

CCSS-Aligned Mathematical Task

The Brownie Sharing Problem, Grade 5

By Jennifer Stone, Alejandro Ramirez, Lavay Myles, Alicia Dorman,
Lissett Hernandez

Task

The Brownie Sharing Problem

Norma, Travis, Monica, and Jared are having a friendly baking competition to see who bakes the best brownies. Norma brought 12 brownies to share. Travis brought 6 brownies to share. Monica only brought 3 brownies because her brothers ate the rest. Jared was only able to bring 1 because unfortunately he burnt the entire brownie pan except for one brownie he was able to save.

If the four friends are going to be sharing their brownies with each other to see who bakes the best brownies, how can they share them equally? What fractional amount of brownie will each person get?

Solve the problem and justify your answer using words, pictures, number sentences, and/or models to explain your thinking.



Rationale for Lesson

The reason we chose to work on this particular standard is two fold: NF is a major domain for 5th grade, and 5.NF.3 has limited materials/lessons available based on our current Curriculum Map

*Note: This task is intended to be used as a culminating task. If you chose to use it as a concept lesson, it's recommended that each part of the task be separated and shared in parts.

CA Common Core State Standards for Content

5.NF.3 Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions, mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret $\frac{3}{4}$ as the result of dividing 3 by 4, noting that $\frac{3}{4}$ multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size $\frac{3}{4}$. If 9 people want to share a 50 pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*

CA Common Core State Standards for Mathematical Practice

MP 1 Make sense of problems and persevere in solving them.

- Find meaning in problems
- Look for entry points
- Analyze, conjecture and plan solution pathways
- Monitor and adjust
- Verify answers
- Ask themselves the question: "Does this make sense?"

MP 2 Reason abstractly and quantitatively.

- Make sense of quantities and their relationships in problems
- Learn to contextualize and decontextualize
- Create coherent representations of problems

MP 3 Construct viable arguments and critique the reasoning of others.

- Understand and use information to construct arguments
- Make and explore the truth of conjectures
- Recognize and use counterexamples
- Justify conclusions and respond to arguments of others

MP 4 Model with Mathematics.

- Apply mathematics to problems in everyday life
- Make assumptions and approximations
- Identify quantities in a practical situation
- Interpret results in the context of the situation and reflect on whether the results make sense

MP 6 Attend to precision.

- Communicate precisely to others

- Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes
- Calculate accurately and efficiently

MP 7 Look for and make use of structure

- Apply general mathematical rules to specific situations
- Look for the overall structure and patterns in mathematics
- See complicated things as single objects or as being composed of several objects

DOK Level: 3

Application- Level: DOK 3

- Use concepts to solve non-routine problems
- Use & show reasoning, planning, and evidence

Evaluation- Level: DOK 3

- Cite evidence and develop a logical argument for concepts or solutions
- Describe, compare, and contrast solution method
- Verify reasonableness of results

Enduring Understandings

- A fraction describes the division of a whole into equal parts, and it can be interpreted in more than one way depending on the whole to be divided.
- Connect fractions with division, understanding that $5 \div 3 = 5/3$ or, more generally, $a/b = a \div b$ for whole numbers a and b , with b not equal to zero
- Understand fractions as division of two whole numbers
- Understand that dividing two whole numbers (a divided by b) is the same as writing the fraction (a/b)
- Students solve related word problems and demonstrate their understanding using concrete

Materials Needed

Construction paper, grid paper, scissors, crayons, colored pencils, markers (Students are also able to use their normal math tools- tiles, counters, etc.)

Set-Up Phase

The goal of this lesson is to have students explore and find the relationship between division (a divided by b) and fractions (a/b) through the use of a real life problem. The task seeks to use the student's prior knowledge of division to discover the connection between division and fractions and to help them to generalize that new understanding.

