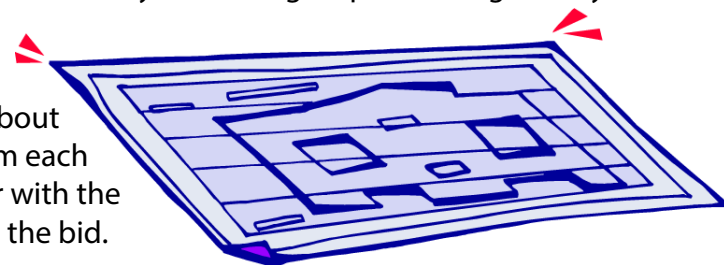


Extreme Fraction Makeover

Background: You are an independent site-development contractor. An eccentric customer wants a makeover for her backyard, and you hope to win the bid. Although she has an unlimited number of square tiles in four colors, this customer wants you to design a patio, using exactly 144 tiles in an attractive way.

Design Challenge: Working with your crew, design and build a patio in your customer’s backyard. The shape and pattern are up to you, but the customer has some definite ideas about the use of the colors, as listed under Criteria, below. She has also requested a full report from each crewmember on the use of her tiles when you are finished (see report form). The contractor with the most attractive design—and the correct answer on number 14 in the report form—will win the bid.



Criteria:

- You must use exactly 144 tiles.
- The border of the area must be made of red tiles, and the number of red border tiles must be 44, 46, or 48.
- The blue tiles will represent a swimming pool.
- In addition to red and blue tiles, you must use green and yellow tiles.
- Exactly $\frac{1}{3}$ of the 144 tiles must be green.
- In your presentation to the customer, you must (a) give a summary of the required report and (b) point out the finest qualities of your design to persuade the customer that your design is best.

Materials: Select items from **one** of the two lists below.

List 1	List 2
<ul style="list-style-type: none"> • cardboard or construction paper (12 by 18 inches) • glue • model tiles (1-inch square) in four colors 	<ul style="list-style-type: none"> • colored pencils (red, green, blue, and yellow) • graph paper on which to plan

Targeted Standard of Learning: Mathematics 5.6
Supporting SOL: Mathematics 5.2, 5.3, 5.8; English 5.1, 5.2

Targeted Standard for Technological Literacy: 11
Supporting STL: 1, 8, 9, 13, 20

Tips for Teachers

Targeted Standards of Learning:

Mathematics 5.6 The student will solve single-step and multistep practical problems involving addition and subtraction with fractions and mixed numbers and express answers in simplest form.

Supporting SOL: Mathematics 5.2, 5.3, 5.8; English 5.1, 5.2

Targeted Standards for Technological Literacy:

11 Students will develop the abilities to apply the design process.

Supporting STL: 1, 8, 9, 13, 20

Prior Knowledge & Skill	Materials & Preparation	Safety Issues	Class Management	Materials Provided	Design Process
<ul style="list-style-type: none"> Working with equivalent fractions, comparing and ordering fractions, and recognizing and naming fractions in their equivalent decimal form and vice versa Concepts of area and perimeter 	<ul style="list-style-type: none"> Prepare baggies of one-inch squares of construction paper in the four colors. Make sure the one-inch squares are accurately cut and that there is an adequate number of each color (perhaps 60) in each baggie to allow for the group's choices. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Groups of three The materials in List 1 provide for concrete modeling, while those in List 2 provide for more abstract sketching. Students should be given the choice. Allow enough graph paper per group for starting over. 	<ul style="list-style-type: none"> Design Brief Guided Portfolio (adapt as appropriate/optional) Rubric Assessments 	<p>Follow the Design Process:</p> <ul style="list-style-type: none"> Restate the problem. Brainstorm solutions. Create the best solution. Test the solution. Evaluate the solution.

Tips for Teachers, continued

Extension Ideas:

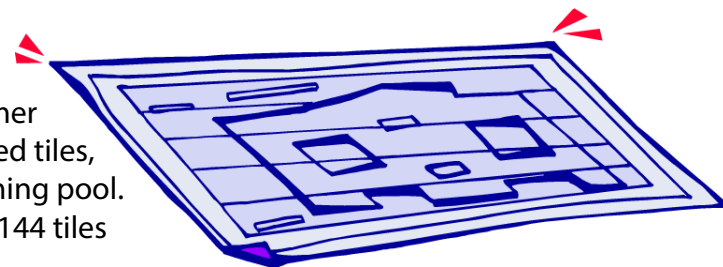
- Have students use the color tiles selected by their group in creating their design plan to make their own fraction questions.
- Have each team come up with multiple design plans.
- Have students design and create a piece of yard furniture to scale from select materials to put next to the pool.

