

# Digital SAT Math

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## Algebra

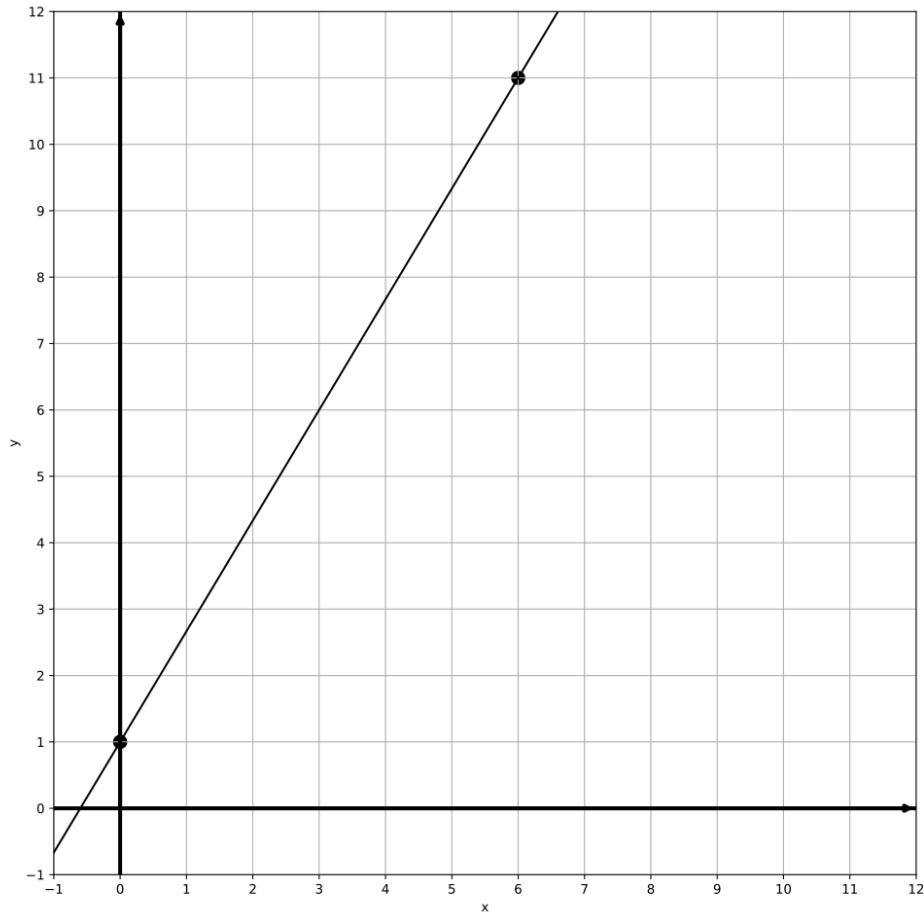
## SAT Math Algebra

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1. A research study shows that the average number of hours students spend on community service per year,  $x$ , can be estimated by the function  $f(x) = 5x + 89$ . Which statement best interprets the value 89 in this context?
- A. Students will spend a total of 89 hours on community service after 5 years.
  - B. The average number of community service hours is expected to grow by 5 hours each year.
  - C. The average hours of community service increased from 89 hours after each year.
  - D. The estimated number of community service hours was 89 hours when no additional hours are counted.



2. The graph of line  $g$  is shown in the  $xy$ -plane. Line  $k$  is defined by  $70x + py = w$ , where  $p$  and  $w$  are constants. If line  $k$  is graphed in this  $xy$ -plane, resulting in the graph of a system of two linear equations, the system of two linear equations will have infinitely many solutions. What is the value of  $p + w$ ?



3. If  $86(x + 9) = 36(x + 9) + 150$ , what is the value of  $x + 9$ ?

- A. -9
- B. -6
- C. 3
- D. 6

4. Based on the table, which equation represents the linear relationship between the number of diplomatic missions,  $d$ , and the associated costs,  $c$ ?

input	output
83	-4870
54	-2985
14	-385

- A.  $c + 65d = 525$
- B.  $c - 65d = -525$
- C.  $c + 65d = -525$
- D.  $c - 65d = 525$

5. The graph of a linear function  $g(x)$  is given by the equation  $g(x) = 3f(x - 5) + 5$ . what is the y-intercept of the linear function  $f$  in the  $xy$ -plane?

$x$	$g(x)$
0	-25
5	20
8	47

- A.  $(0, -10)$
- B.  $(0, 0)$
- C.  $(0, 5)$
- D.  $(0, 10)$

6. A space research organization is planning a mission that involves launching two types of satellites. The total cost of launching  $x$  number of communication satellites and  $y$  number of observation satellites is represented by the equation

65.  $6x + 287.0y = 7052$ . How much more does it cost to launch one observation satellite than one communication satellite?

7. A solar panel's energy output is modeled by the function  $f$ , which gives the estimated energy output in watts,  $x$  years after the panel was first installed. Based on the equation  $f(x) = 4x + 55$ , what does 55 represent in this context?

