Close Read: "Skateboard Science"

Grade 6, Unit 4

INTRODUCTION: This is a science article. It's a nonfiction piece about scientific subject.

You will *close read* this text and answer the questions on the following pages. Make sure to follow each of the directions below.

DIRECTIONS:

(1) **Get a sense of the gist.** Read the whole text from beginning to end one time to get a sense of what it's about.

(2) **Read Section 1 closely**. Reread just pages 489 to 490.

- ☐ Mark your starting and stopping points: Start at the beginning of the text. Stop after "Well ... I was glad it never came to those things."
- ☐ **While you reread**, circle any words that you don't know. Try to figure out what the words mean. Can you tell from context clues? Can you look it up? Can you ask someone?
- ☐ **After you reread**, write 1-2 sentences of what the section is mostly about. Write this in the space labeled "Section 1 Gist."
- ☐ **After you reread,** answer the Section 1 Questions. Write your answers in the chart.

(3) **Read Section 2 closely**. Reread just pages 491 to 492.

- ☐ Mark your starting and stopping points: Start at "We took the skateboard to the top of Magnolia Avenue, which was the street I lived on." Read to the end of the text.
- ☐ **While you reread**, circle any words that you don't know. Try to figure out what the words mean. Can you tell from context clues? Can you look it up? Can you ask someone?
- ☐ **After you reread**, write 1-2 sentences of what the section is mostly about. Write this in the space labeled "Section 2 Gist."
- ☐ **After you reread,** answer the Section 2 Questions. Write your answers in the chart.

(4) **Write about the text**. Read the question at the top of page 8.

- ☐ Complete the graphic organizer.
- ☐ Write your essay.
- ☐ Use the rubric to assess your rubric and write an explanation of why you graded it the way you did.

Section 1: pp. 489 – 490

What is the GIST of this section? (1-2 sentences)

____

____

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(1) Who are "the sidewalk surfers of the 30s, 40s, and 50s," and what was their mission" (page 489, lines 2-4)?	
(2) What do the authors mean by "skateboarders have a higher calling" (page 489, line 7)?	
(3) How are modern day skateboarders able to "defy the laws of physics" (page 489, lines 13-16)?	

(4) What is an ollie?	
(5) What is amazing about an ollie?	
(6) What are the three forces acting on a skateboard during an ollie?	

Section 2: pp. 491 – 492

What is the GIST of this section? (1-2 sentences)

____

____

____

____

(7) Explain the purpose of the arrows in the skateboarding graphics on pages 491-492.	
(8) Why does a skateboarder need to crouch down when performing an ollie?	
(9) What happens to the board when the skater uses his rear foot to exert more force than his front foot during the jump?	

(10) What happens to the board in graphic two when the tail strikes the ground (page 491)?	
(11) In graphic three, how does the skater "drag the board upward even higher" (page 491, line ___)?	
(12) What does "seemingly stuck together" mean in graphic four (page 491)?	
(13) Explain the role of gravity in landing an ollie.	
(14) How do the words in the glossary help you explain what an ollie is (page 492)?	

Write About the Text

DIRECTIONS: Use the chart to record evidence from the text about the changing forces that go into doing an ollie.

Force	How the Force Contributes to an Ollie

Prompt: Write an essay in which you analyze the changing forces that go into doing an ollie. Use evidence from the text to support your response.

DIRECTIONS: Use the rubric below to *assess* (grade) your essay. Mark the grade you would give yourself in each row. Then, write an explanation for why you assessed yourself the way you did.

Grades 6-8 English Language Arts Essay Rubric

Idea Development	
• **QUALITY AND DEVELOPMENT OF CENTRAL IDEA *** • **SELECTION AND EXPLANATION OF EVIDENCE AND/OR DETAILS *** • **ORGANIZATION** • **EXPRESSION OF IDEAS** • **AWARENESS OF TASK AND MODE**	
5	• Central idea is insightful and fully developed • Skillful selection and explanation of evidence and/or details • Skillful and/or subtle organization • Rich expression of ideas • Full awareness of the task and mode
4	• Central idea is clear and well-developed • Effective selection and explanation of evidence and/or details • Effective organization • Clear expression of ideas • Full awareness of the task and mode
3	• Central idea is general and moderately developed • Appropriate selection and explanation of evidence and/or details • Moderate organization • Adequate expression of ideas • Sufficient awareness of the task and mode
2	• Central idea may be present and is somewhat developed • Limited selection and explanation of evidence and/or details • Limited organization • Basic expression of ideas • Partial awareness of the task and mode
1	• Central idea is not developed • Insufficient evidence and/or details • Minimal organization • Poor expression of ideas • Minimal awareness of the task and mode
0	• The response shows evidence the student has read the text, but does not address the question or incorrectly responds to the question.