- Solve the task prior to the lesson
- Make sure students have access to solving the task from the

beginning by:

- reading the problem to the students out loud as they follow along
- having students read the problem out loud with the teacher
- having students read the problem silently to themselves
- allowing students protected independent work time to solve the problem on their own
- providing talk time with students to discuss their thoughts and plan with an elbow partner
- giving students another opportunity to work independently
- allowing students more time to work with a different partner
- having the problem displayed on an overhead projector or black board so that it can be referred to as the problem is read.
- making certain that students understand the vocabulary used in the task (number line, interval, decimals)
- The terms that may cause confusion to students could be posted as the words come up

Universal Access Considerations

- For ELs and SWD students, it may be necessary to chunk the task into smaller workable pieces
- Develop a communication guide to assist those same EL and SLD students in communicating their solution paths with their classmates
- In the Set Up Phase, provide clarification to students with vocabulary and ensure all students understand the task themselves
- Provide manipulatives and tools for students to use should they choose to
- Be strategic in your grouping to allow all students the same success with the task
- Have students work with at least two different partners to allow them to have a variety of perspectives
- Question: How are you going to ensure students are giving sufficient and adequate opportunities to communicate with their groups/partners about the task? How will you provide for these opportunities?

Setting the Context for the Task

In prior grades, students learn to model division where the dividend is greater than the divisor and the quotient is usually a whole number with/or without a remainder. This problem seeks to use that experience and understanding to explore what happens when the dividend is smaller than the divisor, and through this process of discovery, find the relationship between a divided by b and a/b .

Activating Prior Knowledge

Have the students partner-share/create a circle map on the idea of “equal.” They could talk to their partners as they create their circle map and then share out. Teacher may add ideas to class circle map and discuss this idea of equal sharing.

Tell students to follow along as you read the problem.

Use a brace map with students, asking “What is the question asking?” and “What do we already know?” Another option is to pair-share before sharing out.

Explore Phase

- Students will get 5-7 minutes of private think time to generate ideas about the problem and solution, using grid paper, construction paper, and scissors to divide the brownies equally between friends.
- Circulate around the class as students work individually.
- After several minutes, tell students they may work with a partner or in their groups.
- Conversation skills: All students may be encouraged to share their solution paths with partners at their table group, focusing on building their ideas verbally (fortifying) and adjusting their ideas, based on the conversation. Students may be encouraged to compare and contrast their ideas with partners (negotiating). Please see attached Conversation Skills Place Mat
- Clarify any confusion they may have but do not tell them how to solve the problem. Examples may be: adding all the brownies together, assuming the brownies are all the same size.

Focusing Questions:

What are you being asked to find?

What do you know?

Have you ever had to share something when there were more people than things to share? What did you do?

What are some strategies you know to help you solve problems?

How might you use a picture to show the problem? How might you use the grid paper?

Possible Student Strategies	Assessing Questions	Advancing Questions
(Fair Share Model) Students might draw a picture of the brownies and then break each brownie up into the number of friends who are sharing it. Then give each friend a piece from each brownie until they are all distributed. After, they would count the number of pieces	What is the question that you are being asked to answer? How does your solution match the question “What fractional amount of each brownie does each friend get?” What does the number in	What is another way that you might solve this problem? What is an equation that matches your picture? How can you solve this

Possible Student Strategies	Assessing Questions	Advancing Questions
each person got.	your solution represent? How might you write your answer as a fraction?	problem using pictures/graph paper/numbers? What are some other ways that you might use numbers to solve this problem? In what ways are the different strategies that you used to solve the problem the same? How are they different?
(Fair Share with Division Model) Students might draw the number of brownies being shared as rectangles, cut the brownies into the number of people. Count the pieces and then divide by the number of friends sharing, then give each person that number of pieces.	How might division with whole numbers help you solve the problem?	How might you write an equation to show your thinking?
(Number Line Model) A student might draw a number line and divide each whole number into the number of friends and count the number of pieces that would make. Then count up to the number of friends, repeatedly until all the pieces are counted. Then give the	How did a number line help you solve the problem?	How might you write an explanation of your strategy so that someone else can try it?

