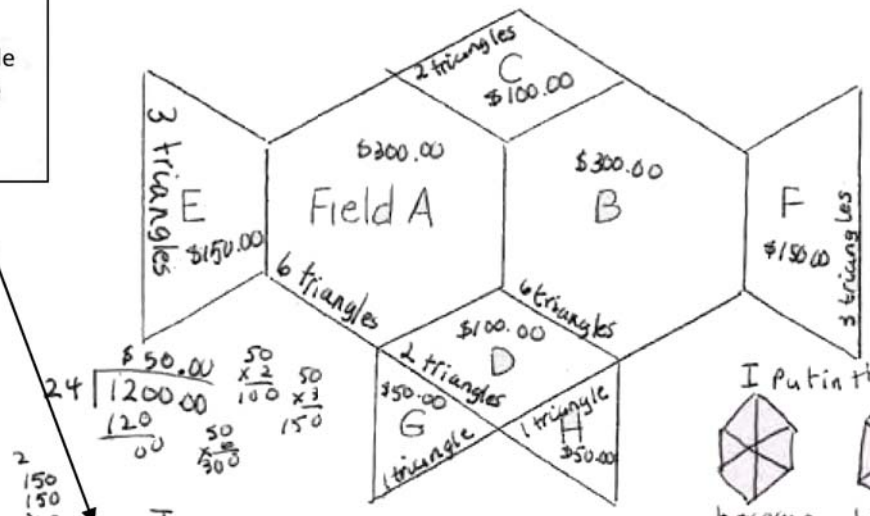
Grade 4 Math: Farmer Fred
Annotated Student Work

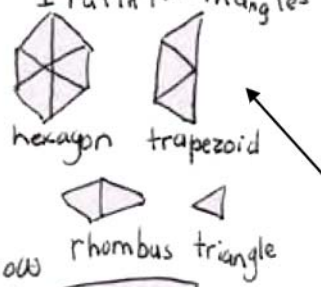
Grade 4

Name_____

Farmer Fred

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.





$50.00
24 | 1200.00
120
00

50 x 2 = 100
50 x 3 = 150
50 x 6 = 300

2
150
150
300
300
100
100
50
+ 50
1200

I will draw a diagram I have to find out how much each field is worth. So find how many triangles and divide into $1200.00 to get the answer.

Answer
Field EF $150.00
Field AB $300.00
Field CD $100.00
Field GH $50.00

page 1 of 1

The student correctly extends understanding of fraction equivalence and ordering (4. NF 1, 2), but does not build fractions from unit fractions by applying and extending previous understandings of operations on fractions (4.NF 3 a, b, d). The student uses operations with whole numbers to solve the second part of the problem (4.OA 2).

The student models with mathematics by accurately diagramming the shapes of the fields and providing all necessary labels.

The student uses precise mathematical language to support her/his viable argument. Some terms include the names of shapes, fraction and money notation.

The student does not reflect on her/his solution to make a connection about the structures, regularities, or trends in the problem.

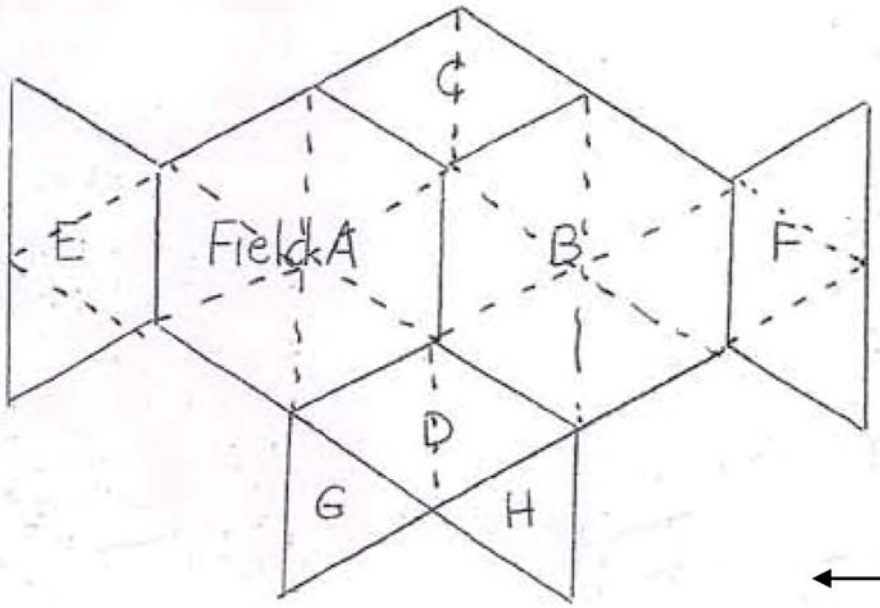
The student is able to make sense of most of the problem. The student applies fractional understanding by determining the correct number of triangles for each shape but does not label the fractional value of each field the triangles represent. The student finds the correct worth of each field.