Standard English Conventions	
• **SENTENCE STRUCTURE** • **GRAMMAR, USAGE, AND MECHANICS**	
3	• Consistent control of a variety of sentence structures relative to length of essay • Consistent control of grammar, usage and mechanics relative to complexity and/or length of essay
2	• Mostly consistent control of sentence structures relative to length of essay • Mostly consistent control of grammar, usage, and mechanics relative to complexity and/or length of essay
1	• Little control and/or no variety in sentence structure and/or • Little control of grammar, usage, and mechanics relative to complexity and/or insufficient length
0	• Sentences are formed incorrectly with no control of grammar, usage and mechanics and/or insufficient length.

Explain why you assessed (graded) yourself the way you did. Make sure to give examples from your essay to back up your assessment.

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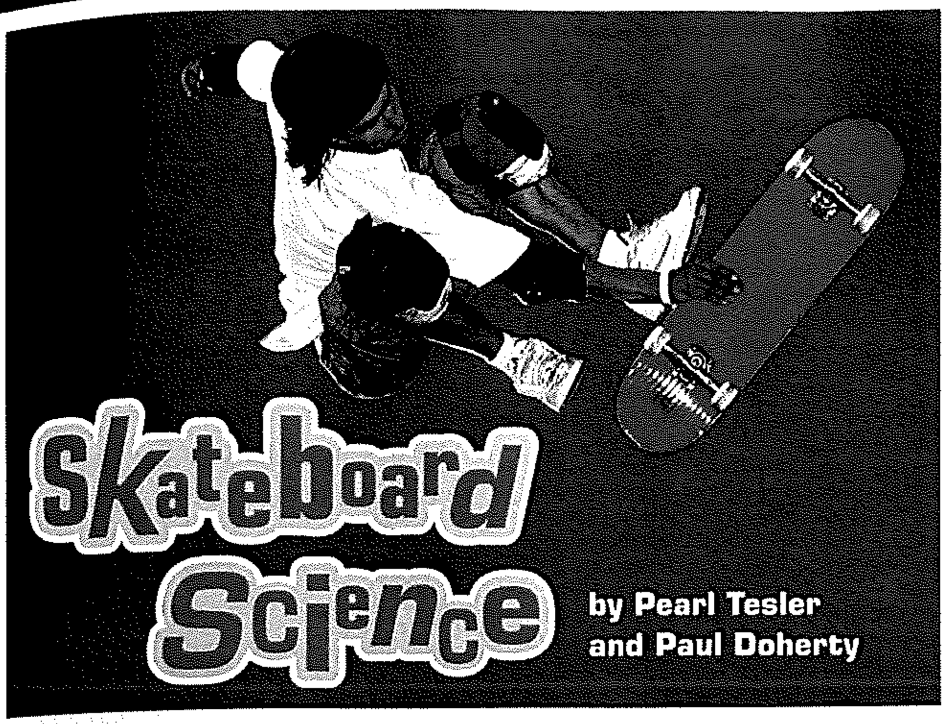

Skateboard Science

by Pearl Tesler and Paul Doherty

In the Beginning, Skateboarding Was Simple. . . . A

With nothing more than a two-by-four on roller-skate wheels, the sidewalk surfers of the 30s, 40s, and 50s had a straightforward mission: Start at the top of a hill and ride down. The primary goal was just to stay on and avoid collisions; given the humble equipment and rough road conditions, it was no small challenge. Now, thanks in part to improvements in design and materials, skateboarders have a higher calling.

In a blur of flying acrobatics, skaters leap and skid over and onto obstacles, executing flips and turns of ever increasing complexity—all at top speeds. For onlookers and beginners, it can be hard to follow the action, let alone answer the question that springs naturally to mind: How on earth do they do that? While it may seem that modern skateboarders are defying the laws of physics, the truth is that they're just using them to their advantage. Let's take a closer look at a fundamental skateboarding move and the physics principles behind it.

FOCUS ON FORM
A science article is a short piece of nonfiction on a scientific subject. The author's purpose for writing a science article is usually to inform or explain. Science articles often use illustrations to clarify ideas and information.

A USE TEXT FEATURES
Preview the **title, subheadings,** and **illustrations.** Based on these text features, what do you think you will learn from this article?

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B TAKE NOTES
Use the article's subheadings as topics for notes, leaving space beneath them. Then, as you read, jot down key information about the topics in the appropriate spaces.

