RETHINK EDUCATION
North Carolina Department of Public Instruction

An At-Home Guide for Families

8th Grade Mathematics in North Carolina Public Schools

Course Outline

At the end of the course, my child will know…

- numbers that never end and never repeat are irrational and estimate their value to one decimal place.
- exponents tell how many times to multiply the base and rewrite numbers with exponents (2^3) to numbers without exponents (8).
- scientific notation is a way to write very large and very small numbers and how to convert between standard notation and scientific notation.
- that angles inside and outside of a triangle have a special relationship and use to solve problems.
- that the angles created by a line through parallel lines have special relationships and use the special relationships to solve problems.
- translations, rotations, and reflections are rigid transformations and that dilations are a non-rigid transformation and use multiple transformations to transform figures on a coordinate plane.
- two figures are congruent if they are the same size and same shape and similar if the sides are proportional and determine if two figures are congruent or similar.
- how to use the Pythagorean Theorem to find lengths on the coordinate plane and to solve real-world problems.
- how the volume formulas for cylinders, cones, and spheres are created and use the formulas to solve problems.
- how to write linear equations and inequalities with one variable and use to solve problems.
- the solution to a pair of linear equations is where the two lines intersect and recognize when the pair of linear equations have no solution, one solution, or infinite solutions.
- functions have one output for each input and create rules (or equations) to represent the relationship between the input and output for a linear function.
- the slope and initial value of line can be determined from a graph, two points, or words, and use the slope and initial value to write a linear equation and interpret what the slope and initial mean in the context of the problem.
- scatterplots display data points and can show a positive or negative linear association, nonlinear association, or no association and identify any outliers, gaps, or clusters.

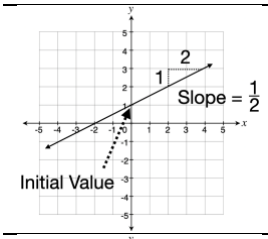
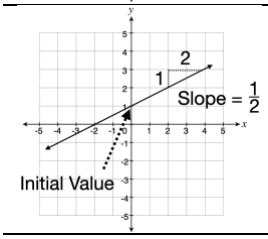
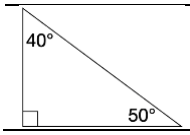
- two-way tables summarize data for two categories and use two-way tables and calculate the relative frequencies to describe any association between the two variables.

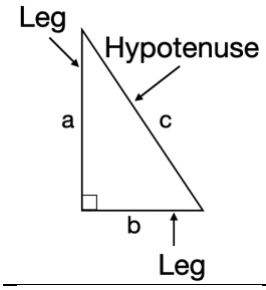
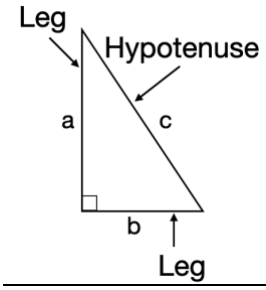
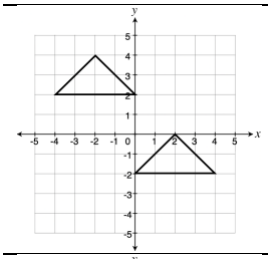
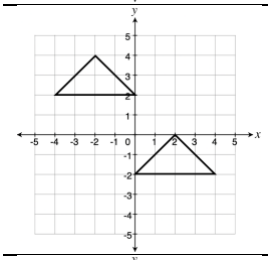
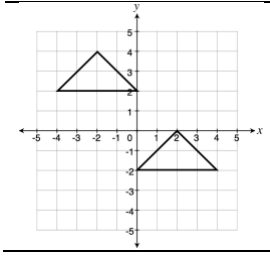
Curious what the specific standards are for 8th Grade Math in North Carolina?

