Public Schools of North Carolina
State Board of Education | Department of Public Instruction

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Introduction to High School Mathematics ● Unpacked Content

For the new Essential Standards that will be effective in all North Carolina schools in the 2012-13 School Year.

What is the purpose of this document?
To increase student achievement by ensuring educators understand what the standards mean a student must know and be able to do completely and comprehensively.

What is in the document?
Descriptions of what each standard means a student will know and be able to do. The "unpacking" of the standards done in this document is an effort to answer a simple question "What does this standard mean that a student must know and be able to do?" and to ensure that description is helpful, specific and comprehensive.

How do I send Feedback?
We intend the explanations and examples in this document to be helpful, specific and comprehensive. That said, we believe that as this document is used, teachers and educators will find ways in which the unpacking can be improved and made ever more useful. Please send feedback to us at feedback@dpi.state.nc.us and we will use your input to refine our unpacking of the standards. Thank You!

Just want the standards alone?
You can find the standards alone at www.ncpublicschools.org

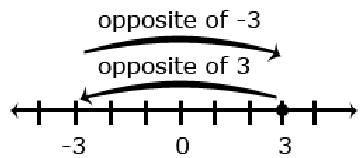
Number and Operations

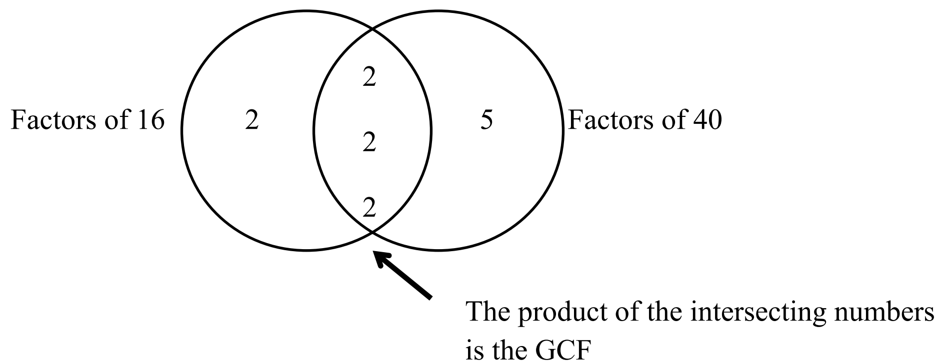
Essential Standard

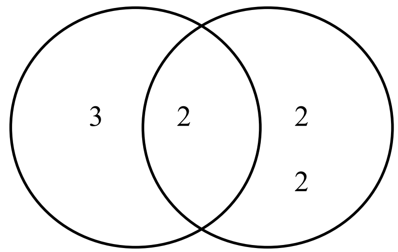
OIM.N.1 Understand rational numbers

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **tenths, hundredths, number line, greater than >, lesser than <, opposite, absolute value, factor, multiple, order of operations, greatest common factor (GCF), least common multiple (LCM), prime number, exponent, ^, base, exponential notation, integer**

Clarifying Objectives	**Unpacking** What does this standard mean that a student will know and be able to do?
OIM.N.1.1 Compare integers, decimals and fractions.	• Students use a number line to compare two integers, two decimals, or two fractions, recognizing that numbers to the right are larger than the numbers to the left. • Students compare two decimals using models to understand place value **Example 1:** 0.1 is larger than 0.09 because 0.1 is one tenth and 0.09 is 9 hundredths. • Students compare fractions using models or identifying the common denominator. • Students use <, >, or = in their comparisons.
OIM.N.1.2 Identify equivalent fractions, decimals, and percents.	• Students use models to identify equivalent decimals. They recognize that two decimals such as 0.2 and 0.20 are equivalent. • Students identify equivalent fractions, recognizing that equivalent fractions are created when the numerator and denominator are multiplied that the same number (equal to 1). • Students identify equivalent fractions and decimals, fractions and percents, and decimals and percents. They recognize that equivalent amounts represent the same ratio **Example 1:** $0.25 = \frac{25}{100} = 25\%$, which also is equal to $\frac{1}{4}$.
OIM.N.1.3 Identify absolute values and opposites.	• Students use a number line to identify opposites. Students understand that numbers are opposite when they are the same distance from 0 but one number is in a positive direction and one number is in a negative direction. Students recognize that the opposite of 0 is 0 and that opposites add to 0.