Differentiation Option: For students with more advanced reading skills, the following page is provided as an alternative to page 1.

Extreme Fraction Makeover

Background: You are an independent site-development contractor. An eccentric customer wants a makeover for her backyard, and you hope to win the bid. Although she has an unlimited number of square tiles in four colors, this customer wants you to design a patio, using exactly 144 tiles in an attractive way.

Design Challenge: Working with your crew, design and build a patio in your customer’s backyard. The shape and pattern are up to you, but you must use exactly 144 tiles. The customer has some definite ideas about the use of the colors. The border of the area must be made of red tiles, and the number of red border tiles must be 44, 46, or 48. The blue tiles will represent a swimming pool. In addition to red and blue tiles, you must use green and yellow tiles. Exactly one-third of the 144 tiles must be green.



The customer has requested a full report from each crewmember on the use of her tiles when you are finished (see report form). In your presentation to the customer, you must (a) give a summary of the required report and (b) point out the finest qualities of your design to persuade the customer that your design is best. The contractor with the most attractive design—and the correct answer on number 14 in the report form—will win the bid.

Materials: Select items from **one** of the two lists below.

List 1	List 2
<ul style="list-style-type: none"> • cardboard or construction paper (12 by 18 inches) • glue • model tiles (1-inch square) in four colors 	<ul style="list-style-type: none"> • colored pencils (red, green, blue, and yellow) • graph paper on which to plan

Targeted Standard of Learning: Mathematics 5.6
Supporting SOL: Mathematics 5.2 a-b, 5.3 a-b, 5.8 a-b; English 5.1 a-e, 5.2

Targeted Standard for Technological Literacy: 11
Supporting STL: 1, 8, 9, 13, 20

Guided Portfolio, p1

Name _____

Group Members _____



1. What is the problem? State the problem in your own words.

Guided Portfolio, p2

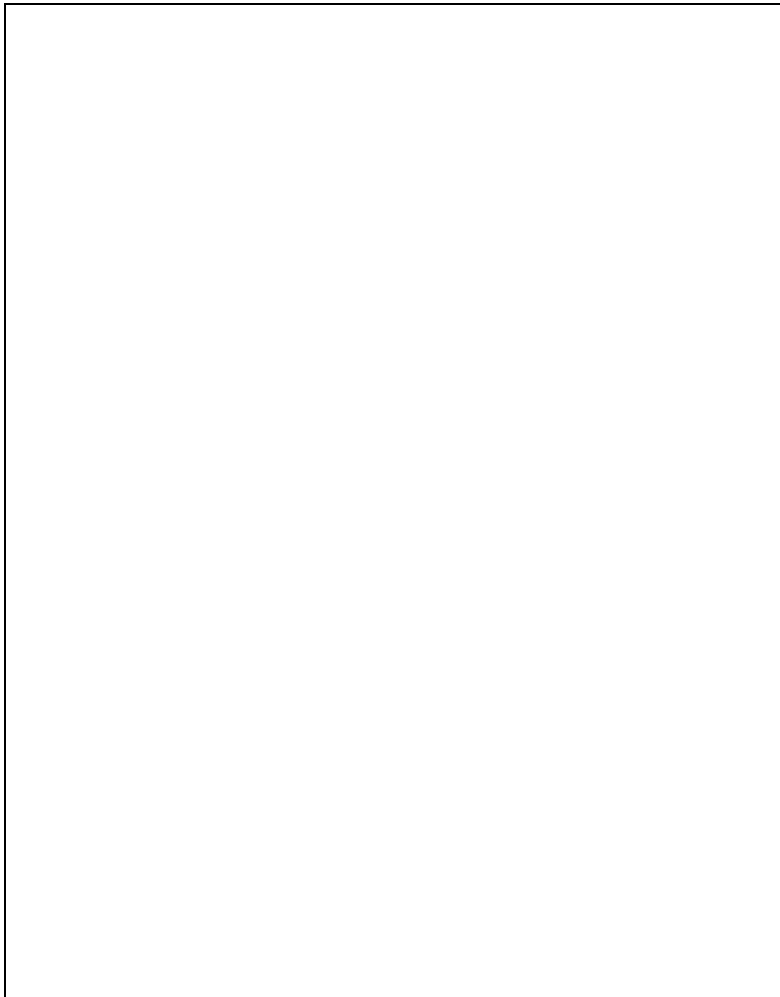
Name _____

2. Brainstorm solutions. Sketch and/or describe some possible solutions.

Name _____

3. Create the solution you think is best.

Keep notes about your problems and how you solve them. Make sketches if they help.



