Family Guides: Supporting Learning in the 2020-21 School Year

HIGH SCHOOL Math

ABOUT THIS GUIDE

These days, because of the COVID-19 pandemic, students are often learning at home. It's a challenge for all of us. While parents, family members, grandparents, and other caregivers are all pitching in, we know students don't always have the information and resources they need. So, we include all those important people when we talk about how families can support high schooler's learning in this guide.

Families want to know more about what their teens are learning in school, so they can support them. In the early grades, they are usually able to offer help. Then, students get older, the content gets more challenging; and students gain ownership over their learning. Suddenly, parents and caregivers can feel like they don't have much help to offer. But that's not the case. Research confirms that families still have a big role to play in helping students learn. It's just a different role.

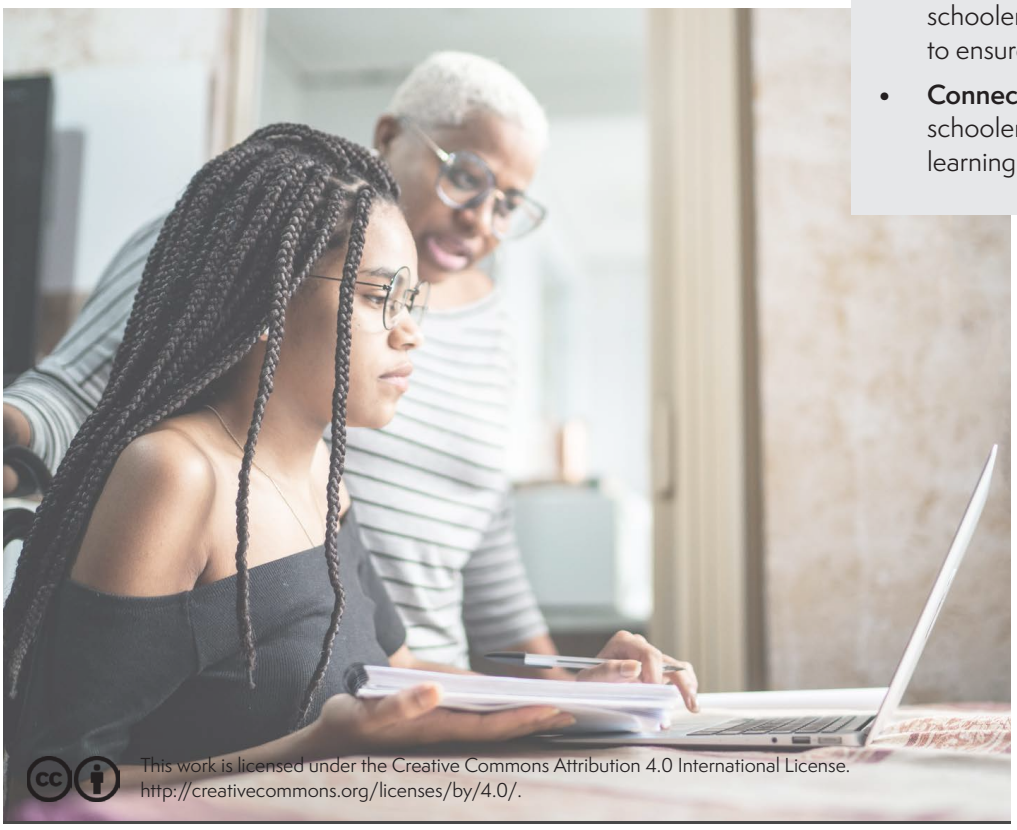
Especially now, as more learning is happening away from school buildings and on-line, how can families be supportive? In addition to providing encouragement, a study of more than 50,000 students found that relating what middle and high school kids are learning in school to their future life goals is one of the most effective ways families can help.[i] What doesn't work? Trying to be directly involved with schoolwork. It can feel to high schoolers like you're interfering or even confusing them. And this IS the time to encourage students to take more responsibility and be more independent.

This guide was developed so students and their families can understand the most important math content and skills students should learn in high school.

[i]Harvard Graduate School of Education (2009). Hill: Parents need to link schoolwork to future goals. http://www.gse.harvard.edu/news/09/05/hill-parents-need-link-schoolwork-future-goals.