- A. The solar panel will be producing 55 watts each year.
- B. The solar panel's energy output will reach 55 watts after 2 years.
- C. The estimated energy output of the solar panel was 55 watts when it was first installed.
- D. The solar panel is expected to stop working after 55 years.

8. A certain school has a total of 46 students enrolled in a club. The number of students in the club is at least 32 more than the number of students who have signed up for a volunteer activity. If we let  $x$  represent the number of students signed up for the volunteer activity, which inequality represents this situation?

- A.  $x + 32 \leq 46$
- B.  $x + 46 \geq 32$
- C.  $x + 32 \geq 46$
- D.  $x + 46 \leq 32$

9. What is the y-coordinate of the y-intercept of the graph of  $y = g(x)$  in the xy-plane?  $g(x) = f(x) - 8$ , where  $f(x) = 7(74x - 22)$

- A. -176
- B. -170
- C. -162
- D. -154

10. A company produces eco-friendly products. The total revenue of the company in the year 2023 is represented by the equation  $831 = 71 + 76(x - 8)$ , where  $x$  represents the number of years since 2015. If the revenue is expected to reach 831 dollars in 2023, how many years since 2015 has the company been operating?

- A. 10 years
- B. 15 years
- C. 18 years
- D. 20 years

# SAT Math Algebra Solutions

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1. A research study shows that the average number of hours students spend on community service per year,  $x$ , can be estimated by the function  $f(x) = 5x + 89$ . Which statement best interprets the value 89 in this context?
- A. Students will spend a total of 89 hours on community service after 5 years.
  - B. The average number of community service hours is expected to grow by 5 hours each year.
  - C. The average hours of community service increased from 89 hours after each year.
  - D. The estimated number of community service hours was 89 hours when no additional hours are counted.

## Answer

D

## Solution

**Concept Check :** The intent of this question is to assess the student's understanding of function interpretation, specifically the concept of the y-intercept in the context of a linear equation. The student is expected to recognize what the constant term in the linear equation represents regarding the average number of hours spent on community service.

**Solution Strategy :** To approach this problem, the student should first identify the components of the linear equation provided,  $f(x) = 5x + 89$ . The student needs to recognize that the term ' $x$ ' represents the number of years, and the function  $f(x)$  represents the estimated average hours spent on community service. The constant term '89' should then be interpreted in relation to what it signifies in this context.

**Quick Wins :** Consider breaking down the function into its parts: the slope (5) and the y-intercept (89). Remember that the y-intercept indicates the value of the function when  $x$  is 0. Think about what it means for students who have not yet spent any time on community service, and how that relates to the average hours in this scenario. This perspective can clarify the meaning of the constant term.

**Mistake Alert :** Be cautious not to confuse the slope with the y-intercept. The slope (5) indicates how much the average number of hours increases with each additional year, while the y-intercept (89) has a specific meaning that should not be overlooked. Additionally, ensure you are interpreting '89' correctly in the context of

the problem—this is not just a number but has relevance to the average hours spent on community service.

**SAT Know-How :** This problem falls under the category of algebra, specifically focusing on interpreting linear equations and their components. It assesses the student's ability to read and understand the context of mathematical functions. The ability to interpret the y-intercept in a real-world scenario is a valuable skill in SAT problem-solving, highlighting the importance of grasping how mathematical concepts apply beyond mere calculations.

**Step 1: Understand the Function**  $f(x) = 5x + 89$ .

The function is in the form  $y = mx + b$ , where  $m$  is the slope and  $b$  is the y-intercept.

**Step 2: Identify the meaning of the constant term, 89.**

In a linear equation, the y-intercept (89 in this case) represents the starting value - the value of the function when  $x = 0$ .

**Step 3: Analyze the context provided by the problem.**

In this context, the value 89 represents the estimated initial average hours of community service before any additional time ( $x = 0$ ) is counted.

**Step 4: Check each option for alignment with the interpretation of 89.**

Option A is incorrect because it confuses the function's application over 5 years.

