

SECTION 6

HARRISON CENTRAL



HIGH SCHOOL

**MATH PTA AND
CREATIVE COMMONS
FAMILY GUIDE WITH
RESOURCES**



National
PTA

1200 14TH STREET, NW
WASHINGTON, DC 20005

PARENTS' GUIDE TO Student Success

This guide provides an overview of what your child will learn during high school in mathematics. It focuses on the key skills your child will learn in math, which will build a strong foundation for success in many of the other subjects he or she studies throughout high school. This guide is based on the new Common Core State Standards, which have been adopted by more than 40 states. These K-12 standards are informed by the highest state standards from across the country. If your child is meeting the expectations outlined in these standards, he or she will be well prepared for success after graduation.

HIGH SCHOOL MATH

WHY ARE ACADEMIC STANDARDS IMPORTANT?

Academic standards are important because they help ensure that all students, no matter where they live, are prepared for success in college and the workforce. They help set clear and consistent expectations for students, parents, and teachers; build your child's knowledge and skills; and help set high goals for all students.

Of course, high standards are not the only thing needed for our children's success. But standards provide an important first step — a clear roadmap for learning for teachers, parents, and students. Having clearly defined goals helps families and teachers work together to ensure that students succeed. Standards help parents and teachers know when students need extra assistance or when they need to be challenged even more. They also will help your child develop critical thinking skills that will prepare him or her for college and career.

HOW CAN I HELP MY CHILD?

You should use this guide to help build a relationship with your child's teacher. You can do this by talking to his or her teacher regularly about how your child is doing — beyond parent-teacher conferences.

At home, you can play an important role in setting high expectations and supporting your child in meeting them. If your child needs a little extra help or wants to learn more about a subject, work with his or her teacher to identify opportunities for tutoring, to get involved in clubs after school, or to find other resources.

THIS GUIDE INCLUDES

- An overview of some of the key things your child will learn in math in high school
- Topics of discussion for talking to your child's teacher about his or her academic progress
- Tips to help your child plan for college and career

Mathematics

To prepare for college and career, your child will study mathematics across a broad spectrum, from pure mathematics to real-world applications. Numerical skill and quantitative reasoning remain crucial even as students move forward with algebra. Algebra, functions, and geometry are important not only as mathematical subjects in themselves but also because they are the language of technical subjects and the sciences. And in a data-rich world, statistics and probability offer powerful ways of drawing conclusions from data and dealing with uncertainty. The high school standards also emphasize using mathematics creatively to analyze real-world situations — an activity sometimes called “mathematical modeling.”

The high school standards are organized into six major content areas: Number and Quantity; Algebra; Functions; Modeling; Geometry; and Statistics and Probability.

A Sample of the Work Your Child Will Be Doing To Become Ready for College and Career

NUMBER AND QUANTITY

- Working with rational and irrational numbers, including working with rational exponents (e.g., rewriting $(5^3)^{1/2}$ as $5\sqrt{5}$)
- Solving problems with a wide range of units and solving problems by thinking about units (e.g., “The Trans Alaska Pipeline System is 800 miles long and cost \$8 billion to build. Divide one of these numbers by the other. What is the meaning of the answer?”; “Greenland has a population of 56,700 and a land area of 2,175,800 square kilometers. By what factor is the population density of the United States, 80 persons per square mile, larger than the population density of Greenland?”)

ALGEBRA

- Solving real-world and mathematical problems by writing and solving nonlinear equations, such as quadratic equations ($ax^2 + bx + c = 0$)
- Interpreting algebraic expressions and transforming them purposefully to solve problems (e.g., in solving a problem about a loan with interest rate r and principal P , seeing the expression $P(1+r)^n$ as a product of P with a factor not depending on P)

FUNCTIONS

- Analyzing functions algebraically and graphically, and working with functions presented in different forms (e.g., given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum)
- Working with function families and understanding their behavior (such as linear, quadratic, and exponential functions)

APPLICATIONS

- Analyzing real-world situations using mathematics to understand the situation better and optimize, troubleshoot, or make an informed decision (e.g., estimating water and food needs in a disaster area, or using volume formulas and graphs to find an optimal size for an industrial package)

PROOFS

- Proving theorems about triangles and other figures (e.g., that the angles in a triangle add to 180°)
- Solving applied problems involving trigonometry of right triangles

- Using coordinates and equations to describe geometric properties algebraically (e.g., writing the equation for a circle in the plane with specified center and radius)

STATISTICS AND PROBABILITY

- Making inferences and justifying conclusions from sample surveys, experiments, and observational studies
- Working with probability and using ideas from probability in everyday situations (e.g., comparing the chance that a person who smokes will develop lung cancer to the chance that a person who develops lung cancer smokes)

Keeping the conversation focused.