THIS GUIDE INCLUDES

- **What High Schoolers Are Learning** – What experts say is the most important content (knowledge and skills) for students to learn in math during high school – and a few internet resources to help learn it.
- **Talking About Math with your High Schooler** – Ideas for families and their teens to talk about school.
- **Education Words** – Sometimes, educators and students use words that have a specific meaning in school. Those words are bolded. Understanding those terms will help you speak the same language.
- **Tips for Talking with Teachers** – How high schoolers, parents, and teachers can work together to ensure success.
- **Connecting Classrooms to Careers** – Helping high schoolers see the connection between classroom learning and their future.



Seek Common Ground

STUDENT ACHIEVEMENT PARTNERS

There are two math course pathways most commonly taught in U.S. high schools. One is the traditional course sequence of Algebra I, Geometry, and Algebra II. In recent years, some school have transitioned to teaching an integrated sequence, often called Integrated Math I, Integrated Math II, and Integrated Math III. The same content is taught in both pathways; it's just in a different order and often at different times. Since these are the two most common approaches in U.S. high schools, we provide information on both below, by course title.

It's worth noting that some students will begin this three-year sequence while they are in middle school, and many students will take additional math courses after they've completed this core set of courses. In addition to checking your state's and district's high school course graduation requirements, it's also important that students think about their post-high school plans to determine how much more math they should take and which additional courses match their future goals.

TRADITIONAL COURSE SEQUENCE

ALGEBRA I: WHAT HIGH SCHOOLERS ARE LEARNING

Students taking Algebra I will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- Creating equations and **systems of equations** to solve problems in context. For example, on June 21st, the day was four and a half hours longer than the previous night. How long was the previous night? Present the steps clearly and logically so that your classmates can follow along with your solution.
- Creating, analyzing, and applying functions. This work involves using equations, graphs, and tables that represent functions in different ways. The emphasis is on **linear, quadratic,** and **exponential functions.** For example, a mathematical model for farming predicts how much grain, y, will be harvested if a given amount of fertilizer, *x*, is applied. The model for the relationship is $y = 676 + 3.4x - (0.01754)x^2$, where x and y are measured in kilograms per acre or kg/acre. Is more fertilizer always better in this model? Estimate the best amount of fertilizer to use. (A graph of the relationship can be seen at https://www.desmos.com/calculator/16ua1no8td.)
- Reasoning **quantitatively** and using units to solve problems. For example, a nurse needs to know how much of a medicine to give a child who weighs 10 kg. The child should receive 25 mg of medicine for each kg of body weight. The medicine is packaged in bottles of liquid with 750 mg of medicine per 15 ml of liquid. How many ml of liquid should the child receive?
- Interpreting and identifying ways to rewrite expressions, such as the difference of squares, factoring out a common **monomial,** or regrouping while writing expressions in equivalent forms to solve problems. For example, rewriting $2x^2 3x^3y^2$ as $6x^5y^2$ or rewriting $(3t^2 + t) + (2 + t^2)$ as $4t^2 + t + 2$.
- Interpreting and comparing **shape, center,** and **spread** of realistic data sets to summarize, represent, and interpret **categorical** and **quantitative data.**

ALGEBRA I: TOOLS AND RESOURCES TO HELP

- Here is a readiness check on how well your student is applying **linear functions** through a game
  https://www.mathgames.com/skill/8.69-algebra-linear-function
- Videos on how to solve **systems of equations** using various methods
  http://www.mathtv.com/topic/algebra/systems-of-equations
- Practice activities to write **linear functions** based on a graph
  https://www.desmos.com/calculator/d0kidwd2uw
- This online game provides practice with recognizing the graphs of **quadratic functions** by matching a given **quadratic function** with the graph that represents it
  http://www.purposegames.com/game/quadratic-functions-quiz
- Analyze the differences between **exponential** and **linear functions** in a series of activities
  https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:exponential-growth-decay
- Activities, videos, and tutorials using units to reason **quantitatively**
  https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:working-units/x2f8bb11595b61c86:word-problems-multiple-units/e/units
- Practice your skills in factoring various types of quadratic expressions through a game
  https://www.mangahigh.com/en/games/wrecksfactor
- Activities for comparing and understanding data sets
  https://www.khanacademy.org/math/statistics-probability
- Videos and tutorials about **quantitative data**
  https://study.com/academy/lesson/what-is-quantitative-data.html