Jumping: The Ollie B

Invented in the late 1970s by Alan "Ollie" Gelfand, the ollie has become a skateboarding fundamental, the basis for many other more complicated tricks.

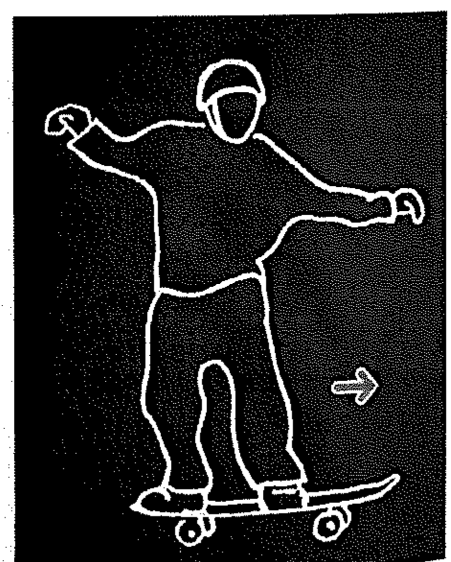
In its simplest form, the ollie is a jumping technique that allows skaters to hop over obstacles and onto curbs. What's so amazing about the ollie is the way the skateboard seems to stick to the skater's feet in midair. Seeing pictures of skaters performing soaring four-foot ollies, many people assume that the board is somehow attached to a skater's feet. It's not. What's even more amazing about the ollie is that to get the skateboards to jump up, the skaters push down on the board! . . . Let's take a closer look.

Forces in the Ollie

Imagine a skater rolling along a flat surface. As he does so, there are three forces acting on the skateboard. One of these forces is the weight of the rider. Another is the force of gravity on the board itself. The third is the force of the ground pushing up on the skateboard. Since these three forces balance out to zero, the skateboard doesn't speed up or slow down. It rolls along at a constant speed. C

C SCIENCE ARTICLE
Why do you need to read lines 30–36 to fully understand the illustration?

As the skater gets ready to perform an ollie, he crouches down. This will help him jump high when the time comes. (Don't believe it? Stand perfectly straight and try jumping without crouching . . . you didn't get very high, did you?) Now let's follow the changing forces that go into making an ollie.



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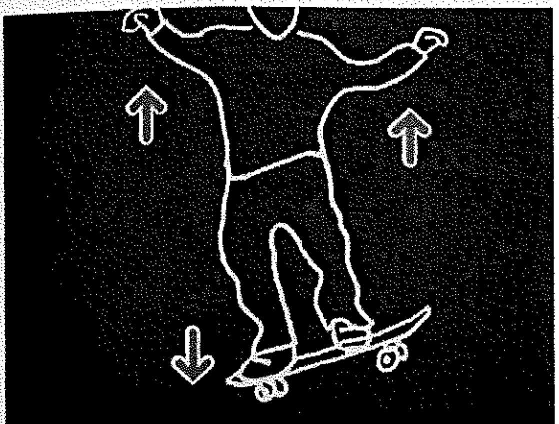
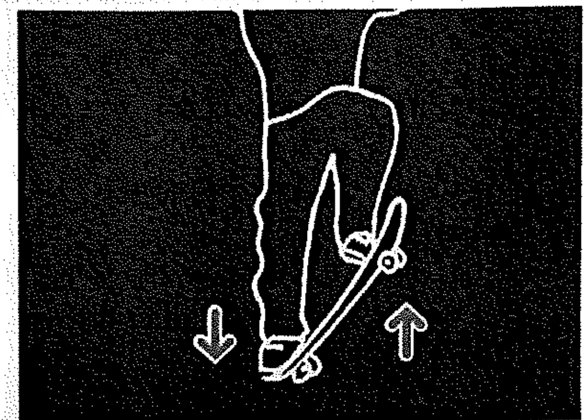
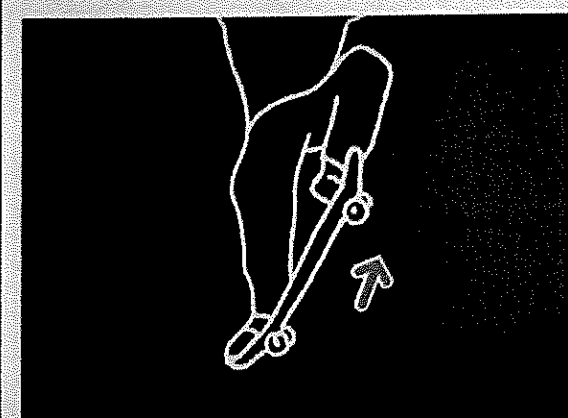


