CollegeBoard

Official SAT® Practice on Khan Academy®

Resources for Math Teachers

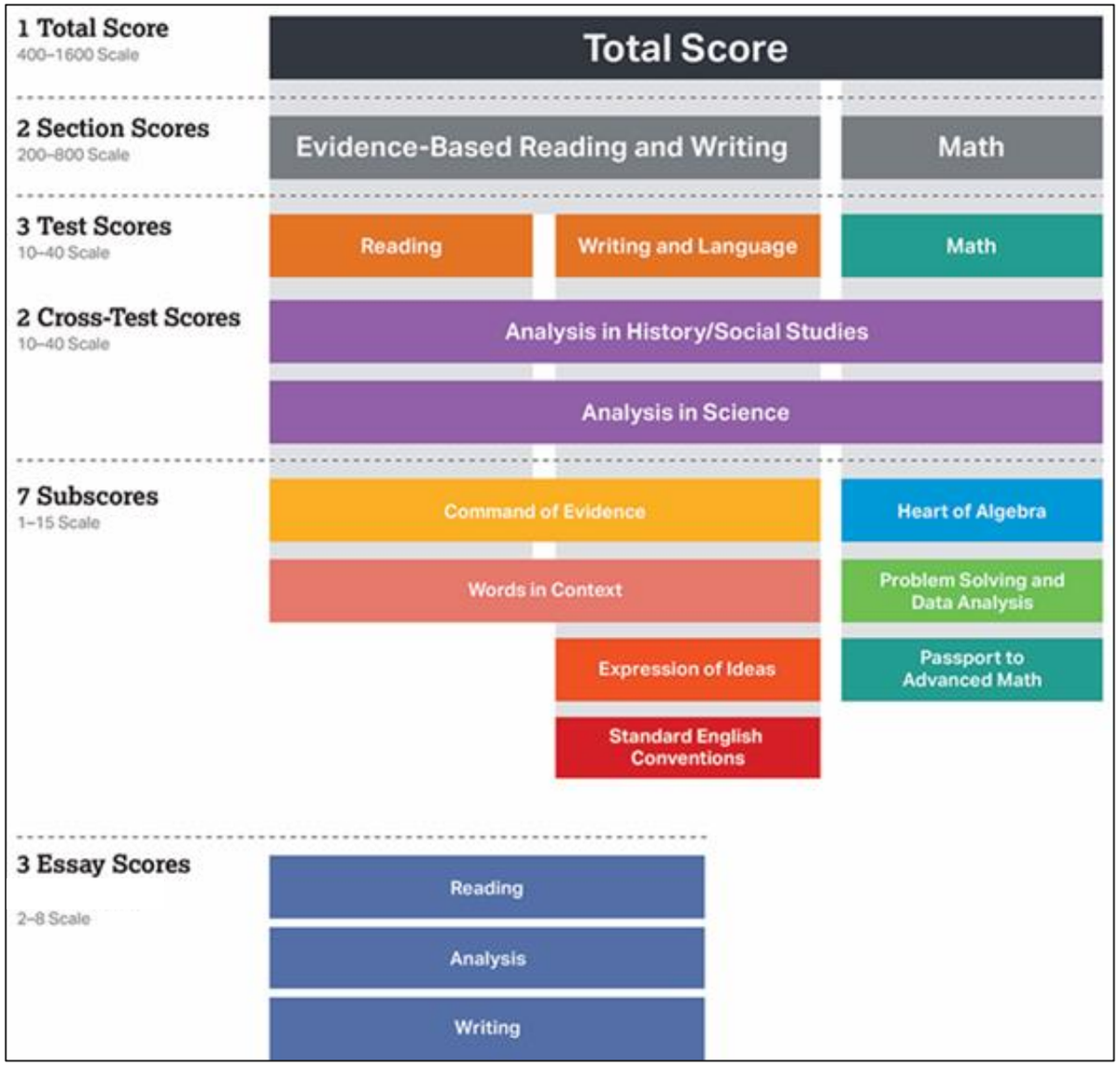
December 13-17, 2021

Agenda

What we'll cover in today's webinar:

- Overview of the Math Subscores
- Official SAT® Practice on Khan Academy® Math Lesson Plans and Resources
- Official SAT® Practice on Khan Academy®
  - Getting Started: Student Experience
  - Teacher Dashboard Tools: Educator Experience
    - Coach Tools
    - Planning for Usage
- Instructional Strategies for the Math Test

SAT® Scores and Subscores



Math That Matters Most

Students will engage in three key areas that contribute most to college readiness:

- Problem solving and data analysis
- Mastery of linear equations and systems
- Manipulation of more complex equations

SAT® Math Test Features

Calculator/No-Calculator portions

Focus on application, conceptual understanding, and procedural skill and fluency

Multiple question types

Multistep problems

Question sets

Math Test Information

The overall aim of the SAT® Math Test is to assess fluency with, understanding of, and ability to apply the mathematical concepts most strongly prerequisite for and useful across a wide range of college majors and careers.

Total Questions on the SAT® Math Test: 58

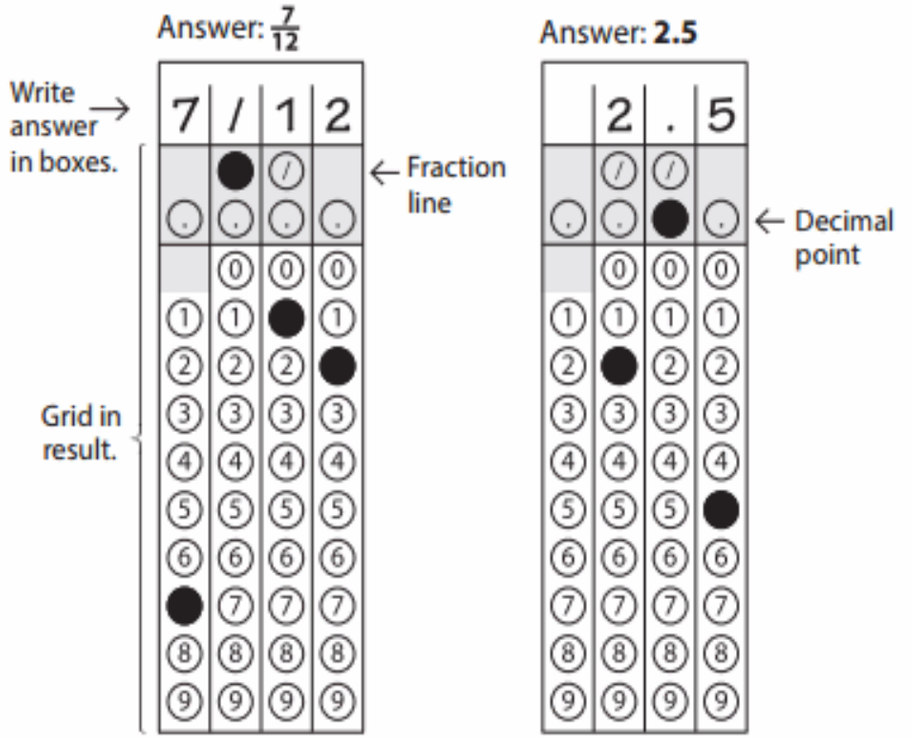
- Multiple Choice (45 questions)
- Student-Produced Response (13 questions)

Calculator and No-Calculator Portions

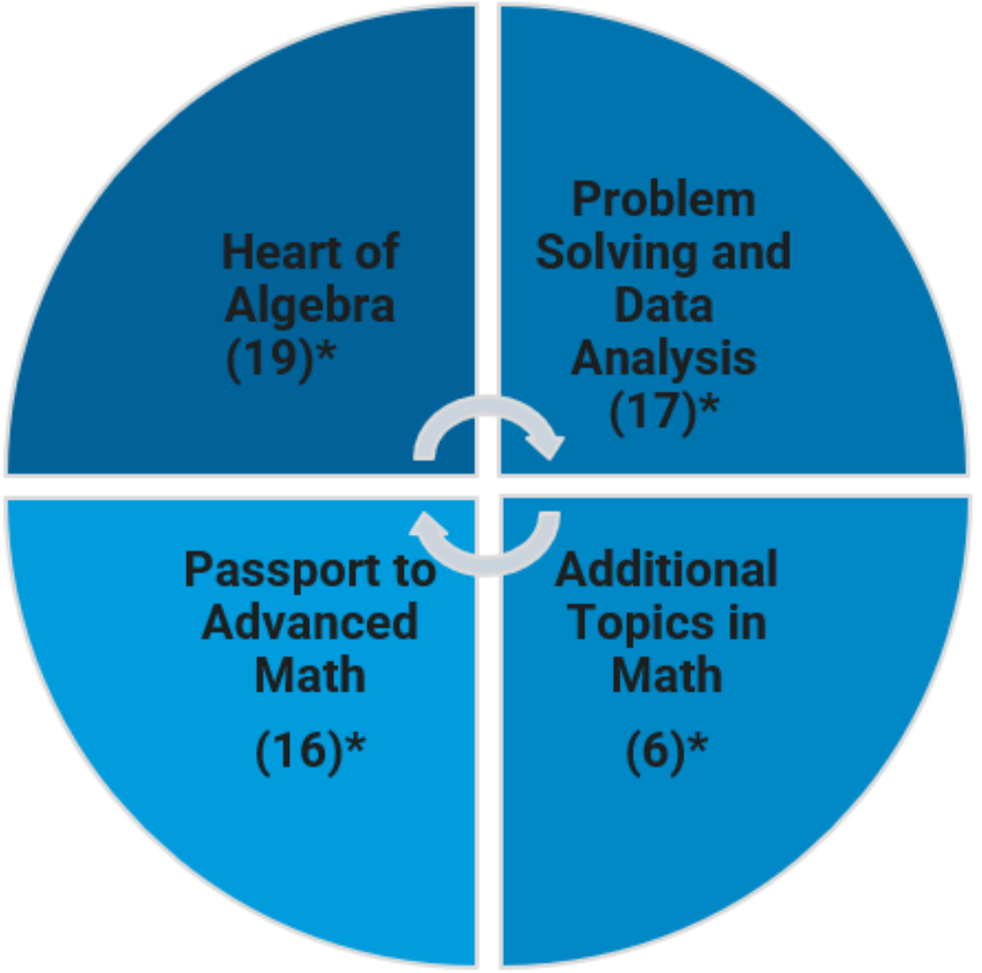
- The Calculator portion
  - gives insight into students' capacity to use appropriate tools strategically;
  - includes more complex modeling and reasoning questions;
  - includes questions in which the calculator could be a deterrent to expedience; and
  - allows students to use handheld calculator tools.
- The No-Calculator portion
  - allows the SAT® Suite to assess fluencies valued by postsecondary instructors and includes conceptual questions for which a calculator will not be helpful.

Student-Produced Response Questions

- The answer to each student-produced response question is a number (fraction, decimal, or positive integer) that will be entered into a grid on the answer sheet.
- Students may also enter a fraction line or a decimal point.



Math Test Domains



**Represents the number of questions in this domain*

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Official SAT® Practice Lesson Plans: Resources to Prepare for the Math Test

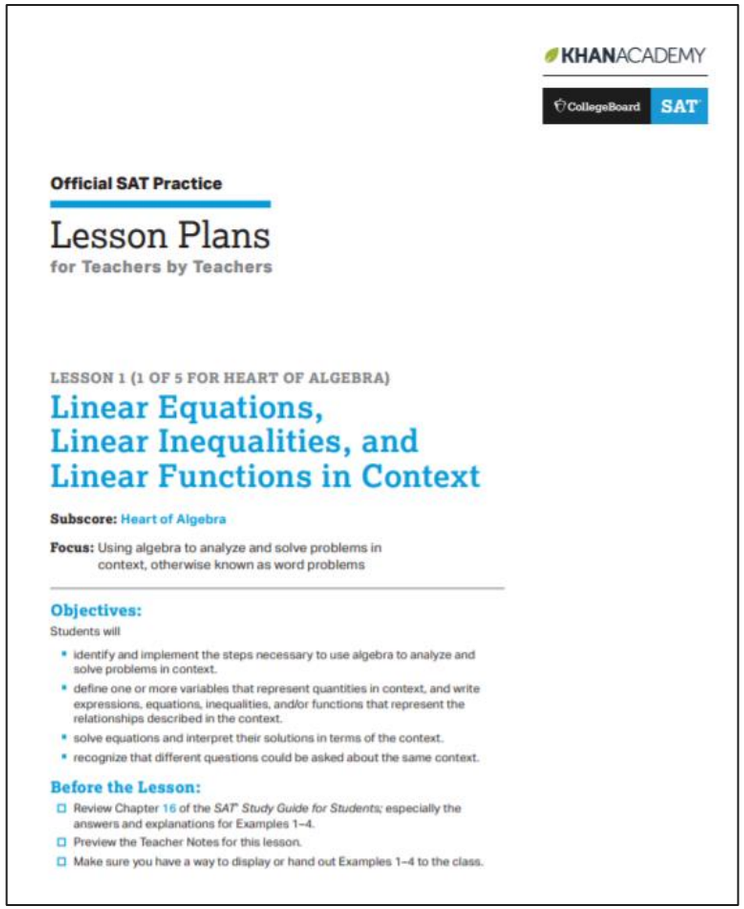
Heart of Algebra

Algebra is the language of high school mathematics.

The Heart of Algebra domain includes:

- analyzing and fluently solving equations and systems of equations;
- creating expressions, equations, and inequalities to represent relationships between quantities and to solve problems; and
- rearranging and interpreting formulas.

Heart of Algebra: Lesson Plan



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Lesson Plans

for Teachers by Teachers

LESSON 1 (1 OF 5 FOR HEART OF ALGEBRA)

Linear Equations, Linear Inequalities, and Linear Functions in Context

Subscore: Heart of Algebra

Focus: Using algebra to analyze and solve problems in context, otherwise known as word problems

Objectives:

Students will

- identify and implement the steps necessary to use algebra to analyze and solve problems in context.
- define one or more variables that represent quantities in context, and write expressions, equations, inequalities, and/or functions that represent the relationships described in the context.
- solve equations and interpret their solutions in terms of the context.
- recognize that different questions could be asked about the same context.

Before the Lesson:

- ☐ Review Chapter 16 of the *SAT® Study Guide for Students*; especially the answers and explanations for Examples 1–4.
- ☐ Preview the Teacher Notes for this lesson.
- ☐ Make sure you have a way to display or hand out Examples 1–4 to the class.

- Discuss the opening activity.
- Assign the example problems.
- Review the answer choices and discuss as a class.
- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Linear function word problems.

Linear Equations, Linear Inequalities, and Linear Functions in Context

Heart of Algebra: Opening Activity

Divide the class into three groups (one for each of the first three example problems).

Each group can split into pairs for this activity. Problems can be displayed and/or on slips of paper handed out to students.

As they complete the problem, ask them to record the following:

- Solve the problem. Show all work and answer the question.
- What do you need to know to solve this problem?
- What is the process you used to solve this problem?

After pairs of students have completed solving their example problems, have them share the process with their group and see that all reach a consensus about the answers, what they needed to know, and the process for solving them.

Heart of Algebra: Opening Activity

Example 1

In 2014, County X had 783 miles of paved roads. Starting in 2015, the county has been building 8 miles of new paved roads each year. At this rate, how many miles of paved road will County X have in 2030? (Assume that no paved roads go out of service.)

Example 2

In 2014, County X had 783 miles of paved roads. Starting in 2015, the county has been building 8 miles of new paved roads each year. At this rate, if n is the number of years after 2014, which of the following functions f gives the number of miles of paved road there will be in County X? (Assume that no paved roads go out of service.)

A. $f(n) = 8 + 783n$

B. $f(n) = 2{,}014 + 783n$

C. $f(n) = 783 + 8n$

D. $f(n) = 2{,}014 + 8n$

Heart of Algebra: Opening Activity

Example 3

In 2014, County X had 783 miles of paved roads. Starting in 2015, the county has been building 8 miles of new paved roads each year. At this rate, in which year will County X first have at least 1,000 miles of paved roads? (Assume that no paved roads go out of service.)

Heart of Algebra: Class Discussion

Have the class read all three example problems.

What do you need to know to solve each problem?

Do the following:

- Define the term “variable.”
- Write an expression and explain how to substitute a value for a variable.
- Create a function for a given situation/context.
- Solve an equation/inequality and interpret a solution.
- Create a list of steps for solving these types of problems.
- Define one or more variables that represent quantities in the question.
- Write one or more equations, expressions, inequalities, or functions that represent the relationships described in the question.
- Solve the equation and interpret the solution in terms of what the question is asking.

Heart of Algebra: Class Discussion

- Explain that this example has no choices since it is a student-produced response question. Then, explain how to solve the item.

Example 1

In 2014, County X had 783 miles of paved roads. Starting in 2015, the county has been building 8 miles of new paved roads each year. At this rate, how many miles of paved road will County X have in 2030? (Assume that no paved roads go out of service.)

The first step in answering this question is to decide what variable or variables you need to define. Since the number of miles paved depends on the year, we can define a variable to represent the year. The number of years after 2014 can be represented using the variable n. Then, since the question says that County X had 783 miles of paved road in 2014 and is building 8 miles of new paved roads each year, the expression $783 + 8n$ gives the number of miles of paved roads in County X in the year that is n years after 2014. The year 2030 is $2030 - 2014 = 16$ years after 2014; thus, the year 2030 corresponds to $n = 16$. Hence, to find the number of miles of paved roads in County X in 2030, substitute 16 for n in the expression $783 + 8n$, giving $783 + 8(16) = 783 + 128 = 911$. Therefore, at the given rate of building, County X will have 911 miles of paved roads in 2030.

(Note that this example has no choices. It is a student-produced response question. On the SAT, you would grid your answer in the spaces provided on the answer sheet.)

Heart of Algebra: Class Discussion

- Explain the answer choice rationale, along with the rationales for the incorrect answer choices.

Example 2

In 2014, County X had 783 miles of paved roads. Starting in 2015, the county has been building 8 miles of new paved roads each year. At this rate, if n is the number of years after 2014, which of the following functions f gives the number of miles of paved road there will be in County X? (Assume that no paved roads go out of service.)

A) $f(n) = 8 + 783n$

B) $f(n) = 2{,}014 + 783n$

C) $f(n) = 783 + 8n$

D) $f(n) = 2{,}014 + 8n$

This question already defines the variable and asks you to create or identify a function that describes the context. The discussion in Example 1 shows that the correct answer is choice C.

Heart of Algebra: Class Discussion

- Explain that this example has no choices since it is a student-produced response question. Then, explain how to solve the item.

Example 3

In 2014, County X had 783 miles of paved roads. Starting in 2015, the county has been building 8 miles of new paved roads each year. At this rate, in which year will County X first have at least 1,000 miles of paved roads? (Assume that no paved roads go out of service.)

In this question, you must create and solve an inequality. As in Example 1, let n be the number of years after 2014. Then the expression $783 + 8n$ gives the number of miles of paved roads in County X n years after 2014. The question is asking when there will first be at least 1,000 miles of paved roads in County X. This condition can be represented by the inequality $783 + 8n \geq 1{,}000$. To find the year in which there will first be at least 1,000 miles of paved roads, you solve this inequality for n. Subtracting 783 from each side of $783 + 8n \geq 1{,}000$ gives $8n \geq 217$. Then dividing each side of $8n \geq 217$ by 8 gives $n \geq 27.125$. Note that an important part of relating the inequality $783 + 8n \geq 1{,}000$ back to the context is to notice that n is counting calendar years, and so the value of n must be an integer. The least value of n that satisfies $783 + 8n \geq 1{,}000$ is 27.125, but the year $2014 + 27.125 = 2041.125$ does not make sense as an answer, and in 2041, there would be only $783 + 8(27) = 999$ miles of paved roads in the county. Therefore, the variable n needs to be rounded up to the next integer, and so the least possible value of n is 28. Therefore, the year that County X will first have at least 1,000 miles of paved roads is 28 years after 2014, which is 2042.