Possible Student Strategies	Assessing Questions	Advancing Questions
first person all the number 1 pieces, etc.		
Misconception: (Fair Share the People) A student may try dividing the friends into equal pieces instead of the brownies.	What is being shared, the brownies or the friends? How can you represent the situation using a drawing or manipulatives?	
Misconception: Students might not answer the question “what fractional amount of the brownie will each friend get?” and instead answer, “How many pieces would each person get?”	What do the number of pieces represent in regards to each whole brownie?	

Share, Discuss, and Analyze Phase

The teacher orchestrates the discussion, allowing the students to discuss posted work using a projector. Possible questions:

- Talk with a neighbor about how this student solved the problem. What strategy was used?
- How do you explain this person’s thinking based on this solution?
- How do you know if the brownies are fairly shared?
- What patterns do you see with the other brownies?
- What connections can you make between your solution and another solution?
- What connections can you make between all/any of the solutions that were shared? (This is an opportunity to do the protocol “Clearer and Stronger” where the student talks to one partner to share their idea and listen to their partners, then the partners change for a second and third opportunity to make their idea clearer and stronger. Please see the attached protocol.)
- What do the fractions and division have in common?
- Based on our discussion today, what new understandings do we have around fractions?
- What have you learned that you might be able to use in other problem solving situations?

Application

(Apply the learning goals to another problem to give an opportunity to practice the learning, this could be discussion at the table, an exit ticket, a journal entry.)

What is 1 divided by 5?

What is 3 divided by 5?

What does $\frac{2}{3}$ represent?

What does $\frac{7}{8}$ represent?

Summary

(Include the key learning to ensure it is included in the debriefing of the lesson)
When we divide, the dividend can be smaller than the divisor, and in that case, the answer is a fraction, a/b .

Students can apply knowledge of division to discover the connection between division and fractions and to help them to generalize that new understanding.

Quick-Write

(Create a prompt that will provide the students with self-reflection time in their math journal)

Explain the steps you would take to divide 2 by 5. In context: What would happen if Lexus showed up with two brownies to share. How could Lexus share her brownies with Norma, Travis, Monica, Jared, and herself? Be sure to explain your process and provide pictures and/or models to prove your work.



The Brownie Sharing Problem

Norma, Travis, Monica, and Jared are having a friendly baking competition to see who bakes the best brownies. Norma brought 12 brownies to share. Travis brought 6 brownies to share. Monica only brought 3 brownies because her brothers ate the rest. Jared was only able to bring 1 because unfortunately he burnt the entire brownie pan except for one brownie he was able to save.

If the four friends are going to be sharing their brownies with each other to see who bakes the best brownies, how can they share them equally? What fractional amount will each person get?

Solve the problem and justify your answer using words, pictures, number sentences, and/or models to explain your thinking.



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Solve the problem and justify your answer using words, pictures, number sentences, and/or models to explain your thinking.

1. How could Norma share her 12 brownies equally?
What fractional amount will each person get?

2. How could Travis share his 6 brownies equally?
What fractional amount will each person get?

3. How could Monica share her 3 brownies equally?
What fractional amount will each person get?

4. How could Jared share his 1 brownie equally?
What fractional amount will each person get?

Stronger & Clearer Each Time Optional Activity Name _____

1. Topic:

My Initial Response:

Stronger & Clearer Each Time

- 1) Talk to at least 3 people. Each time you talk to a partner, take notes on what he/she says.
- 2) Each time you talk to a partner, you can build from and borrow the ideas and language of previous partners. Try to make your answer *stronger each time* with better evidence, examples, and explanations; and try to make your idea *clearer each time* by using a topic sentence, logical ways to organize and link sentences, and precise words.
- 3) At the end, write a final response to the topic. You can use ideas, evidence, or language you heard from your partners.

Question/Prompt:	
Partner #1's name: _____	<i>Ideas, evidence, and language from this person that will help my idea to be stronger and clearer:</i>
Partner #2's name: _____	<i>Ideas, evidence, and language from this person that will help my idea to be stronger and clearer:</i>

Partner #3's name: _____	<i>Ideas, evidence, and language from this person that will help my idea to be stronger and clearer:</i>
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At the end, write a final response to the topic on problem 3. You can use ideas, evidence, or language you heard from your partners.