Guided Portfolio, p4

Name _____

4. Test your solution.

Did your crew use exactly 144 tiles?	YES	NO
Did you use 44, 46, or 48 red tiles as a border?	YES	NO
Did you use blue tiles to represent a swimming pool?	YES	NO
Did you use all four color tiles?	YES	NO
Are one-third of your tiles green?	YES	NO
Has your crew planned for a presentation to point out the best qualities of your design to the customer?	YES	NO
Have you done your paper work to present to the customer?	YES	NO

Guided Portfolio, p5

Name _____

5. Evaluate your solution.

Was your design the best solution? Would one of your other ideas have been better? Why, or why not?

What would you have done differently?

Could you add to it to make it better? What would you add to it?

Extreme Fraction Makeover Report to Customer

Use your group's design to answer these questions. Put all answers in simplified form.

1. How many tiles of each color did you use? Blue: _____ Green: _____ Red: _____ Yellow: _____ **Total: 144**
2. What is the ratio of yellow tiles to blue tiles? _____
3. What fraction of the 144 tiles are blue? _____
4. What fraction of the 144 tiles are yellow? _____
5. What fraction of the 144 tiles are green? _____
6. What fraction of the 144 tiles are blue and yellow? _____
7. What fraction of the 144 tiles are blue, red, and yellow? _____
8. What fraction of the 144 tiles are NOT green? _____
9. What decimal fraction of the 144 tiles are red? _____
10. What is the ratio of all the tiles to those tiles that are square in shape? _____

11. Is your design shaped like a rectangle? _____ If so, how many rows of tiles does it have? _____ How many columns of tiles does it have? _____
12. Is 144 a prime or composite number? _____
13. If each tile represents a one-foot-by-one-foot square, what is the perimeter of your design? _____
14. What is the difference between the number of tiles in the border and the number of one-foot segments that make up the perimeter? _____
15. Write a rule that expresses the relationship between the number of border tiles and the perimeter of the design. Why does it work? _____
16. Why should the customer pick your design over the others? _____

Rubric for Extreme Fraction Makeover

Name _____ Date _____

0—no evidence; 1—limited understanding; 2—some understanding with room for improvement; 3—good understanding with room for improvement; 4—substantial understanding

Design Brief Rubric	0	1	2	3	4
The student restated the problem in his/her own words.					
The student brainstormed more than one idea.					
The student kept notes and/or made sketches while creating a solution, to include problems and how they were solved.					
The student tested to make sure					
<ul style="list-style-type: none"> • the design uses exactly 144 tiles in four colors 					
<ul style="list-style-type: none"> • the border tiles are red and there are 44, 46, or 48 of them 					
<ul style="list-style-type: none"> • the blue tiles could be the shape of a swimming pool 					
<ul style="list-style-type: none"> • one-third of the tiles are green. 					
The student evaluated how he/she could make it better next time.					

Rubric for Extreme Fraction Makeover

Name _____ Date _____

0—no evidence; 1—limited understanding; 2—some understanding with room for improvement; 3—good understanding with room for improvement; 4—substantial understanding

Communication: Speaking, Listening, Media Literacy Rubric		0	1	2	3	4
5.1 The student will listen, draw conclusions, and share responses in subject-related group learning activities. a) Participate in and contribute to discussions across content areas. b) Organize information to present reports of group activities. c) Summarize information gathered in group activities. d) Communicate new ideas to others. e) Demonstrate the ability to collaborate with diverse teams. f) Demonstrate the ability to work independently.						
5.2 The student will use effective verbal and nonverbal communication skills to deliver planned oral presentations. a) Maintain eye contact with listeners. b) Use gestures to support, accentuate, and dramatize verbal message. c) Use facial expressions to support and dramatize verbal message. d) Use posture appropriate for communication setting. e) Determine appropriate content for audience. f) Organize content sequentially around major ideas. g) Summarize main points as they relate to main idea or supporting details. h) Incorporate visual media to support the presentation. i) Use language and style appropriate to the audience, topic, and purpose.						

Standards of Learning

English (2010)

Communication: Speaking, Listening, Media Literacy Rubric

- 5.1 The student will listen, draw conclusions, and share responses in subject-related group learning activities.
- Participate in and contribute to discussions across content areas.
 - Organize information to present in reports of group activities.
 - Summarize information gathered in group activities.
 - Communicate new ideas to others.
 - Demonstrate the ability to collaborate with diverse teams.
 - Demonstrate the ability to work independently.
- 5.2 The student will use effective verbal and nonverbal communication skills to deliver planned oral presentations.
- Maintain eye contact with listeners.
 - Use gestures to support, accentuate, and dramatize verbal message.
 - Use facial expressions to support and dramatize verbal message.
 - Use posture appropriate for communication setting.
 - Determine appropriate content for audience.
 - Organize content sequentially around major ideas.
 - Summarize main points as they relate to main idea or supporting details.
 - Incorporate visual media to support the presentation.
 - Use language and style appropriate to the audience, topic, and purpose.