Heart of Algebra: Closing Activity

- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Linear function word problems.
- Create a list of terms related to this lesson with the class.
- Let students know that they will not have to know these terms for the SAT, but being familiar with the concepts will help them to succeed.
- Examples include:
  - Variable
  - Linear
  - Expression
  - Function
  - Equation
  - Inequality
  - Independent and dependent variable

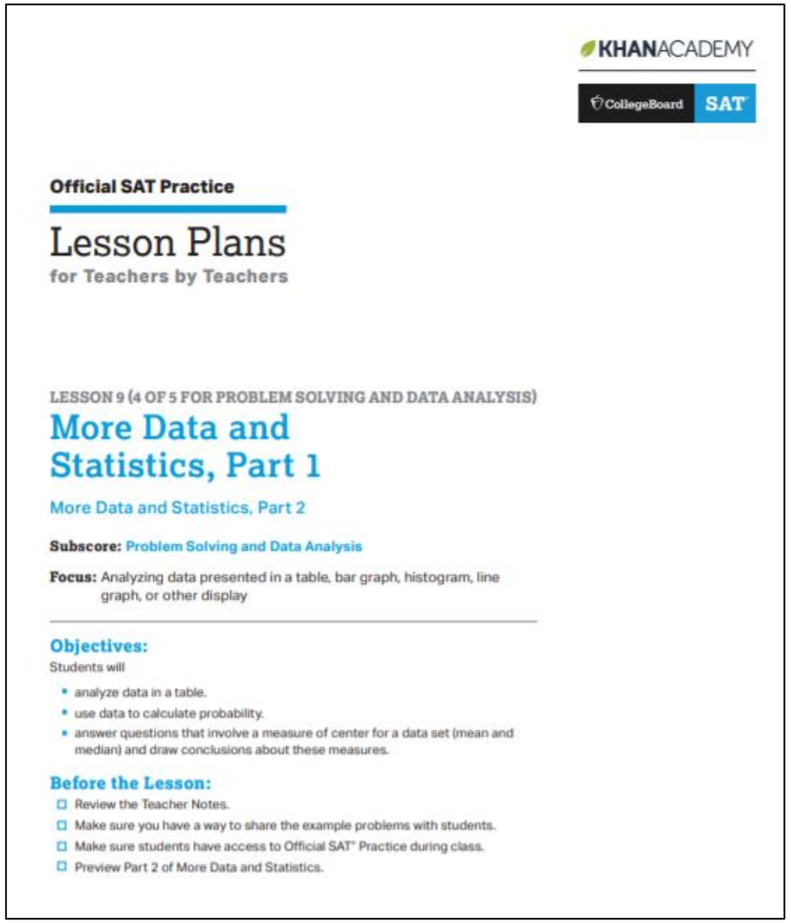
Problem Solving and Data Analysis

- Quantitative Reasoning
- Analysis of Data
  - Ratios
  - Percentages
  - Proportional reasoning

In Problem Solving and Data Analysis, students will encounter an important feature of the SAT® Suite of Assessments: **multipart questions.**

- Students can do more sustained thinking and explore situations in greater depth if asked more than one question about a given scenario.
- Students will generally see longer problems in their postsecondary work.
- Students will be asked to describe relationships shown graphically.

Problem Solving and Data Analysis: Lesson Plan



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LESSON 9 (4 OF 5 FOR PROBLEM SOLVING AND DATA ANALYSIS)

More Data and Statistics, Part 1

More Data and Statistics, Part 2

Subscore: Problem Solving and Data Analysis

Focus: Analyzing data presented in a table, bar graph, histogram, line graph, or other display

Objectives:

Students will

- analyze data in a table.
- use data to calculate probability.
- answer questions that involve a measure of center for a data set (mean and median) and draw conclusions about these measures.

Before the Lesson:

- ☐ Review the Teacher Notes.
- ☐ Make sure you have a way to share the example problems with students.
- ☐ Make sure students have access to Official SAT® Practice during class.
- ☐ Preview Part 2 of More Data and Statistics.

More Data and Statistics, Part 1

- Discuss the opening activity.
- Assign the example problems.
- Review the answer choices and discuss as a class.
- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Data collection and conclusions: Basic example and Data collection and conclusions: Harder example.

Problem Solving and Data Analysis: Opening Activity

Ask students to group themselves into pairs.

Have them complete the two example problems.

After pairs of students have completed solving their example problems, have them share the process with each other.

See that all pairs of students reach a consensus about the answers, what information is needed to solve the problems, and the process for solving it.

Problem Solving and Data Analysis: Opening Activity

Example 1

A store is deciding whether to install a new security system to prevent shoplifting. Based on store records, the security manager of the store estimates that 10,000 customers enter the store each week, 24 of whom will attempt to shoplift. Based on data provided from other users of the security system, the manager estimates the results of the new security system in detecting shoplifters would be as shown in the table below.

	Alarm sounds	Alarm does not sound	Total
Customer attempts to shoplift	21	3	24
Customer does not attempt to shoplift	35	9,941	9,976
Total	56	9,944	10,000

According to the manager's estimates, if the alarm sounds for a customer, what is the probability that the customer did *not* attempt to shoplift?

A) 0.0003

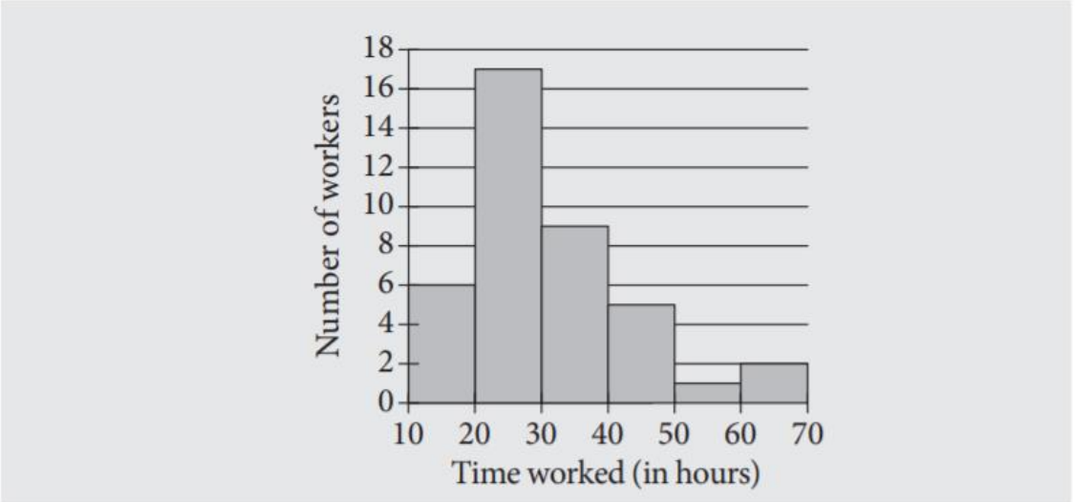
B) 0.0035

C) 0.0056

D) 0.625

Problem Solving and Data Analysis: Opening Activity

Example 2



The histogram above summarizes the distribution of time worked last week, in hours, by the 40 employees of a landscaping company. In the histogram, the first bar represents all workers who worked at least 10 hours but less than 20 hours; the second represents all workers who worked at least 20 hours but less than 30 hours; and so on. Which of the following could be the median and mean amount of time worked, in hours, for the 40 employees?

A. Median = 22, Mean = 23

B. Median = 24, Mean = 22

C. Median = 26, Mean = 32

D. Median = 32, Mean = 30

Problem Solving and Data Analysis: Class Discussion

Have the class discuss the two example problems and the answer rationales.

What do you need to know to solve each problem?

- Probability is the measure of how likely an event is. When calculating the probability of an event, use the following formula:
  - Probability = number of favorable outcomes/total number of possible outcomes

- Mean, median, and mode are measures of center for a data set, while range and standard deviation are measures of spread.

Problem Solving and Data Analysis: Class Discussion

- Explain the answer choice rationale, along with the rationales for the incorrect answer choices.

A store is deciding whether to install a new security system to prevent shoplifting. Based on store records, the security manager of the store estimates that 10,000 customers enter the store each week, 24 of whom will attempt to shoplift. Based on data provided from other users of the security system, the manager estimates the results of the new security system in detecting shoplifters would be as shown in the table below.

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According to the manager's estimates, if the alarm sounds for a customer, what is the probability that the customer did *not* attempt to shoplift?

A) 0.0003

B) 0.0035

C) 0.0056

D) 0.625

According to the manager's estimates, the alarm will sound for 56 customers. Of these 56 customers, 35 did *not* attempt to shoplift. Therefore, if the alarm sounds, the probability that the customer did *not* attempt to shoplift is $\frac{35}{56} = \frac{5}{8} = 0.625$. The correct answer is choice D.

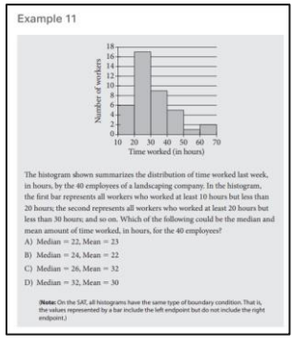
Example 10 is an example of a conditional probability, the probability of an event given that another event is known to have occurred. The question asks for the probability that a customer did not attempt to shoplift given that the alarm sounded.

Problem Solving and Data Analysis: Class Discussion

- Explain the answer choice rationale, along with the rationales for the incorrect answer choices.

If the number of hours the 40 employees worked is listed in increasing order, the median will be the average of the 20th and the 21st numbers on the list. The first 6 numbers on the list will be workers represented by the first bar; hence, each of the first 6 numbers will be at least 10 but less than 20. The next 17 numbers, that is, the 7th through the 23rd numbers on the list, will be workers represented by the second bar; hence, each of the next 17 numbers will be at least 20 but less than 30. Thus, the 20th and the 21st numbers on the list will be at least 20 but less than 30. Therefore, any of the median values in choices A, B, or C are possible, but the median value in choice D is not.

Example 11



The histogram shown summarizes the distribution of time worked last week, in hours, by the 40 employees of a landscaping company. In the histogram, the first bar represents all workers who worked at least 10 hours but less than 20 hours; the second represents all workers who worked at least 20 hours but less than 30 hours; and so on. Which of the following could be the median and mean amount of time worked, in hours, for the 40 employees?

A) Median = 22, Mean = 23
B) Median = 24, Mean = 22
C) Median = 26, Mean = 32
D) Median = 32, Mean = 30

(Note: On the SAT, all histograms have the same type of boundary condition. That is, the values represented by a bar include the left endpoint but do not include the right endpoint.)

Now let's find the possible values of the mean. Each of the 6 employees represented by the first bar worked at least 10 hours but less than 20 hours. Thus, the total number of hours worked by these 6 employees is at least 60. Similarly, the total number of hours worked by the 17 employees represented by the second bar is at least 340; the total number of hours worked by the 9 employees represented by the third bar is at least 270; the total number of hours worked by the 5 employees represented by the fourth bar is at least 200; the total number of hours worked by the 1 employee represented by the fifth bar is at least 50; and the total number of hours worked by the 2 employees represented by the sixth bar is at least 120. Adding all these hours shows that the total number of hours worked by all 40 employees is at least $60 + 340 + 270 + 200 + 50 + 120 = 1{,}040$. Therefore, the mean number of hours worked by all 40 employees is at least $\frac{1{,}040}{40} = 26$. Therefore, only the values of the mean given in choices C and D are possible. Because only choice C has possible values for both the median and the mean, it is the correct answer.

Problem Solving and Data Analysis: Closing Activity

- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Data collection and conclusions: Basic example and Data collection and conclusions: Harder example.
- Create a list of terms related to this lesson with the class.
- Inform the students that they will not need to know these terms for the SAT, but stress the advantages of being familiar with the concepts.
- Examples include:
  - Conditional probability
  - Mean
  - Median
  - Mode
  - Range
  - Outliers
  - Histogram
  - Box Plot

Passport to Advanced Math

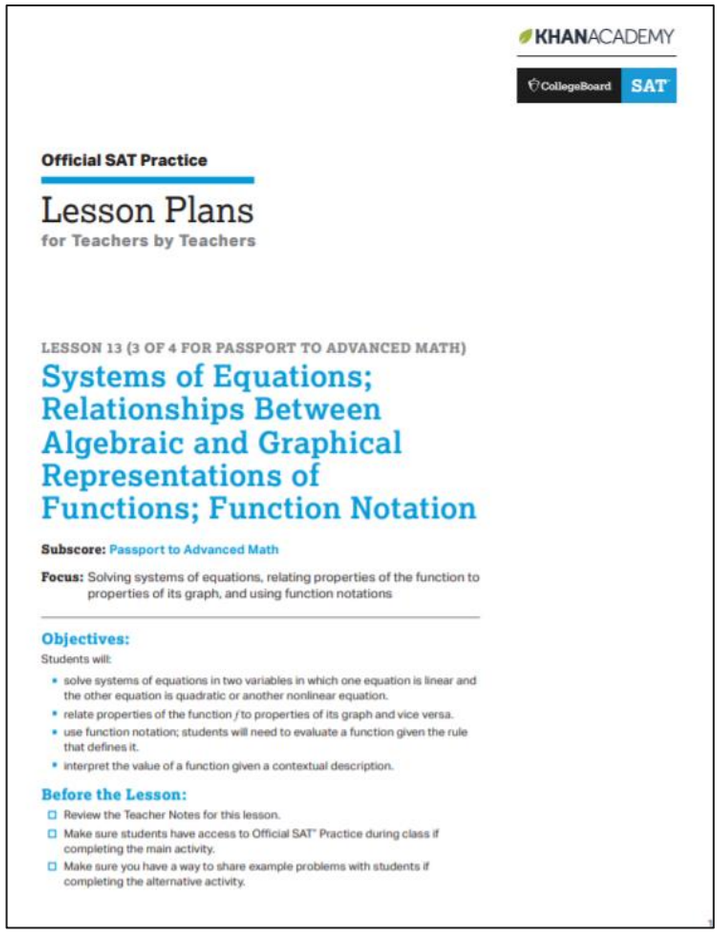
Problems in Passport to Advanced Math will cover topics that have great relevance and utility for college and career work, such as:

- understanding the structure of expressions;
- analyzing, manipulating, and rewriting expressions;
- reasoning with more complex equations; and
- interpreting and building functions.

Students will

- create and solve quadratic and exponential problems;
- create and solve radical and rational equations;
- solve systems of equations; and
- understand the relationship between zeros and factors of polynomials.

Passport to Advanced Math: Lesson Plan



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LESSON 13 (3 OF 4 FOR PASSPORT TO ADVANCED MATH)

Systems of Equations; Relationships Between Algebraic and Graphical Representations of Functions; Function Notation

Subscore: Passport to Advanced Math

Focus: Solving systems of equations, relating properties of the function to properties of its graph, and using function notations

Objectives:

Students will:

- solve systems of equations in two variables in which one equation is linear and the other equation is quadratic or another nonlinear equation.
- relate properties of the function *f* to properties of its graph and vice versa.
- use function notation; students will need to evaluate a function given the rule that defines it.
- interpret the value of a function given a contextual description.

Before the Lesson:

- ☐ Review the Teacher Notes for this lesson.
- ☐ Make sure students have access to Official SAT® Practice during class if completing the main activity.
- ☐ Make sure you have a way to share example problems with students if completing the alternative activity.

- Discuss the opening activity.
- Assign the two example problems.
- Review the answer choices and discuss as a class.
- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Nonlinear equation graphs: Basic example and Nonlinear equation graphs: Harder example.

Systems of Equations: Relationships Between Algebraic and Graphical Representations of Functions; Function Notation

Passport to Advanced Math: Opening Activity

Ask students to group themselves into pairs.

Have them complete the two example problems.

After pairs of students have completed solving their example problems, have them share the process with each other.

See that all pairs of students reach a consensus about the answers, what information is needed to solve the problems, and the process for solving it.

Passport to Advanced Math: Opening Activity

1. $3x + y = -3$
   $(x + 1)^2 - 4(x + 1) - 6 = y$

   If (x, y) is a solution of the system of equations above and $y > 0$, what is the value of y?

2. The graph of which of the following functions in the xy-plane has x-intercepts at -4 and 5?

   A. $f(x) = (x + 4)(x - 5)$

   B. $g(x) = (x - 4)(x + 5)$

   C. $h(x) = (x - 4)^2 + 5$

   D. $k(x) = (x + 5)^2 - 4$

Passport to Advanced Math: Class Discussion

Have the class discuss the two example problems and the answer rationales.

What do you need to know to solve each problem?

- Recognizing classic quadratic patterns such as $x^2 - y^2 = (x - y)(x + y)$ can improve speed and accuracy.
- When solving for a variable in an equation involving fractions, a good first step is to clear the variable out of the denominators of the fractions.
- Remember to multiply both sides of an equation by an expression when the expression cannot be equal to zero.

Passport to Advanced Math: Class Discussion

- Explain that this example has no choices since it is a student-produced response question. Then, explain how to solve the item.

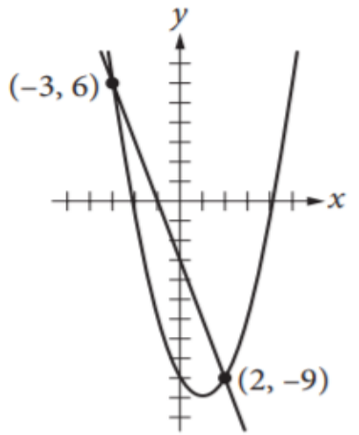
$$3x + y = -3$$

$$(x + 1)^2 - 4(x + 1) - 6 = y$$

If (x, y) is a solution of the system of equations above and $y > 0$, what is the value of y?

$(x + 1)^2 - 4(x + 1) - 6 = -3(x + 1)$. Since the factor $(x + 1)$ appears as a squared term and a linear term, the equation can be thought of as a quadratic equation in the variable $(x + 1)$, so collecting the terms and setting the expression equal to 0 gives you $(x + 1)^2 - (x + 1) - 6 = 0$. Factoring gives you $((x + 1) - 3)((x + 1) + 2) = 0$, or $(x - 2)(x + 3) = 0$. Thus, either $x = 2$, which gives $y = -3 - 3(2) = -9$; or $x = -3$, which gives $y = -3 - 3(-3) = 6$. Therefore, the solutions to the system are $(2, -9)$ and $(-3, 6)$. Since the question states that $y > 0$, the value of y is 6.

One method for solving systems of equations is substitution. If the first equation is solved for y, it can be substituted in the second equation. Subtracting $3x$ from each side of the first equation gives yc $y = -3 - 3x$, which can be rewritten as $y = -3(x + 1)$.
Substituting $-3(x + 1)$ for y in the second equation gives you



Passport to Advanced Math: Class Discussion

- Explain the answer choice rationale, along with the rationales for the incorrect answer choices.

The graph of which of the following functions in the xy-plane has x-intercepts at -4 and 5?

A) $f(x) = (x + 4)(x - 5)$

B) $g(x) = (x - 4)(x + 5)$

C) $h(x) = (x - 4)^2 + 5$

D) $k(x) = (x + 5)^2 - 4$

The x-intercepts of the graph of a function correspond to the zeros of the function. All the functions in the choices are defined by quadratic equations, so the answer must be a quadratic function. If a quadratic function has x-intercepts at -4 and 5, then the values of the function at -4 and 5 are each 0; that is, the zeros of the function occur at $x = -4$ and at $x = 5$. Since the function is defined by a quadratic equation and has zeros at $x = -4$ and $x = 5$, it must have $(x + 4)$ and $(x - 5)$ as factors. Therefore, choice A, $f(x) = (x + 4)(x - 5)$, is correct.

