SREB Readiness Courses
Transitioning to college and careers

Math Ready

Unit 1 . Algebraic Expressions
Student Manual

Name

Unit 1 . Algebraic Expressions
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Task #1: Bucky the Badger

Restate the Bucky the Badger problem in your own words:

Construct a viable argument for the following:

About how many total push-ups do you think Bucky did during the game?

Write down a number that you know is too high.

Write down a number that you know is too low.

What further information would you need to know in order to determine the exact number of total push-ups Bucky did in the course of the game?

If you're Bucky, would you rather your team score their field goals at the start of the game or the end?

What are some numbers of pushups that Bucky will never do in any game?

Task #2: Reasoning about Multiplication and Division and Place Value

Use the fact that $13 \times 17 = 221$ to find the following:

a. 13×1.7

b. 130×17

c. 13×1700

d. 1.3×1.7

e. $2210 \div 13$

f. $22100 \div 17$

g. $221 \div 1.3$

(http://illustrativemathematics.org/illustrations/272)

Task #3: Felicia's Drive

As Felicia gets on the freeway to drive to her cousin's house, she notices that she is a little low on gas. There is a gas station at the exit she normally takes, and she wonders if she will have to get gas before then. She normally sets her cruise control at the speed limit of 70mph and the freeway portion of the drive takes about an hour and 15 minutes. Her car gets about 30 miles per gallon on the freeway, and gas costs $3.50 per gallon. (http://illustrativemathematics.org/illustrations/80)

a. Describe an estimate that Felicia might do in her head while driving to decide how many gallons of gas she needs to make it to the gas station at the other end.

b. Assuming she makes it, how much does Felicia spend per mile on the freeway?

Numbers and Operations

Magic Math: Number Guess

Original Number	Instructions

Numbers and Operations

Magic Math: Birthday Trick

Do you believe that I can figure out your birthday by using simple math?

Get a calculator and ask your classmate to try the following. Your classmate must press equal (or enter) between every step.

a) Enter the month of his/her birth into the calculator. (Ex: enter 5 for May)

b) Multiply that number by 7.

c) Subtract 1 from that result.

d) Multiply that result by 13.

e) Add the day of birth. (Ex: For June 14th add 14)

f) Add 3.

g) Multiply by 11.

h) Subtract the month of birth.

i) Subtract the day of birth.

j) Divide by 10.

k) Add11.

l) Divide by 100.

Task #4: Miles to Kilometers

The students in Mr. Sanchez's class are converting distances measured in miles to kilometers. To estimate the number of kilometers, Abby takes the number of miles, doubles it, then subtracts 20% of the result. Renato first divides the number of miles by 5 and then multiplies the result by 8.

a. Write an algebraic expression for each method.

b. Use your answer to part (a) to decide if the two methods give the same answer.

(http://illustrativemathematics.org/illustrations/433)

Independent Practice:

School Lunches & Movie Tickets

Find the cost of school lunches (adult and student) for three different area schools. Then create a table of values. Also find the number of students and teachers at each school.

Write an expression based on the table for each of the following:

Schools	Student	Adult
A		
B		
C		

A. Cost of feeding 30 students and 5 adults
B. Cost of feeding 43 adults and 75 students
C. Cost of feeding each of the school's students and teachers.

Find movie tickets prices at five different cities around the country. Include adult, children, matinee and regular shows.

City	Adult matinee	Adult regular	Child matinee	Child regular
A				
B				
C				
D				
E				

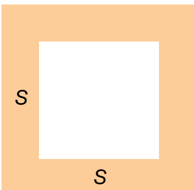
A. You have $100. In which city can you take the most adults and children to the matinee, if for every two children there is an adult?

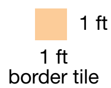
B. What is the cost of four children and three adults for a matinee in each of the five cities?

C. Which city has the best deal for a family of five to attend the movies? Decide whether it is a matinee or regular show.