My Final Response:

Maria Salazar #32
Oct 9, 2015



The Brownie Sharing Problem

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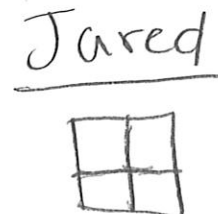
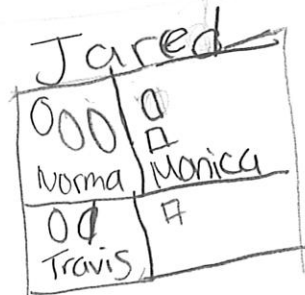
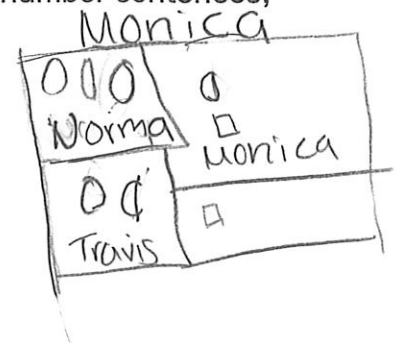
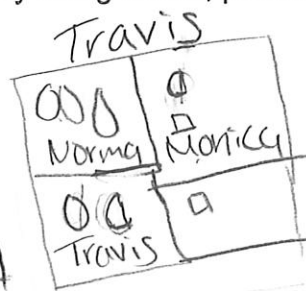
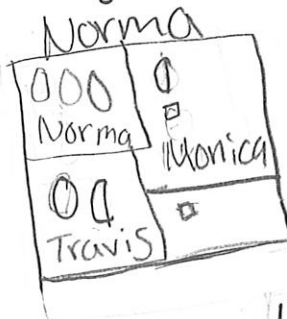
$$\text{Norma} = 12$$

$$\text{Travis} = 6$$

$$\text{Monica} = 3$$

$$\text{Jared} = 1$$

①



So, Norma will give 3 brownies, Travis will give $1\frac{1}{2}$ brownies, Monica will give $\frac{1}{2}$ and $\frac{1}{4}$, and Jared will give $\frac{1}{4}$.

room 14

Joscelyn Chavez 6
Oct 9, 2015



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① $\frac{1}{4}$ Jared = 1 brownie



② $\frac{1}{4}$ he can cut it in four pieces
③ $\frac{1}{4}$ Each get 25% of the brownie

Norma = 12 brownies

She can divide 12 brownies in four.

④ III ⑤ III ⑥ III ⑦ III

each gets three brownies.

$\begin{array}{r} 3 \\ \times 4 \\ \hline 12 \end{array}$

⑧ $\frac{1}{2}$ Travis = 6 brownies

⑨ $\frac{1}{2}$ She can do the same thing as Norma, he can divide by four.

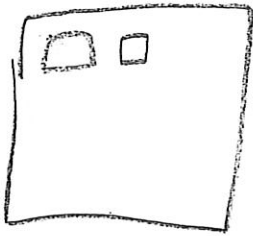
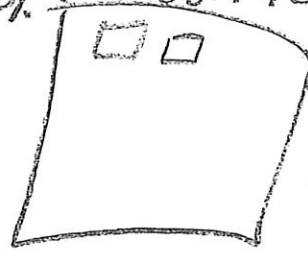
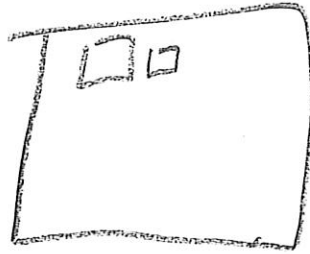
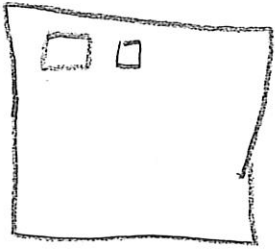
1 whole Brownie = $\square$
half a Brownie = $\square$

Travis continue

each get a Brownie and half
a brownie.

Monica = 3 brownies

half = $\square$
a brownie = $\square$
25% brownie = $\square$



each gets half
a brownie with

25% of a whole Brownie

She can cut 2 whole brownies
in half and the last one
in four pieces.