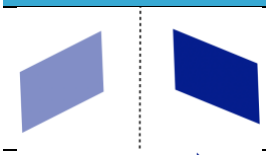
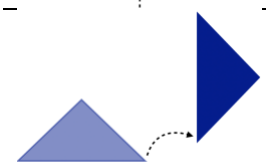
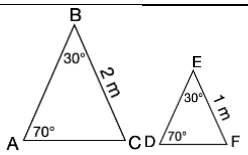
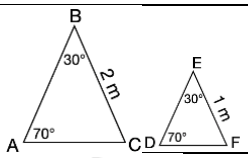
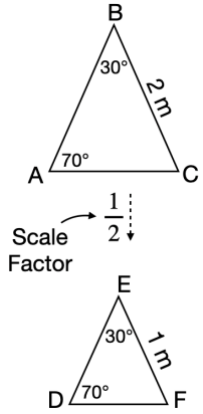
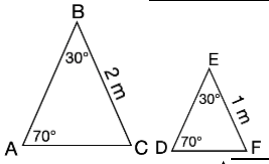
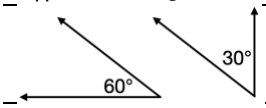
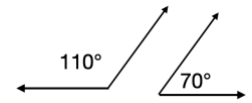
Check out the **North Carolina Standard Course of Study** to learn more. Looking for additional explanations about what students should be able to do at the end of this course? Check out **NC DPI's unpacked contents document** aligned to the course standards.

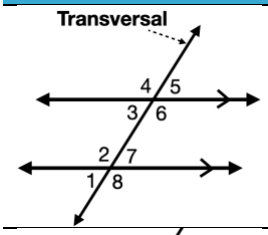
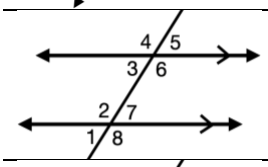
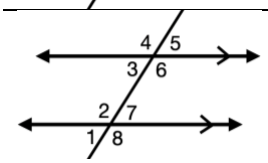
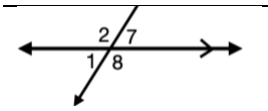
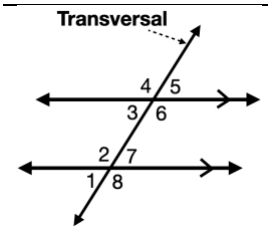
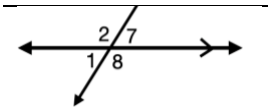
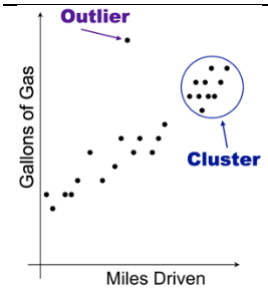
RETHINK EDUCATION
North Carolina Department of Public Instruction

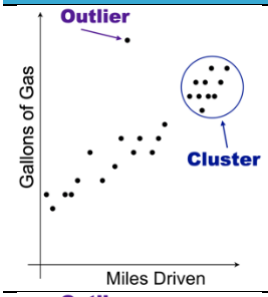
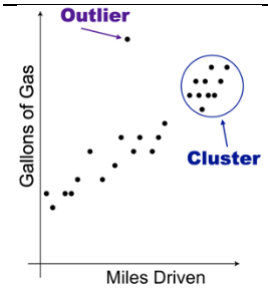
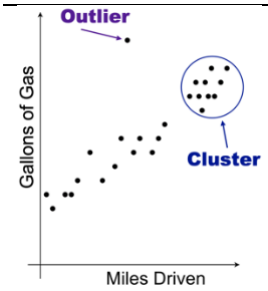
Key Vocabulary

Visual	Term	Definition
$\sqrt{5}$	**Square Root**	A value that when multiplied by itself gives the number.
$\sqrt[3]{7}$	**Cube Root**	A special number that when a certain value is multiplied three times, gives that number.
$\pi = 3.14159265 \ldots$	**Irrational Number**	Numbers that, in decimal form, never terminate and never repeat.
Base → 3^5 ← Exponent	**Exponent**	Number placed to the upper-right of a base that indicates how many times the base is multiplied.
2.1×10^{11}	**Scientific Notation**	A way of writing very large or very small numbers. A number is written in scientific notation when a number between 1 and 10 is multiplied by a power of 10.
$y = 2x^2 - 3x$	**Function**	A rule applied to an input value and yields an output.
	**Initial value**	In a linear function, it is what you start or begin with.
	**Slope**	The steepness of a line, expressed as a ratio or rate of change.
$y = 3x - 5$	**Linear Relationship**	Describes the relationship between a variable and a constant
$y = 3x - 5$	**Linear Equation**	An equation which produces a straight line.
$y = 3x - 5$	**Slope-Intercept Form**	A linear equation written in the form y = mx + b, where m is the slope and b is the y-intercept.
	**Right Triangle**	A triangle with one 90° or right angle.