Task 5: Swimming Pool

You want to build a square swimming pool in your backyard. Let *s* denote the length of each side of the swimming pool (measured in feet). You plan to surround the pool by square border tiles, each of which is 1 foot by 1 foot (see figure).





A teacher asks her students to find an expression for the number of tiles needed to surround such a square pool, and sees the following responses from her students:

$4(s+1)$

s^2

$4s+4$

$2s+2(s+2)$

$4s$

Is each mathematical model correct or incorrect? How do you know?

$4(s+1)$ ______________________________

s^2 ______________________________

$4s+4$ ______________________________

$2s+2(s+2)$ ______________________________

$4s$ ______________________________

Task #6: Smartphones

Suppose *p* and *q* represent the price (in dollars) of a 64GB and a 32GB smartphone, respectively, where $p > q$. Interpret each of the expressions in terms of money and smartphones. Then, if possible, determine which of the expressions in each pair is larger.

$p+q$ and $2q$

$p+0.08p$ and $q+0.08q$

$600-p$ and $600-q$

Task #7: University Population

Let *x* and *y* denote the number male and female students, respectively, at a university. where $x < y$. If possible, determine which of the expressions in each pair is larger? Interpret each of the expressions in terms of populations.

$x+y$ and $2y$

$\frac{x}{x+y}$ and $\frac{y}{x+y}$

$\frac{x-y}{2}$ and $\frac{x}{x+y}$

$\frac{x-y}{2}$ and $\frac{x-y}{2}$

Independent Practice

For each pair of expressions below, without substituting in specific values, determine which of the expressions in the given pairs is larger. Explain your reasoning in a sentence or two.

$5+t^2$ and $3-t^2$

$\frac{15}{x^2+6}$ and $\frac{15}{x^2+7}$

$(s^2+2)(s^2+1)$ and $(s^2+4)(s^2+3)$

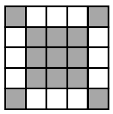
$\frac{8}{k^2+2}$ and k^2+2

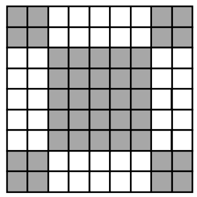
Task #8: Sidewalk Patterns

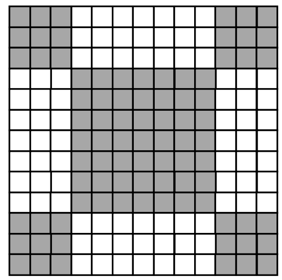
Sidewalk Patterns

In Prague some sidewalks are made of small square blocks of stone.

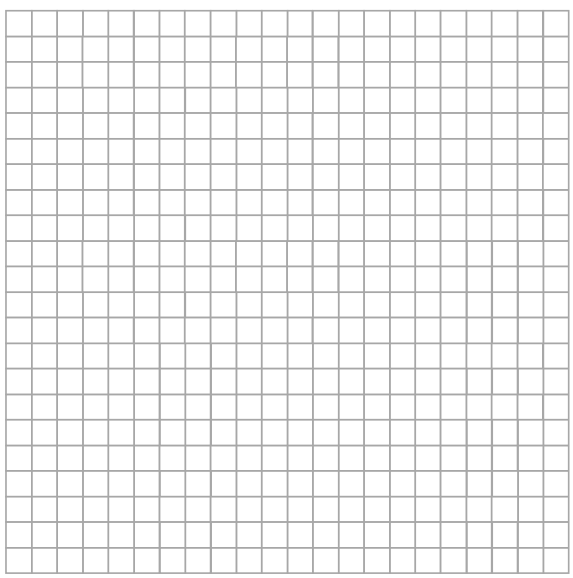
The blocks are in different shades to make patterns that are in various sizes.


Pattern #1


Pattern #2


Pattern #3

Draw the next pattern in this series.


Pattern #4

1. Complete the table below

Pattern number, *n*	1	2	3	4
Number of white blocks	12	40		
Number of gray blocks	13			
Total number of blocks	25			

2. What do you notice about the number of white blocks and the number of gray blocks?

____

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.

a. Fill in the blank spaces in this list.