When you talk to the teacher, do not worry about covering everything. Instead, keep the conversation focused on the most important topics. In high school, these include:

- Does my child have a strong grounding in arithmetic, including operations on fractions, decimals, and negative numbers?
- Does my child take a thinking approach to algebra and work with algebraic symbols fluently?
- Is my child comfortable using coordinates in algebra and geometry?
- Can my child break a complex problem down into parts and apply the math he or she knows to problems outside of mathematics?
- Does my child use terms precisely and make logical arguments?
- Does my child have the knowledge to learn advanced mathematics after high school if he or she so chooses?

Ask to see a sample of your child's work. Ask the teacher questions such as: Is this piece of work satisfactory? How could it be better? Is my child on track? How can I help my child improve or excel in this area? If my child needs extra support or wants to learn more about a subject, are there resources to help his or her learning outside the classroom?

Talking to Your Child's Teacher

PARENT TIPS

Planning for College and Career

At the beginning of each school year, sit down with your child's teachers, counselor or other staff to discuss what it will take for your child to graduate, your child's goals, and his or her plans after high school. Create a plan together to help your child reach these goals, and follow it every year to make sure he or she is on track.

This plan should include:

- **An appropriate course sequence to meet your child's goals.** For example, if your child wants to study biosciences in college, he or she will likely need additional or advanced math and science courses in high school to be prepared for college-level coursework.
- **The most appropriate extracurricular activities for your child to participate in.** For example, if your child is interested in journalism or photography, encourage him or her to sign up for the school newspaper or yearbook. These activities will help your child expand his or her learning outside of school and may help foster new hobbies or interests.
- **Ways you can help your child prepare for college or career.** For example, if your child is interested in a particular field, look to see if internships exist to build his or her work experience in that subject area. Look for college fairs to attend, and encourage your child to visit colleges he or she might be interested in.
- **Finding ways to pay for college or advanced training.** College can be expensive, but there are lots of ways to get financial help, such as scholarships, grants, work study programs, and student loans. You just need to make the time for you and your child to do the research. You can start by helping your child fill out the FAFSA (Free Application for Federal Student Aid) during his or her senior year of high school. Visit www.fafsa.ed.gov for help and more information on FAFSA and financial aid.

For more information, the full standards are available at www.corestandards.org.

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

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.¹ 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.

¹Harvard Graduate School of Education (2009). Hill: Parents need to link schoolwork to future goals. https://www.gse.harvard.edu/news/grad_09/03/hill-parents-need-link-schoolwork-future-goals.



HIGH SCHOOL Math

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.



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 schools 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.

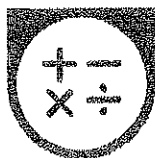
TRADITIONAL COURSE SEQUENCE

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/16us1no8td>.)
- ☐ 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 $2x^2 + 3x^3 + x^2$ as $6x^3 + x^2$ or rewriting $\{3i^2 + 1\} + \{2 + i^2\}$ as $4i^2 + 1 + 2$.
- ☐ 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



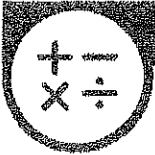
- Here is a readiness check on how well your student is applying linear functions through a game
<https://www.mathgames.com/skill/8.69-algebra-linear-function>
- Videos on how to solve **systems of equations** using various methods
<http://www.mathtv.com/topic/algebra/systems-of-equations>
- Practice activities to write **linear functions** based on a graph
<https://www.desmos.com/calculator/d0kicldw2uw>
- 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.

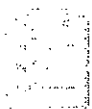


GEOMETRY: TOOLS AND RESOURCES TO HELP



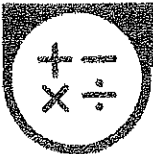
- Investigate **congruence** by manipulating the parts (sides and angles) of a triangle
<https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Congruence-Theorems/>
- Here's a game to engage with **transformations** or a combination of **transformations**
<https://rich.maths.org/transformationgame>
- 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/wYINhjKr>
- 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?f=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

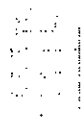


Students taking Algebra II will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- 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)