Visual	Term	Definition
	**Legs**	The two shorter sides of a right triangle. They form the right angle.
	**Hypotenuse**	The longest side of a right triangle. The side opposite the right angle.
$a^2+b^2=c^2$	**Pythagorean Theorem**	States in a right triangle the length of the hypotenuse (c) squared is equal to the sum of the squares of the lengths of the legs: $a^2+b^2=c^2$.
	**Transformation**	Changing the position, size, or orientation of a shape. There are four transformations we can perform: translation, reflection, rotation, and dilation.
	**Congruent Figures**	Two or more figures having the same shape and same size. The figures do not have to be in the same position or direction. Congruent symbol: ≅
	**Rigid Transformation**	A motion that does not affect the size or shape of the figure.

Visual	Term	Definition
	**Reflection**	A figure is flipped over an imaginary line without changing the size or shape.
	**Rotation**	A figure is moved around a fixed point without changing the size or shape.
	**Translation**	A translation moves a figure either horizontally or vertically without changing the size or shape.
	**Similar Figures**	Figures that have congruent corresponding angles and corresponding sides are proportional. Same shape, different size. Symbol: ~
	**Dilation**	A transformation that produces a figure that is the same shape but a different size.
	**Scale Factor**	A ratio that describes the shrink or stretch of an image.
	**Angle-Angle Criterion**	If two interior angles of two triangles are congruent, the two triangles are similar.
	**Complementary Angles**	Two angles whose sum is 90 degrees.
	**Supplementary Angles**	Two angles whose sum is 180 degrees.

Visual	Term	Definition
	**Transversal**	A line that cuts across 2 or more other lines.
	**Adjacent Angles**	Angles that are immediately next to each other. Such as angles 4 and 5.
	**Alternate Interior Angles**	Angles created when a transversal intersects parallel lines that lie inside the parallel lines on the opposite sides of the transversal. Such as angles 3 and 7.
	**Alternate Exterior Angles**	Angles created when a transversal intersects parallel lines that lie outside the parallel lines on the opposite sides of the transversal. Such as angles 7 and 8.
	**Corresponding Angles**	Angles that are in the same position made by a line cutting through 2 or more lines; if the intersected lines are parallel the corresponding angles are of equal size; one inside and one outside parallel lines on the same side of transversal. Such as angles 1 and 3.
	**Vertical Angles**	A pair of angles directly opposite each other, formed by intersecting straight lines. Such as angles 2 and 8.
	**Bivariate Data**	Data for two variables. Usually two types of related data.

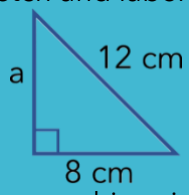
Visual	Term	Definition
	**Scatter Plot**	A graph in which the values of two variables are plotted along two axes. The pattern of the resulting points revealing any correlation present.
	**Cluster**	Data points in a scatter plot that form a distinct group.
	**Outlier**	A data point that does not fit into the pattern and deviates in an extreme way.
Color Preference Red Blue Total Boy 5 6 11 Girl 4 9 13 Total 9 15 24	**Two Way Table**	A statistical table that shows the observed number or frequency for two variables where the rows indicating one category and the columns indicating the other category.

Learning in Action: Grade Level Skills

Examples of Grade Level Skills

Problem: Find the length of the missing leg for a right triangle with a hypotenuse measuring 12 cm and leg measuring 8 cm. Round to the nearest tenth.
Solution:

Sketch and label the triangle.



Because this a right triangle and one side is missing, use the Pythagorean Theorem.

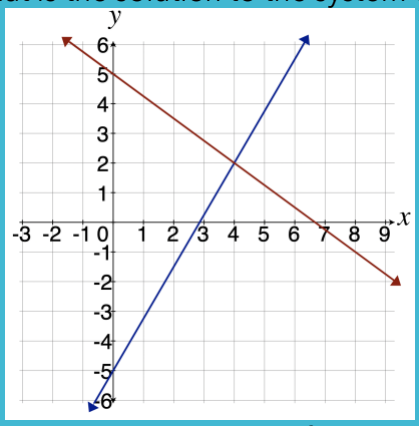
$$a^2 + b^2 = c^2$$
$$a^2 + 8^2 = 12^2$$
$$a^2 + 64 = 144$$
$$a^2 + 64 - 64 = 144 - 64$$
$$a^2 = 80$$
$$a = \sqrt{80}$$