$25 = 5^2$ $81 =$ ______ $169 =$ ______ $289 = 17^2$

b. How many blocks will pattern #5 need? ______________

c. How many blocks will pattern #*n* need? ______________

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.

____

____

b. Pattern # 6 has a total of 625 blocks.
How many white blocks are needed for pattern #6? ______________
Show how you figured this out.

Task #9: Expression Pairs: Equivalent or Not?

$a+(3-b)$ and $(a+3)-b$

$2+\frac{k}{5}$ and $10+k$

$(a-b)^2$ and a^2-b^2

$3(z+w)$ and $3z+3w$

$-a+2$ and $-(a+2)$

$\frac{1}{x+y}$ and $\frac{1}{x}+\frac{1}{y}$

x^2+4x^2 and $5x^2$

$\sqrt{x^2+y^2}$ and $x+y$

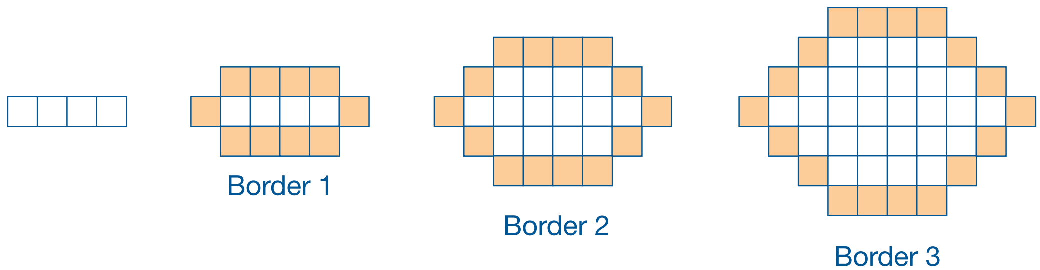
$bc-cd$ and $c(b-d)$

$(2x)^2$ and $4x^2$

$2x+4$ and $x+2$

Task #10: Kitchen Floor Tiles

Fred has some colored kitchen floor tiles and wants to choose a pattern to make a border around white tiles. He generates patterns by starting with a row of four white tiles. He surrounds these four tiles with a border of colored tiles (Border 1). The design continues as shown below:



Fred writes the expression $4(b-1) + 10$ for the number of tiles in each border, where b is the border number, $b \geq 1$.

- Explain why Fred's expression is correct.

- Emma wants to start with five tiles in a row. She reasons, "Fred started with four tiles and his expression was $4(b-1) + 10$. So if I start with five tiles, the expression will be $5(b-1) + 10$. Is Emma's statement correct? Explain your reasoning.

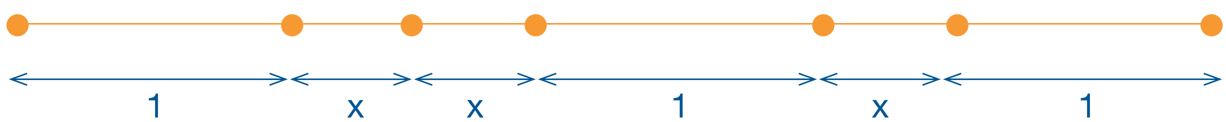
- If Emma starts with a row of n tiles, what should the expression be?

Adapted from: http://illustrativemathematics.org/illustrations/215

Independent Practice

On the figure below, indicate intervals of length:

- x+1
- 3x+1
- 3(x+1)



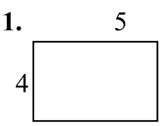
What do your answers tell you about whether 3x+1 and 3(x+1) are quivalent?

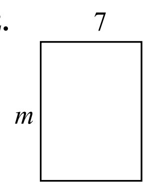
Task #11: Distributive Property Using Area

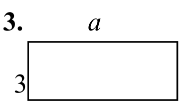
Distributive Property Using Area

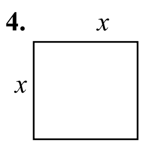
NAME ______________________________

Write the expression that represents the area of each rectangle.