Mathematics (2009)

Number and Number Sense

- 5.2 The student will
- recognize and name fractions in their equivalent decimal form and vice versa; and
 - compare and order fractions and decimals in a given set from least to greatest and greatest to least.
- 5.3 The student will
- identify and describe the characteristics of prime and composite numbers; and
 - identify and describe the characteristics of even and odd numbers.

Computation and Estimation

5.6 The student will solve single-step and multistep practical problems involving addition and subtraction with fractions and mixed numbers and express answers in simplest form.

Measurement

5.8 The student will

- a) find perimeter, area, and volume in standard units of measure;
- b) differentiate among perimeter, area, and volume and identify whether the application of the concept of perimeter, area, or volume is appropriate for a given situation;
- c) identify equivalent measurements within the metric system;
- d) estimate and then measure to solve problems, using U.S. Customary and metric units; and
- e) choose an appropriate unit of measure for a given situation involving measurement, using U.S. Customary and metric units.

Standards for Technological Literacy

Standard 1: Students will develop an understanding of the characteristics and scope of technology.

Standard 8: Students will develop an understanding of the attributes of design.

Standard 9: Students will develop an understanding of engineering design.

Standard 11: Students will develop the abilities to apply the design process.

Standard 13: Students will develop the abilities to assess the impact of products and systems.

Standard 20: Students will develop an understanding of and be able to select and use construction technologies.

Please give us some feedback.

Complete the form below to let us know how this design brief worked for you and your students. Please be specific so that we might use your suggestions to improve the activity. *You can fill this out on your computer, or you can print it, fill it out manually, and scan it.*

Teacher: _____

School: _____

School division: _____

Design brief title: _____

Background	<i>Put an X in the appropriate column:</i>	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Does it set the context for the activity?				
Is it age-appropriate in language, length, and complexity?				
Does it reference prior learning and/or research that the students did that will facilitate designing a solution to a problem?				
Is it detailed enough that an adult will understand the purpose for the design brief?				
COMMENTS. <i>If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.</i>				

Design Challenge	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Does the challenge support your curriculum?			
Is it age-appropriate in language, length, and complexity?			
Is it detailed enough that an adult will understand the purpose for the design brief?			
COMMENTS. <i>If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.</i>			

Criteria Criteria are part of the challenge. They set the limitations for the design. They are not directions.	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use	N/A
Are the limitations age-appropriate?				
Do the limitations encourage critical thinking?				
Is the application of mathematic knowledge/skills integrated into the criteria? If not, should the skill area be addressed?				
Is the application of science knowledge/skills integrated into the criteria? If not, should the skill area be addressed?				
Is the application of social studies knowledge/skills integrated into the criteria? If not, should the skill area be addressed?				
Are language skills integrated into the criteria? If not, should the skill area be addressed?				
COMMENTS. <i>If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.</i>				

Materials Materials help set the limitations for the design. The list should include materials that might work.	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use	N/A
Does the materials list encourage a variety of design solutions?				
Does the materials list include a variety of choices for joining items?				
Does the materials list include materials that force students to make decisions?				
COMMENTS. <i>If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.</i>				

Tools Tools can be used in the construction of the designed product. They are used to manipulate materials. They cannot become part of the product.	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Are the tools listed age appropriate?			
Are all tools needed for the activity included?			
COMMENTS. <i>If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.</i>			

Standards of Learning	Yes	No
Does the design brief reinforce the targeted Standard of Learning(s)?		
Are the supporting Standards of Learning appropriate?		
What Standards of Learning would you add or remove?		

Standards for Technological Literacy	Yes	No
Does the design brief reinforce the targeted Standard(s) for Technological Literacy?		
Are the supporting Standards for Technological Literacy appropriate?		
What Standards for Technological Literacy would you add or remove?		

Tips for Teachers	Yes	No
Are the tips listed in the chart helpful for a first-time teacher?		
What tips would you add?		

Guided Portfolio	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Are the instructions and questions age appropriate and clear?			
In the "Test your solution" section, do the questions force students to thoroughly test their solutions?			
In the "Evaluate your solution" section, do the questions force students to honestly evaluate their solutions			
COMMENTS. <i>If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.</i>			

<p>Additional Comments Please use this area to provide general suggestions for improving this design brief.</p>