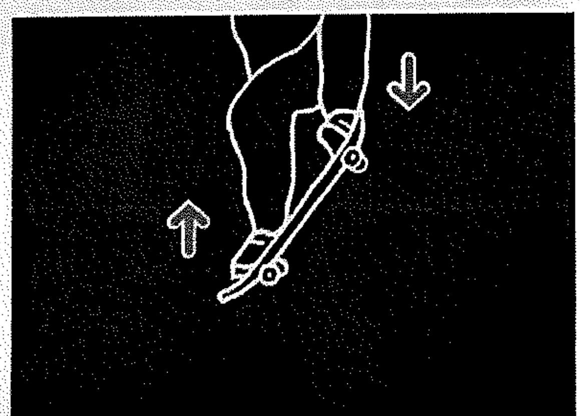
1 The skater pushes himself upward by explosively straightening his legs and raising his arms. During the jump, his rear foot exerts a much greater force on the tail of the board than his front foot does on the nose. This causes the board to pivot counterclockwise about the rear wheel, which means the tail of the board touches the ground. D



2 As the tail strikes the ground, the ground pushes back. The result of this upward force is that the board bounces up and begins to pivot clockwise, this time around its center of mass, which is the center of the board.



3 With the board now completely in the air, the skater slides his front foot forward, using the friction between his foot and the rough surface of the board to drag the board upward even higher.



4 The skater then begins to push his front foot down, raising the rear wheels and leveling out the board. Meanwhile, he lifts his rear leg to get it out of the way of the rising tail of the board. If he times this motion perfectly, his rear foot and the rear of the board rise in perfect unison, seemingly "stuck" together.

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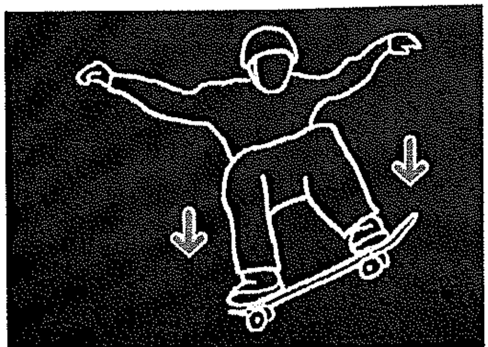
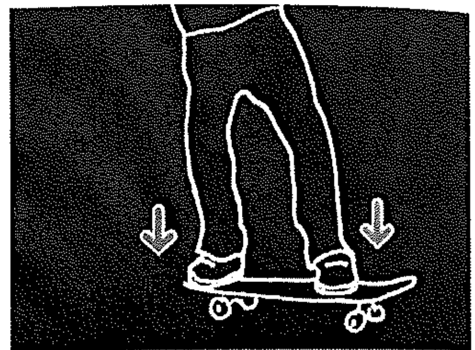
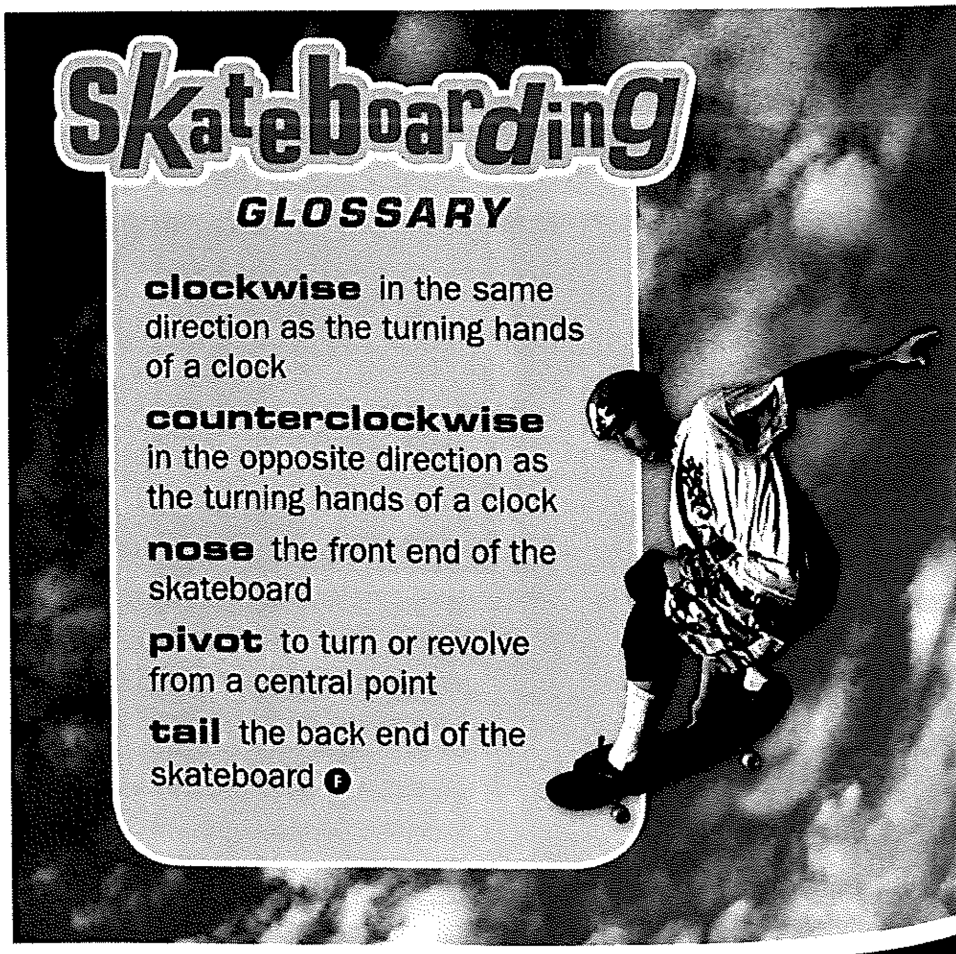