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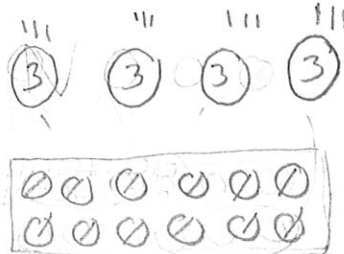
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4 friends

Norma = 12 b

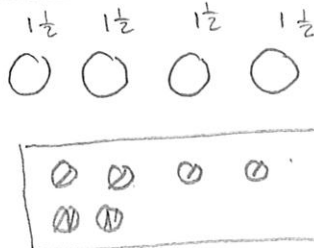
$$12 \div 4 = 3$$



Norma is going to share 3 equal brownies.

4 friends

Travis = 6 b

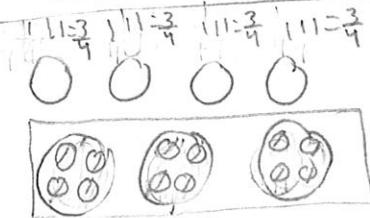


Travis is going to share $1\frac{1}{2}$ equal brownies

$$4 \overline{) 6} \begin{array}{r} 1.5 \\ 4 \times 1.5 = 6 \\ \hline 0 \end{array} \quad 1.5 = \frac{3}{2}$$

4 friends

Monica = 3

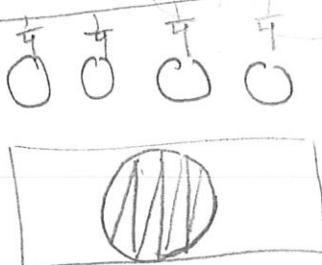


Monica is going to share $\frac{3}{4}$ or 3 pieces of brownies equally.

$$3 \overline{) 4} \begin{array}{r} 1.33 \\ 3 \times 1.33 = 3.99 \\ \hline 0.01 \end{array}$$

Jared = 1

4 friends



Jared is going to share $\frac{1}{4}$, or 1 piece of the brownie.

$$4 \overline{) 1} \begin{array}{r} 0.25 \\ 4 \times 0.25 = 1 \\ \hline 0 \end{array}$$



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Norma Monica's Brownies

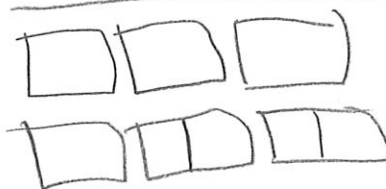
N	N	T	M	M	J
N	T	T	M	J	J

$$N=12 \quad T=6$$

$$M=3 \quad J=1$$

Brownies	N	T	M	J
1	2	2		
2	1 1/2	1 1/2		
3	3	3		
4	1 1/2	1 1/2		

Travis's Brownies



= 4 whole brownies
4 half T

Monica's Brownies

N	N	T	M	M	J
N	T	T	M	J	J

= 12 p

Jared's Brownie

M	J
T	N

= 4 p

So, Norma will get 3 of her brownies 1 1/2 of Travis's, 3 small pieces of Monica's and 1/2 of Jared's.

Monica's Plate

MB: $1\frac{1}{2}$ NB: 3 whole

TB: $\frac{3}{4}$ of a whole JB: $\frac{1}{4}$ of a whole

Norma's Plate

MB: $1\frac{1}{2}$ NB: 3 whole

TB: $\frac{3}{4}$ of a whole JB: $\frac{1}{4}$ of a whole

Travis's Plate

MB: $1\frac{1}{2}$ NB: 3 whole

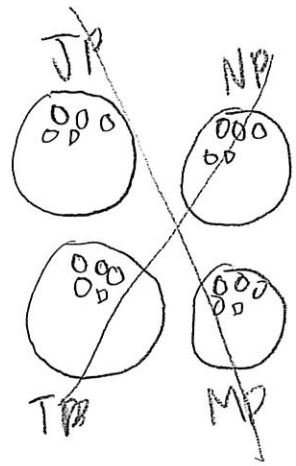
TB: $\frac{3}{4}$ of a whole JB: $\frac{1}{4}$ of a whole