GEOMETRY: WHAT HIGH SCHOOLERS ARE LEARNING

Students taking Geometry will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- ◯ Understanding **congruence** and **similarity** in terms of plane **transformation.** Using **congruence** and **similarity** concepts to prove theorems, especially theorems about **transversals,** triangles, and **quadrilaterals.**
- ◯ Using area and **volume** formulas to solve real-world and mathematical problems of geometric measurement. For example, using **volume** formulas for cylinders, pyramids, cones, or spheres to solve problems, and applying geometric concepts to model situations.
- ◯ Defining **trigonometric ratios** and solving real-world problems involving right triangles.
- ◯ Working with geometric **shapes** in the coordinate plane, including by deriving the equation of a **circle.**
- ◯ Understanding **independent** and **conditional probability,** and using them to interpret data and compute probabilities of **compound events.**

GEOMETRY: TOOLS AND RESOURCES TO HELP

- Investigate **congruence** by manipulating the parts (sides and angles) of a triangle
  https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Congruence-Theorems/
- Here's a game to engage with **transformations** or a combination of **transformations**
  https://nrich.maths.org/transformationgame
- This website reviews the relationship between angles, parallel lines, and **transversals** to help you lay the foundation for proofs
  https://tutors.com/math-tutors/geometry-help/proving-lines-are-parallel
- Try out this applet to prove triangle **congruence**
  https://www.geogebra.org/m/d9HrmyAp#material/wYtNhjKr
- Concepts of **volume** are introduced through a unique and memorable song
  https://www.flocabulary.com/unit/volume-cone-cylinder-sphere/
- Explore the **trigonometric ratios** to find an unknown side or angle in a right triangle
  http://www.learnalberta.ca/content/mejhm/index.html?l=0&ID1=AB.MATH.JR.SHAP&ID2=AB.MATH.JR.SHAP.TRIG&lesson=html/object_interactives/trigonometry/use_it.html
- Videos that show you how to derive the equation of a **circle** in the coordinate plane
  https://www.ck12.org/geometry/circles-in-the-coordinate-plane/lesson/circles-in-the-coordinate-plane-geom/
- This series of videos takes you through multiple lessons on **conditional probability**
  https://www.onlinemathlearning.com/conditional-probability-cp3.html
- An interactive tool that shows the significance of **conditional probabilities** and independent events
  http://www.cut-the-knot.org/Curriculum/Probability/ConditionalProbability.shtml
- Basics in understanding probability
  https://www.khanacademy.org/math/statistics-probability/probability-library

ALGEBRA II: WHAT HIGH SCHOOLERS ARE LEARNING

Students taking Algebra II will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- ◯ Creating equations and **systems of equations** to solve problems in context. For example, at the circus, tickets are half price for kids younger than age 12. Our school bought tickets for 14 kids younger than age 12 and for 20 kids aged 12 and older. The total cost of the tickets was $108. How much is a circus ticket for a kid younger than age 12? Show the algebra steps you took to solve the problem. Present the steps clearly and logically so that your classmates can follow along with your solution.
- ◯ Creating, analyzing, and applying functions. This work involves using equations, graphs, and tables that represent functions in different ways. The emphasis is on **polynomial, exponential,** and **trigonometric functions.** For example, Susanna heard some exciting news about a celebrity. Within a day she told 4 friends who hadn't heard the news yet. By the next day, each of those friends told 4 other people who also hadn't yet heard the news. By the next day, each of those people told 4 more, and so on. Assume the news continues to spread in this way. Let N be the function that assigns to d the number of people who hear the news on the d^{th} day. Write an expression for $N(d)$. On which day will at least 100,000 people hear the rumor for the first time? Show the algebra steps you took to solve the problem. Present the steps clearly and logically so that your classmates can follow along with your solution.