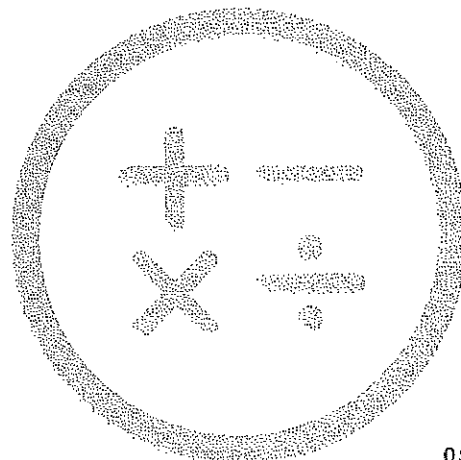


- Interpreting and identifying ways to rewrite expressions, such as when simplifying **rational expressions** or when rewriting expressions involving **radicals** and **rational exponents**. For example, rewriting $\frac{x}{(x^2+3x)}$ as $\frac{1}{(x+3)}$; rewriting $7^{1.5}$ in any of the equivalent forms $7^{3/2}$, $\sqrt[3]{343}$, $(\sqrt{7})^3$, 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.purposcgames.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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INTEGRATED MATH 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>
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- 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>

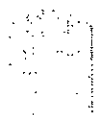


INTEGRATED MATH I: TOOLS AND RESOURCES TO HELP (continued)



- 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.nclm.org/Classroom-Resources/Illuminations/Interactives/Congruence-Theorems/>
- Here is a game to engage with **transformations** or a combination of transformations
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INTEGRATED MATH II: WHAT HIGH SCHOOLERS ARE LEARNING



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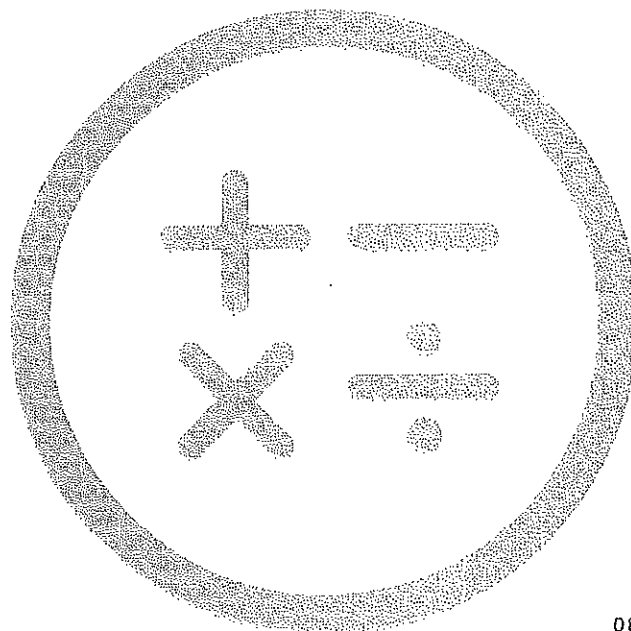
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- Relating zeros of polynomials to their factors. For example, to solve the equation $9x = x^3$, one can first rewrite the equation as $9x - x^3 = 0$. Next, one can factor the left-hand side to produce the equation $x(3 + x)(3 - x) = 0$. This form 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>.]
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- 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.

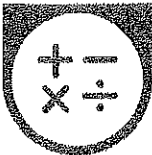


INTEGRATED MATH II: TOOLS AND RESOURCES TO HELP

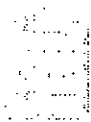


- Play this game to practice your skills in factoring various types of quadratic expressions
<https://www.mangahigh.com/en/games/wrecksfactor>
- Videos that demonstrate how to rewrite radical expressions with **rational exponents**
<http://www.artofproblemsolving.com/Videos/index.php?type=introalgebra#chapter11>
- 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



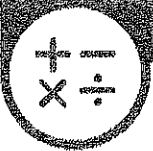
Students taking Math III will spend the most time working on the following topics. By the end of the year, they should understand the topics well to provide a foundation for success in additional coursework and as preparation for both college and career.

- 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 $2x^23x3^2$ 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 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>