	 • Students use a number line to identify absolute value as the distance a number is from zero. • Students understand that since distance is positive, the absolute value of a number will be positive. **Example 1:** |5| and |-5| is 5 since both 5 and -5 are 5 away from zero.
OIM.N.1.4 Use order of operations to simplify numerical expressions.	Students understand that there is an order to simplifying numerical expression. Step 1: Simplify any operations in parentheses Step 2: Simplify any exponents Step 3: Multiply or divide, whichever comes first as the expression is read left to right Step 4: Add or subtract, whichever comes first as the expression is read left to right **Example 1:** 4 + 20 ÷ 2 x 3 4 + 10 x 3 Divide since it comes before the multiplication 4 + 30 Multiplication before addition 34 **Example 2:** 6 + 3(11 – 3^2) 6 + 3 x (11 – 9) Simplify the exponent by multiplying 3 x 3 6 + 3 x 2 Simplify inside the parenthesis 6 + 6 Multiplication before addition 12

OIM.N.1.5 Identify the greatest common factor and least common multiple.	• Students find the greatest common factor of two whole numbers less than or equal to 100. **<u>Example 1:</u>** Find the greatest common factor of 40 and 16 *Solution:* Possible solutions include: 1) listing the factors of 40 (1, 2, 4, 5, 8, 10, 20, 40) and 16 (1, 2, 4, 8, 16), then taking the greatest common factor (8); or 2) listing the prime factors of 40 (2 • 2 • 2 • 5) and 16 (2 • 2 • 2 • 2) and then multiplying the common factors (2 • 2 • 2 = 8).  **NOTE:** The expectation is to determine the GCF regardless of the method.

	• Students find the least common multiple of two whole numbers less than or equal to twelve. **<u>Example 2:</u>** Find the least common multiple of 6 and 8. *Solution:* Possible solutions include: 1) listing the multiples of 6 (6, 12, 18, 24, 30, …) and 8 (8, 26, 24, 32, 40…), then taking the least in common from the list (24); or 2) using the prime factorization. Factors of 6  Factors of 8 The LCM is the product of all the numbers in the Venn Diagram. Step 1: find the prime factors of 6 and 8. $6 = 2 \bullet 3$ $8 = 2 \bullet 2 \bullet 2$ Step 2: Find the common factors between 6 and 8. In this example, the common factor is 2 Step 3: Multiply the common factors and any extra factors: $2 \bullet 2 \bullet 2 \bullet 3$ or 24 **NOTE:** The expectation is to determine the LCM regardless of the method.
OIM.N.1.6 Use calculators to solve non-negative integer exponential expressions.	• Students understand that exponents can be used to express repeated multiplication. The base is the number being multiplied. The exponent tells the number of times to multiply the base times itself. • Using calculators students simplify expressions with exponents and whole number bases. Students recognize that 2^3 entered in a calculator will compute $2 \bullet 2 \bullet 2$ **<u>Example 1:</u>** Write 3^5 in expanded form. *Solution:* $3 \bullet 3 \bullet 3 \bullet 3 \bullet 3 = 343$ **<u>Example 2:</u>** Write $6 \bullet 6 \bullet 6 \bullet 6$ using exponential notation. *Solution:* $6^4 = 1{,}296$

Number and Operations

Essential Standard

OIM.N.2 Apply mathematical operations with rational numbers to solve problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **numerator, denominator, fraction, common denominator, integers, algebraic expression, mixed numbers, percent, scale factor**

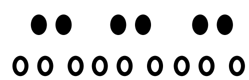
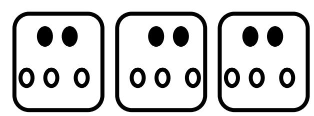
Clarifying Objectives	Unpacking What does this standard mean that a student will know and be able to do?
OIM.N.2.1 Use calculators to solve real world fraction and mixed number problems.	• Students solve addition, subtraction, multiplication and division fraction problems in a real-world context with a calculator.
OIM.N.2.2 Use calculators to solve real world decimal problems.	• Students solve addition, subtraction, multiplication and division decimal problems in a real-world context with a calculator.
OIM.N.2.3 Use calculators to solve real world integer problems.	• Students solve integer problems with a calculator – possible scenarios include debt, distances between above/below sea level, gain/loss, temperatures
OIM.N.2.4 Use addition, subtraction, multiplication and division with calculators to evaluate algebraic expressions.	• Students evaluate algebraic expressions, using order of operations as needed. **<u>Example 1:</u>** Given the expression $3x + 2y$, find the value of the expression when x is equal to 4 and y is equal to 3. *Solution:* This problem requires students to understand that multiplication is understood when numbers and variables are written together and to use the order of operations to evaluate. $3x + 2y$ $3 \cdot 4 + 2 \cdot 3$ $12 + 6$ 18

Number and Operations

Essential Standard

OIM.N.3 Apply ratios, proportions and percents to solve problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **ratio, proportion, unit rate, scale factor, map**