ALGEBRA II: WHAT HIGH SCHOOLERS ARE LEARNING (continued)

- Interpreting and identifying ways to rewrite expressions, such as when simplifying **rational expressions** or when rewriting expressions involving **radicals** and **rational exponents.** For example, rewriting $\frac{x}{(x^2+3x)}$ as $\frac{1}{(x+3)}$; rewriting $7^{1.5}$ in any of the equivalent forms $7^{3/2}$, $\sqrt{343}$, $(\sqrt{7})^3$, or $7\sqrt{7}$.
- Relating zeros of polynomials to their factors. For example, to solve the equation $9x = x^3$, one can first rewrite the equation as $9x - x^3 = 0$. Next, one can factor the left-hand side to produce the equation $x(3 + x)(3 - x) = 0$. This form of the equation implies there are three solutions, $x = 0$, $x = 3$, and $x = -3$. The equation $9x - x^3 = 0$ can also be analyzed using a graph of the function $y = 9x - x^3$. (A graph of this relationship can be seen at https://www.desmos.com/calculator/x4nalzravs.)
- Using the **mean** and **standard deviation** of a data set. Understanding and evaluating random processes underlying statistical experiments, and drawing conclusions based on graphical and numerical summaries.

ALGEBRA II: TOOLS AND RESOURCES TO HELP

- This applet helps you explore **polynomial functions** of degrees up to 5
  https://www.analyzemath.com/polynomial2/polynomial2.htm
- Khan Academy can help you construct and analyze **exponential functions**
  https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:exp-model/x2ec2f6f830c9fb89:construct-exp/e/construct-exponential-models-according-to-rate-of-change
- This **trigonometric functions** game provides practice with recognizing the graphs
  https://www.purposegames.com/game/trig-functions-quiz
- Use this practice link to review simplifying **rational expressions**
  https://www.mesacc.edu/~scotz47781/mat120/notes/rational/simplifying/simplifying.html
- Videos and practice problems for evaluating exponents and **radicals**
  https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:exp/x2ec2f6f830c9fb89:eval-exp-rad/v/fractional-exponents-with-numerators-other-than-1
- Use this site to review factoring to find zeros of **polynomial functions**
  https://courses.lumenlearning.com/ivytech-collegealgebra/chapter/use-factoring-to-%EF%AC%81nd-zeros-of-polynomial-functions/
- Watch this video on the measures of **spread** to help you describe and compare data sets
  https://vimeo.com/439576447

INTEGRATED COURSE SEQUENCE

INTEGRATED MATH I: WHAT HIGH SCHOOLERS ARE LEARNING

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- Interpreting and comparing **shape, center** and **spread** of realistic data sets to summarize, represent, and interpret **categorical** and **quantitative data.**
- Understanding **congruence** and **similarity** in terms of plane **transformation.** Using **congruence** and **similarity** concepts to prove theorems, especially theorems about **transversals,** triangles, and **quadrilaterals.**

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- Practice activities to write **linear functions** based on a graph https://www.desmos.com/calculator/d0kidwd2uw
- This online game provides practice with recognizing the graphs of **quadratic functions** by matching a given **quadratic function** with the graph that represents it http://www.purposegames.com/game/quadratic-functions-quiz
- Construct and analyze **exponential functions** https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:exp-model/x2ec2f6f830c9fb89:construct-exp/e/construct-exponential-models-according-to-rate-of-change
- Activities, videos, and tutorials using units to reason **quantitatively** https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:working-units/x2f8bb11595b61c86:word-problems-multiple-units/e/units

INTEGRATED MATH I: TOOLS AND RESOURCES TO HELP (continued)

- Comparing and understanding data sets
  https://www.khanacademy.org/math/statistics-probability
- Investigate **congruence** by manipulating the parts (sides and angles) of a triangle
  https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Congruence-Theorems/
- Here is a game to engage with **transformations** or a combination of **transformations**
  https://nrich.maths.org/transformationgame