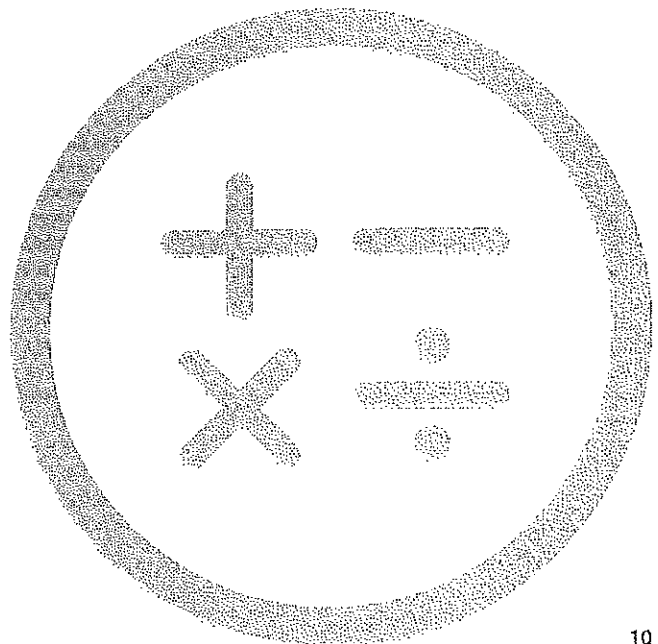


TALKING ABOUT MATH WITH YOUR HIGH SCHOOLER:

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

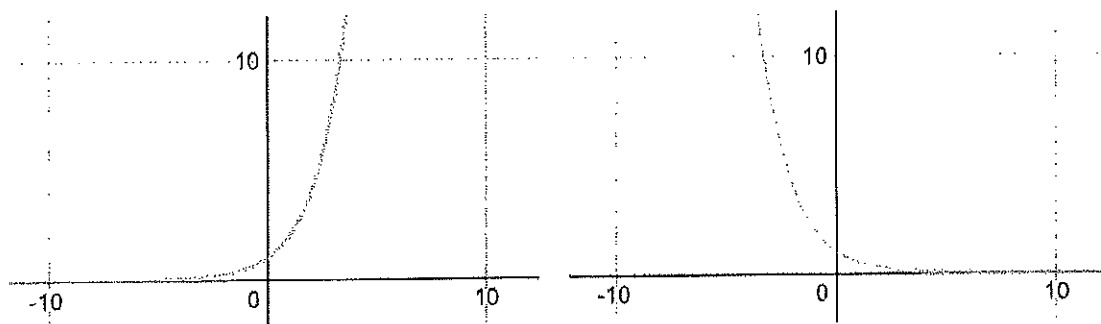
The likelihood of one event occurring with some relationship to one or more other events. For example, the probability (P) that event B occurs because event A has occurred, written as $P(B|A)$.

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

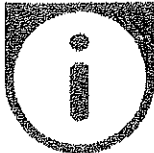
A nonlinear function of the form $y = ab^x$, where $a \neq 0$, $b \neq 1$, and $b > 0$. The diagram shows graphs of two different exponential functions.

**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 $\sqrt{2}$, $\sqrt[4]{16x^3}$.

Rational exponents

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

Rational expressions

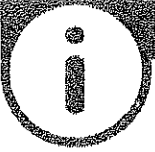
A ratio of two polynomials; a fraction in which the numerator and/or the denominator are polynomials.

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:

$$\text{Equation 1: } y = x - 1$$

$$\text{Equation 2: } y = 3x + 7$$

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

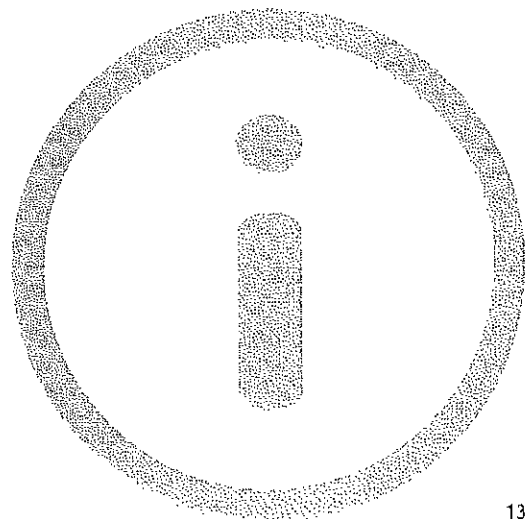
A function (such as the sine, cosine, tangent, cotangent, secant, or cosecant) of an arc or angle expressed in terms of the ratios of pairs of sides of a right-angled triangle.