Passport to Advanced Math: Closing Activity

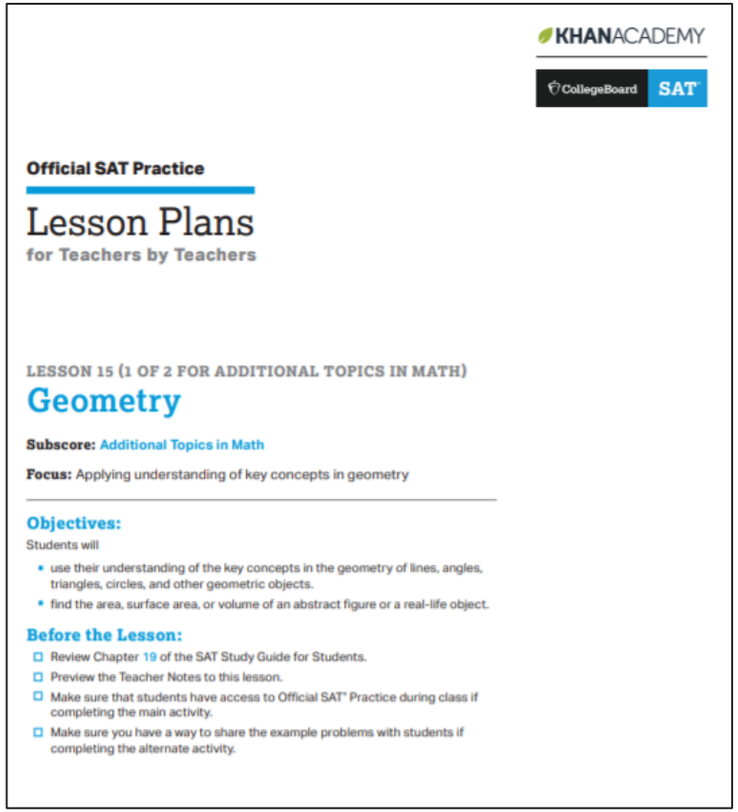
- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Nonlinear equation graphs: Basic example and Nonlinear equation graphs: Harder example.
- Create a list of terms related to this lesson with the class.
- Let students know that they will not have to know these terms for the SAT, but being familiar with the concepts will help them to succeed.
- Examples include:
  - Domain
  - Range
  - Intercepts
  - Maximum and minimum values
  - End behavior
  - Asymptotes
  - Symmetry
  - Transformations

Additional Topics in Math

The SAT® will require the geometric and trigonometric knowledge most relevant to postsecondary education and careers:

- **Geometry**
  - Analysis
  - Problem solving
- **Trigonometry**
  - Sine
  - Cosine
  - Tangent
- **Pythagorean Theorem**

Additional Topics in Math: Lesson Plan



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LESSON 15 (1 OF 2 FOR ADDITIONAL TOPICS IN MATH)

Geometry

Subscore: Additional Topics in Math

Focus: Applying understanding of key concepts in geometry

Objectives:

Students will

- use their understanding of the key concepts in the geometry of lines, angles, triangles, circles, and other geometric objects.
- find the area, surface area, or volume of an abstract figure or a real-life object.

Before the Lesson:

- ☐ Review Chapter 19 of the SAT Study Guide for Students.
- ☐ Preview the Teacher Notes to this lesson.
- ☐ Make sure that students have access to Official SAT® Practice during class if completing the main activity.
- ☐ Make sure you have a way to share the example problems with students if completing the alternate activity.

Geometry

- Discuss the opening activity.
- Assign the example problem.
- Review the answer choices and discuss as a class.
- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Congruence and similarity: Basic example and Congruence and similarity: Harder example.

Additional Topics in Math: Opening Activity

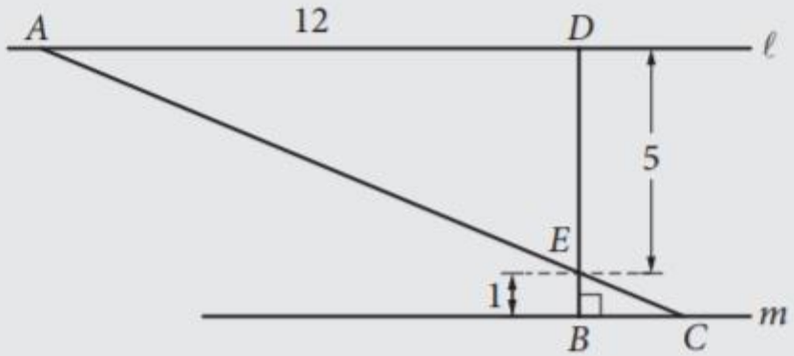
Ask students to group themselves into pairs.

Have them complete the example problem.

After pairs of students have completed solving the example problem, have them share the process with each other.

See that all pairs of students reach a consensus about the answer, what information is needed to solve the problem, and the process for solving it.

Additional Topics in Math: Opening Activity



In the figure above, line ℓ is parallel to line m, segment BD is perpendicular to line m, and segment AC and segment BD intersect at E. What is the length of segment AC?

Additional Topics in Math: Class Discussion

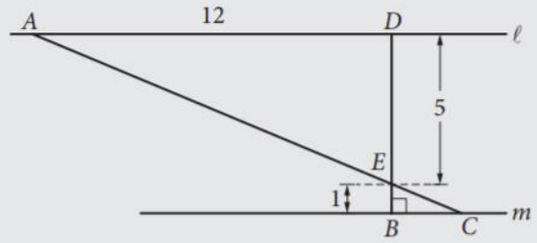
Have the class discuss the the example problem and the answer rationales.

What do students need to know to solve each problem?

- Vertical angles have the same measure.
- When parallel lines are cut by a transversal, the alternate interior angles have the same measure.
- If two angles of a triangle are congruent to (have the same measure as) two angles of another triangle, the two triangles are similar.
- The Pythagorean theorem: $a^2 + b^2 = c^2$, where a and b are the lengths of the legs of a right triangle and c is the length of the hypotenuse.
- If two triangles are similar then all ratios of lengths of corresponding sides are equal.

Additional Topics in Math: Class Discussion

- Explain that this example has no choices since it is a student-produced response question. Then, explain how to solve the item.



In the figure above, line ℓ is parallel to line m, segment BD is perpendicular to line m, and segment AC and segment BD intersect at E. What is the length of segment AC?

Since segment AC and segment BD intersect at E, $\angle AED$ and $\angle CEB$ are vertical angles, and so the measure of $\angle AED$ is equal to the measure of $\angle CEB$. Since line ℓ is parallel to line m, $\angle BCE$ and $\angle DAE$ are alternate interior angles of parallel lines cut by a transversal, and so the measure of $\angle BCE$ is equal to the measure of $\angle DAE$. By the angle-angle theorem, $\triangle AED$ is similar to $\triangle CEB$, with vertices A, E, and D corresponding to vertices C, E, and B, respectively.

Also, $\triangle AED$ is a right triangle, so by the Pythagorean theorem, $AE = \sqrt{AD^2 + DE^2} = \sqrt{12^2 + 5^2} = \sqrt{169} = 13$. Since $\triangle AED$ is similar to $\triangle CEB$, the ratios of the lengths of corresponding sides of the two triangles are in the same proportion, which is $\frac{ED}{EB} = \frac{5}{1} = 5$. Thus, $\frac{AE}{EC} = \frac{13}{EC} = 5$, and so $EC = \frac{13}{5}$. Therefore, $AC = AE + EC = 13 + \frac{13}{5} = \frac{78}{5}$.

Additional Topics in Math: Closing Activity

- Assign the corresponding worked examples from Official SAT Practice on Khan Academy Congruence and similarity: Basic example and Congruence and similarity: Harder example.
- Create a list of terms related to this lesson with the class.
- Let students know that they will not have to know these terms for the SAT, but being familiar with the concepts will help them to succeed.
- Examples include:
  - Pythagorean theorem
  - Properties of parallel and perpendicular lines
  - Properties of equilateral and isosceles triangles
  - Properties of trapezoids and parallelograms
  - Radius, diameter, circumference
  - Measure of central angles and inscribed angles
  - Arc length and area of sectors
  - Tangents and chords

CollegeBoard

Official SAT® Practice on Khan Academy

Tiffany's Path to Success

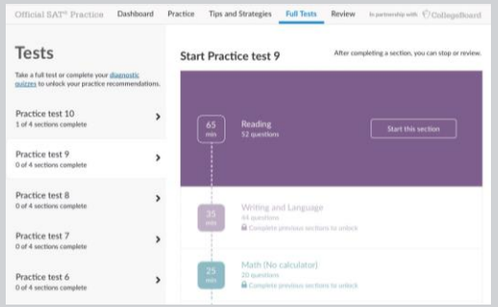
SEND SCORE DATA

COLLEGE BOARD → KHAN ACADEMY

OR TAKE A DIAGNOSTIC QUIZ

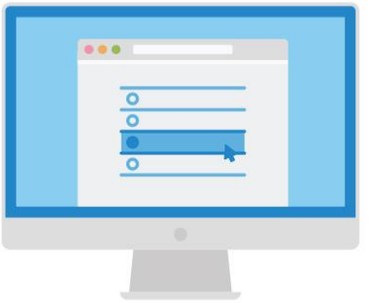
PERSONALIZED LEARNING ROADMAP

ONLINE OFFICIAL SAT PRACTICE TESTS



POWERED BY SCHOOLS, EDUCATORS, COMMUNITY GROUPS

CONTINUOUS PRACTICE

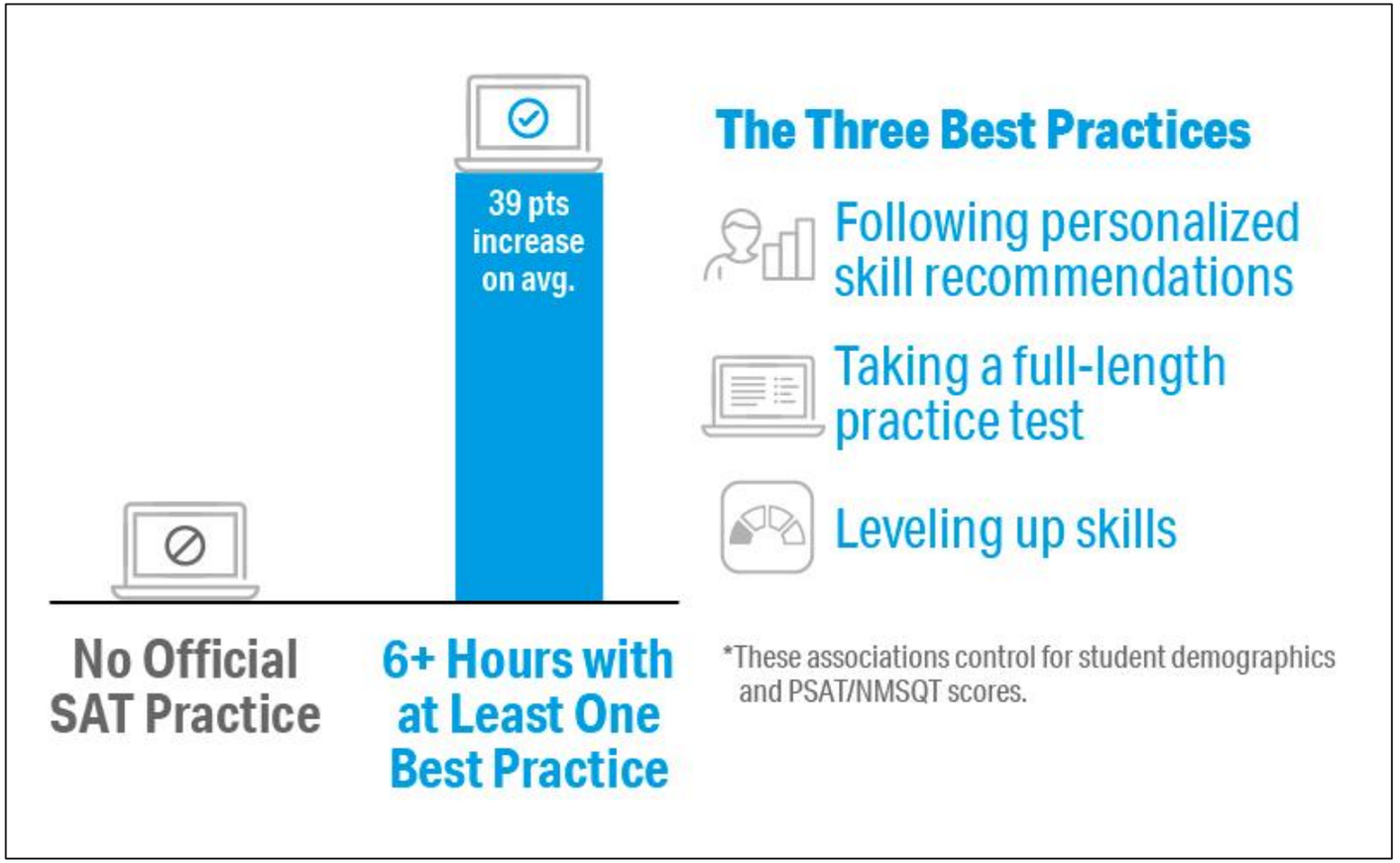


Success!

SAT® Achievement Associated with Official SAT Practice on Khan Academy®

These results are based on over 500,000 students from the class of 2019.

Practice is associated with better SAT® outcomes regardless of gender, race, and parental education level.



Student Experience

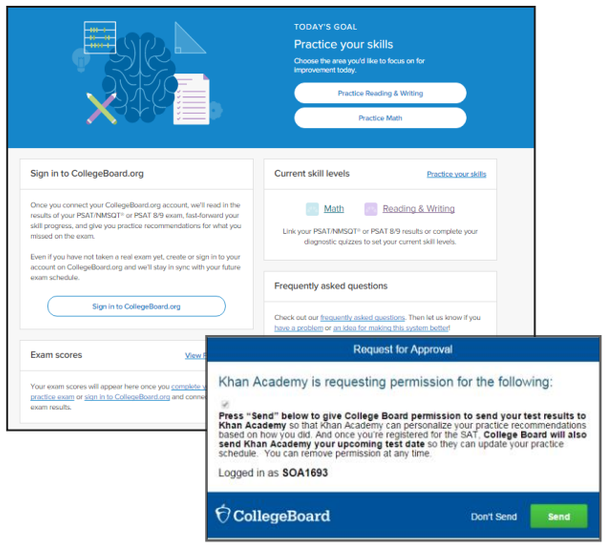
Why Link Khan Academy® and College Board Accounts?

Personalized practice and recommendations:
Once students link their accounts, Khan Academy individualizes student practice based on their results from the SAT®, PSAT/NMSQT™, PSAT™ 10, and PSAT™ 8/9.

Jump right into practice:
No additional diagnostic quizzes are needed.

Steps to Link College Board and Khan Academy® Accounts

View a short video about the linking steps.



Step 1

Students log in or create a Khan Academy® account at www.satpractice.org.

Step 2

When prompted, students can agree to link their Khan Academy® and College Board accounts.

Step 3

Students sign in or create a College Board account.

Step 4

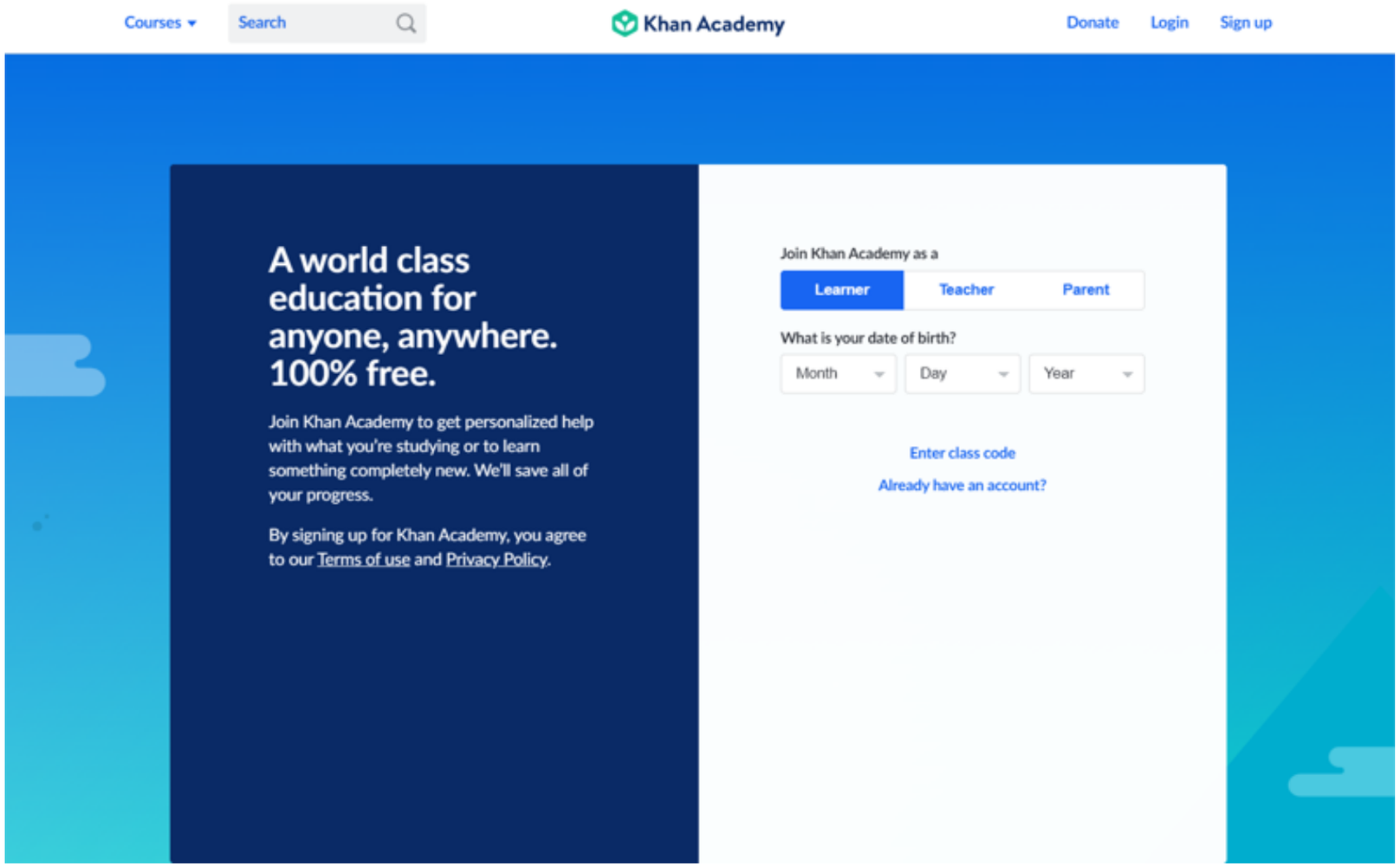
When prompted, students click “Allow” to authorize the account linking.