INTEGRATED MATH II: WHAT HIGH SCHOOLERS ARE LEARNING

Students taking Math II will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- ◯ Creating equations and **systems of equations** to solve problems in context. For example, at the circus, tickets are half price for kids younger than age 12. Our school bought tickets for 14 kids younger than age 12 and for 20 kids aged 12 and older. The total cost of the tickets was $108. How much is a circus ticket for a kid younger than age 12? Show the algebra steps you took to solve the problem. Present the steps clearly and logically so that your classmates can follow along with your solution.
- ◯ Interpreting and identifying ways to rewrite expressions, such as the difference of squares, factoring out a common **monomial,** or regrouping while writing expressions in equivalent forms to solve problems. For example, rewriting $2x^2 3x^3y^2$ as $6x^5y^2$ or rewriting $(3t^2 + t) + (2 + t^2)$ as $4t^2 + t + 2$.
- ◯ Interpreting and identifying ways to rewrite expressions, such as when rewriting expressions involving **radicals** and **rational exponents.** For example, rewriting $7^{1.5}$ in any of the equivalent forms $7^{3/2}$, $\sqrt{343}$, $(\sqrt{7})^3$, or $7\sqrt{7}$.
- ◯ Relating zeros of polynomials to their factors. For example, to solve the equation $9x = x^3$, one can first rewrite the equation as $9x - x^3 = 0$. Next, one can factor the left-hand side to produce the equation $x(3 + x)(3 - x) = 0$. This form of the equation implies there are three solutions, $x = 0$, $x = 3$, and $x = -3$. The equation $9x - x^3 = 0$ can also be analyzed using a graph of the function $y = 9x - x^3$. (A graph of this relationship can be seen at https://www.desmos.com/calculator/x4nalzravs.)
- ◯ Understanding **congruence** and **similarity** in terms of plane **transformation.** Using **congruence** and **similarity** concepts to prove theorems, especially theorems about **transversals,** triangles, and **quadrilaterals.**
- ◯ Using area and **volume** formulas to solve real-world and mathematical problems of geometric measurement. For example, using **volume** formulas for cylinders, pyramids, cones, or spheres to solve problems, and applying geometric concepts to model situations.
- ◯ Defining **trigonometric ratios** and solving real-world problems involving right triangles.
- ◯ Working with geometric **shapes** in the coordinate plane, including by deriving the equation of a **circle**.
- ◯ Understanding **independent** and **conditional probability,** and using them to interpret data and compute probabilities of **compound events.**

INTEGRATED MATH II: TOOLS AND RESOURCES TO HELP

- Play this game to practice your skills in factoring various types of quadratic expressions
  https://www.mangahigh.com/en/games/wrecksfactor
- Videos that demonstrate how to rewrite radical expressions with **rational exponents**
  http://www.artofproblemsolving.com/Videos/index.php?type=introalgebra#chapter11
- Review factoring to find zeros of **polynomial functions**
  https://courses.lumenlearning.com/ivytech-collegealgebra/chapter/use-factoring-to-%EF%AC%81nd-zeros-of-polynomial-functions/
- This website reviews the relationship between angles, parallel lines, and **transversals** to help you lay the foundation for proofs
  https://tutors.com/math-tutors/geometry-help/proving-lines-are-parallel
- Try out this applet to prove triangle **congruence**
  https://www.geogebra.org/m/d9HrmyAp#material/wYtNhjKr
- Concepts of **volume** are introduced through a unique and memorable song
  https://www.flocabulary.com/unit/volume-cone-cylinder-sphere/
- Explore the **trigonometric ratios** to find an unknown side or angle in a right triangle
  http://www.learnalberta.ca/content/mejhm/index.html?l=0&ID1=AB.MATH.JR.SHAP&ID2=AB.MATH.JR.SHAP.TRIG&lesson=html/object_interactives/trigonometry/use_it.html
- Videos that show you how to derive the equation of a **circle** in the coordinate plane
  https://www.ck12.org/geometry/circles-in-the-coordinate-plane/lesson/circles-in-the-coordinate-plane-geom/
- This series of videos takes you through multiple lessons on **conditional probability**
  https://www.onlinemathlearning.com/conditional-probability-cp3.html
- An interactive tool that shows the significance of **conditional probabilities** and independent events
  http://www.cut-the-knot.org/Curriculum/Probability/ConditionalProbability.shtml
- Basics in understanding probability
  https://www.khanacademy.org/math/statistics-probability/probability-library