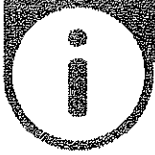
Trigonometric ratios

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

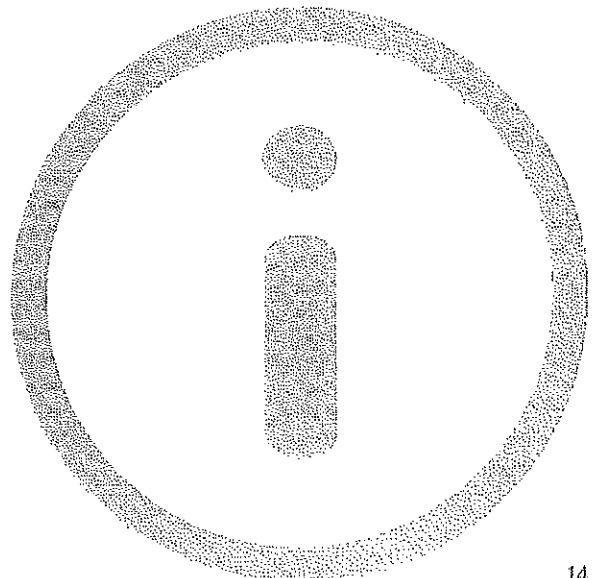
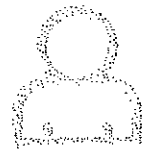
All students, particularly high schoolers who are engaged in more complex and sophisticated areas of study, should feel empowered to engage in conversation with their teachers about their progress and the content they are learning. Throughout the school year, students can use the following questions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



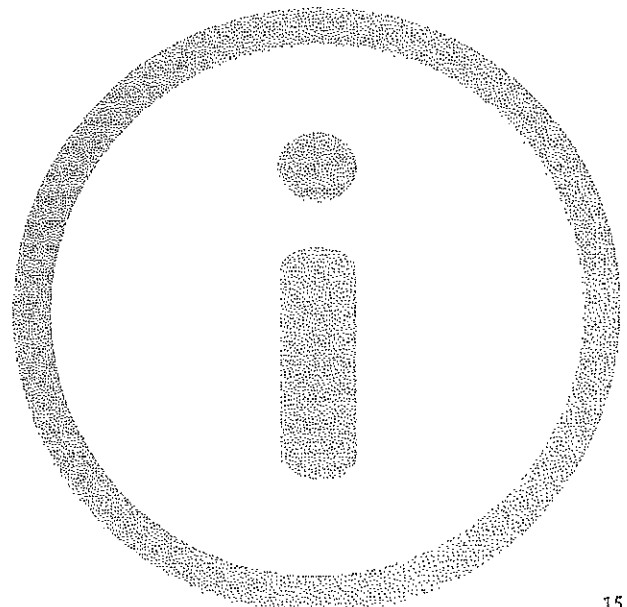


CONNECTING CLASSROOMS TO CAREERS



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.



TOP PICKS | 10 TOOLS

10 Best Math Tools for High School Students

CK-12

Super STEM, social studies resource with highly customizable content

Bottom line: Making content accessible to kids with different learning styles, CK-12 could be the key to mastery for some students.

Grades: K-12 Price: Free



Khan Academy

Missions boost learning with balance of focus and freedom to explore

Bottom line: A solid resource for math and science instruction as well as foundational knowledge in a number of other high school subjects.

Grades: K-12 Price: Free



PhET Interactive Simulations

Massive collection of excellent (and free!) science and math simulations

Bottom line: Instantly add meaningful lab experiences to math and science classrooms for exactly \$0? It's tough to beat that.

Grades: 3-12

Price: Free



CueThink

Social approach to problem-solving promotes deep math learning

Bottom line: An innovative, community-based platform that helps students plan, strategize, and collaborate.

Grades: 5-12

Price: Free to try, Paid



Math Nation

Approachable video courses break down math, build up student skills

Bottom line: This is a fantastic resource for students and teachers alike, with a straightforward, accessible approach to learning math and an admirable approach to differentiation.

Grades: 6-12

Price: Free, Paid



CanFigureIt Geometry

Flex your deductive reasoning muscles with geometric proofs

Bottom line: A really good way for math students to learn about proofs and explore them from a number of angles.

Grades: 6–12 Price: Free



Desmos

Elegant graphing calculator and math simulations promote collaboration

Bottom line: Part calculator, part interactive simulation tool, Desmos is a standout example of inquiry-driven math with super-smart instructional supports.

Grades: 6–12 Price: Free



GeoGebra

Create, share, and modify math models and simulations

Bottom line: Free, open-source software that lets teachers build or adapt learning experiences to meet their kids' needs.

Grades: 6–12 Price: Free



Virtual Nerd

Flip a classroom with these free video math tutorials

Bottom line: High-quality but monotonous math tutorials can be a good classroom supplement.

Grades: 6–12 Price: Free



Brilliant

Challenge top students with self-guided math, science, and CS courses

Bottom line: This learning and review site can be an exciting challenge for passionate students, but may be too much for struggling kids.

Grades: 7–12

Price: Free to try. Paid 