⑤ The board is now level at its maximum height. With both feet touching the board, the skater and board begin to fall together under the influence of gravity.



⑥ Gravity eventually wins out and the skater bends his legs to absorb the impact of the landing. **E**

E STEPS IN A PROCESS
Notice how many steps there are in an ollie according to this article. Be sure to restate the same number of steps in your chart.



Skateboarding

GLOSSARY

clockwise in the same direction as the turning hands of a clock

counterclockwise in the opposite direction as the turning hands of a clock

nose the front end of the skateboard

pivot to turn or revolve from a central point

tail the back end of the skateboard **F**

F SCIENCE ARTICLE
Why might the authors have chosen to include a glossary of terms with this article?

GR 6
WK 2

4.2 More Than One Way to Say It
Equivalent Expressions II

A group of students worked on the ladder problem. Four of them came up with equations relating the number of steel pieces P to the number of squares n.

Tabitha: $P = n + n + n + 1$	Chaska: $P = 1 + 3n$
Latrell: $P = 4n$	Eva: $P = 4 + 3(n - 1)$

Recall that groups of mathematical symbols such as $n + n + n + 1$, $1 + 3n$, $4n$, and $4 + 3(n - 1)$ are called *algebraic expressions*. Each expression represents the value of the dependent variable P. When two expressions give the same results for every value of the variable, they are called **equivalent expressions.**

Which expressions for P are equivalent? Explain why.

Problem 4.2

A 1. What thinking might have led the students to their ideas?

2. Do the four equations predict the same numbers of steel pieces for ladders of any height n? Test your ideas by comparing values of P when $n = 1, 5, 10$, and 20.

3. Which of the expressions for the number of steel pieces in a ladder of n squares are equivalent? Explain why.

4. Are any of the expressions equivalent to your own from Problem 4.1? How can you be sure?

B 1. Think about building a tower of cubes. Write two more expressions that are equivalent to the expression you wrote in part (2) of Question B in Problem 4.1. Explain why they are equivalent.

2. Pick two equivalent expressions from part (1). Use them to generate a table and graph for each. Compare the tables and graphs.

ACE Homework starts on page 100.

4.3 Putting It All Together

Equivalent Expressions III

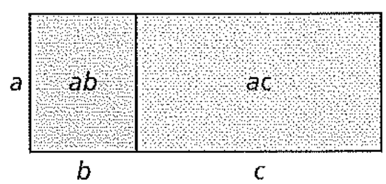
In an expression such as $1 + 3n$, the 1 and the $3n$ are called **terms** of the expression. In the expression $4 + 3(n - 1)$ there are 2 terms, 4 and $3(n - 1)$. Note that the expression $(n - 1)$ is both a factor of the term $3(n - 1)$ and a difference of two terms. The 3 is the **coefficient** of n in the expression $1 + 3n$.

The Distributive Property helps to show that two expressions are equivalent. It states that for any numbers a, b, and c the following is true:

$$a(b + c) = ab + ac$$

This means that:

- A number can be expressed both as a product and as a sum.
- The area of a rectangle can be found in two different ways.



The expression $a(b + c)$ is in *factored form.*

The expression $a(b) + a(c)$ is in *expanded form.*

The expressions $a(b + c)$ and $ab + ac$ are *equivalent expressions.*

- Use the Distributive Property to write an equivalent expression for $5x + 6x$.
- How does this help write an equivalent expression for $n + n + n + 1$?