INTEGRATED MATH III: WHAT HIGH SCHOOLERS ARE LEARNING

Students taking Math III will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- Creating equations and **systems of equations** to solve problems in context. For example, at the circus, tickets are half price for kids younger than age 12. Our school bought tickets for 14 kids younger than age 12 and for 20 kids aged 12 and older. The total cost of the tickets was $108. How much is a circus ticket for a kid younger than age 12? Show the algebra steps you took to solve the problem. Present the steps clearly and logically so that your classmates can follow along with your solution.
- Interpreting and identifying ways to rewrite expressions, such as the difference of squares, factoring out a common **monomial,** or regrouping while writing expressions in equivalent forms to solve problems. For example, rewriting $2x^2 3x^3 y^2$ as $6x^5 y^2$ or rewriting $(3t^2 + t) + (2 + t^2)$ as $4t^2 + t + 2$.
- Interpreting and identifying ways to rewrite expressions, such as when simplifying **rational expressions.** For example, rewriting $\frac{x}{(x^2+3x)}$ as $\frac{1}{(x+3)}$.
- Creating, analyzing, and applying functions. This work involves using equations, graphs, and tables that represent functions in different ways. The emphasis is on **polynomial, exponential,** and **trigonometric functions.** For example, Susanna heard some exciting news about a celebrity. Within a day she told 4 friends who hadn't heard the news yet. By the next day, each of those friends told 4 other people who also hadn't yet heard the news. By the next day, each of those people told 4 more, and so on. Assume the news continues to spread in this way. Let N be the function that assigns to d the number of people who hear the news on the d^{th} day. Write an expression for $N(d)$. On which day will at least 100,000 people hear the rumor for the first time? Show the algebra steps you took to solve the problem. Present the steps clearly and logically so that your classmates can follow along with your solution.
- Working with geometric **shapes** in the coordinate plane, including by deriving the equation of a **circle**.
- Using the **mean** and **standard deviation** of a data set. Understanding and evaluating random processes underlying statistical experiments, and drawing conclusions based on graphical and numerical summaries.

INTEGRATED MATH III: TOOLS AND RESOURCES TO HELP

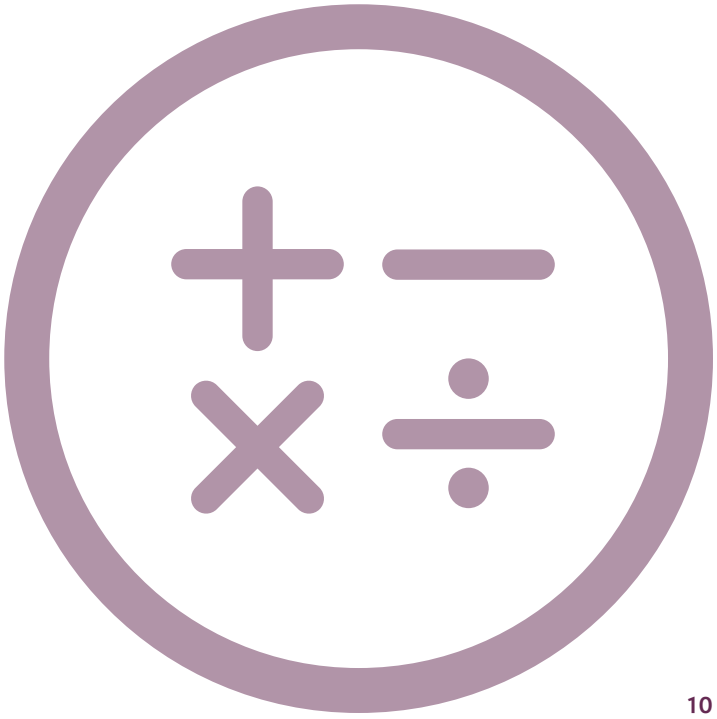
- Play this game to practice your skills in factoring various types of quadratic expressions https://www.mangahigh.com/en/games/wrecksfactor
- Use this practice link to review simplifying **rational expressions** https://www.mesacc.edu/~scotz47781/mat120/notes/rational/simplifying/simplifying.html
- Explore **polynomial functions** of degrees up to 5 https://www.analyzemath.com/polynomial2/polynomial2.htm
- Khan Academy can help you construct and analyze **exponential functions** https://www.khanacademy.org/math/algebra2/x2ec2f6f830c9fb89:exp-model/x2ec2f6f830c9fb89:construct-exp/e/construct-exponential-models-according-to-rate-of-change
- Videos that show you how to derive the equation of a **circle** in the coordinate plane https://www.ck12.org/geometry/circles-in-the-coordinate-plane/lesson/circles-in-the-coordinate-plane-geom/
- Watch this video on the measures of **spread** to help you describe and compare data sets https://vimeo.com/439576447

TALKING ABOUT MATH WITH YOUR HIGH SCHOOLER:

High school is an opportunity for students to take more ownership of their learning. The content students learn will become increasingly sophisticated. Acknowledging your teen's interests throughout this time can help to engage them in the study of mathematics.