Clarifying Objectives	**Unpacking** What does this standard mean that a student will know and be able to do?
OIM.N.3.1 Use standard ratio notation for expressing ratios in part-to-part or a part-to-whole relationship.	A ratio is the comparison of two quantities or measures. The comparison can be part-to-whole (ratio of guppies to all fish in an aquarium) or part-to-part (ratio of guppies to goldfish). **<u>Example 1:</u>** A comparison of 6 guppies and 9 goldfish could be expressed in any of the following forms: $\frac{6}{9}$, 6 to 9 or 6:9. If the number of guppies is represented by black circles and the number of goldfish is represented by white circles, this ratio could be modeled as  These values can be regrouped into 2 black circles (goldfish) to 3 white circles (guppies), which would reduce the ratio to, $\frac{2}{3}$, 2 to 3 or 2:3.  Students should be able to identify and describe any ratio using "For every _____ there are _____"
OIM.N.3.2 Use proportional reasoning to solve real world problems including recipes and unit rates.	Students recognize the use of ratios, unit rate and multiplication in solving problems, which could allow for the use of fractions and decimals.

Example 1:
In trail mix, the ratio of cups of peanuts to cups of chocolate candies is 3 to 2. How many cups of chocolate candies would be needed for 9 cups of peanuts.

Peanuts	Chocolate
3	2

Solution: One possible solution is for students to find the number of cups of chocolate candies for 1 cup of peanuts by dividing both sides of the table by 3, giving $\frac{2}{3}$ cup of chocolate for each cup of peanuts. To find the amount of chocolate needed for 9 cups of peanuts, students multiply the unit rate by nine ($9 \bullet \frac{2}{3}$), giving 6 cups of chocolate.

Example 2:
At Books Unlimited, 3 paperback books cost $18. What would 7 books cost? How many books could be purchased with $54.
Solution: To find the price of 1 book, divide $18 by 3. One book is $6. To find the price of 7 books, multiply $6 (the cost of one book times 7 to get $42. To find the number of books that can be purchased with $54, multiply $6 times 9 to get $54 and then multiply 1 book times 9 to get 9 books. Students use ratios, unit rates and multiplicative reasoning to solve problems in various contexts, including measurement, prices, and geometry. Notice in the table below, a multiplicative relationship exists between the numbers both horizontally (times 6) and vertically (ie. 1 x 7 = 7; 6 x 7 = 42). Red numbers indicate solutions.

Number of Books (n)	Cost (C)
1	6
3	18
7	42
9	54

Example 3:

Ratios can also be used in problem solving by thinking about the total amount for each ratio unit.
The ratio of orange juice concentrate to water in punch is 1: 3. If you were making 32 cups of punch, how many cups of orange juice would be needed.
Solution: Students recognize that the total ratio would produce 4 cups of punch. To get 32 cups, the ratio would need to be duplicated 8 times, resulting in 8 cups of orange juice concentrate.

Example 4:

Compare the number of black to white circles. If the ratio remains the same, how many black circles will you have if you have 60 white circles?

●●●●○○○

Black	4	40	20	60	?
White	3	30	15	45	60

Example 5:

If steak costs $2.25 per pound, how much does 0.8 pounds cost? Explain how you determined your answer.

Example 6:

Sam averages 60 miles per hour on his trip. How many miles did he travel after 4 hours?

OIM.N.3.3 Use appropriate strategies to solve percent problems.

Percentages are a rate per 100. Models, such as percent bars or 10 x 10 grids should be used to model percents.

- Students use ratios to identify percents.

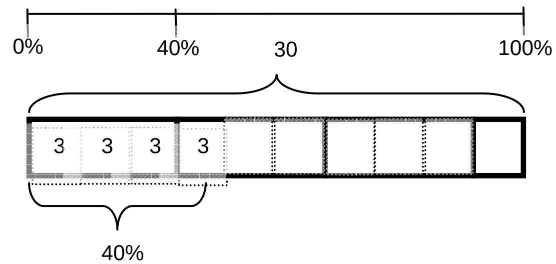
Example 1:

What percent is 12 out of 25?
Solution: One possible solution method is to set up a ratio table:
Multiply 25 by 4 to get 100. Multiplying 12 by 4 will give 48, meaning that 12 out of 25 is equivalent to 48 out of 100 or 48%

Part	Whole
12	25
?	100

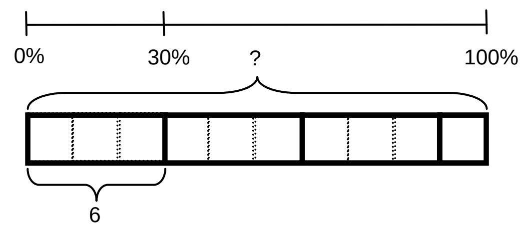
- Students use percentages to find the part when given the percent, by recognizing that the whole is being divided into 100 parts and then taking a part of them (the percent).