Step 5

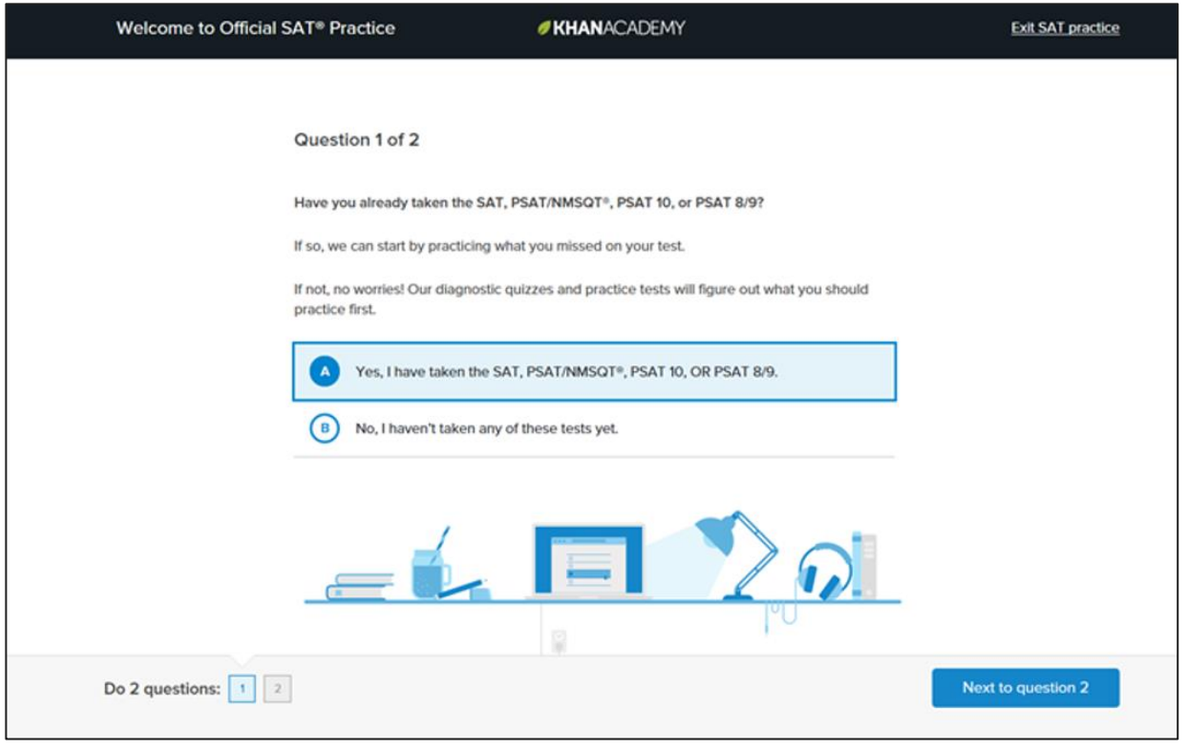
Students start practicing on Official SAT® Practice on Khan Academy®!

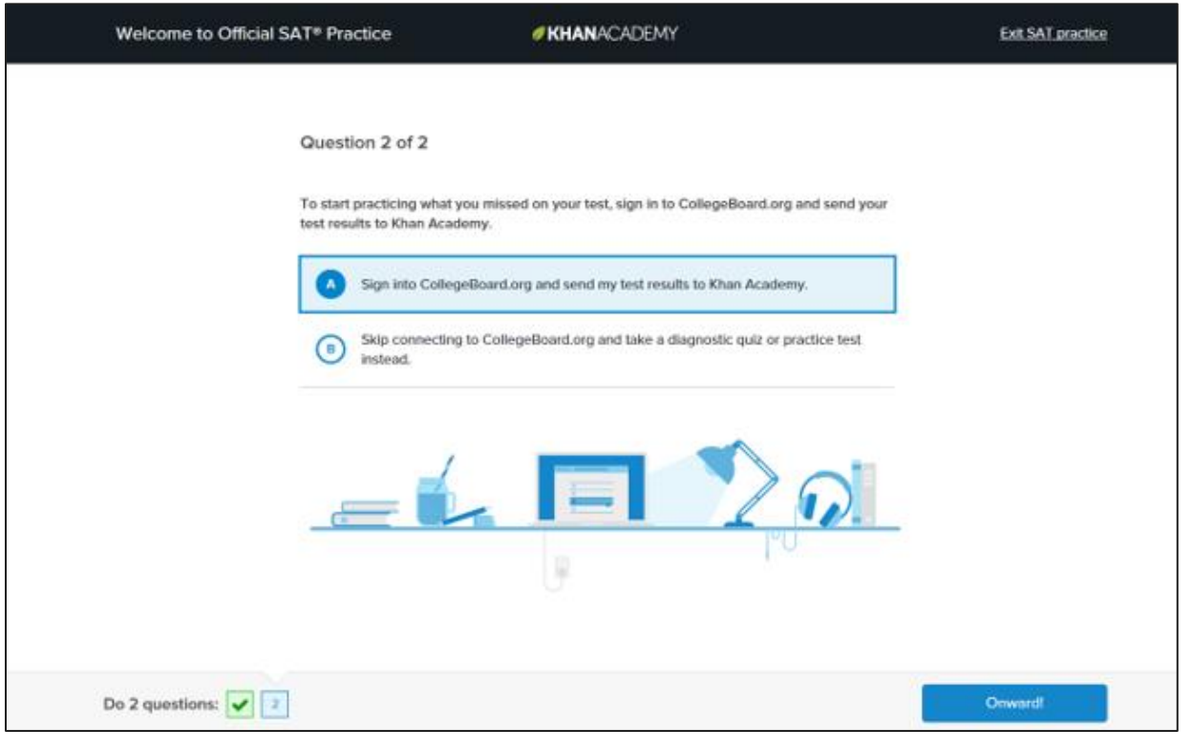
Step 1: Create or Log In to Khan Academy® Account

www.satpractice.org

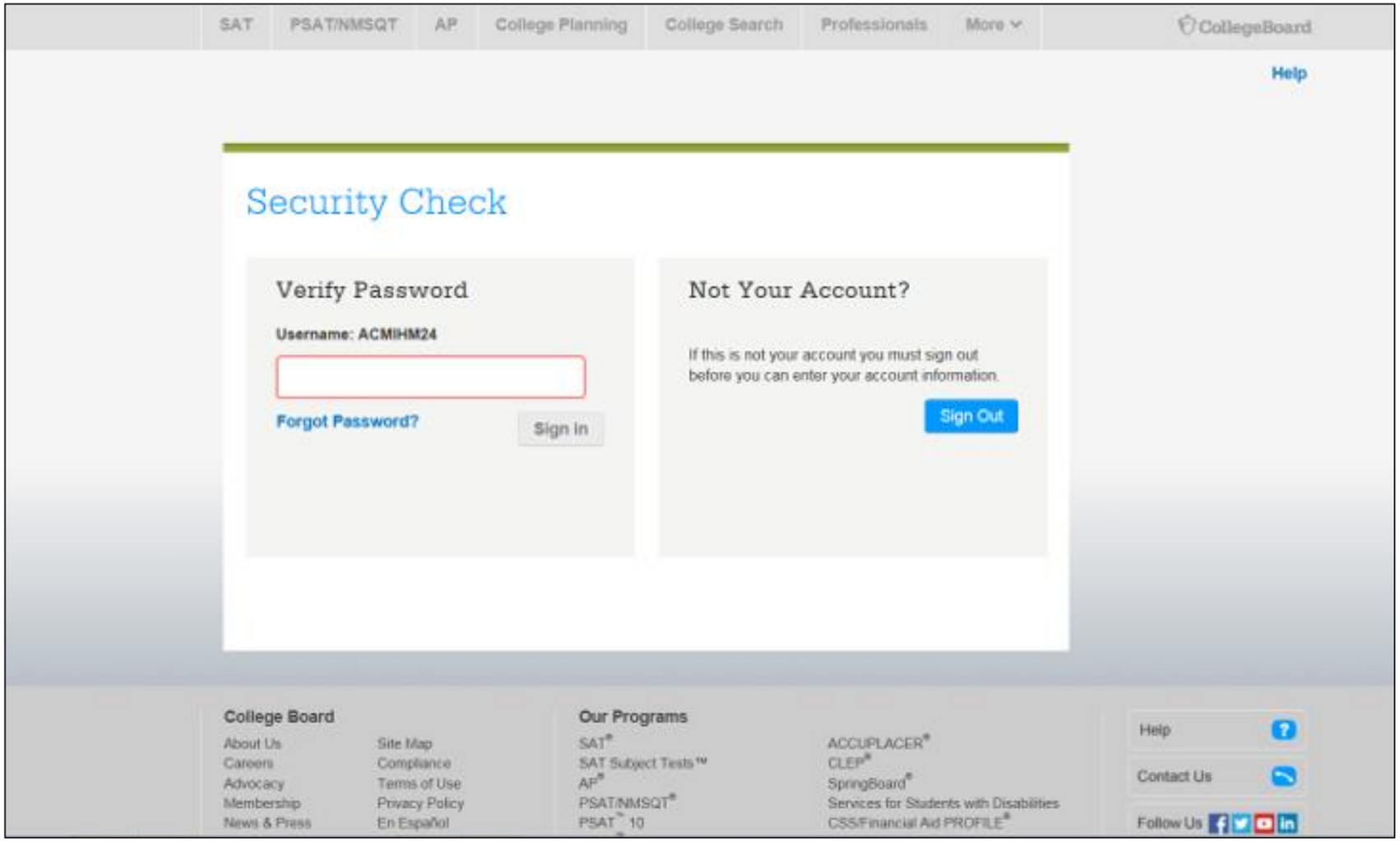


Step 2: Link Khan Academy® and College Board Accounts

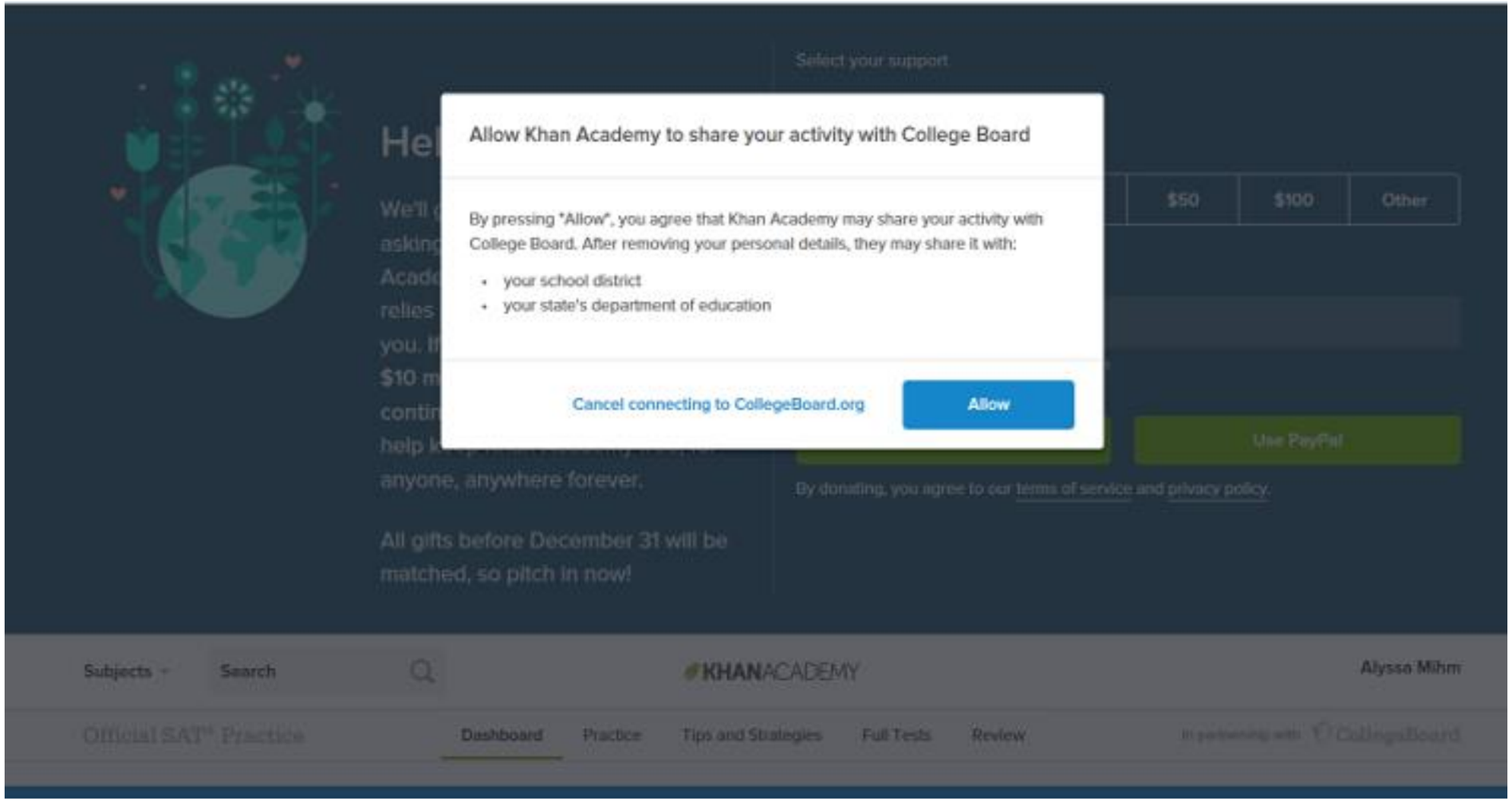




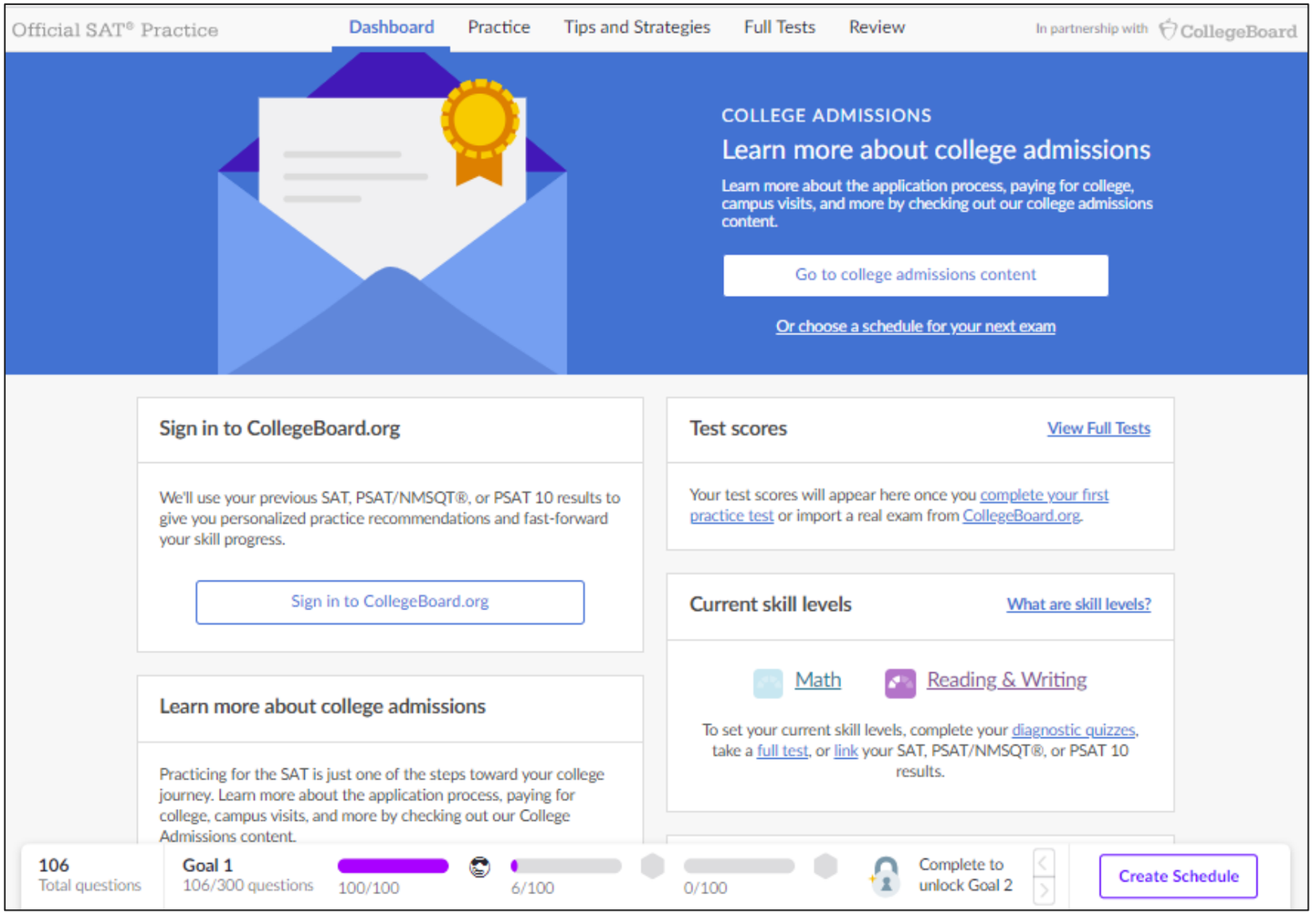
Step 3: Sign In to College Board Account



Step 4: Click “Allow” to Authorize



Step 5: Start Practicing via the Dashboard



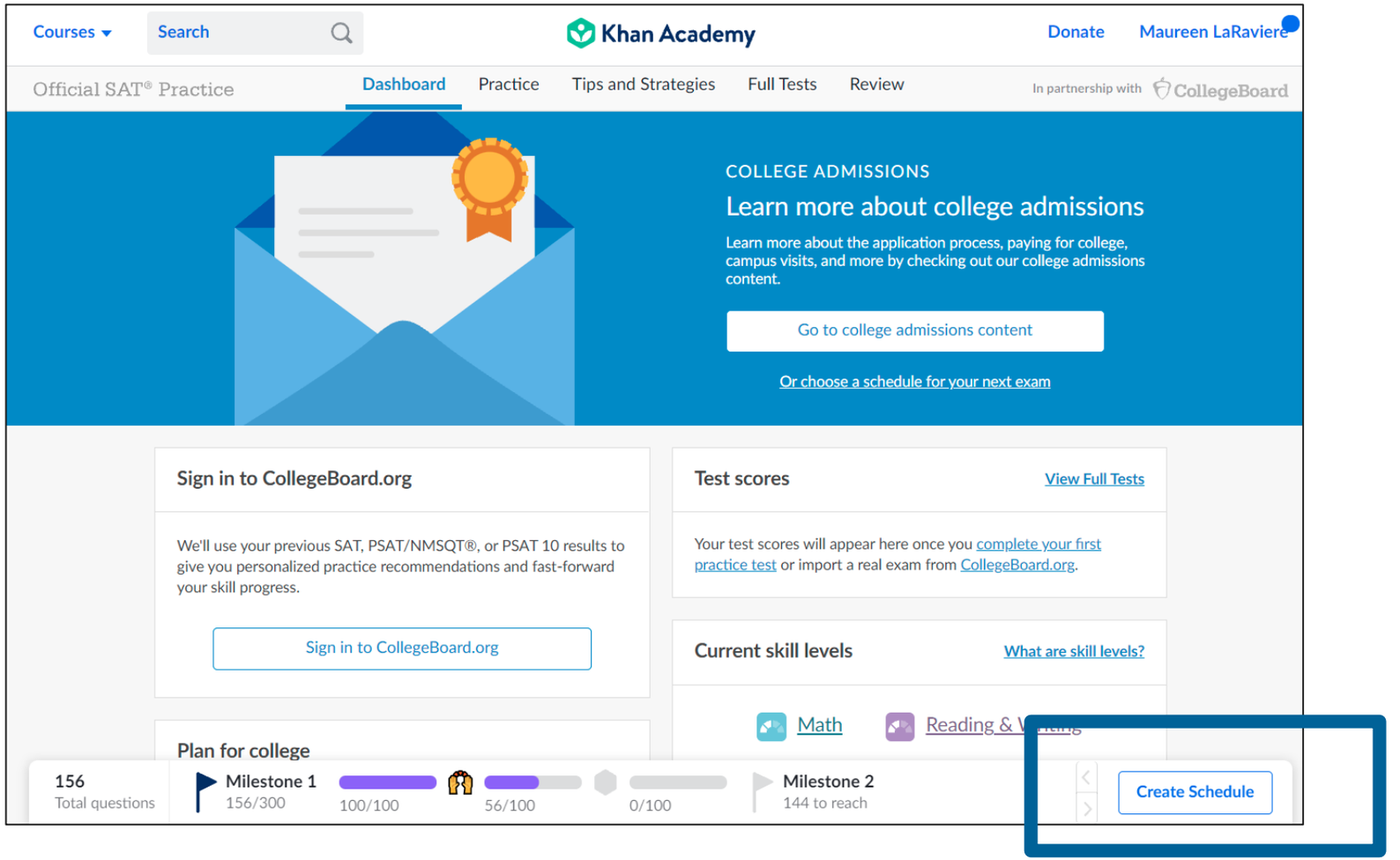
Skill Levels in Official SAT Practice

- When students reach a higher level in a skill, they will be asked harder questions or given more complex passages when they practice that skill.
- A student's overall levels for Math and Reading & Writing are averages calculated by adding up individual skill levels and dividing by how frequently each skill appears on the exam.