Below are a few tips on how parents can encourage teens to engage with high school mathematics:

- Talk about the math your student is learning. What makes them feel successful? What new concepts are they learning? Where do they feel they need an additional math challenge or support?
- Find resources together that they feel are relevant and helpful to their course of study. Suggest that they talk to their teachers about the resources, extensions and practice activities they find.
- Ask students to name topics of study that are directly relevant to their world. For example,
  - In Algebra 1, students can calculate a trajectory for shooting a basketball into a hoop.
  - In Geometry, students can determine how much area is needed to install a pool, calculate the amount of water needed to fill the pool and estimate the time it will take to fill the pool.
  - In Algebra 2, students can examine how **exponential functions** can model real world features, such as trends in energy use.
  - In Math I, students can use exponential equations to understand and represent repayment models on future school loans.
  - In Math II, students can use probability to plan around how likely it is that they will need to file an insurance claim based on the percentage of drivers that hit a deer within the last year.
  - In Math III, students can use trigonometry and technology to graph sine and cosine functions that model sound waves in order to adjust **volume** and pitch.
- Encourage students to think about careers they might like to have when they are an adult. Help them learn about how math is a part of these jobs



EDUCATION WORDS

Sometimes, you'll hear educators use a word that has a specific meaning in schools. Understanding those terms will help you speak the same language!

Categorical data
Data that can be separated into different groups, consisting of labels or non-numeric entries. This can include rankings (for example, finishing places in a race), classifications (for example, brands of cereal), and binary outcomes (for example, coin flips).

Center
In statistics, the center is the median and/or value of a data set. In geometry, the center is a point that is the same distance from all locations of the perimeter on the figure.

Circle
A circle is a closed plane curve consisting of all points at an equal distance from the **center.**

Compound events
The likelihood of two or more independent events happening at the same time.

Conditional probability
The likelihood of one event occurring with some relationship to one or more other events. For example, the probability *(P)* that event *B* occurs because event *A* has occurred, written as *P(B|A).*

Congruence
Two figures or **shapes** in the plane are congruent if they are identical in **shape** and size, or identical in **shape** and size after one or the other is reflected.

Exponential function
A nonlinear function of the form $y = ab^x$, where $a \neq 0$, $b \neq 1$, and $b > 0$. The diagram shows graphs of two different exponential functions.

Independent probability
Two events are independent if the probability of one event is unrelated to the probability of the other event.

Linear function
Any function of the form $f(x) = ax + b$ that makes a straight line when it is graphed.

EDUCATION WORDS (continued)

Mean
A statistically "central" value of a set of numbers, calculated by adding all the numbers and dividing by how many numbers there are; sometimes called an average.

Monomial
An algebraic expression of one of the following types: a number (such as 47); a variable, possibly with whole-number exponents (such as z or x^3); a product of several variables, possibly with whole-number exponents (such as xyz or p^2q); and/or a product of a number and one or more variables, possibly with whole-number exponents (such as $-3a^2bc$).

Polynomial function
A function, such as a quadratic, a cubic, a quartic, and so on, involving only non-negative integer powers of x. When a polynomial function is completely factored, each of the factors helps identify zeros of the function.

Quadratic function
A function in one variable with the form $y = ax^2 + bx + c$, where a, b, and c are real numbers, and where $a \neq 0$ or, in the vertex form $f(x) = a(x - h)^2 + k$, where $a \neq 0$. The graph of a quadratic function is a "U **shape**" called a parabola.

Quadrilateral
A closed, two-dimensional **shape** with four straight sides.

Quantitative data
Consists of numbers that represent counts or measurements, for example, height, weight, or age.

Quantitatively/Quantitative reasoning
Knowing and flexibly using different properties of operations to create a coherent representation by considering units and attending to the meaning of quantities.

Radicals
Any expression containing a radical symbol, for example $\sqrt{2}$, $\sqrt[4]{16x^8}$.