Example 2:
What is 40% of 30?



Solution:
If 100% is 30 then each block is 3 ($30 \div 10$). Forty percent would be 4 of the boxes or 4 times 3.

Example 3:
30% of the students in Mrs. Rutherford's class like chocolate ice cream, then how many students are in Mrs. Rutherford's class if 6 like chocolate ice cream?



Solution: Each block represents 10%. If 30% (3 blocks) is 6, then each block represents 2 students. To find 100% then each block would be 2 so 2 x 10 =20 students.

Example 4:
A credit card company charges 17% interest on any charges not paid at the end of the month. Make a ratio table to show how much the interest would be for several amounts. If your bill totals $450 for this month, how much interest would you have to pay if you let the balance carry to the next month?

Charges	$1	$50	$100	$200	$450
Interest	$0.17	$8.50	$17	$34	?

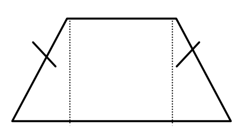
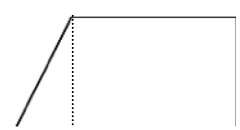
OIM.N.3.4 Use scale factors and models to solve real world problems.	• Given a scale factor, students determine the distance on a map, or the dimensions of a figure.

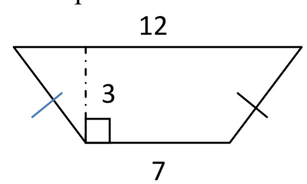
Geometry

Essential Standard

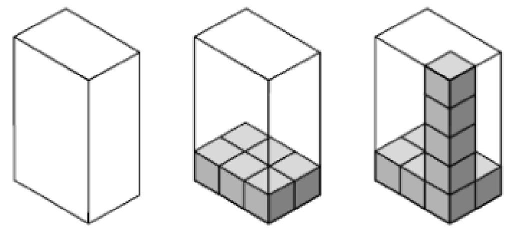
OIM.G.1 Use properties of two- and three-dimensional figures to solve problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **perimeter, circumference, area, polygon, quadrilateral, octagon, pentagon, hexagon, circle, Pi, π, diameter, radius, triangle, rectangle, square, volume, cube, length, width, height, rectangular prism, cylinder, base of cylinder, square root, Pythagorean Theorem, hypotenuse, squared, cubed**

Clarifying Objectives	**Unpacking** What does this standard mean that a student will know and be able to do?
OIM.G.1.1 Calculate perimeter of polygons and circumference of circles to solve real world problems.	• Students understand that perimeter is the distance **around** a polygon and circumference is the distance around a circle. • To calculate the perimeter of a polygon, the length of each side is added. • Using a model to represent the diameter, students understand that the length of the diameter will go around the circle approximately 3 times, giving the relationship represented by Pi (π). • Students use the formula $C = 2\pi r$ to calculate the circumference.
OIM.G.1.2 Calculate areas of polygons and circles to solve real world problems	• Students understand that area gives the number of squares needed to **cover** a polygon or circle. Finding the area of triangles is introduced in relationship to the area of rectangles – a rectangle can be decomposed into two congruent triangles. Therefore, the area of the triangle is ½ the area of the rectangle. The area of a rectangle can be found by multiplying base x height; therefore, the area of the triangle is ½ bh or (b x h)/2. Students decompose shapes into rectangles and triangles to determine the area. For example, a trapezoid can be decomposed into triangles and rectangles (see figures below). Using the trapezoid's dimensions, the area of the individual triangle(s) and rectangle can be found and then added together. Special quadrilaterals include rectangles, squares, parallelograms, trapezoids, rhombi, and kites.  Isosceles trapezoid  Right trapezoid **Note:** Students recognize the marks on the isosceles trapezoid indicating the two sides have equal measure.

	Example 1: Find the area of a right triangle with a base length of three units, a height of four units, and a hypotenuse of 5. *Solution:* Students understand that the hypotenuse is the longest side of a right triangle. The base and height would form the 90°angle and would be used to find the area using: A = ½ bh A = ½ (3 units)(4 units) A = ½ 12 units^2 A = 6 units^2 Example 2: Find the area of the trapezoid shown below using the formulas for rectangles and triangles.  *Solution:* The trapezoid could be decomposed into a rectangle with a length of 7 units and a height of 3 units. The area of the rectangle would be 21 units^2. The triangles on each side would have the same area. The height of the triangles is 3 units. After taking away the middle rectangle's base length, there is a total of 5 units remaining for both of the side triangles. The base length of each triangle is half of 5. The base of each triangle is 2.5 units. The area of one triangle would be ½ (2.5 units)(3 units) or 3.75 units^2. Using this information, the area of the trapezoid would be: 21 units^2 3.75 units^2 +3.75 units^2 28.5 units^2 • Students use the formula Area = πr^2 to find the area of a circle.
OIM.G.1.3 Calculate volume of rectangular prisms and cylinders.	• Students understand that volume is the amount needed to ***fill*** a three-dimensional figure. • Students calculate the volume of a rectangular prism by finding the area of one layer (the base) and recognizing that this amount will be the same in each of the layers. The formula, V = Bh, represents this process, where *B*