Create a Practice Schedule

Create a Practice Schedule

Students can create the practice schedule from their Dashboard page.

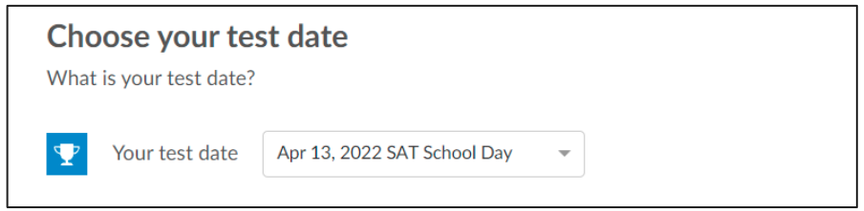


Create a Practice Schedule

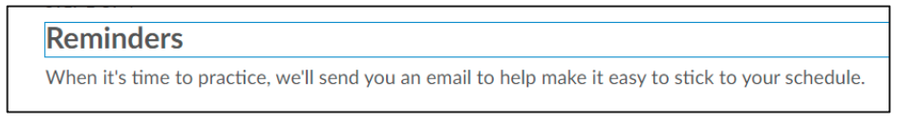
Students can create the practice schedule from their Dashboard page.

There are four steps:

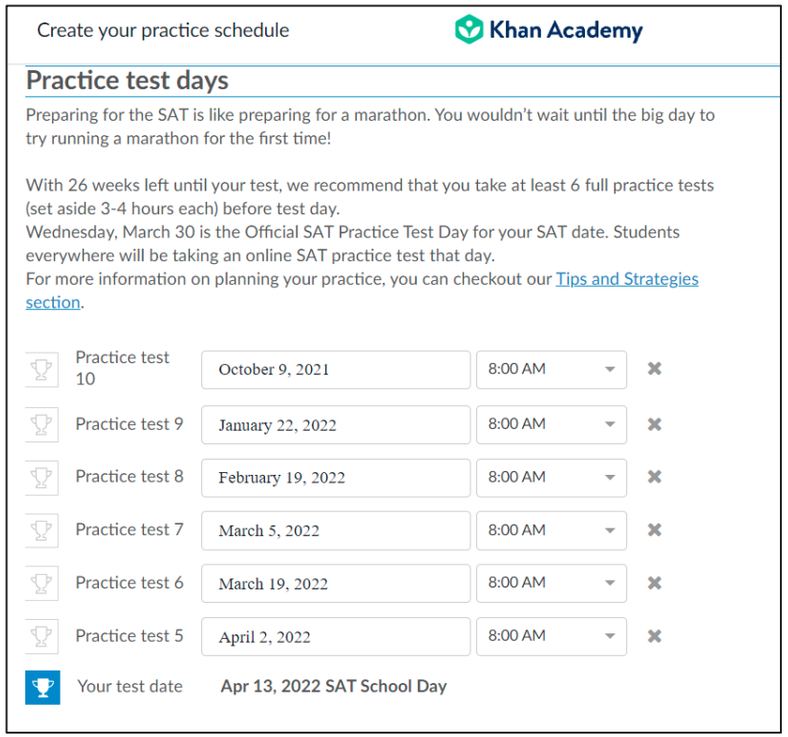
Step One



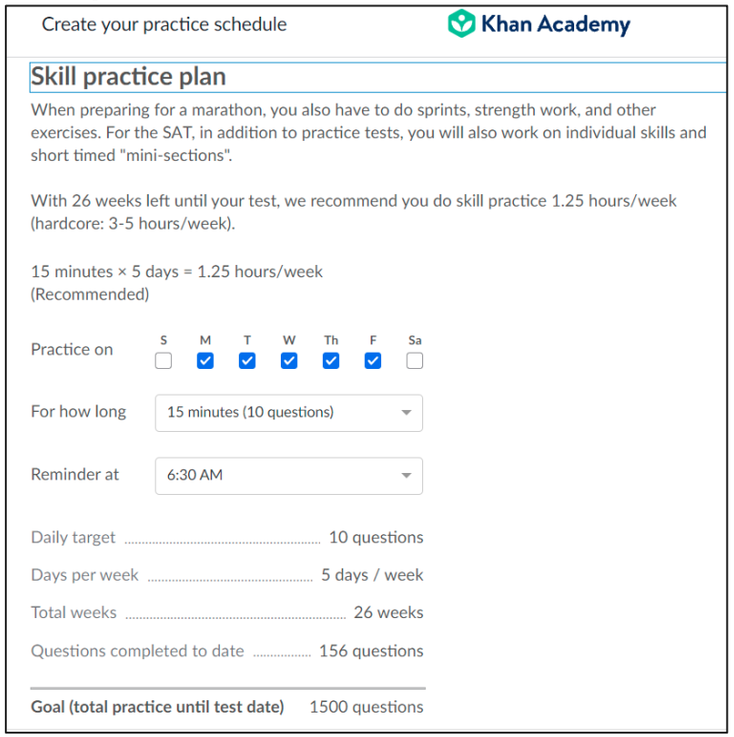
Step Two



Step Three



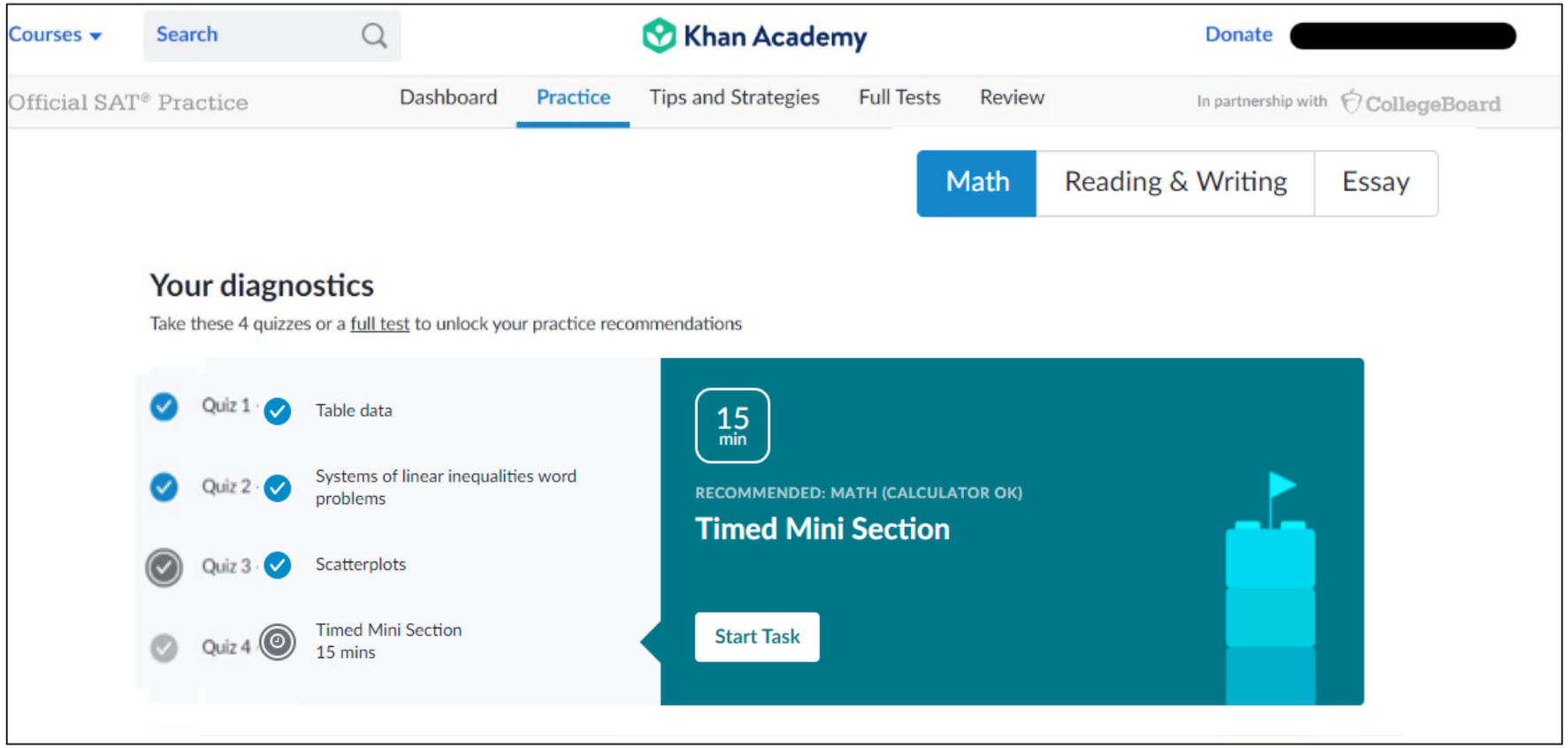
Step Four



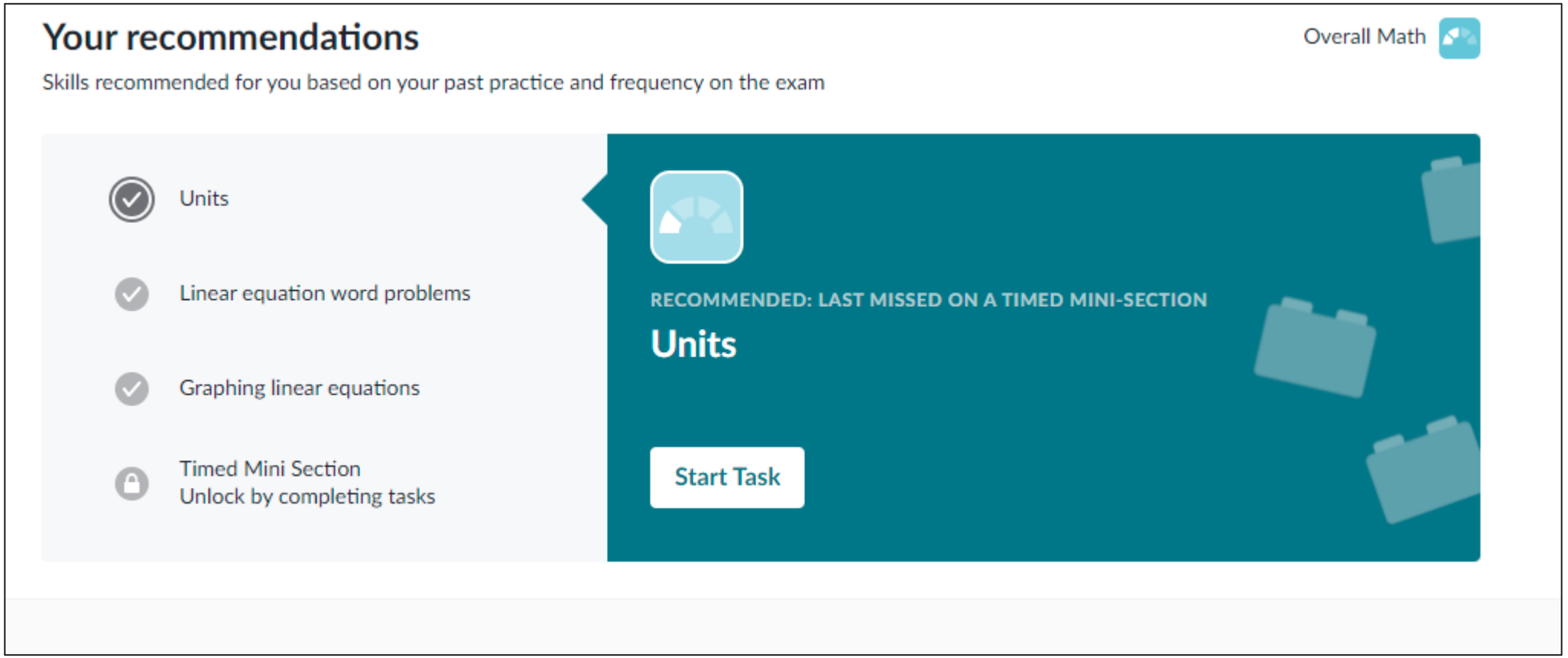
CollegeBoard

Diagnostic Quizzes and Personalized Practice Recommendations

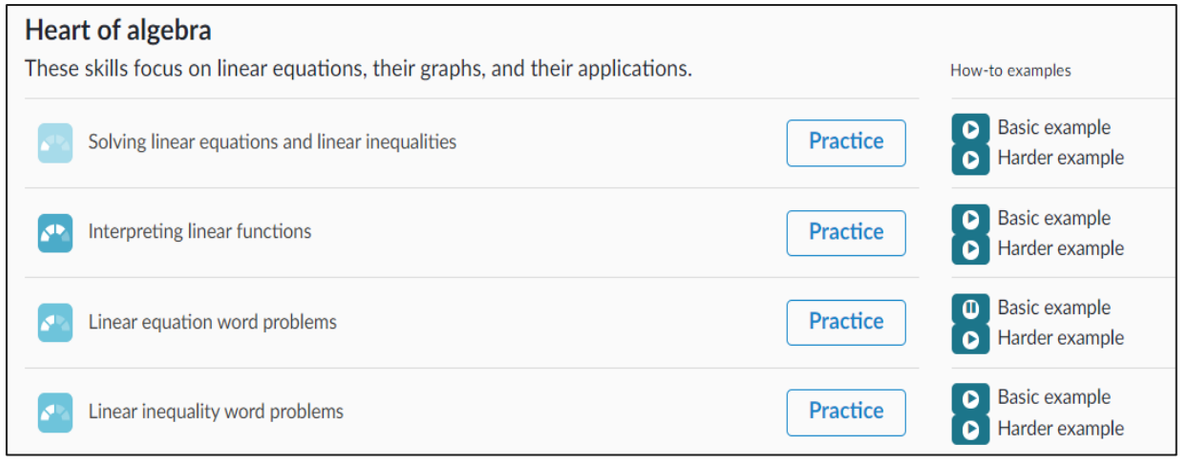
Diagnostic Quizzes

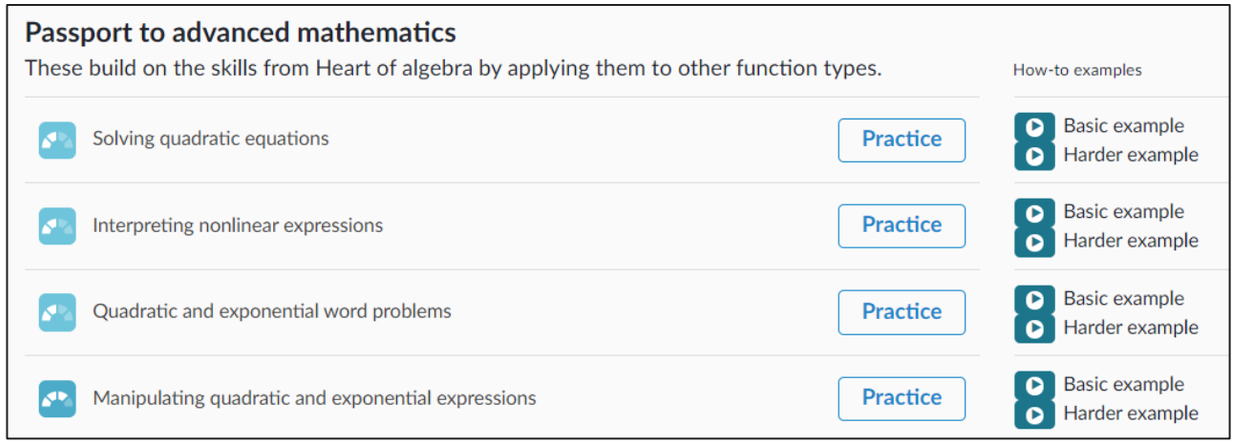


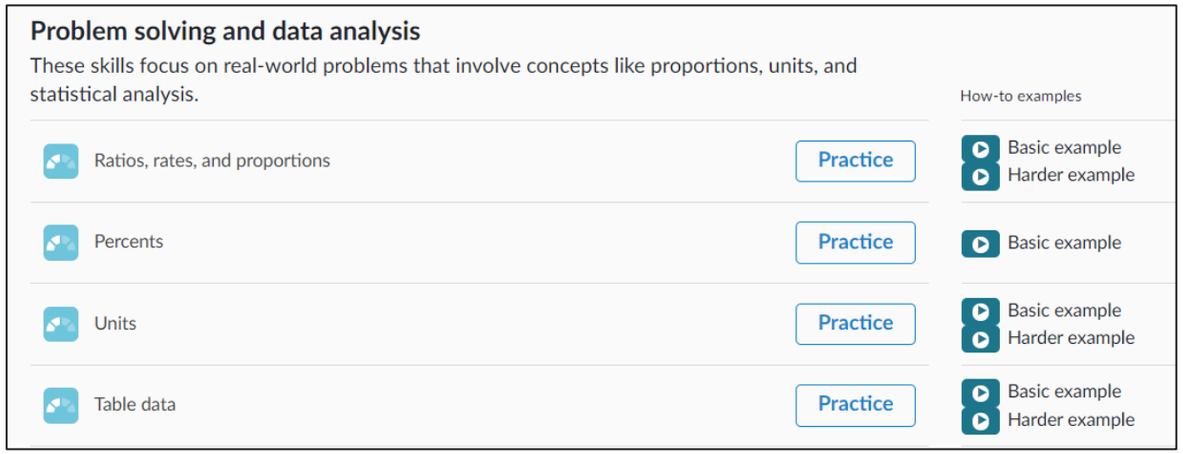
Practice Recommendations

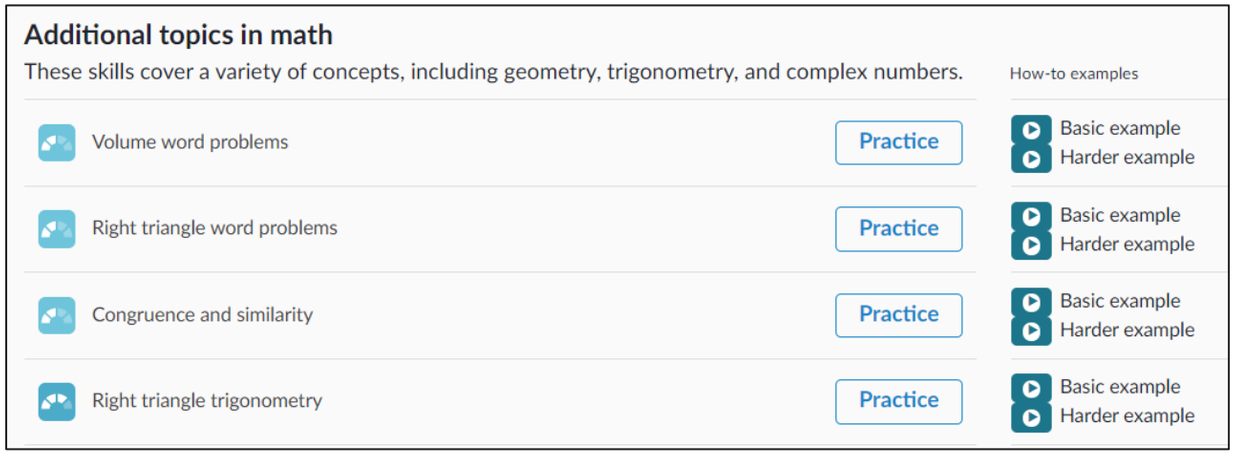


Practice Recommendations









CollegeBoard

Create Classes and Explore the Teacher Dashboard

CollegeBoard

Create Classes and Add Students

How Do I Get Started?

