

SAT Math Toolkit
Heart of Algebra – Linear Equations in One Variable
HOA.LE1

Average SAT Frequency: 4.5

SAT Test Specifications

- HOA.LE1.1 Create and use linear equations in one variable to solve problems in a variety of contexts.
- HOA.LE1.2 Create a linear equation in one variable, and when in context interpret solutions in terms of the context.
- HOA.LE1.3 Solve a linear equation in one variable, making strategic use of algebraic structure.
- HOA.LE1.4.a For a linear equation in one variable, interpret a constant, variable, factor, or term in a context.
- HOA.LE1.4.b For a linear equation in one variable, determine the conditions under which the equation has no solution, a unique solution, or infinitely many solutions.
- HOA.LE1.5 Fluently solve a linear equation in one variable.

CCSS Best Bridge

- 6.EE.6 Reason about and solve one-variable equations and inequalities. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
- 6.EE.7 Reason about and solve one-variable equations and inequalities. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.
- 6.EE.7 Reason about and solve one-variable equations and inequalities. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.
- 6.RP.3 Understand ratio concepts and use ratio reasoning to solve problems. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- 7.RP.2 Analyze proportional relationships and use them to solve real-world and mathematical problems. Recognize and represent proportional relationships between quantities.
- 8.EE.7 Analyze and solve linear equations and pairs of simultaneous linear equations. Solve linear equations in one variable.
- 8.F.4 Use functions to model relationships between quantities. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- A-CED.1 Create equations that describe numbers or relationship. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
- A-CED.2 Create equations that describe numbers or relationship. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- F-BF.1 Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities.

Examples of Student Actions

- Students develop the ability to solve problems by defining variables, relating them to one another, and writing an equation.
- Students know that an equation is a statement of equality between two expressions.
- Students find values to assign to variables in equations that make the equations true statements. When values are substituted for the variables in an equation, the equation is either true or false.
- Students solve equations, including those with variables on both sides, using properties of equality.
- Students investigate a problem that can be solved by reasoning quantitatively and by creating equations in one variable.
- Students write, solve, and graph one-step linear equations.
- Students use properties of equality to rewrite an equation and to show two equations are equivalent.
- Students formulate and use different strategies to solve one-step and multi-step linear equations.
- Students create models to represent, analyze, and solve problems related to linear equations.

Academic Skills and Suggestions for Improvement (from Skills Insight) with Examples of Student Actions
HOA.LE1

	6-14	15-19	20-24	25-29	30-34	35-40
Academic Skills	n/a	<ul style="list-style-type: none"> Create a simple expression or equation in one variable that represents a context. Evaluate a one-variable expression by substituting a value for the variable. 	<ul style="list-style-type: none"> Create an expression or equation in one variable that models a context. Solve a linear equation in one variable. 	<ul style="list-style-type: none"> Solve a linear equation in one variable. Interpret a term from a linear equation in one variable in the form $ax+b=c$. Identify a key feature of one representation of a linear relationship based on information about a different representation. 	<ul style="list-style-type: none"> Create and use linear relationships to solve a problem. Solve a linear equation in one variable or a system of linear equations in two variables that requires computation with fractions or decimals. 	<ul style="list-style-type: none"> Create and solve a linear equation in one variable representing a context, utilizing insight to identify the correct coefficients and constants in the equation. Make connections between different representations of linear equations in one variable, linear functions, linear equations in two variables, systems of two linear equations in two variables, and linear inequalities; these representations often include symbolic representations, which may contain variable constants.
Suggestions for Improvement	<ul style="list-style-type: none"> When reading a real-world problem, identify the quantities that change and create an expression or equation to describe the relationship between them. When substituting in a value for the variable into an expression, remember to use the order of operations to simplify. Pay attention to negative signs, especially when using an exponent. 	<ul style="list-style-type: none"> When reading a real-world problem, identify a quantity that varies (time, distance, age, etc.) and use a variable label to represent that quantity in an equation. When solving linear equations in one variable, think about how to “undo” the equation to get the variable alone. Use the distributive property and/or combine like terms when necessary. The value that makes the equation “true” is the solution to the equation. 	<ul style="list-style-type: none"> Identify terms in linear equations and describe their meaning in relationship to the real-world scenario they represent. 	<ul style="list-style-type: none"> Fluently compute with rational numbers such as fractions and decimals. Apply computation skills with fractions and decimals when solving one-variable equations that contain them. Apply inverse operations to solve equations. 	n/a	n/a
Examples of Student Actions	<ul style="list-style-type: none"> Students develop the ability to solve problems by defining variables, relating them to one another, and writing an equation. Students understand that an equation is a statement of equality between two expressions. 	<ul style="list-style-type: none"> Students find values to assign to variables in equations that make the equations true statements. When values are substituted for the variables in an equation, the equation is either true or false. 	<ul style="list-style-type: none"> Students solve equations, including those with variables on both sides, using properties of equality. Students investigate a problem that can be solved by reasoning quantitatively and by creating equations in one variable. 	<ul style="list-style-type: none"> Students write, solve, and graph one-step linear equations. Students use properties of equality to rewrite an equation and to show two equations are equivalent. 	<ul style="list-style-type: none"> Students formulate and use different strategies to solve one-step and multi-step linear equations. 	<ul style="list-style-type: none"> Students create models to represent, analyze, and solve problems related to linear equations.