With their plans almost complete, the Ocean Bike Tours partners have made a list of tour operating costs.

Tour Operating Costs (OCEAN BIKE TOURS)	
• Bike rental	\$30 per person
• Food and campsite	\$120 per person
• Rental of a bus and a trailer for bikes	\$1,000

- What equation can represent the total costs?
- Is there more than one possible equation? Explain.

Problem 4.3

The next step in planning is to write these costs as algebraic expressions.

A What equations show how the three cost variables depend on the number of riders n?

1. bike rental $B = \square$
2. food and campsite fees $F = \square$
3. rental of the bus and trailer $R = \square$

B Three of the business partners write equations that relate total tour cost C to the number of riders n:

Celia's equation: $C = 30n + 120n + 1000$

Theo's equation: $C = 150n + 1000$

Liz's equation: $C = 1150n$

1. **a.** Are any or all of these equations correct? If so, are they equivalent? Explain why.

   b. For the equations that are correct, explain what information each term and coefficient represents in the equation.

Problem 4.3 continued

2. Compare the equations. Use Order of Operations guidelines to complete the table below of sample (n, C) values. What does the table suggest about which expressions for C are equivalent?

Operating Cost Related to Number of Customers

Number of Customers n	5	10	15	20	25
$C = 30n + 120n + 1000$	■	■	■	■	■
$C = 150n + 1000$	■	■	■	■	■
$C = 1150n$	■	■	■	■	■

3. What results would you expect if you were to graph the three equations below?

$$C = 30n + 120n + 1000$$

$$C = 150n + 1000$$

$$C = 1150n$$

Check your ideas by graphing.

4. Use properties of operations such as the Distributive Property to show which expressions for cost are equivalent.

C 1. For each expression below, list the terms and the coefficient in each term.

a. $5x + x + 6$ **b.** $10q - 2q$

2. Use the properties of operations to write an equivalent expression for each expression above.

3. Show that $1 + 3n = 4 + 3(n - 1)$.

D Sidney points out that all three partners left out the cost of the Wild World Amusement Park trip. The cost for that part of the tour is $W = 50 + 10n$. How does this cost factor change each correct equation?

ACE Homework starts on page 100.

4.4 Finding the Unknown Value
Solving Equations

The Ocean Bike Tours partners decide to charge $350 per rider.
This leads them to an equation giving tour income I for n riders: $I = 350n$.
You can use the equation to find the income for 10 riders.

$$I = 350n$$

$$I = 350 \times 10$$

$$I = 3{,}500$$

Suppose you are asked to find the number of riders needed to reach a tour income goal of $4,200. In earlier work you used tables and graphs to estimate answers. You can also use the equation: $4{,}200 = 350n$.

Solving the equation means finding values of n that makes the equation $4{,}200 = 350n$ a true statement. Any values of n that work are called **solutions of the equation.**

One way to solve equations is to think about the fact families that relate arithmetic operations. Examples:

$5 + 7 = 12$
$5 = 12 - 7$

Both equations describe true relationships between 5, 7, and 12.

$5(7) = 35$
$5 = 35 \div 7$

Both equations describe true relationships between 5, 7, and 35.

- How are fact families helpful to solve equations such as $c = 350n$?

When you find the solution of an equation, it is always a good idea to check your work.

Is $n = 12$ a solution for $4{,}200 = 35n$?

Substitute 12 for n: $4{,}200 = 35(12)$.

Is this a true statement?

Multiplying 35 by 12 equals 4,200.

Yes, 12 is the solution.

Problem 4.4

A Single admissions at Wild World Amusement Park cost $21. If the park sells n single admissions in one day, its income is $I = 21n$.

1. Write an equation to answer this question: How many single admissions were sold on a day the park had income of $9,450 from single admissions?
2. Solve the equation. Explain how you found your answer.
3. How can you check your answer?

B On the Ocean Bike Tours test run, Sidney stopped the van at a gas station. The station advertised 25 cents off per gallon on Tuesdays.

1. Write an equation for the Tuesday discount price d. Use p as the price on other days.
2. Use the equation to find the price on days other than Tuesday if the discount price is $2.79.

C Ocean Bike Tours wants to provide bandanas for each person. The cost of the bandanas is $95.50 for the design plus $1 per bandana.

1. Write an equation that represents this relationship.
2. Use the equation to find the cost for 50 bandanas.
3. Use the equation to find the number bandanas if the total cost is $116.50.

In Questions A–C you wrote and solved equations that match questions about the bike tour. Knowing about the problem situation often helps in writing and solving equations. But the methods you use in those cases can be applied to other equations without stories to help your reasoning.