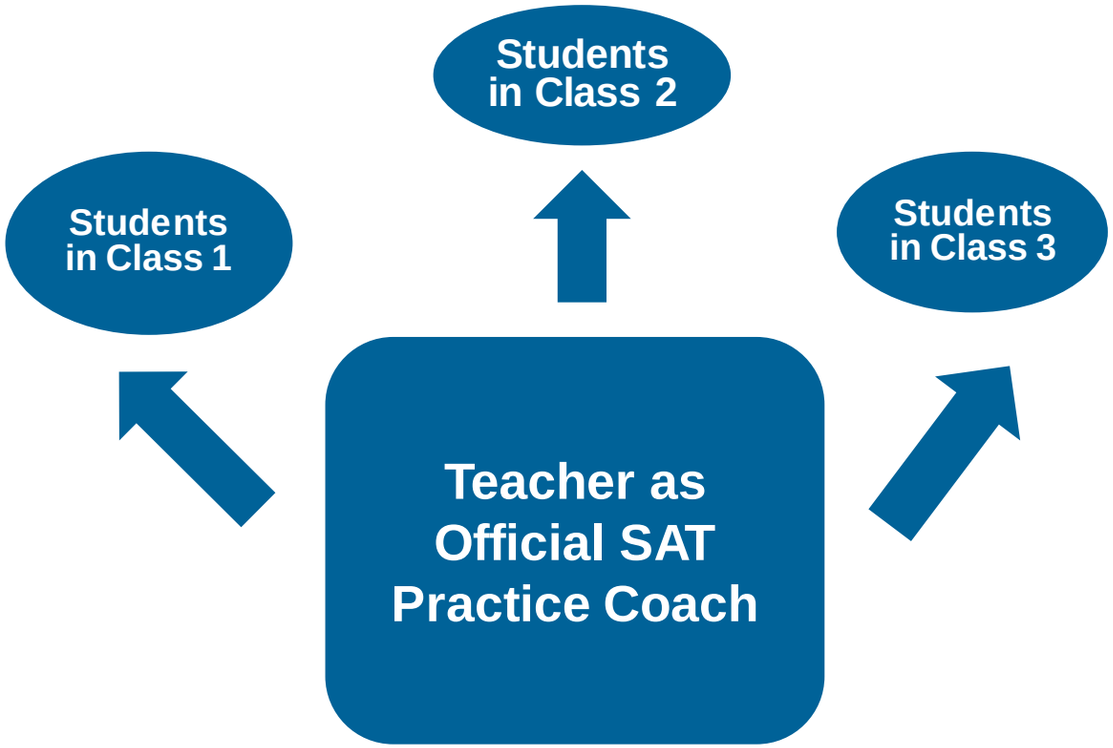
Free personalized study plan for students

Free resources for educators

How to get started with Coach Tools:
Coach Tools Guide
Coach Tools FAQ

- Create classes in Khan Academy® that have SAT® reporting enabled
  - New SAT® class
  - New subject matter class + SAT®
  - Existing class with SAT® reporting enabled
- Add students and become their coach
  - With individual emails
  - With a class code
  - With Google Classroom
- Gather student permissions in order to see their SAT® Practice data
- Confirm that all students in your SAT® reporting-enabled class have received the notification and clicked “Share my SAT® activity with [coach].”

Inviting and Managing Students



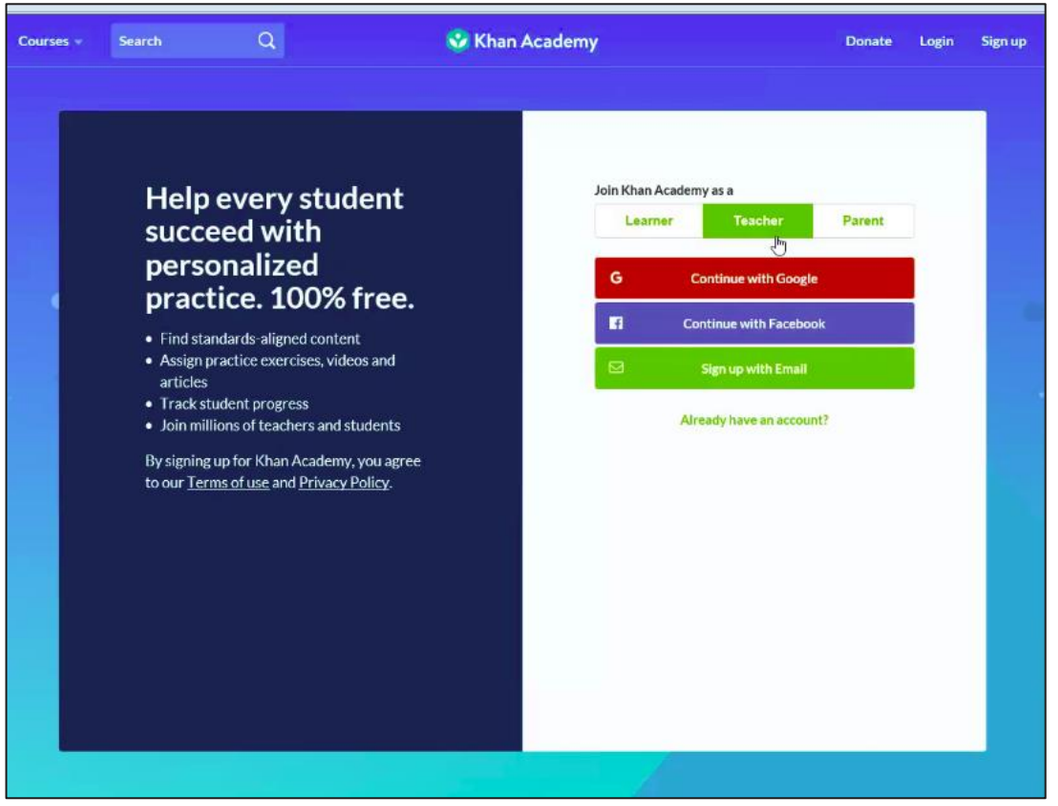
Teacher:

- sends invitation to each class separately
- assigns content that links to the class
- monitors progress

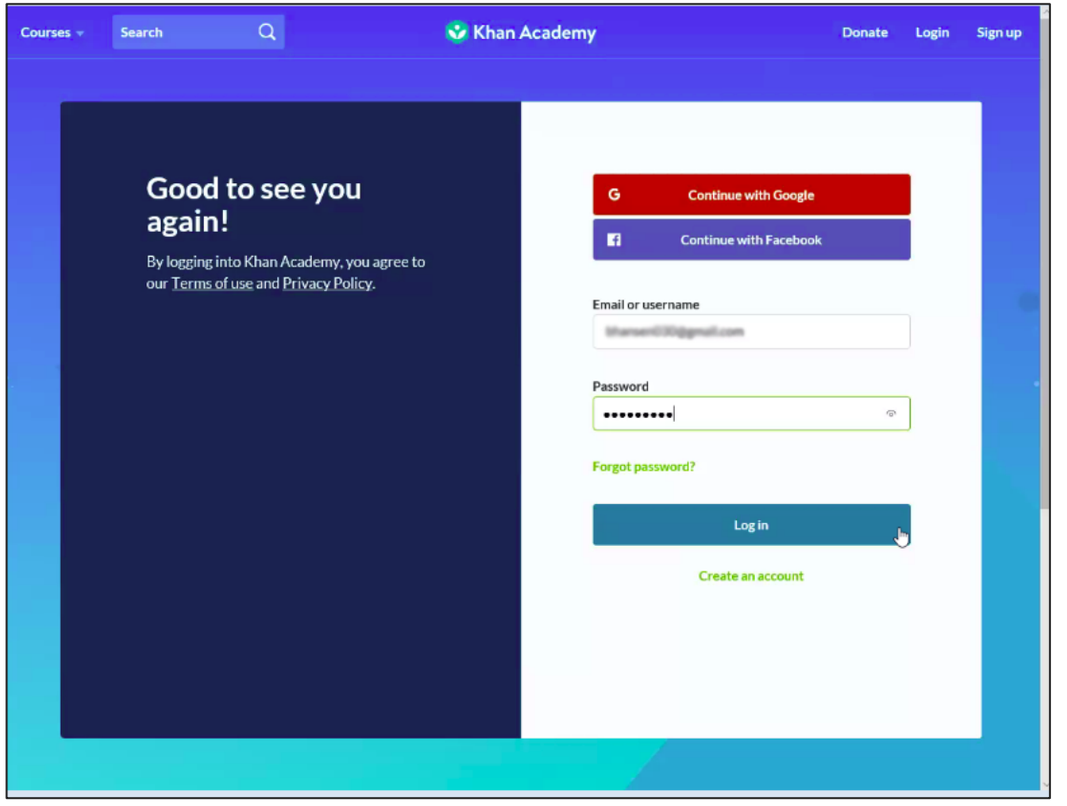
Designated Coach:

- sends invitation to all students
- monitors linkage and general progress
- provides school staff updates on students' progress

Step 1: Create an Account or Log In



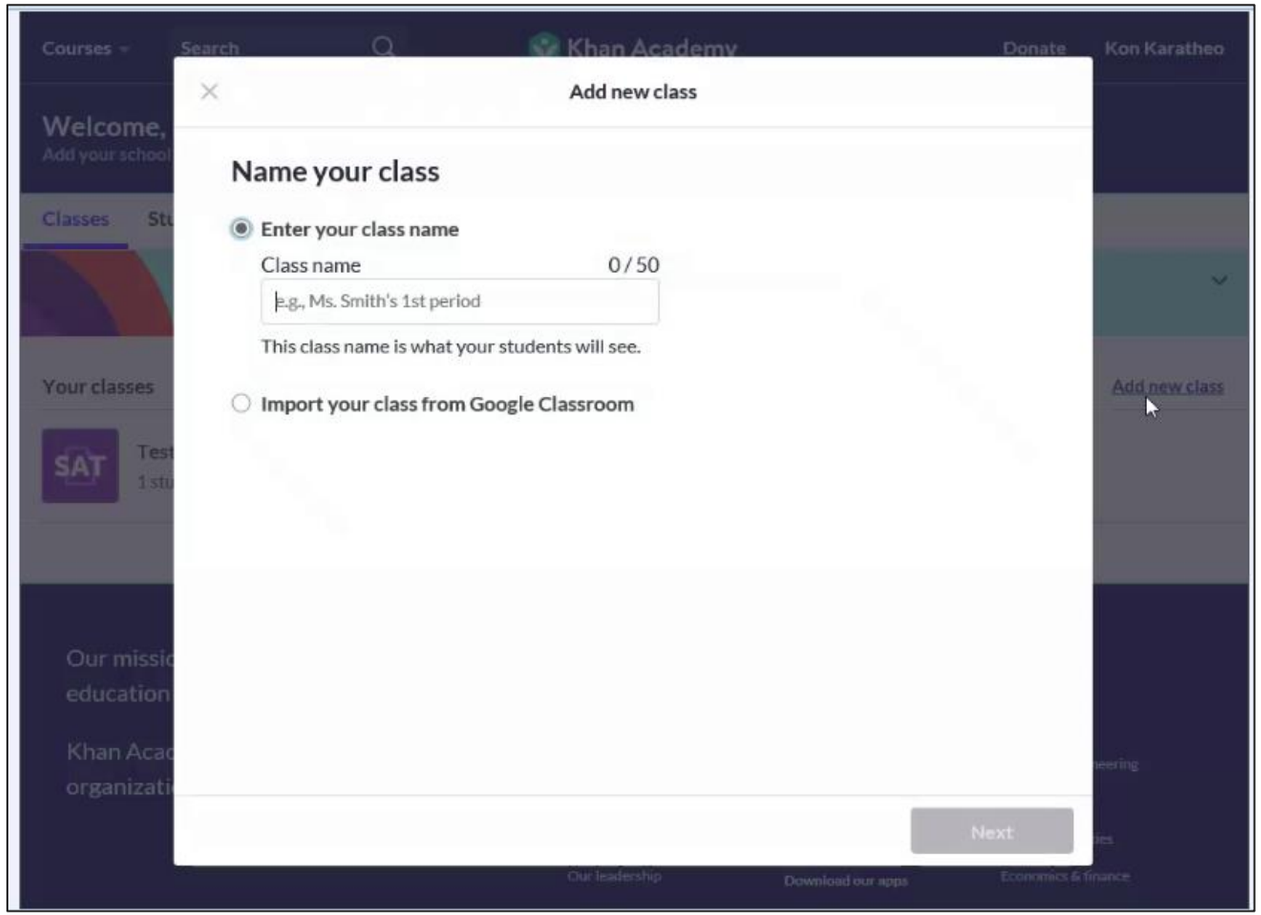
If you don't have a Khan Academy® account, create one at https://www.khanacademy.org/sat.



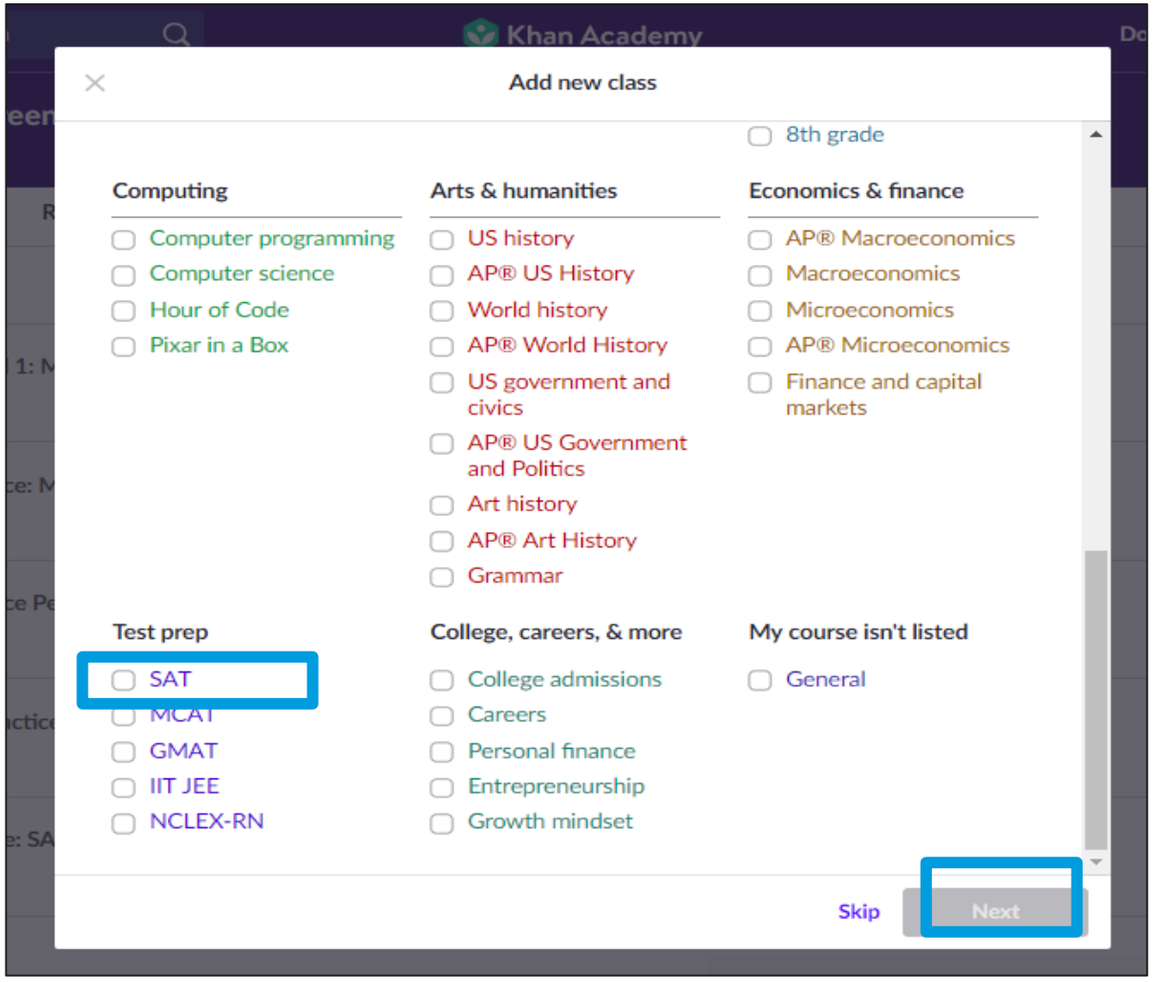
Log in to your Khan Academy® account at https://www.khanacademy.org/sat.

Step 2: Add a New Class

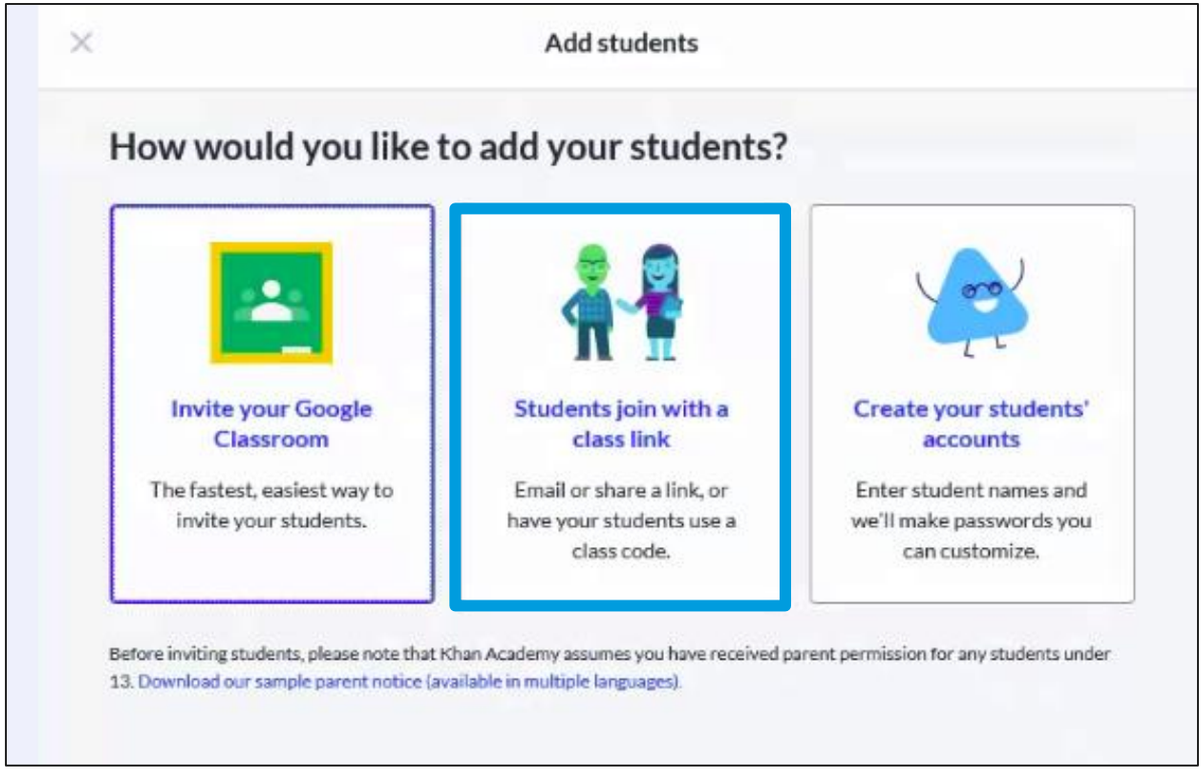
For more information on Google Classroom, read the following article on Khan Academy®.