Estimate the square root using the perfect squares closest to $\sqrt{80}$.

$$\sqrt{64} < \sqrt{80} < \sqrt{81}$$
$$8 < \sqrt{80} < 9$$

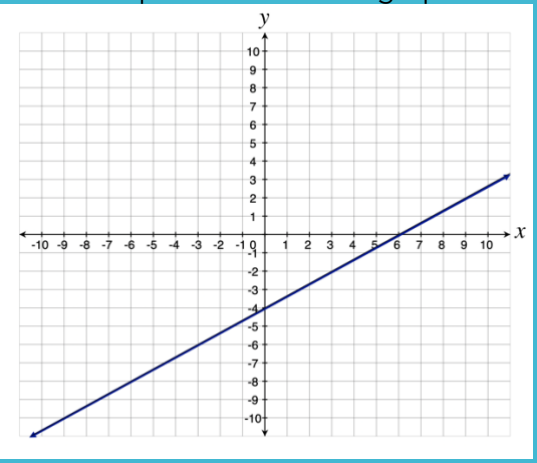
Because $\sqrt{80}$ is only 1 away from $\sqrt{81}$ and the question asks to round to the nearest tenth, $\sqrt{80} \approx 8.9$. Thus, the length of the missing leg is approximately **8.9 cm**.

Problem: What is the solution to the system of equations graphed?



Solution: The solution to a system of equations is all points that are solutions for all equations in the system. Graphically this is where the equations intersect. Here we have two lines that intersect at a single point. That point is the solution to the system. Thus, the solution to the system of equations graphed is **(4, 2)**.

Problem: What is the equation of the line graphed below?



Solution: Use slope-intercept form, $y = mx + b$, to write the equation. The m is the slope or rate of change and b is the y-intercept or where the line crosses the y-axis.

$m = \text{Slope} = \text{Rate of Change} = \dfrac{\text{Vertical Rise}}{\text{Horizontal Run}} = \dfrac{2}{3}$

$b = \text{y} - \text{intercept} = -4$

Substitute into $y = mx + b$ to get the equation $\boldsymbol{y = \frac{2}{3}x - 4}$.

Problem: Which sequence of transformations will ***not*** create a congruent figure?

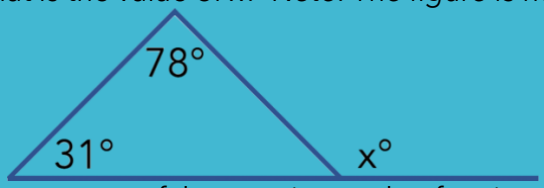
A. Translate right 2 units and translate up 4 units.
B. Rotation 90° about the origin and translate down 1 unit.
C. Translate left 3 units and reflect about the x-axis.
D. Translate up 3 units and dilate by a scale factor of 2.

Solution: Rigid transformations retain the figures shape and size which means the figures are congruent after rigid transformations. Non-rigid transformations change the figures size which means the figures are not congruent.

Translations are rigid transformations because the figure is moved left, right, up, or down. Like a car traveling down a road.
Rotations are rigid transformations because the figure is rotated without any change to its size or shape. Like the hand on an analog clock that moves.
Reflections are rigid transformation because the figure is flipped without any change to shape or size. Like a reflection in a mirror.
Dilations are non-rigid transformations because they grow or shrink. Like the pupil of an eye when exposed to light.

Thus, **D** is the sequence that will *not* create a congruent figure because it includes dilation as one of the transformations.

Problem: What is the value of x? *Note: The figure is not drawn to scale.*



Solution: The measure of the exterior angle of a triangle is equal to the sum of the two remote (non-adjacent) interior angles. So, x can be found as follows:

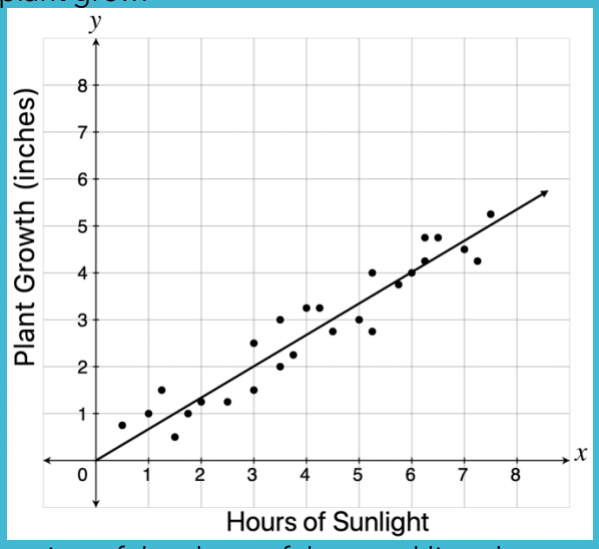
$$x° = 31° + 78° = 109°$$

Another way to find the value of x is that the exterior angle and unknown interior angle are supplementary, which means they add to 180°. The sum of the angles inside the triangle are 180°. The unknown angle inside the triangle can be found by subtracting the known angles from 180°.

$$\text{Interior Angle } = 180° - 31° - 78° = 71°$$
$$\text{Exterior Angle} = x° = 180° - 71° = 109°$$

Thus, the value of x is **109**.

Problem: The scatterplot shows the sunlight some leaf lettuce plants received and the amount each plant grew.



What is the meaning of the slope of the trend line shown on the scatterplot?

Solution: The slope is the rate of change. Write the slope in words first.

$$m = \text{rate of change} = \frac{\text{Rise}}{\text{Run}} = \frac{\text{plant grows 2 inches}}{\text{3 hours of sunlight}}$$

Thus, the meaning of the slope is the **plant grows 2 inches for every 3 hours of sunlight**.

Problem: What is the volume of a cylinder of a diameter of 20 cm and a height of 12 cm? (Note: Volume = $\pi r^2 h$)
Solution: The volume formula uses the radius and height. The height is given but the radius is not. The radius is half the diameter. Use the diameter to find the radius.

$$r = \frac{1}{2}d = \frac{1}{2} \cdot 20 = 10$$

Now substitute the radius and height into the volume formula.

$$V = \pi r^2 h$$
$$V = \pi \cdot 10^2 \cdot 12$$
$$V = \pi \cdot 100 \cdot 12$$
$$V = 1200\pi$$

Thus, the volume of the cylinder is **1200π cm**.
Note: If the problem does not specify where to round, leave π in the answer. If the problem says to round, wait until the last step to substitute 3.14 for π.

Resources

Links and online resources to allow you to support your child's learning.

- Algebra Foundations, Khan Academy
- Grade 8 Mathematics, Open Up Family Resources
- Grade 8 Mathematics, Open Up Student Resources
- 8th Grade Common Core Resource, Inside Mathematics at UTA
- 8th Grade Math, Khan Academy
- 8th Grade Math Resource, MathChimp
- 8th Grade Math Resource, IXL
- Middle School Math Resource, Virtual Nerd
- Pre-Algebra Resource, Virtual Nerd

At-Home Connections

- Tell me how you solved a problem encountered in math class today.
- Tell me about an example of a rigid or non-rigid transformations encountered today and the transformation performed.
- Tell me two objects that are similar and how you know they are similar.

Challenges to Anticipate

It is hard to watch our children struggle but this is an important part of the learning process. Be supportive and encouraging when struggles happen.

- Try the problem even if it is wrong. Learning occurs through failure.

- Ask your child to explain an example to you they understood to help build confidence. Explaining to you will help with their understanding.
- Take a short break to come back to the problem with a clear head.

Working with exponents can be tricky. A common misconception is to multiply the base and exponent ($3^5 \neq 3 \times 5$) instead of expanding the base ($3^5 = 3 \times 3 \times 3 \times 3 \times 3$). Visit Virtual Nerd for more help with working with exponents.

There are relationships between angles and keeping them straight can be challenging. Visit Virtual Nerd for more help with angle relationships and parallel lines.

Communicating with Your Child's Teacher

Still feeling stuck? Reach out to your child's teacher to discuss what you can do further your child's learning. Some questions that might guide your discussion:

- What resources would you suggest I use to support my child?
- Where do you see my child struggling? What can we do together to help?
- What should my child practice at home?
- What collective message can we send together to help my child learn?

Need Technical Help?

Reach out to your student's home school for technical assistance. Include the type of device (PC, Mac, Chromebook, etc.) and browser (Chrome, Firefox, Safari, etc.).