is the area of the base and *h* represents the height . Since the base is a rectangle, the area can be found by multiplying base x height. The number of layers corresponds to the height of the prism.

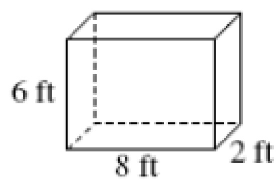


3 x 2 = area of one layer

5 layers

Example 1:

Find the volume of the figure below:



Area = $\pi r^2 h$

A = 3.14 x 5^2 x 4

A = 76.302 cm^3

Solution: The area of the base is 16 ft^2 (8 ft x 2 ft). There are 6 layers so the volume can be found by 16 ft^2 x 6 ft which equals 96 ft^3.

V = Bh

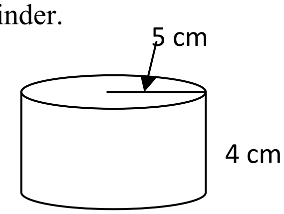
V = 8 ft x 2 ft x 6 ft

V = 96 ft^3

- Students calculate the volume of a cylinder by finding the area of the base (circle) using the formula and then multiply by the height of the cylinder.

Example 2:

Find the volume of the cylinder:



OIM.G.1.4 Use the square root of the area to identify the length of the side of a square.	• Students understand the relationship between geometric squares, area, side length and square roots. **Example 1:** Students create squares with various side lengths and identify the area and side length
OIM.G.1.5 Use the Pythagorean Theorem to solve real world problems.	• Students explain the Pythagorean Theorem as it relates to the area of squares coming off of all sides of a right triangle – the sum of the area of the legs (two smaller sides) squared is equal to the area of the hypotenuse squared.

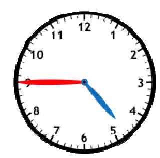
Dimensions	Area	Side Length	Square Root of Area

Measurement

Essential Standard

OIM.M.1 Apply time and measurement skills to solve problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **time, analog, digital, p.m., a.m., hour, minute, second, watch hands, half, quarter, o'clock, colon, interval, noon, midnight, days, week, month, year, measure, length, inch, mile, yard, foot, capacity, volume, gallon, pint, cup, quart, tablespoon, teaspoon, recipe, weight, pound, ounce, ton, temperature, degree, °, Fahrenheit, thermometer**

Clarifying Objectives	**Unpacking** What does this standard mean that a student will know and be able to do?
OIM.M.1.1 Use analog and digital clocks to tell time.	• Students read a.m. and p.m. times on a digital clock, recognizing that a colon separates the hours and minutes. • Students read time to the nearest minute on an analog clock. • Students understand the relationship between times such as 8:45 and "quarter til 9", 2:15 and "quarter past 2", 6:50 and "10 til 7, etc. • Students recognize that 12:00 p.m. is noon and 12:00 a.m. is midnight. • Students recognize that there are 60 seconds in 1 minutes and 60 minutes in 1 hour. **Example:** What is the time shown on the clock to the right? *Solution:* 4:45 or "quarter til 5" 
OIM.M.1.2 Identify regularly scheduled activities based on time	Students read various schedules to solve problems. Possible examples include bus schedules of arrivals and departures, class schedules, movie schedules
OIM.M.1.3 Use time to solve problems.	This standard calls for students to solve elapsed time, including word problems. Students could use clock models or number lines to solve. On the number line, students should be given the opportunities to determine the intervals and size of jumps on their number line. Students could use pre-determined number lines (intervals every 5 or 15 minutes) or open number lines (intervals determined by students).
OIM.M.1.4 Use a calendar to solve problem	• Students understand that there are 7 days in a week and 12 months in a year. • Students read a calendar understanding that reading vertically gives the dates of all the Mondays, Tuesdays, etc. and that one week is the length across the calendar. • Students solve problems using a calendar.