Step 3: Add SAT® under Test Prep



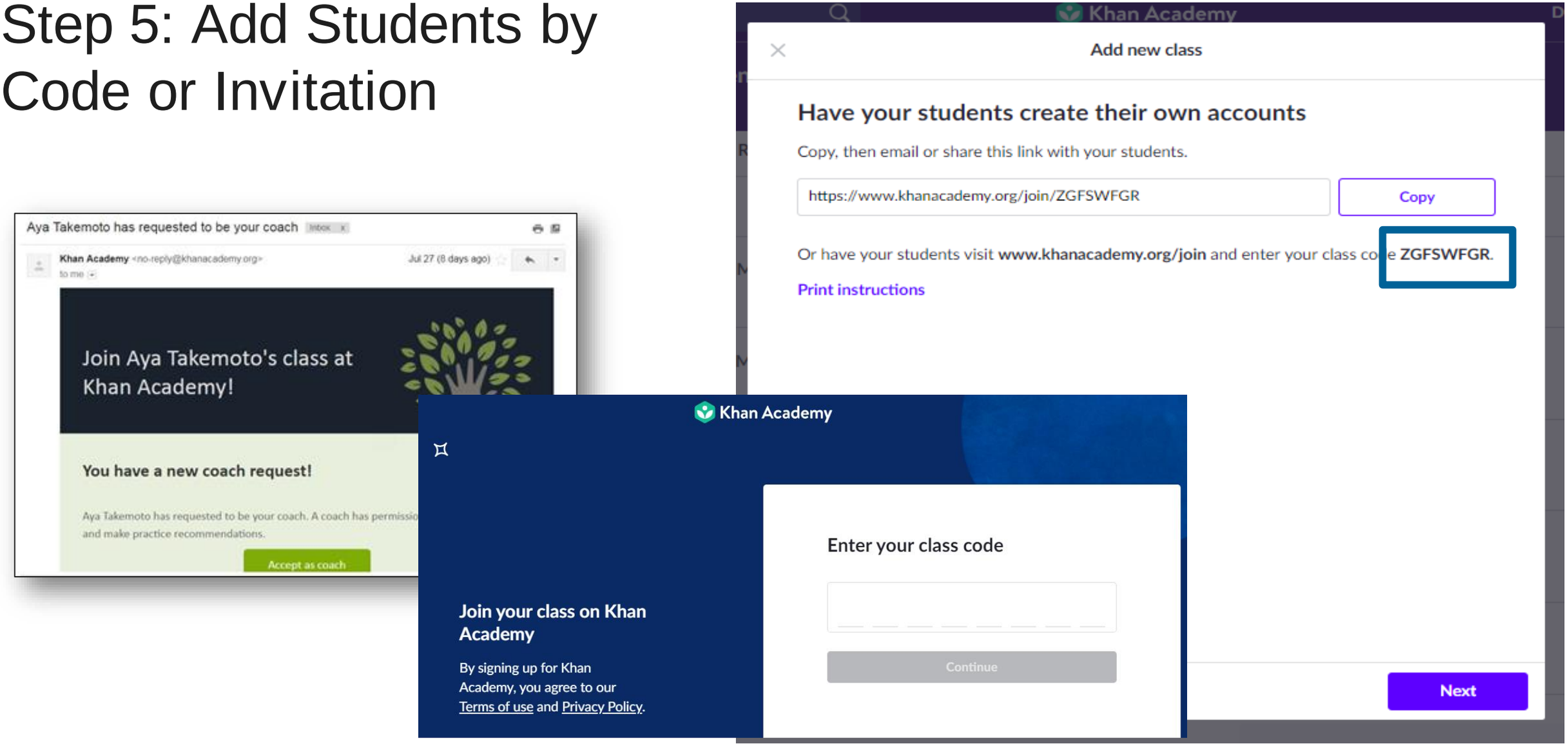
Step 4: Add Students



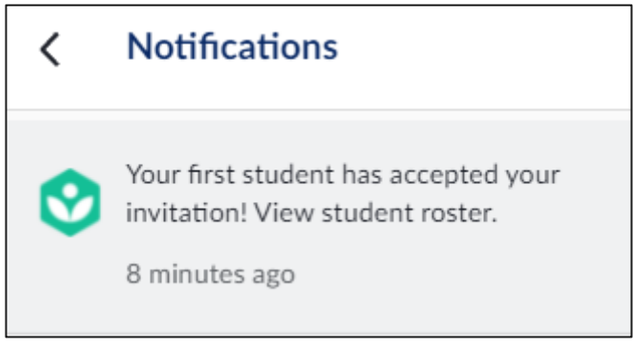
Select the method for adding students to your class.

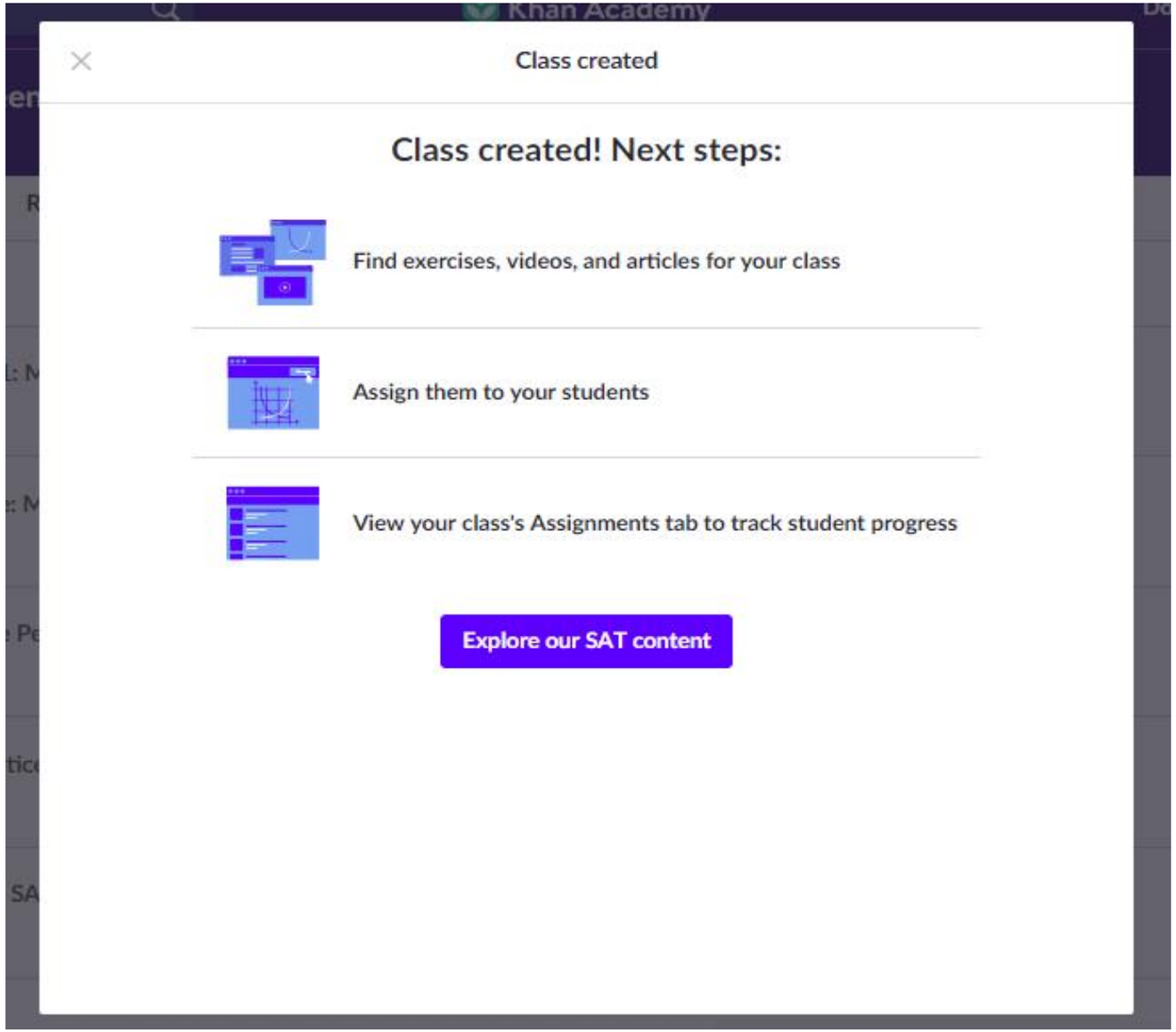
Note: Once one class is created, the "Add new class" link can be selected to create additional classes.

Step 5: Add Students by Code or Invitation



Success!

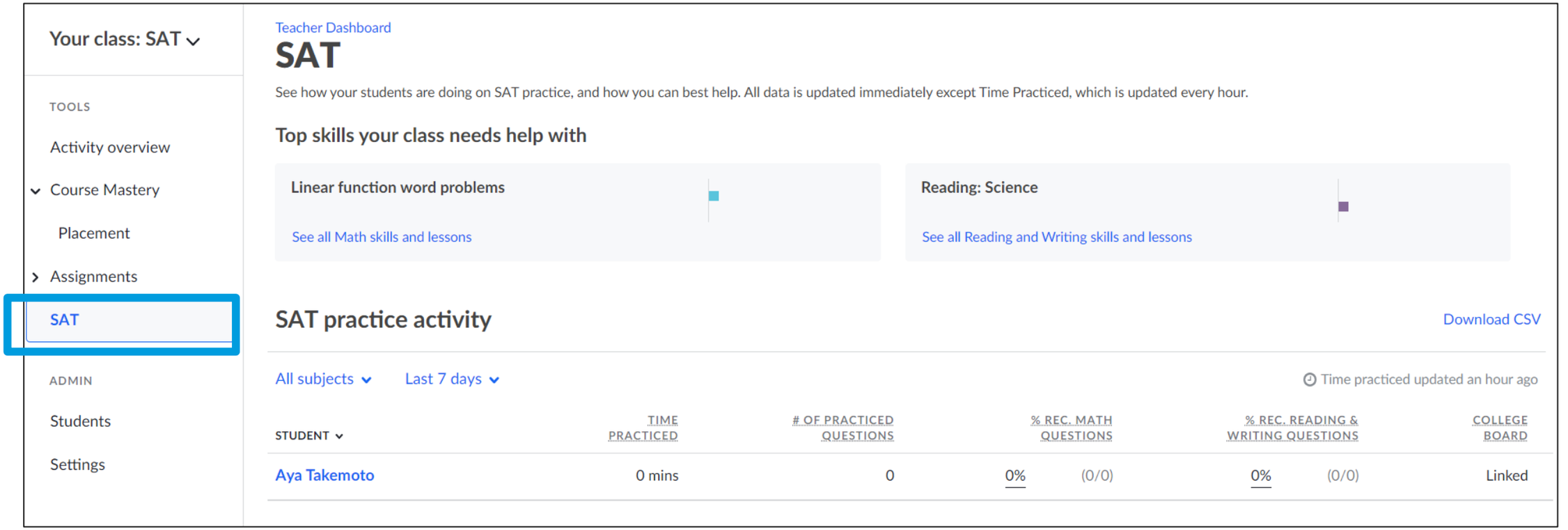

Notifications
Your first student has accepted your invitation! View student roster.
8 minutes ago


Class created
Class created! Next steps:
Find exercises, videos, and articles for your class
Assign them to your students
View your class's Assignments tab to track student progress
Explore our SAT content

CollegeBoard

Explore the Teacher Dashboard

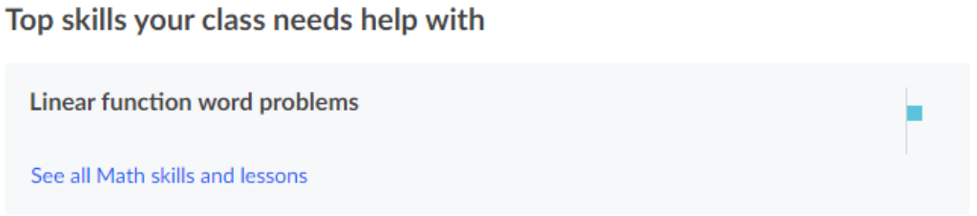
Accessing SAT Content



Classroom Dashboard

See how your students are doing on SAT practice and how you can best help.

All data are updated immediately except Time Practiced, which is updated every hour.

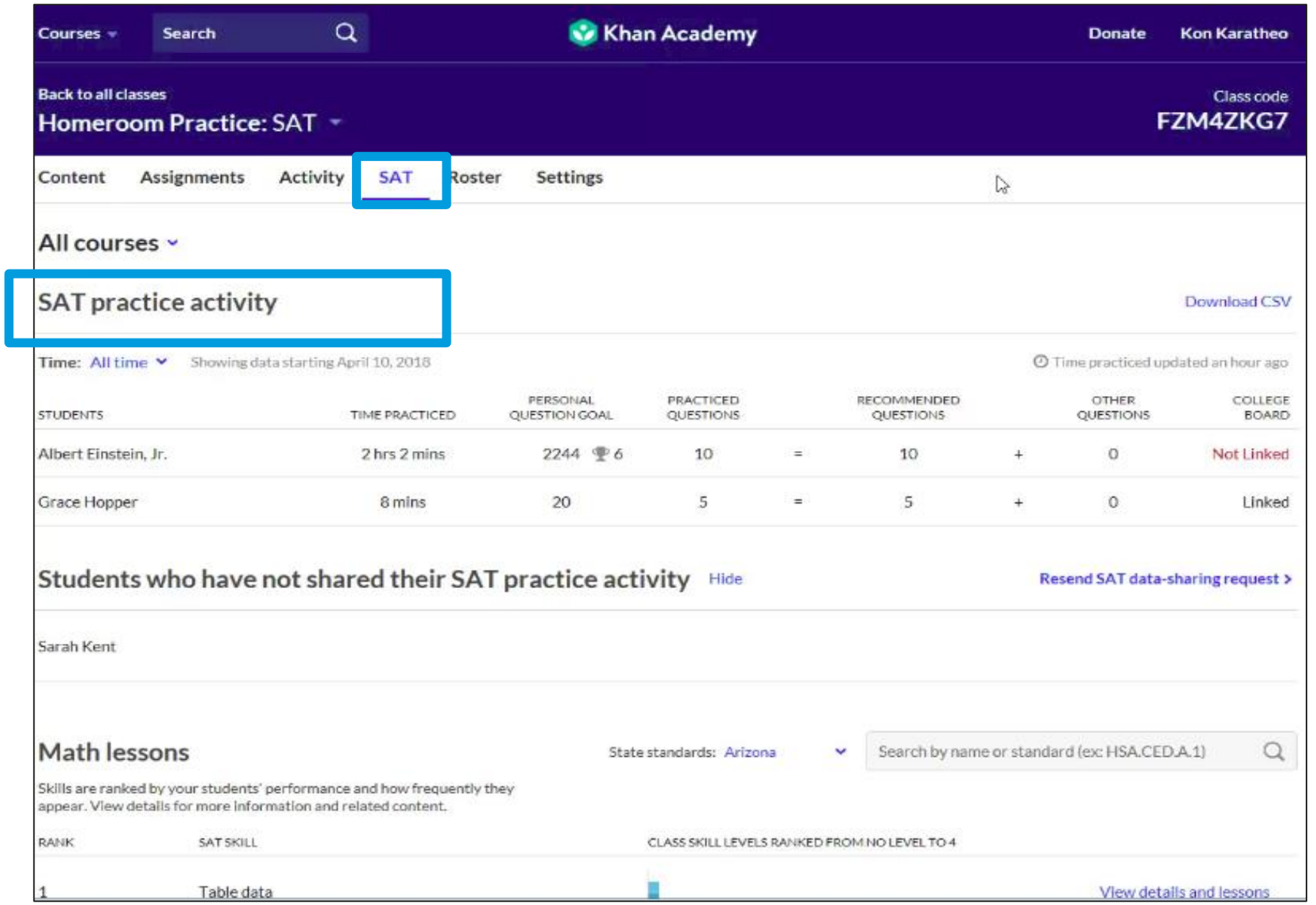


Math lessons

Skills are ranked by your students' performance and how frequently they appear. View details for more information and related content.

RANK	SAT SKILL	CLASS SKILL LEVELS RANKED FROM NOT STARTED TO 4	
1	Linear function word problems		View details and lessons
2	Solving systems of linear equations		View details and lessons
3	Linear equation word problems		View details and lessons
4	Percents		View details and lessons
5	Ratios, rates, and proportions		View details and lessons
6	Structure in expressions		View details and lessons
7	Table data		View details and lessons
8	Operations with polynomials		View details and lessons

SAT® Tab: Practice Activity



SAT® Tab: Time Practiced

TIME PRACTICED	# OF PRACTICED QUESTIONS	% REC. MATH QUESTIONS		% REC. READING & WRITING QUESTIONS		COLLEGE BOARD
25 hrs 35 mins	216	74.6%	(88/118)	67.3%	(66/98)	Linked
1 min	0	0%	(0/0)	0%	(0/0)	Not Linked
1 hr 11 mins	27	0%	(0/5)	0%	(0/22)	Linked

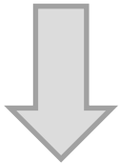
SAT® Tab: Number of Practiced Questions

TIME PRACTICED	# OF PRACTICED QUESTIONS	% REC. MATH QUESTIONS		% REC. READING & WRITING QUESTIONS		COLLEGE BOARD
25 hrs 35 mins	216	74.6%	(88/118)	67.3%	(66/98)	Linked
1 min	0	0%	(0/0)	0%	(0/0)	Not Linked
1 hr 11 mins	27	0%	(0/5)	0%	(0/22)	Linked

SAT® Tab:
Percent Completed of Recommended Math and Reading & Writing Questions

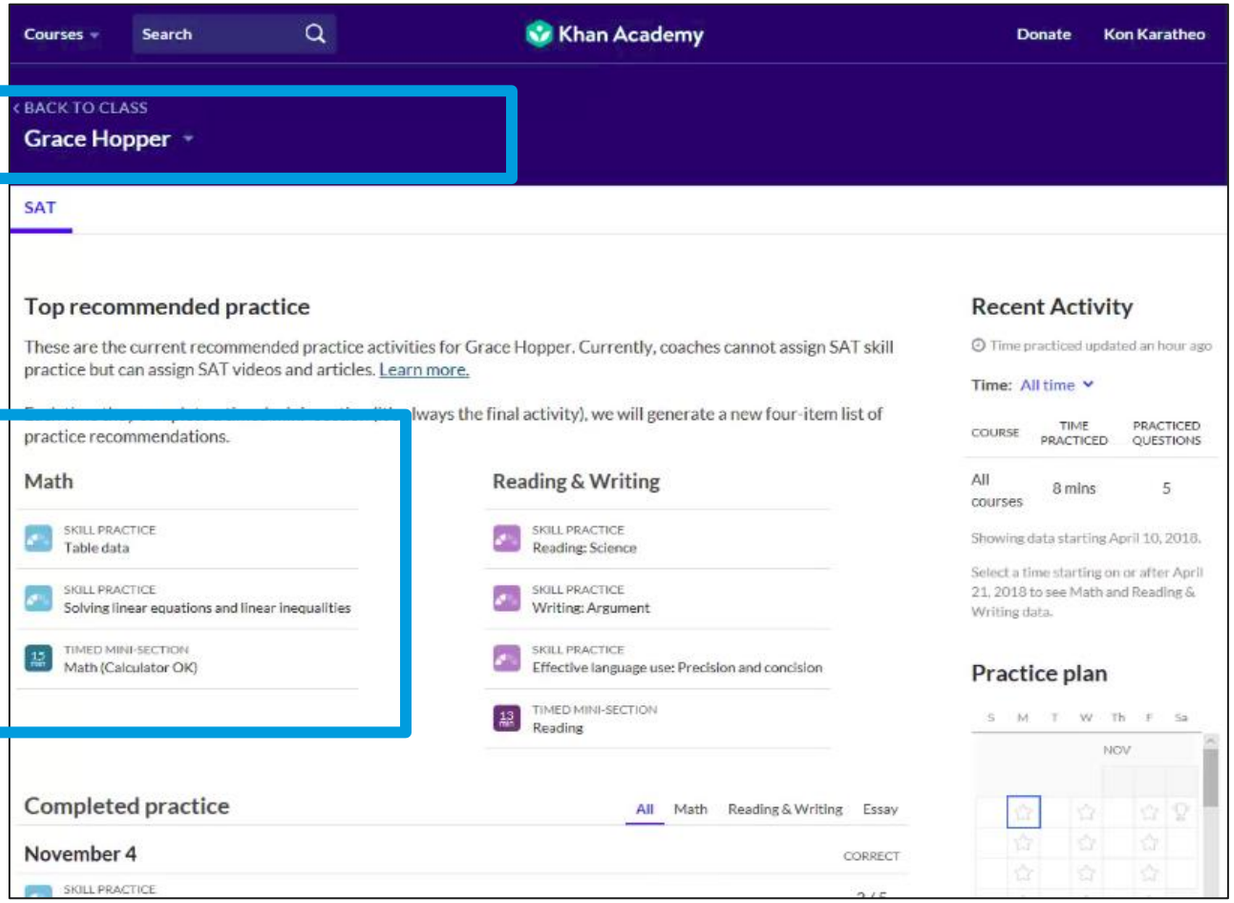
TIME PRACTICED	# OF PRACTICED QUESTIONS	% REC. MATH QUESTIONS		% REC. READING & WRITING QUESTIONS		COLLEGE BOARD
25 hrs 35 mins	216	74.6%	(88/118)	67.3%	(66/98)	Linked
1 min	0	0%	(0/0)	0%	(0/0)	Not Linked
1 hr 11 mins	27	0%	(0/5)	0%	(0/22)	Linked