Jared's Plate

MB: $1\frac{1}{2}$ NB: 3 whole

TB: $\frac{3}{4}$ of a whole JB: $\frac{1}{4}$ of a whole

N=12 M=6 T=3 J=1





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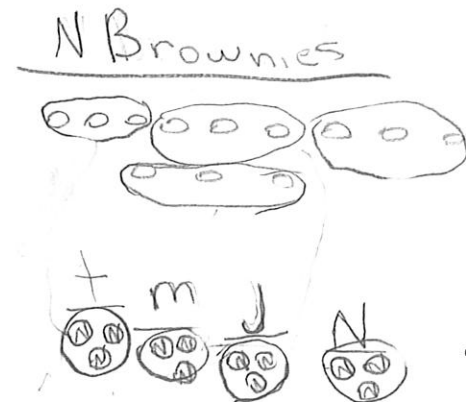
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$N = 12$ Brownies
 $T = 6$ Brownies
 $M = 3$ Brownies
 $J = 1$ Brownie

the girl T Brownies
 get 1 and
 1 half of

Brownies $\frac{T}{M}$ $\frac{M}{J}$ $\frac{J}{N}$



M Brownies



they
 all get
 one and
 one fourths
 of monica
 Brownie

$\frac{T}{M}$ $\frac{M}{J}$ $\frac{J}{N}$

J Brownie

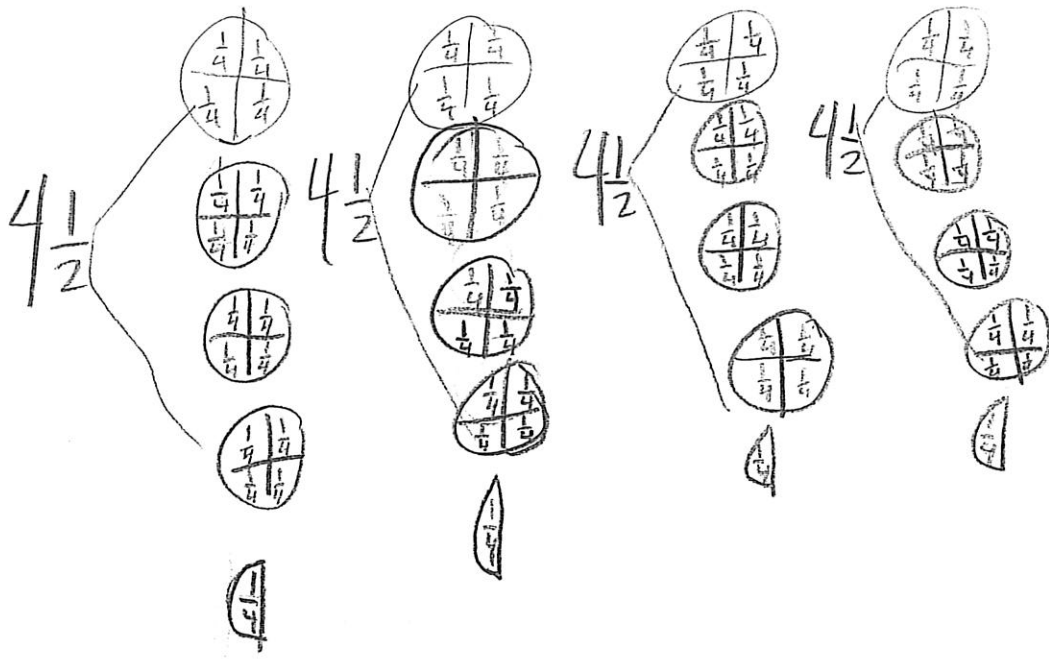


$\frac{T}{J}$ $\frac{M}{J}$ $\frac{J}{N}$

they all
 get one
 half of
 Jared
 Brownie

this is
 how much
 they would
 get equally from
 everybody

Emin Lopez.



It would be this because 409 could make wholes and halves. Also each one could get equal parts by making wholes and quarters of each.