	Example 1: You need to schedule a follow-up appointment with your doctor 2 weeks from September 20. What day is your appointment? **Example 2:** Your cousins are coming for a visit on November 10. You need to call one week before their arrival to confirm their arrival time. On what date should you call?
OIM.M.1.5 Use standard measurement tools to measure length, capacity, weight and temperature.	• Students identify the appropriate tool for measuring length, capacity, weight or temperature. • Students use pictures (or the actual tool) to measure the length, capacity, weight or temperature of an object. Appropriate units are used with the numerical measurement.

Algebra

Essential Standard

OIM.A.1 Apply algebraic properties to solve problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **equations, inequalities, less than, <, greater than, >, less than or equal to, ≤, greater than or equal to, ≥, variable, coefficient, "like" term, constant, expression, distributive property, equivalent expressions**

Clarifying Objectives	Unpacking What does this standard mean that a student will know and be able to do?
OIMA.1.1 Use appropriate strategies to solve one and two-step equations resulting in positive solutions in real world contexts.	• Students use various strategies to solve one-step and two-step equations.

Example 1:

Joey had 26 papers in his desk. His teacher gave him some more and now he has 100. How many papers did his teacher give him?

Solution:

This situation can be represented by the equation $26 + n = 100$ where n is the number of papers the teacher gives to Joey. This equation can be stated as "some number was added to 26 and the result was 100". Students ask themselves "What number was added to 26 to get 100?" to help them determine the value of the variable that makes the equation true.

One way to solve this equation is using a Bar Model: Each bar represents one of the values. Students use this visual representation to demonstrate that 26 and the unknown value together make 100.

100	
26	n

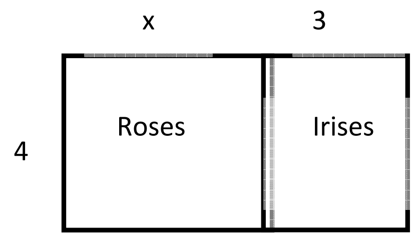
Example 2:

The youth group is going on a trip to the state fair. The trip costs $52. Included in that price is $11 for a concert ticket and the cost of 2 passes, one for the rides and one for the game booths. Each of the passes cost the same price. Write an equation representing the cost of the trip and determine the price of one pass.

x	x	11
52		

$$2x + 11 = 52$$
$$2x = 41$$
$$x = \$20.50$$

OIMA.1.2 Represent inequalities in real world situations	Many real-world situations are represented by inequalities. Students write an inequality and represent solutions on a number line for various contextual situations. **<u>Example 1:</u>** The class must raise at least \$80 to go on the field trip. If *m* represents money, then the inequality $m \geq$ to \$80. Students recognize that possible values can include too many decimal values to name. Therefore, the values are represented on a number line by shading.  A number line diagram is drawn with an open circle when an inequality contains a < or > symbol to show solutions that are less than or greater than the number but not equal to the number. The circle is shaded, as in the example above, when the number is to be included. Students recognize that possible values can include fractions and decimals, which are represented on the number line by shading. Shading is extended through the arrow on a number line to show that an inequality has an infinite number of solutions.
OIMA.1.3 Use appropriate strategies to solve one and two-step inequalities using whole numbers in real world contexts.	• Students solve one-step and two-step inequalities (no negative coefficients) **<u>Example 1:</u>** Florencia has at most \$60 to spend on clothes. She wants to buy a pair of jeans for \$22 dollars and spend the rest on t-shirts. Each t-shirt costs \$8. Write an inequality for the number of t-shirts she can purchase. *Solution:* $8x + 22 \leq 60$ where *x* is the number of t-shirts $8x \leq 38$ subtract 22 from both sides $x \leq 4.7$ divide both sides by 8 Since Florencia cannot buy .7 of a t-shirt then the number of t-shirts she can buy should be 4 or less.
OIMA.1.4 Illustrate the distributive property using area models.	• Students use the distributive property to write equivalent expressions. Area models can be used to illustrate the distributive property with variables. Given that the width is 4 units and the length can be represented by x + 3, the area of the flowers below can be expressed as $4(x + 3)$ or $4x + 12$.

	
OIMA.1.5 Understand the use of the distributive property and combining like terms to write equivalent algebraic expressions.	• Students demonstrate an understanding of like terms as quantities being added or subtracted with the same variables and exponents. **Example:** 3x + 4x are like terms and can be combined as 7x; however, $3x + 4x^2$ are not. This concept can be illustrated by substituting in a value for *x*. For example, 9*x* – 3*x* = 6*x* not 6. Choosing a value for *x*, such as 2, can prove non-equivalence. 9(2) – 3(2) = 6(2) however 9(2) – 3(2) ? 6 18 – 6 = 12 18– 6 ? 6 12 = 12 12 ≠ 6 • Students simplify algebraic expressions using the distributive property and combining like terms. **Example:** To simplify 2(*x* + 4) + 3*x* 2*x* + 8 + 3*x* (distribute the 2 to the *x* and 4) 5*x* + 8 (combine like terms 2*x* and 3)