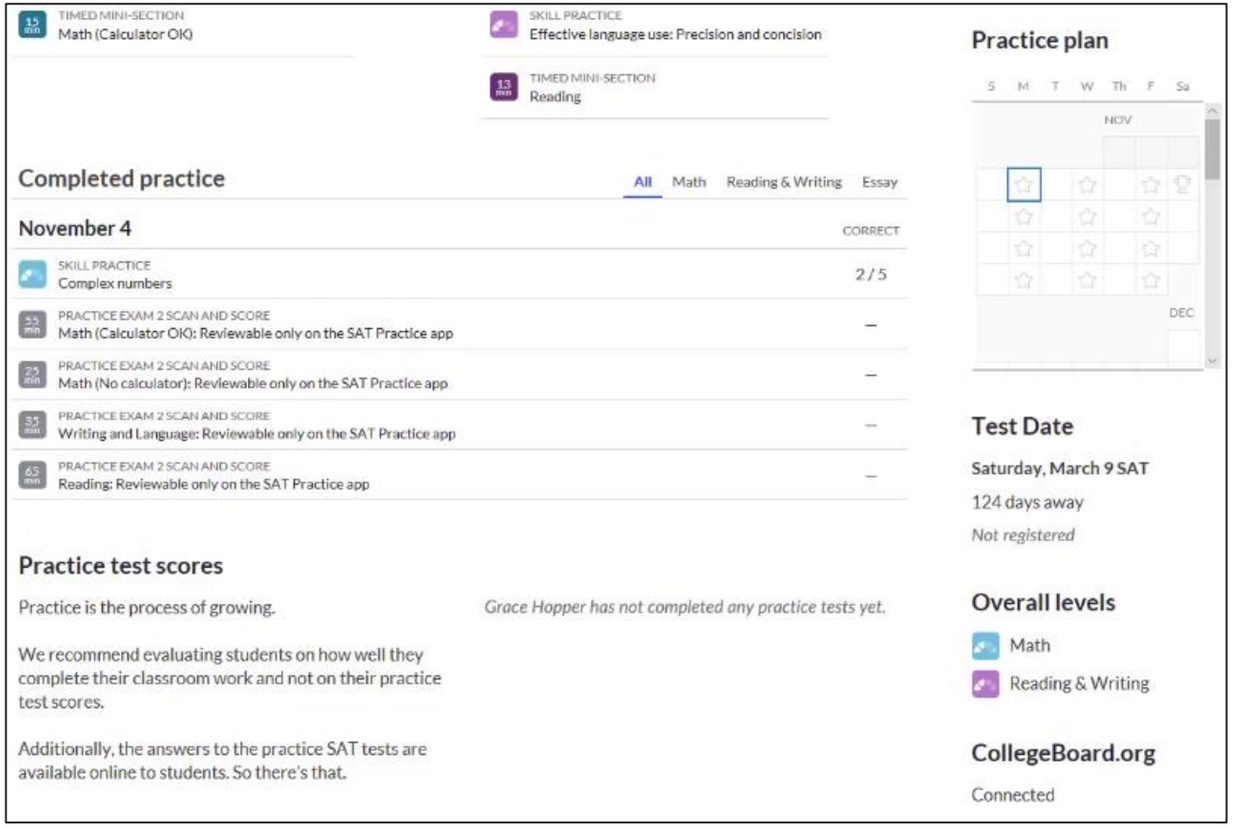
SAT® Tab: Linkage



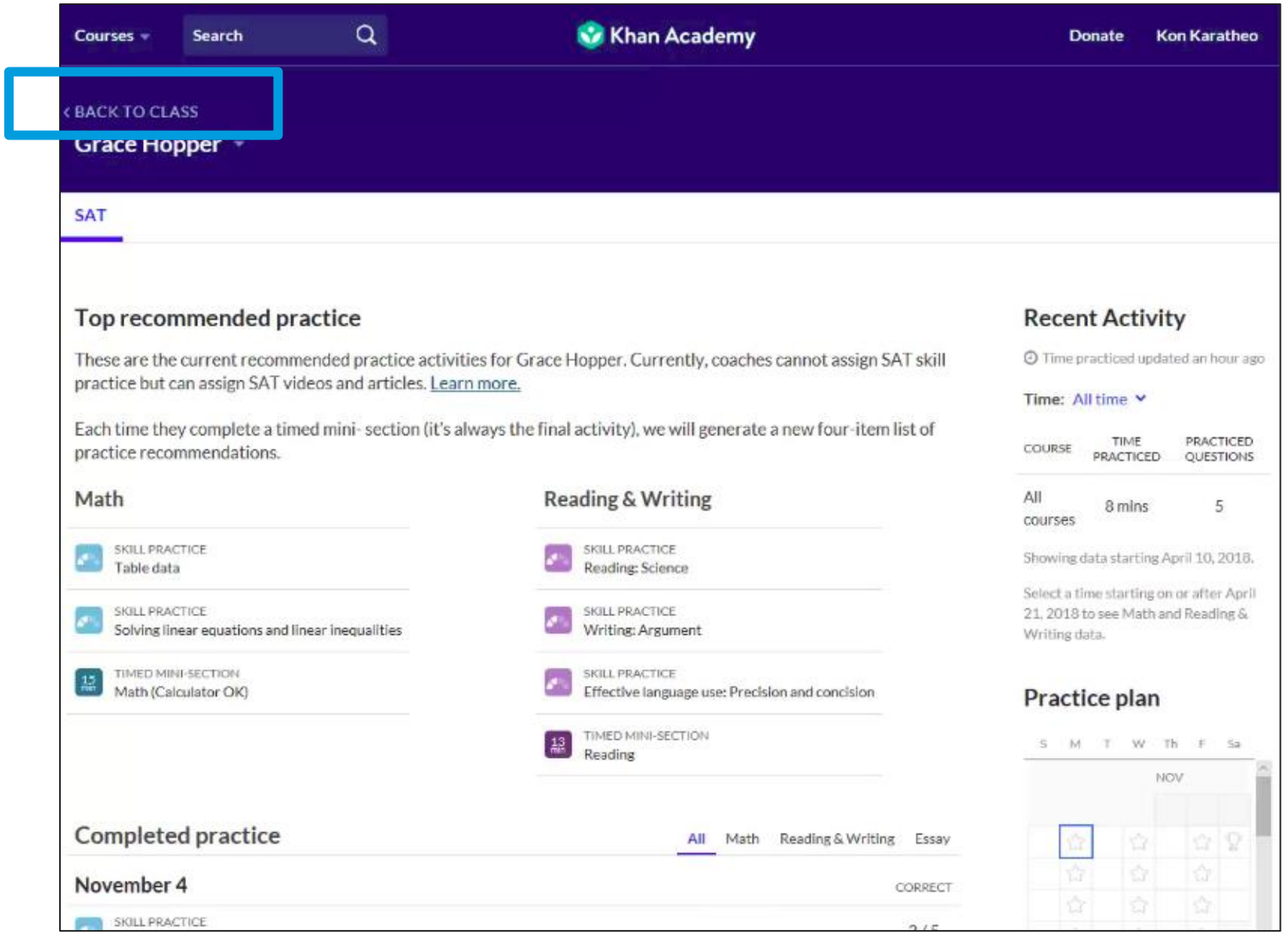
TIME PRACTICED	# OF PRACTICED QUESTIONS	% REC. MATH QUESTIONS		% REC. READING & WRITING QUESTIONS		COLLEGE BOARD
25 hrs 35 mins	216	74.6%	(88/118)	67.3%	(66/98)	Linked
1 min	0	0%	(0/0)	0%	(0/0)	Not Linked
1 hr 11 mins	27	0%	(0/5)	0%	(0/22)	Linked

SAT® Tab: Select a Student

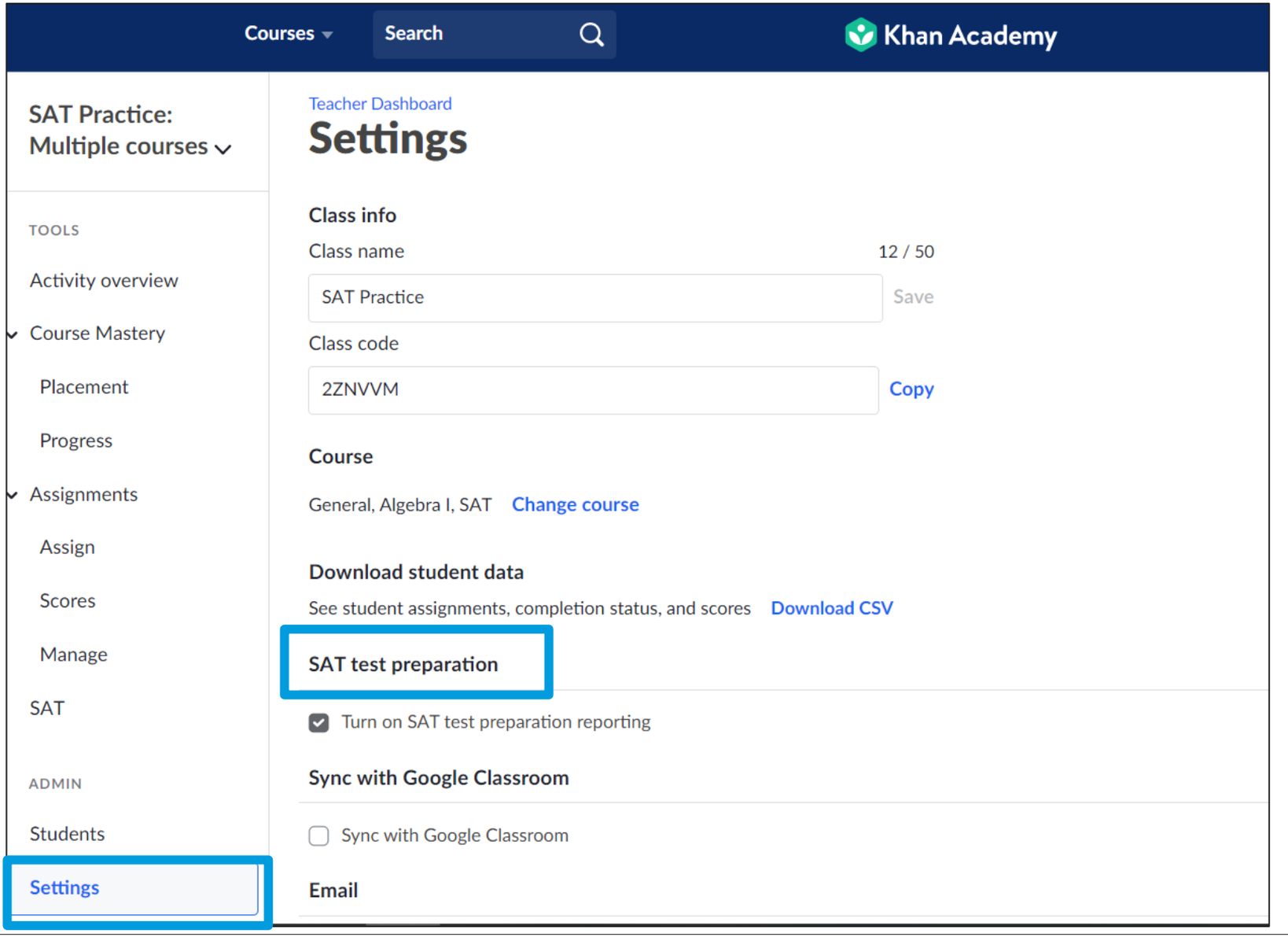




Back to Classes



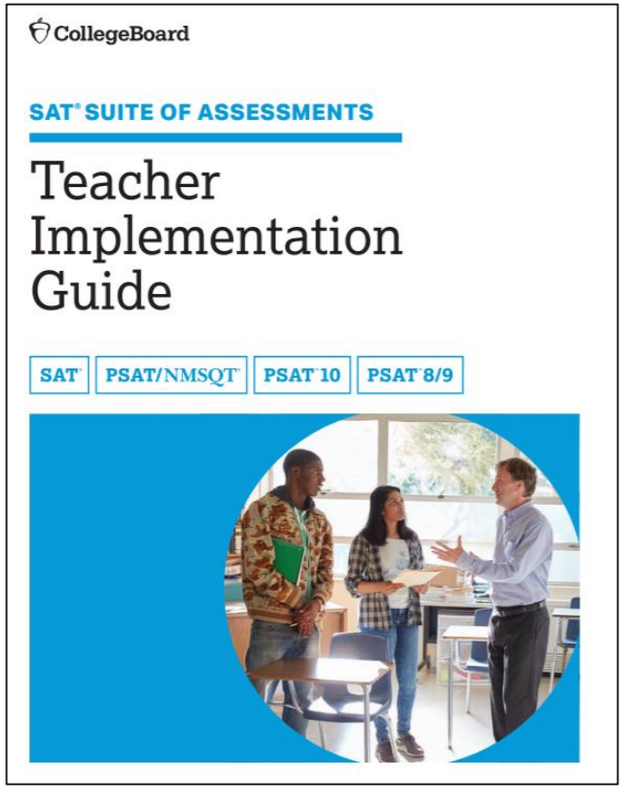
Settings


Courses
Search
Khan Academy
SAT Practice: Multiple courses
TOOLS
Activity overview
Course Mastery
Placement
Progress
Assignments
Assign
Scores
Manage
SAT
ADMIN
Students
Settings
Teacher Dashboard
Settings
Class info
Class name
12 / 50
SAT Practice
Save
Class code
2ZNVVM
Copy
Course
General, Algebra I, SAT
Change course
Download student data
See student assignments, completion status, and scores
Download CSV
SAT test preparation
Turn on SAT test preparation reporting
Sync with Google Classroom
Sync with Google Classroom
Email

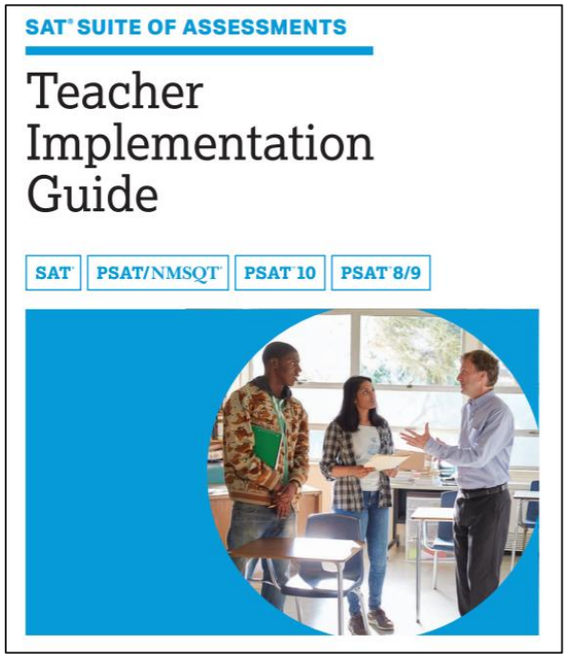
CollegeBoard

Instructional and Skill-Building Strategies

Teacher Implementation Guide



General Math Strategies

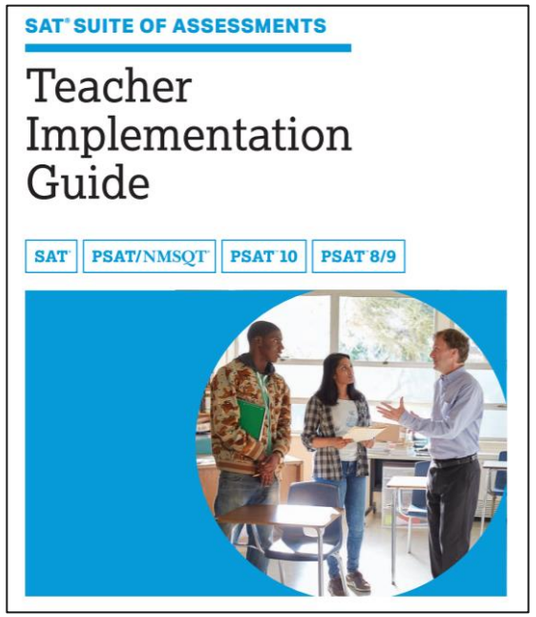


https://collegereadiness.collegeboard.org/pdf/redesigned-sat-k12-teacher-implementation-guide.pdf

Instructional Strategies for Math:

- Ensure that students practice solving multistep problems.
- Encourage students to express quantitative relationships in meaningful words and sentences to support their arguments and conjectures.
- Separate students into small working groups. Ask them to discuss how to arrive at solutions.
- Vary the types of problems in assignments so that students aren't always using the same strategy to find solutions.
- Assign problems or other assessments that do not allow the use of a calculator.
- Develop interest and facility in math by providing frequent opportunities for students to interpret and apply mathematical skills and concepts in real-world contexts, particularly in the sciences and social studies.

Math: Skill-Building Strategies



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Skill-Building Strategies for Math:

- Provide students with explanations and/or equations that incorrectly describe a graph and ask them to identify errors.
- Ask students to create pictures, tables, graphs, lists, models, and/or verbal expressions to interpret text and/or data to help them arrive at a solution.
- Ask students to solve problems that require multiple steps to arrive at the solution.
- Facilitate discussions in which students communicate their own thinking and critique the reasoning of others as they work toward a solution.
- Ask open-ended questions.
- Direct students' attention to real-world situations to provide context for the problem.
- Organize information to present data and answer a question or show a problem solution.
- Use "Guess and Check" to explore different ways to solve a problem when other strategies are not obvious.

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Supporting Student Success with Official SAT® Practice on Khan Academy®

Implementation Models

Coach Resources for Official SAT® Practice

Lesson Plans

Coach Tools FAQ

Coach Tools Guide

Features include these:

Recommended SAT® skills on which to focus based on class performance

- Lesson plans created by teachers and for teachers available for skills in Math, Evidence-Based Reading & Writing, and the Essay
- Links to additional Khan Academy® content and SAT® content that can be assigned based on the greatest needs of the class

Student progress

- Their upcoming SAT® test date
- Problems completed, time spent, and practice tests scheduled

Recently completed activity

- The top recommended skills for practice
- Questions attempted, answer choices, and correct answers
- Practice test scores

Ideas for Increasing Student Engagement

- Designate classes in which students will create and link Khan Academy® accounts.
- Train staff to help students create and link accounts.
- Reach out to local community-based organizations and/or college-access groups to help students log in to their College Board/Khan Academy® accounts and practice.
- Raffle off small prizes for participation (e.g., school gear).
- Incentivize classes/grades to compete with each other (e.g., by percentage of students who have linked their accounts to Khan Academy®; completion of full-length practice tests, etc.).
- Strengthen your school's college-going culture and empower students to think of themselves differently.

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Developing a Plan for Official SAT® Practice

Design an Implementation Plan for Your Classes

1. Share the steps for linking accounts/taking diagnostic quizzes with students.
2. Create an implementation plan for using the Coach Tools.
3. Review SAT® practice resources available here: https://www.isbe.net/Pages/sat-psat.aspx under the Practice Resources accordion.
4. Monitor progress.
5. Measure success.

Please email questions or comments about this presentation to ILSAT@collegeboard.org.

Thank You

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