D Use ideas you've learned about solving equations to solve the equations below. Show your calculations. Check each solution in the equation.

1. $x + 22.5 = 49.25$
2. $37.2 = n - 12$
3. $55t = 176$

ACE Homework starts on page 100.

4.5 It's Not Always Equal

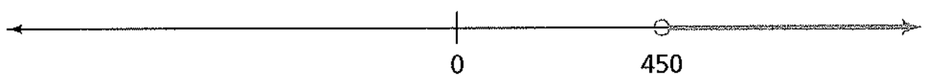
Solving Inequalities

In each part of Problem 4.4 you wrote and solved an equation about Ocean Bike Tours. For example, you wrote the equation $21I = C$. Then you were told that income was \$9,450. You solved the equation $21I = 9{,}450$ to find the number of riders. The solution was $I = 450$.

Suppose you were asked a related question: How many single-admission sales will bring income of more than \$9,450?

To answer this question, you need to solve the inequality $21I > 9{,}450$. That is, you need to find values of the variable I that make the given inequality true. This task is very similar to what you did when comparing rental plans offered by the two bike shops in Problem 2.1.

If $21I = 9{,}450$, then $I = 450$. So, any number $I > 450$ is a solution to the inequality $21I > 9{,}450$. A graph of these solutions on a number line is:



- What are five possible solutions for I?
- What are five more possible solutions for I?
- How many possible solutions does this inequality have?

In general, the solution to a simple inequality can be written in the form $x > c$ or $x < c$. Those solutions can be graphed on a number line. Below are two examples.

$x > c$

$x < c$

- What does the thicker part of each number line tell you about solutions to the inequality?

Problem 4.5

Use what you know about variables, expressions, and equations to write and solve inequalities that match Questions A–C. In each case, do the following.

- Write an inequality that helps to answer the question.
- Give at least 3 specific number solutions to the inequality.
  Then explain why they work.
- Describe all possible solutions.

A The bungee jump at Wild World charges \$35. How many jumpers are needed for the jump to earn income of more than \$1,050 in a day?

B A gas station sign says regular unleaded gasoline costs \$4 per gallon. How much gas can Mike buy if he has \$17.50 in his pocket?

C Ocean Bike Tours wants to provide bandanas for each customer. The costs are \$95.50 for the design plus \$1 per bandana. How many bandanas can they buy if they want the cost to be less than \$400?

D Use ideas about solving equations and inequalities from Questions A, B, and C to solve the inequalities below.

1. $84 < 14m$
2. $55t > 176$
3. $x + 22.5 < 49.25$
4. $37.2 > n - 12$

E Draw number lines to graph the solutions to all inequalities in Question D.

F
1. Make up a problem that can be represented by the equation $y = 50 + 4x$.
2. Which of these points lie on the graph of the equation? (8, 92), (15, 110)
3. Use a point that lies on the graph to make up a question that the point can answer.
4. Use a point that lies on the graph to write an inequality that the point satisfies.

ACE Homework starts on page 100.

CONNECTED MATHEMATICS® 3

Covering and Surrounding

Also available in interactive, mobile Dash format on Teacher Place.

Two-Dimensional Measurement

Lappan, Phillips, Fey, Friel

Investigation 1

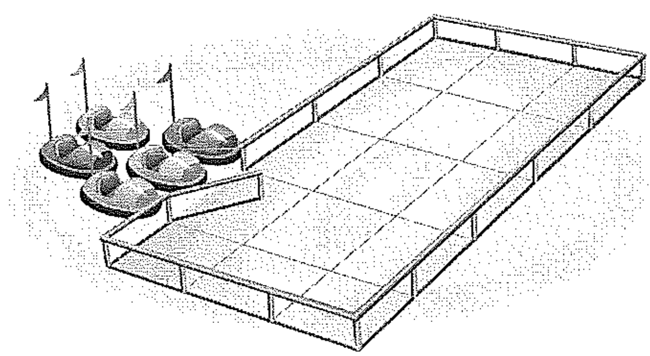
Designing Bumper Cars: Extending and Building on Area and Perimeter

Most people enjoy rides at amusement parks and carnivals such as merry go rounds, Ferris wheels, roller coasters, and bumper cars. A company called Midway Amusement Rides (MARS for short) builds rides for amusement parks and carnivals. To do well in their business, MARS designers have to use mathematical thinking.

1.1 Designing Bumper-Car Rides

Area and Perimeter

Bumper cars are a popular ride at amusement parks and carnivals. Bumper cars ride on a smooth floor with bumper rails surrounding it. MARS makes their bumper-car floors from 1 meter-by-1 meter square tiles. The bumper rails are built from 1 meter sections.