Rational exponents
Expressions with exponents that are rational numbers (as opposed to integers, which are whole and negative numbers).

Rational expressions
A ratio of two polynomials; a fraction in which the numerator and/or the denominator are polynomials.

Shape
In statistics, the ways to describe shape are by the number of peaks, the possession of symmetry, the tendency to skew, or the uniformity in the data set.

Similarity
Two **shapes** are similar if resizing one **shape** would make it congruent to the other **shape;** when **shapes** have equal corresponding angles and proportional corresponding sides. If two **shapes** are similar, one **shape** can become the other if the first can be resized onto the other.

EDUCATION WORDS (continued)

Spread
In a data set, the spread is the measure of how far the numbers are away from the **mean** or median. The further the data values are from the **mean** or median, the greater the spread of the data.

Standard deviation
A measure of how **spread** out numbers in the data set are from its **mean** (see **Spread**).

System of equations
A set of two or more linear equations or inequalities with the same variables that need to be solved together. For example:

Equation 1: $y = x - 1$
Equation 2: $y = 3x + 7$

Transformation
A process that manipulates a polygon or other two-dimensional object on a plane or coordinate system. Mathematical transformations describe how two-dimensional figures move around a plane or coordinate system. Kinds of transformations include a translation (slide), reflection (flip), rotation (turn), dilation (resize), and glide (combination).

Transversals
Lines that cross at least two lines.

Trigonometric function
A function (such as the sine, cosine, tangent, cotangent, secant, or cosecant) of an arc or angle expressed in terms of the ratios of pairs of sides of a right-angled triangle.

Trigonometric ratios
These ratios, also known as trigonometric identities, relate the lengths of the sides of a right-angled triangle to its interior angles.

Volume
The amount of 3-dimensional space enclosed by a boundary or the amount required to fill an object.

TIPS FOR TALKING WITH TEACHERS

All students, particularly high schoolers who are engaged in more complex and sophisticated areas of study, should feel empowered to engage in conversation with their teachers about their progress and the content they are learning. Throughout the school year, students can use the following questions to ask teachers about their performance and self-assess:

- How can I apply what I already know to the content in this course?
- What are the expectations for success in this class? How do these criteria balance between effort and achievement?
- What do you see as areas of strength for me as a mathematician?
- Are there specific resources that I should be aware of to support my learning this year?

Families can also inquire about the content students will learn in class and how to provide support:

- What new content will be learned throughout the year? Which are the most important topics?
- Does my high schooler do better on problems involving more concrete tasks involving numbers or more abstract mathematical concepts?
- Are there topics that students are currently studying or will be learning about that connect to math they've already studied?
- Are there concepts that my teen may have missed out on from earlier this year that they need to go back and review in order to succeed on the material for the rest of this year?

CONNECTING CLASSROOMS TO CAREERS

Helping high schoolers see how what they are learning in school connects to their future is one of the best ways that families can support their kids. In addition to seeking out resources at school and in your community (community colleges are a great place to look), here are a few more ways to get started:

- Help your high schooler think about what jobs they might like to have, and then learn more about the education and training they need for a career in that field.
  https://www.careerzone.ny.gov/views/careerzone/stem/index.jsf
- Does your high schooler like building and fixing things? Helping people? Learn more about how interests could lead to a career.
  https://www.bls.gov/k12/students/careers/career-exploration.htm
- Have your high schooler visit/"shadow" someone who works in a career in which they are interested. Here are some virtual site visits to get started.
  https://www.nebraskacareerclusters.com/
- Has your high schooler expressed interest in a career in the military? Explore military careers here.
  https://www.asvabprogram.com/
- Find a pathway to success: A guide to help students learn how to translate their interests into one of 16 career clusters.
  https://ed.sc.gov/instruction/career-and-technical-education/career-guidance/career-cluster-guides/
- Learn the importance of math for careers and jobs: What teens need to know and how parents can help.
  https://www.niu.edu/mathmatters/careers-jobs/index.shtml
- Are there colleges your high schooler has expressed interest in attending? Together, check out their admissions requirements, including their course-taking requirements. Make sure your student is prepared for and taking the classes they need not just to graduate from high school but to be eligible for college admission.