Algebra

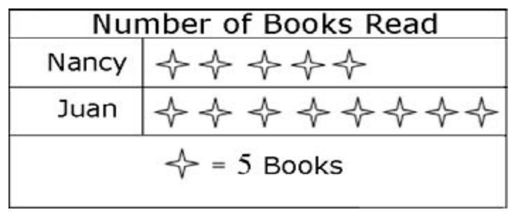
Essential Standard

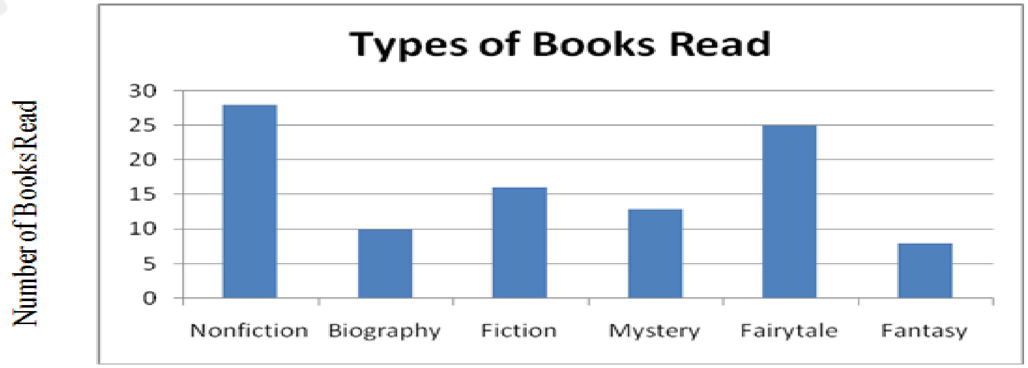
OIM.A.2 Understand patterns and relationships.

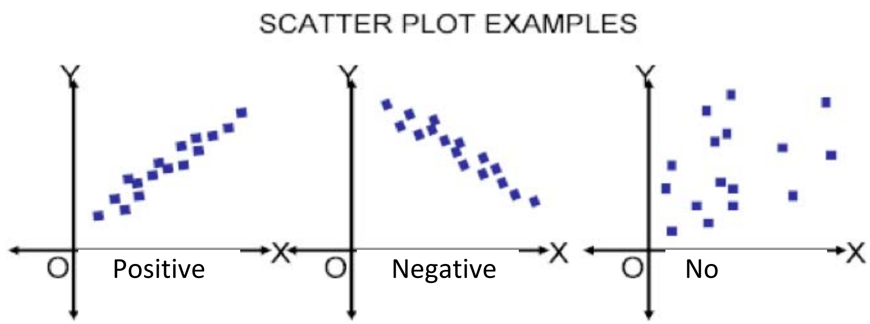
Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **horizontal, vertical, Coordinate Plane, quadrant, ordered pairs, origin, *x*-coordinate, *y*-coordinate, *x*-axis, *y*-axis, slope, rise/run, linear equation, *y*-intercept, coefficient, constant**

Clarifying Objectives	**Unpacking** What does this standard mean that a student will know and be able to do?
OIMA.2.1 Understand the use of the Cartesian Coordinate Plane to graph and identify ordered pairs.	Students recognize the point where the *x*-axis and *y*-axis intersect as the origin. Students recognize that ordered pairs have an *x* –value and *y*-value.
OIMA.2.2 Represent patterns in real world situations using a table, graph, or equation.	• Students identify the *y*-intercept as the *y*-value when *x* is 0 in a table, as the point where a line crosses the *y*-axis on a graph and as the constant in a linear equation. • Students identify the slope as the $\frac{\text{change in the } y \text{ values}}{\text{change in the } x \text{ values}}$ in a table, as the ratio of rise to run in a graph or as the coefficient of *x* in a linear equation.
OIMA.2.3 Identify the slope given a table, graph, or equation.	In a table, the slope can be found by determining the distance between the *x*-values and the *y*-values and using the ratio of rise (y-values) to run (x-values). The distance between 8 and -1 is 9 in a negative direction → -9; the distance between -2 and 1 is 3 in a positive direction. The slope is the ratio of rise to run or $\frac{y}{x}$ or $\frac{-9}{3}$ = -3. This same ratio would occur for any pair of points chosen. <table><tr><th>x</th><th>y</th></tr><tr><td>-2</td><td>8</td></tr><tr><td>0</td><td>2</td></tr><tr><td>1</td><td>-1</td></tr></table> Using graphs, students identify the slope as the $\frac{\text{rise.}}{\text{run}}$ Students recognize that in a linear equation the coefficient of *x* is the slope and the constant is the *y*-intercept.