Grade 4 Math: Farmer Fred
Annotated Student Work

Name_____

Farmer Fred

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.



I will find out the fraction and how much value each field is. I have to find how many sixths there are. I will use pattern Blocks to figure it out and the diagram.

page 1 of 2

The student is able to make sense and persevere in solving the problem. The student applies understanding of fractional parts of a whole in determining the correct fractional value of each field and applies correct number and operations thinking to find the correct worth of each field.

Grade 4 Math: Farmer Fred
Annotated Student Work

The student uses precise mathematical language to support her/his viable argument. Some terms include the names of the shapes, fraction and money notation.

The student correctly extends understanding of fraction equivalence and ordering (4. NF 1, 2), builds fractions from unit fractions by applying and extending previous understandings of operations on fractions (4.NF 3 a, b, d), and uses operations with whole numbers to solve the second part of the problem (4.OA 2).

$50.00
24 | $1200.00
-120
0
0

24
x5
120

50 50
x 6 2
300 100

the fields

field	shape	value	fraction
A	hexagon	$300.00	1/1
B	hexagon	$300.00	1/1
C	rhombus	$100.00	1/3
D	rhombus	$100.00	1/3
E	trapezoid	$150.00	1/2
F	trapezoid	$150.00	1/2
G	triangle	$50.00	1/6
H	triangle	$50.00	1/6

50
x 3
150

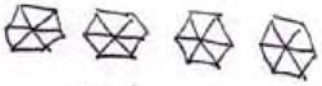
600
200
300
+100
1200

The student models with mathematics by using a table to indicate the fields, their shape, fractional value, and worth. All labels and data are correct.

answer 2

answer 1

Conections
I named the shapes
I see 24/6 ▲ equals 4 hexagons



24 triangles
is 4 hexagons

The student reasons quantitatively by making the connection, "I see 24/6 ▲ equals 4 hexagons."