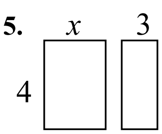
1.


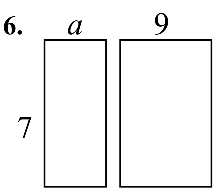
2.


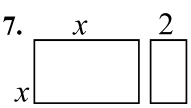
3.


4.


Find the area of each box in the pair.

5.


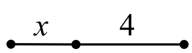
6.


7.


Write the expression that represents the total length of each segment.

8.


____

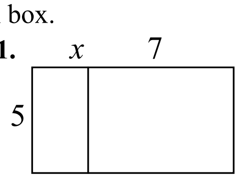
9.


____

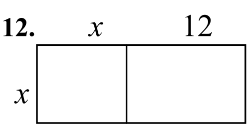
10.


____

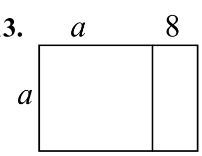
Write the area of each rectangle as the product of ***length*** $\times$ ***width*** and also as a sum of the areas of each box.

11.


Area as Product	Area as Sum
5(x+7)	5x+35

12.


Area as Product	Area as Sum

13.


Area as Product	Area as Sum

This process of writing these products as a sum uses the **distributive property**.

Use the distributive property to re-write each expression as a sum. You may want to draw a rectangle on a separate page to follow the technique above.

14. $4(x+7)=$____________ **15.** $7(x-3)=$____________

16. $-2(x+4)=$____________ **17.** $x(x+9)=$____________

18. $a(a-1)=$____________ **19.** $3m(m+2)=$____________

20. $-4(a-4)=$____________ **21.** $a(a-12)=$____________

Task #12: Factoring a Common Factor Using Area

Factoring a Common Factor Using Area

NAME ______________________________

Fill in the missing information for each: dimensions, area as product, and area as sum

1.

	x	6
2		

___2(x+6)___

___2x+12___

2.

5	5x	20

____

____

3.

		8
	$6x$	48

____

____

4.

	x	
	$10x$	30

____

____

Fill in the missing dimensions from the expression given.

5. $5x+35=5(\_\_\_\_\_\_)$

6. $2x+12=2(\_\_\_\_\_\_)$

7. $3x-21=\_\_(\_\_\_\_\_\_)$

8. $7x-21=\_\_(\_\_\_\_\_\_)$

9. $-3x-15=-3(\_\_\_\_\_\_)$

10. $-5x+45=$ __________

This process of writing a sum or difference as the product of factors is called **factoring**.

Factor these:

11. $4x-16=$ ______________

12. $-7x-35=$ ______________

13. $9x-81=$ ______________

14. $4x+18=$ ___________

Task #13: Distributive Property

Are the expressions equivalent? Sketch and simplify to prove. If the two expressions are not equal write the correct equivalence.

1. $3(x+3)$ and $3x+6$

2. $6(y+1)$ and $6y+6$

3. $x(x+4)$ and x^2+4

4. $y(x+2)$ and $xy+2y$

5. $x(x+y+2)$ and $x^2+xy+2x$

6. $2x(x+3)$ and $2x+6$

Distribute the following. Use a sketch or just distribute if you can.