OIMA.2.4 Represent the equation of a line in slope-intercept form, given the slope and y-intercept.	• Students use the slope-intercept form of an equation $y=mx+b$, where m is the slope (coefficient of x) and b is the y-intercept. Given the slope and y-intercept, students write the equation. Given the slope-intercept form, students identify the slope and the y-intercept.
OIMA.2.5 Represent a linear equation graphically given the slope and y-intercept.	• Students recognize the y-intercept as the starting point for a graph and the slope as the rise/run to get to the next point. Given an equation in slope-intercept form or the slope and y-intercept, students graph the equation.
OIMA.2.6 Represent ordered pairs and linear equations.	• Students recognize that the ordered pairs making up the line satisfy the linear equation associated with the line. • Students understand that the linear equation gives the relationship between the x-coordinate and the y-coordinate of an ordered pair. For example, the following ordered pairs have y-coordinates that are two times the x-coordinate. Therefore, the linear equation for the line would be $y = 2x$. (0, 0) (2, 4) (3, 6) (5, 10) **<u>Example 1:</u>** Which of the following points would not be on the line represented by the equation: $y = 3x + 2$? (0, 2) (-1, -1) (2, 4) (1, 5) *Solution:* (2, 4) would not be on the line because $3 \cdot 2 + 2 = 8$ not the y-coordinate of 4.

Statistics and Probability	
Essential Standard	
OIM.S.1 Understand data in terms of graphical displays, measures of center and range.	
Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this standard are: **data, graph, circle graph, bar graph, pictograph, dot plot, mean, median, mode, range, maximum, minimum, average, linear model, positive association, negative association, no association**	
Clarifying Objectives	**Unpacking** What does this standard mean that a student will know and be able to do?
OIM.S.1.1 Interpret data from circle graphs, bar graphs, pictographs, maps, and scatter plots, in context.	Pose a question: Student should come up with a question. What is the typical genre read in our class? Collect and organize data: student survey Pictographs: Scaled pictographs include symbols that represent multiple units. Below is an example of a pictograph with symbols that represent multiple units. Graphs should include a title, categories, category label, key, and data. How many more books did Juan read than Nancy?  Single Bar Graphs: Students use both horizontal and vertical bar graphs. Bar graphs include a title, scale, scale label, categories, category label, and data.

	 • How many more nofiction books where read than fantasy books? • Did more people read biography and mystery books or fiction and fantasy books? • About how many books in all genres were read? • Using the data from the graphs, what type of book was read more often than a mystery but less often than a fairytale? • What interval was used for this scale? • What can we say about types of books read? What is a typical type of book read?
OIM.S.1.2 Calculate the mean, median, mode and range of a data set.	• Students understand that the mean represents the fair share, or the amount if all the values in a data set were the same. Students calculate mean by finding the sum of the data set and dividing by the number of pieces of data. • Students understand that the median is the middle value is a set of data when ordered from least to greatest. This value indicates that ½ of the data is greater than the median and ½ of the data is less than the median. If there is an even number of data, the mean is determined by finding the average of the two middle numbers. • Students understand the mode is the value that occurs most often in a data set. • Students understand the range of a data set is the distance between the maximum and minimum values. The range determines the consistency is a data set. A large range indicates a data set with inconsistent values; a small range means the values are more consistent. **Example:** This data set shows the number of people who attended a movie theater over a period of 8 days. Identify the mean, median, mode and range of the data. 14 26 21 38 20 35 21 30

OIM.S.1.3 Classify type (positive, negative, no relation) of association of data in scatterplots.	• Scatter plots are used to determine if an association exists between two variables. This association can be positive (as one value increases, the other variable increases), negative (as one value increases, the other variable decreases) or none (no apparent association between the variables). • Given scatter plots, students classify the association between the variables as positive, negative or none.  http://www.ct4me.net/Ohio_Graduation_Math_Test_Prep_DataStrand.htm • Given scenarios, students classify the association between the variables as positive, negative or none. **Examples:** 1. The number of words written and the amount of ink in a pen *Solution: negative →as the number of words increases, the amount of ink decreases* 2. A person's height and their salary *Solution: none* 3. The number of tickets sold at the movie theater and the amount of popcorn cold *Solution: positive →as the number of tickets sold increases, the amount of popcorn increases*
OIM.S.1.4 Represent trends on scatterplots when appropriate, with a linear model.	• Students represent trends when appropriate with a linear model that is representative of most of the points. • Students recognize an appropriate linear model for a scatter plot.