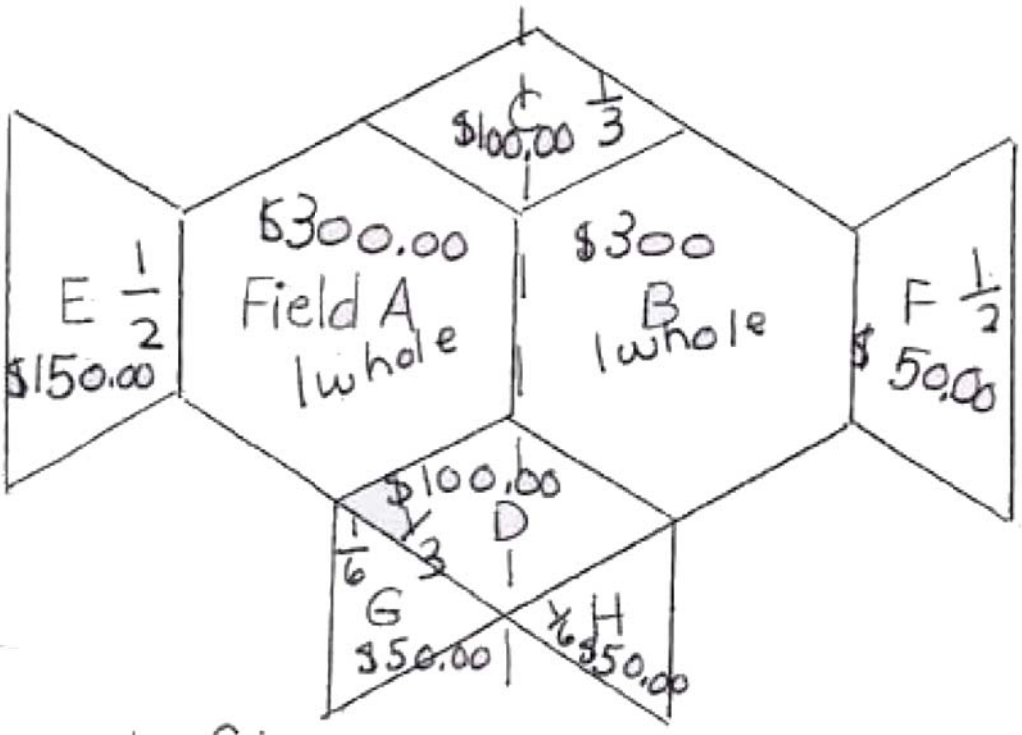
page 2 of 2

Grade 4 Math: Farmer Fred
Annotated Student Work

The student correctly extends understanding of fraction equivalence and ordering (4.nf1,2), builds fractions from unit fractions by applying and extending previous understadings of operations on fractions (4.nf 3.b.d) and uses operations with whole numbers to solve the second part of the problem (4.OA 2). The student also bring an understanding of symmetry to the problem (4,G), decimals (4NF 6), area (4.MD), and percents.

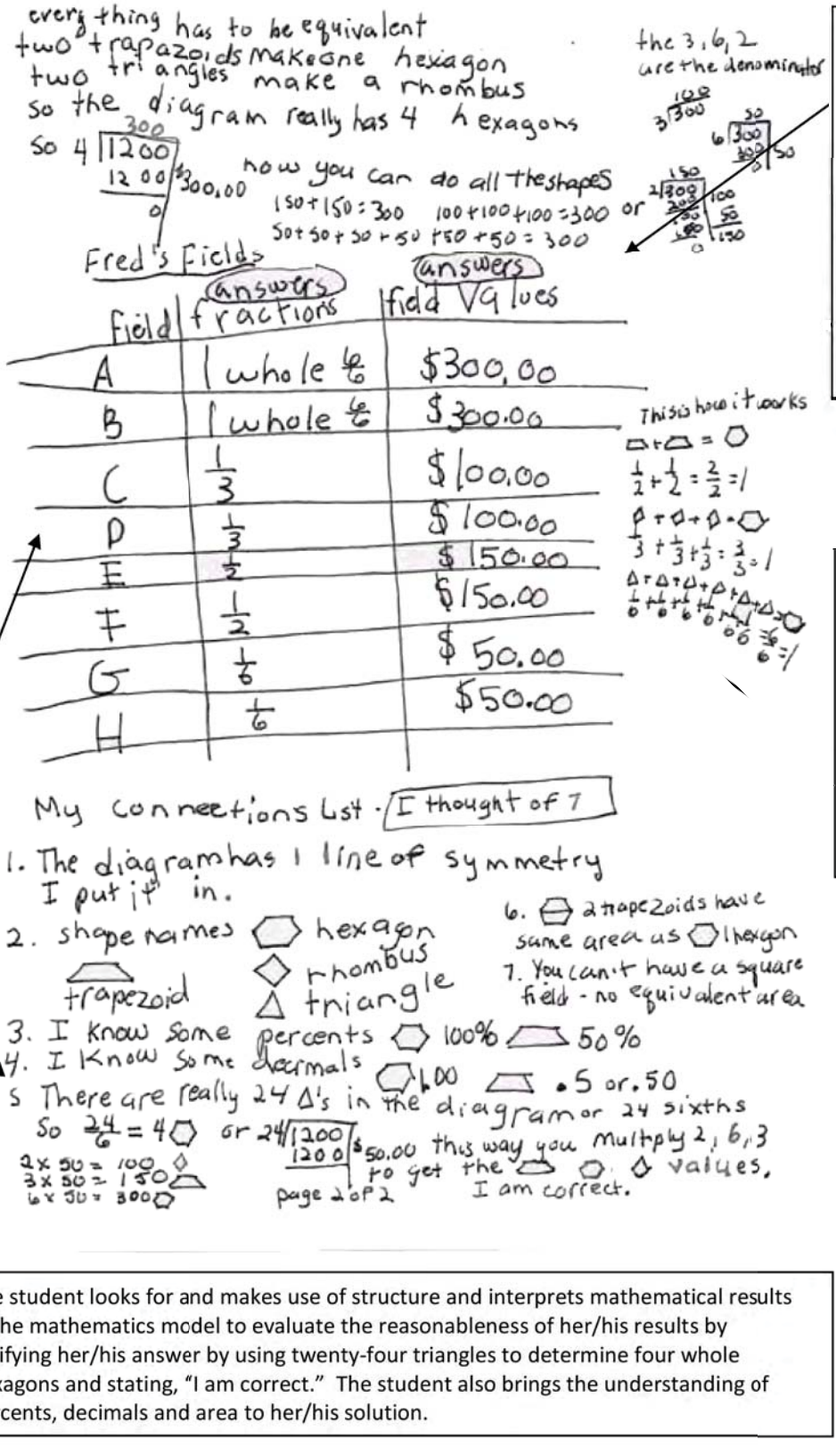
Farmer Fred

Farmer Fred's fields are worth twelve hundred dollars total. The fields are formed with the same properties as your pattern blocks. Each field's value is based on its size. What fraction of the total value is each field worth? How much is each field worth? Show and explain all of your mathematical thinking.