1. $3(x+2)$

2. $4(y-1)$

3. $x(x+6)$

4. $x(y+4)$

5. $3x(x+y-1)$

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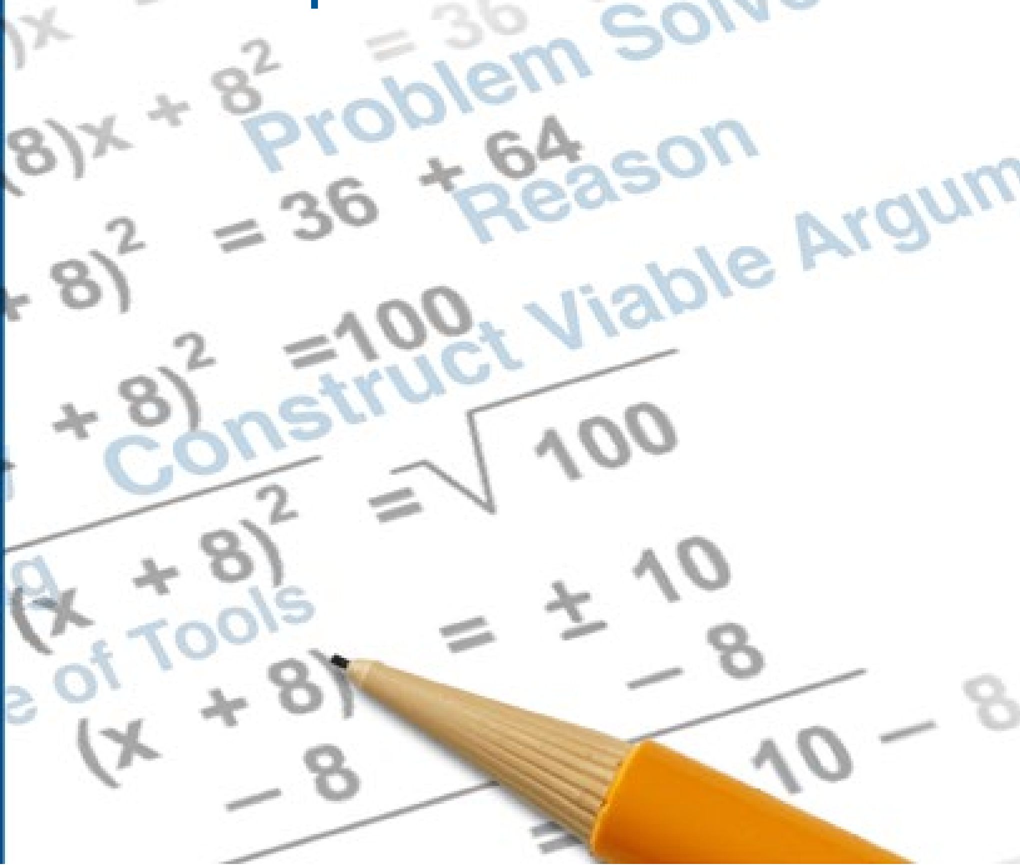
Unit 2 . Equations



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Unit 2 . Equations
Overview

Purpose

In this unit, students will revisit the concept and structure of equations and inequalities. The students will construct and evaluate problems that involve one or two steps while seeking the understanding of how and why equations and inequalities are used in their daily lives. Students are also asked to use the structure of word problems and equations to rewrite and solve equations in different forms revealing different relationships.

Essential Questions:

How might equations, expressions, inequalities and identities be similar? Different? Equivalent?

Why might certain operations be allowed to generate equivalent equations while others cannot?

How can you determine whether or not certain values are solutions to an equation or inequality?

How might you use the same reasoning as in solving equations to rearrange formulas to highlight a quantity of interest?

When can we infer practical meaning from the structure of the equation or inequality being used to model a real-world situation?

How might you use mathematical, practical and/or contextual reasoning when solving equations and inequalities?

Common Core State Standards:

Expressions and Equations

Analyze and solve linear equations and pairs of simultaneous linear equations.

- 8.EE.7: Solve linear equations in one variable.

Seeing Structure in Equations

Interpret the structure of expressions.

- A-SSE.1: Interpret expressions that represent a quantity in terms of its context.
  a. Interpret parts of an expression, such as terms, factors and coefficients.

Write expressions in equivalent forms to solve problems.

- A-SSE.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Creating Equations

Create equations that describe numbers or relationships.

- A-CED.1: Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
- A-CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A-CED.3: Represent constraints by equations or inequalities and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
- A-CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

- A-REI.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution.
- A-REI.2: Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

- A-REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.