Academic Approach®

HOA.LE1 SAT Exemplars

SAT TH01

Easy – No Calculator

17

$$4(r + 2) - 3r = 3(4 - r)$$

What value of r is the solution of the equation above?

Medium - Calculator

33



Note: Figure not drawn to scale.

On \overline{AD} above, $AB = \frac{1}{2}BC$. What is the length of \overline{CD} ?

Hard – No Calculator

15

Kezia is a swimming pool technician who services an average of 12 pools per week. Each pool takes an average of 4 hours to service, and she charges \$20 per hour. If Kezia would like to increase her weekly earnings by \$240, which equation can she use to determine the total number of pools, p , she should service each week?

- A) $p - 12 = \frac{240}{(20)(4)}$
- B) $p + 12 = \frac{240}{(20)(4)}$
- C) $\frac{20}{4}p - 12 = 240$
- D) $\frac{20}{4}p + 12 = 240$

E: 1
M: 15
H: A

Creating and Solving Equations and Inequalities

Creating equations and inequalities in one variable and using them to solve problems

Name: _____

Period: _____

Date: _____

1. Abbie is remodeling her kitchen. She wants to build a kitchen island with a square granite countertop. The price for granite is \$4.80 per square foot (the thickness of the granite slab is already factored into the price) plus a flat \$25.00 processing fee. If Abbie's new countertop costs \$122.20 before taxes, how long is each side of her countertop?
 - A. How much of the cost is directly related to the size of the granite countertop?
 - B. Define a variable that represents the unknown in this scenario. What unit should the variable have?
 - C. Write an equation that relates the information given and the defined variable.
 - D. Solve the equation.
 - E. If Abbie decided to instead get a rectangular countertop that is twice as long as it is wide and costs \$142.60, what are the dimensions of the countertop, in feet?

Creating and Solving Equations and Inequalities

Creating equations and inequalities in one variable and using them to solve problems

2. Brian has a fitness goal of walking at least 45,000 steps every week. His fitness app shows that he takes an average of 5,000 steps per day and an additional 3,500 steps on days he goes to the gym. At the end of a normal week, Brian met his fitness goal.
 - A. Would Brian be able to meet his fitness goal if he didn't go to the gym all week? How many steps would he have walked?

 - B. Define a variable that represents the unknown in this scenario. What unit should the variable have?

 - C. Does the scenario have only one solution? Is the scenario better represented by an equation or an inequality?

 - D. Write an inequality in terms of the information given and the defined variable.

 - E. Solve the inequality. How many possible answers are there?

Challenge Question

3. Farmer Ted is weighing his animals. He knows that a pig weighs approximately $\frac{1}{4}$ as much as a cow. He also knows that a Clydesdale horse weighs about twice what a cow weighs. A sheep weighs approximately 100 pounds less than a pig. If Farmer Ted puts 3 cows, 2 Clydesdale horses, 4 sheep and 1 pig on a giant scale used for weighing semi-trucks, the scale reads 7,850 pounds. Approximately how much does each animal weigh?