Common Core State Standards

6.NS.C.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane . . .

6.EE.A.3 Apply the properties of operations to generate equivalent expressions.

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

Also 6.EE.A.2, 6.EE.A.2a, 6.EE.A.2c, 6.EE.B.6, 6.G.A.1

Two measures tell you important facts about the size of the bumper-car floor plans. The number of tiles needed to cover the floor is a measure of **area.** The number of rail sections needed to surround the floor is a measure of **perimeter.** The bumper-car floor you just saw had the shape of a rectangle. Next, you will see bumper-car floors that are not rectangles.

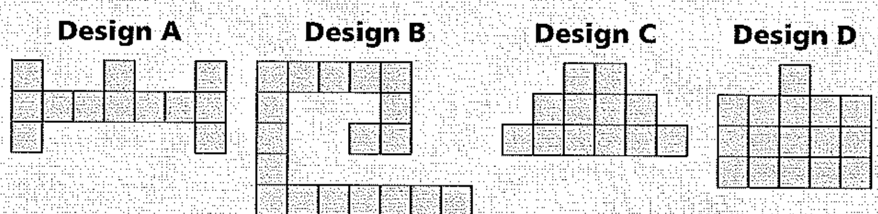
Problem 1.1

When a customer places an order, the designers at MARS use square tiles to model possible floor plans. MARS receives the customer orders below. Experiment with square tiles and then sketch some designs on grid paper for the customer to consider.

A **1.** Lone Star Carnivals in Texas wants a bumper-car ride that covers 36 square meters of floor space and has lots of rail sections. Sketch two or three possible floor plans.

2. Badger State Shows in Wisconsin requests a bumper-car ride with 36 square meters of floor space and 26 meters of rail sections. Sketch two or three floor plans for this request.

B The designers at MARS created four designs for bumper-car rides.



1. Find the area and perimeter of each bumper-car floor plan. Record your data in a table such as the one shown. You will use the "Cost" column of the table in part (3).

Bumper-Car Floor Plans

Design	Area	Perimeter	Cost
A	■	■	■
B	■	■	■

2. Which of the designs can be made from the same number of floor tiles? Will those designs have the same number of rail sections? Explain.

3. The designers at MARS charge \$25 for each rail section and \$30 for each floor tile. For the designs with the same floor area, which design costs the most? Which design costs the least? Explain.

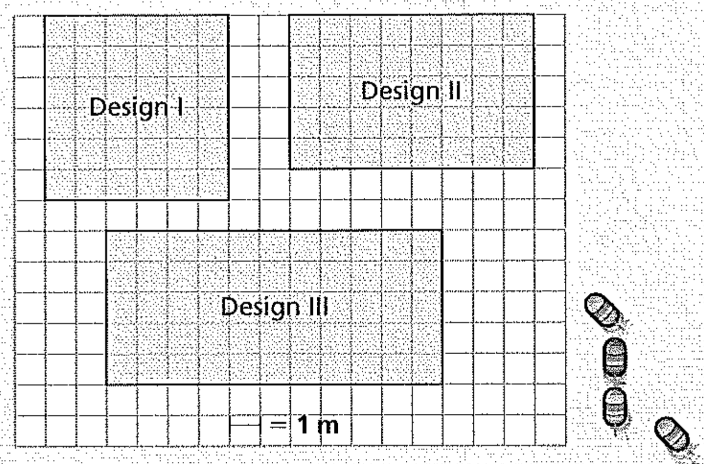
4. Rearrange the tiles in Design B to form a rectangle. Can you make more than one rectangle? If so, are the perimeters the same? Explain.

continued on the next page >

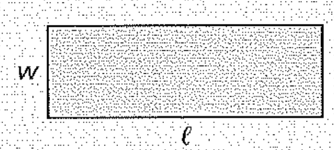
Problem 1.1 *continued*

C Riverview School orders a bumper-car ride in the shape of a rectangle for their fundraising festival. The MARS company sends the school Designs I, II, and III.

1. What is the area of each design? Explain how you found the area.
2. What is the perimeter of each design? Explain how you found the perimeter.



3. The dimensions of a rectangle are called **length** ℓ and **width** w. Look for patterns throughout Problem 1.1 to help you answer the questions below.



   a. Use words to describe a formula for finding the perimeter of a rectangle. Write the formula using symbols. Explain why it works.

   b. Use words to describe a formula for finding the area of a rectangle. Write the formula using symbols. Explain why it works.

   c. Find the perimeter and area of a rectangle with a width of 6 centimeters and a length of 15 centimeters.

ACE Homework starts on page 14.