Name: _____ Date: _____

RATES, PATTERNS AND PROBLEM SOLVING
COMMON CORE ALGEBRA I

Welcome to Algebra I! Algebra at its core is all about using the **properties of numbers** (how they behave) to manipulate unknowns, called **variables**. But, in practicality, Algebra is used to recognize patterns, turn them into mathematical relationships, and then use these relationships for useful purposes. Today's lesson, being the first of the course, is exploratory in nature and will utilize a basic understanding of **rates** or **ratios.**

***Exercise* #1:** Answer the following rate/ratio questions using multiplication and division. Show your calculation (and keep track of your units!).

(a) If there are 12 eggs per carton, then how many eggs do we have in 5 cartons?

(b) If a car is traveling at 65 miles per hour, then how far does it travel in 2 hours?

(c) If a pizza contains 8 slices and there are 4 people eating, how many slices are there per person?

(d) If a biker travels 20 miles in one hour, how many minutes does it take per mile traveled?

Rates show up everywhere in the real world, whether it is your pay per hour of work or the texts you can send per month. Rates are all about multiplication and division because they ultimately are a **ratio** of two quantities, both of which are **changing** or **varying**.

***Exercise* #2:** A runner is traveling at a constant rate of 8 meters per second. How long does it take for the runner to travel 100 meters?

(a) Experiment solving this problem by setting up a table to track how far the runner has moved after each second.

time, *t* (seconds)	Distance, *D* (meters)
1	
2	
5	
10	

(b) Create an equation that gives the distance, *D*, that the person has run if you know the amount of time, *t*, they have been running.

(c) Now, set up and solve a simple algebraic equation based on (b), that gives the exact amount of time it takes for the runner to travel 100 meters.

The previous exercise showed how we can take a pattern and extend it into the world of algebra, a world that contains symbols and conventions that may seem strange, but hopefully somewhat familiar from previous work. In the final exercise, we will tackle a larger problems to see how rates, patterns, and algebra can combine to solve a more challenging problem.

***Exercise* #3:** A man is walking across a 300 foot long field at the same time his daughter is walking towards him from the opposite end. The man is walking at 9 feet per second and the daughter is moving at 6 feet per second. How many seconds will it take them to meet somewhere in the middle?

(a) Draw a diagram to help keep track of where the man and his daughter are after 1 second, 2 seconds, 3 seconds, etcetera. Create a table as well that helps keep track of how far each one of them has traveled as time goes on.

Time (seconds)	Father's Distance (feet)	Daughter's Distance (feet)	Total Distance (feet)
1			
2			
5			
10			

(b) What must be true about the distances the two have traveled when they meet somewhere in the middle?

(c) Create equations similar to *Exercise* #3 to predict the distance the father has traveled and the distance the daughter has traveled.

(d) Create and solve an equation to predict the exact amount of time it takes for the father and daughter to meet in the middle.

Name: _____ Date: _____

RATES, PATTERNS AND PROBLEM SOLVING
COMMON CORE ALGEBRA I HOMEWORK

FLUENCY

1. Answer the following rate questions based on either multiplication or division. Think carefully about which is required (they will be mixed up). Show the calculation and units that you use.

   (a) A child bought 4 bags of rubber bands to make into bracelets. If there are 80 rubber bands per bag, how many total rubber bands did he buy?

   (b) Kirk has 42 pieces of candy to divide evenly between his three children. If he puts the pieces into three boxes, how many pieces of candy are there per box?

   (c) A car traveling on the Taconic parkway travels 84 miles in two hours. What is the cars speed (a special type of rate) in miles per hour?

   (d) A car salesperson earns a $500 fee per car she sells. If she sells 4 cars in one day, how much money does she earn in fees?

2. If there are 4 quarts in a gallon, and 2 pints in a quart, and 2 cups in a pint, then how many cups are in a gallon? Show your calculation or explain how you arrive at your answer.

3. A person driving along the road moves at a rate of 56 miles per hour driven. How far does the person drive in 1.5 hours? Show the calculation you use in your answer and give your answer proper units.

4. Mr. Weiler has 32 students in his class. He wishes to place them into 8 groups of equal size. Which of the following represents the number of students per group?

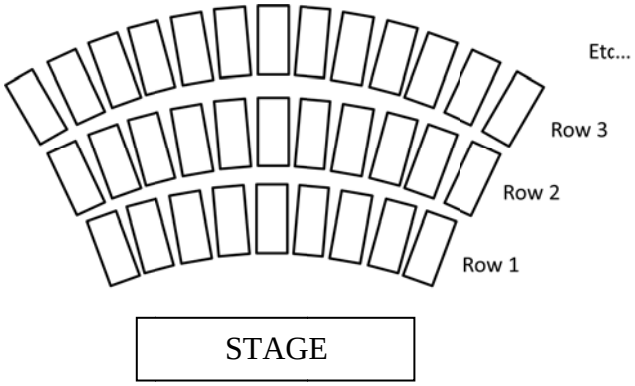
   (1) 256 (3) 6

   (2) 2 (4) 4

APPLICATIONS

5. Seating in theaters or auditoriums is often arranged such that rows closer to the stage have less seats than rows farther away. An **example** of a seating chart for a theater is shown below.

   (a) Assuming this pattern continues, fill out the following table:



Row, r	Number of Seats, S
1	9
2	11
3	
4	
5	
6	
7	

   (b) Jonathan tries to mathematically model the number of seats in a given row. He tries to come up with an equation for the number of seats and determines:

$$S = 7r + 2, \text{ where } S \text{ is the number of seats in row, } r$$

   Does this equation work for $r = 1$? What about for $r = 2$ and $r = 3$? Show calculations that support your yes/no answers.

   (c) The correct equation is: $S = 2r + 7$. Verify this equation matches your table for $r = 1$, $r = 2$, and $r = 3$.

   (d) According to the formula from part (c), how many seats are in the 15^{th} row? Show your calculation.

   (e) Finally, let's say we know that a certain row has 91 seats in it. Which row is it? Try to set up and solve a simple equation that gives you this answer.