I have to figure out what the fields are worth and the fraction of the fields. You can't solve this problem if you don't know fractions. I will make a table and write the answers on it.

Grade 4 Math: Farmer Fred
Annotated Student Work



every thing has to be equivalent
two trapazoids make one hexagon
two triangles make a rhombus
so the diagram really has 4 hexagons
so 4 | 1200 (300) — 12 00 — 0 — $300.00
now you can do all the shapes
150+150=300 100+100+100=300 or
50+50+50+50+50+50=300

the 3, 6, 2 are the denominator

3 | 300 (100)
6 | 300 (50)
2 | 300 (150)
300 (100)
300 (50)
0

Fred's Fields

Field	answers fractions	answers field values
A	1 whole 6/6	$300.00
B	1 whole 6/6	$300.00
C	1/3	$100.00
D	1/3	$100.00
E	1/2	$150.00
F	1/2	$150.00
G	1/6	$ 50.00
H	1/6	$50.00

This is how it works
▱+△ = ⬡
1/2 + 1/2 = 2/2 = 1
◇ + △ + △ = ⬡
1/3 + 1/3 + 1/3 = 3/3 = 1
△+△+△+△+△+△ = ⬡
1/6 + 1/6 + 1/6 + 1/6 + 1/6 + 1/6 = 6/6 = 1

My connections list · I thought of 7

1. The diagram has 1 line of symmetry I put it in.
2. shape names ⬡ hexagon ◇ rhombus ▱ trapezoid △ triangle
3. I know some percents ⬡ 100% ▱ 50%
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5. There are really 24 △'s in the diagram or 24 sixths
   So 24/6 = 4⬡ or 24 | 1200 (50) — 1200 — 0 — $50.00 this way you multiply 2, 6, 3 to get the ▱ ⬡ △ values, I am correct.
   2 x 50 = 100 ◇
   3 x 50 = 150 ▱
   6 x 50 = 300 ⬡
6. ⬡ 2 trapezoids have same area as ⬡ 1 hexagon
7. You can't have a square field - no equivalent area

page 2 of 2

The student is able to make sense and persevere in solving the problem. The student applies correct understanding to determine the fractional value and worth of each field.

The student models mathematics by using a table and diagrams to indicate the fields, their fractional value and worth. All labels and data are correct. The student uses these results to extend thinking to decimals, percents, and area.

The student evaluates the reasonableness of her/his answer by applying a different property of operation.

The student uses precise mathematical language to support her/his viable argument. Some terms include the names of the shapes, area, and fraction, money, decimal, and percent notation.

The student looks for and makes use of structure and interprets mathematical results in the mathematics model to evaluate the reasonableness of her/his results by verifying her/his answer by using twenty-four triangles to determine four whole hexagons and stating, "I am correct." The student also brings the understanding of percents, decimals and area to her/his solution.

Tear-Off Sheet with Suggestions for Helping Students Access Information

Barrier to Learning	Suggested Strategy
Student lacks understanding of math language	Review domain specific vocabulary; create a picture dictionary with student.
Student lacks basic perimeter/area knowledge	Review prior lessons in perimeter and area; use manipulatives to explore perimeter/area concepts.
Students have problems in understanding math word problems (reading comprehension)	Use key words and "picture stories" to help students identify the appropriate operation.
	Build vocabulary through repeated classroom use and picture dictionary.
	Work on reading and understanding problems through modeling in small groups and peer-to- peer situations.
Student struggles with multi-step problems	Break the problem into smaller tasks, an understandable sequence.
Student struggles with writing explanations and math reasoning	Continued use of Math Journaling and Share Time in which classmates critique each other can help strengthen this. Explain to the student that written explanation takes the place of verbal communication and the reader needs to understand how you solve the problem.
Student struggles with creating a rectangle with a given perimeter.	Identify the perimeter of objects by measuring with a ruler. Develop skill through use of geoboard. Have student count each line drawn creating a rectangle.
Student struggles with identifying the area of a rectangle.	Provide multiple methods of find area: counting squares, repeated addition, composite units, multiplying the length and width.