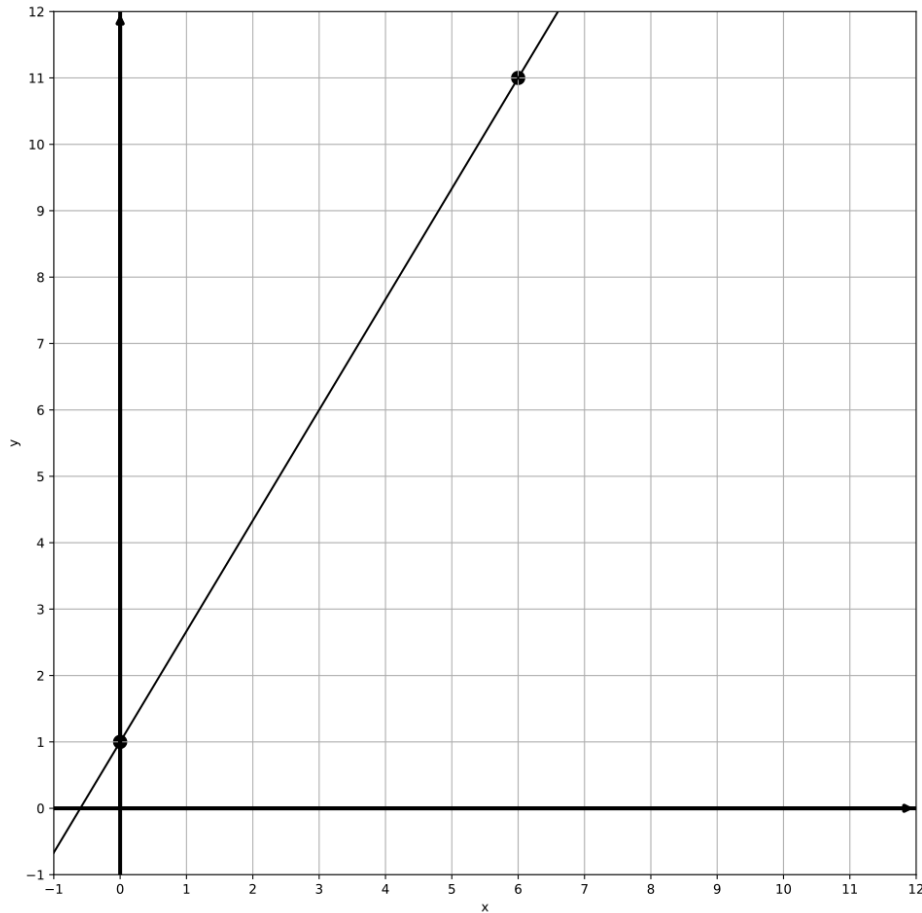
Option B is incorrect because it describes the slope (5) rather than the y-intercept (89).

Option C is incorrect because it suggests 89 is a change rather than an initial value.

Option D correctly identifies 89 as the initial estimate when no additional hours are factored in.



2. The graph of line  $g$  is shown in the  $xy$ -plane. Line  $k$  is defined by  $70x + py = w$ , where  $p$  and  $w$  are constants. If line  $k$  is graphed in this  $xy$ -plane, resulting in the graph of a system of two linear equations, the system of two linear equations will have infinitely many solutions. What is the value of  $p + w$ ?



Answer

-84

Solution

Concept Check : The question intends for students to understand the concept of linear equations and their graphical representations. It tests knowledge of how two lines can have infinitely many solutions, which occurs when the lines are identical (i.e., have the same slope and y-intercept). Students should know how to manipulate equations and identify relationships between coefficients.

Solution Strategy : To solve this problem, students should first analyze the graph provided for line  $g$  to determine its slope and y-intercept. Then, they need to express

line k in slope-intercept form ( $y = mx + b$ ) to compare it to line g. Since the lines must be identical for there to be infinitely many solutions, students will need to equate the coefficients of x and the constant terms to find the values of p and w.

**Quick Wins :** 1. Carefully examine the graph of line g to accurately determine its slope and y-intercept. 2. Write the equation of line k in slope-intercept form, which may involve isolating y. 3. Ensure that both lines (g and k) have the same slope and y-intercept, as this is crucial for having infinitely many solutions. 4. Use algebraic techniques to manipulate the equations and solve for p and w effectively.

**Mistake Alert :** 1. Be cautious with signs when manipulating equations; a small error can lead to incorrect values for p and w. 2. Double-check that both equations represent the same line; ensure that you have correctly identified the slope and y-intercept from the graph. 3. Pay attention to the conditions for infinitely many solutions, as it specifically requires the lines to be identical rather than just parallel.

**SAT Know-How :** This problem falls under the category of Algebra, specifically focusing on the graphs of linear equations. It assesses the student's ability to analyze linear equations, understand their graphical representations, and manipulate algebraic expressions to find solutions. Mastering this type of problem is essential for SAT success, as it requires a combination of visual interpretation and algebraic reasoning.

1. Find the equation of line g using the points (0, 1) and (6, 11).

The slope of line g is  $\frac{11-1}{6-0} = \frac{10}{6} = \frac{5}{3}$ .

Using the point (0, 1), the y-intercept b is 1.

Therefore, the equation of line g is  $y = \frac{5}{3}x + 1$ .

Multiply throughout by 3 to eliminate fractions:  $3y = 5x + 3$ .

Rearranging gives:  $5x - 3y = -3$ .

2. Since line k must be the same as line g for infinitely many solutions:

Line k is given by  $70x + py = w$ .

Comparing with  $5x - 3y = -3$ , we see that line k must be a multiple of line g.

Therefore,  $\frac{70}{5} = 14$ , so the entire equation must be multiplied by 14.

$5x - 3y = -3$  becomes  $70x - 42y = -42$  when multiplied by 14.

Therefore,  $p = -42$  and  $w = -42$ .

3. Calculate p + w:  $p + w = -42 + (-42) = -84$ .

3. If  $86(x + 9) = 36(x + 9) + 150$ , what is the value of  $x + 9$ ?

- A. -9
- B. -6
- C. 3
- D. 6

### Answer

C

### Solution

**Concept Check :** The intent of this question is to assess the student's ability to solve a linear equation using the substitution method. Students are expected to understand how to isolate variables and perform algebraic operations to find the value of ' $x + 9$ '.

**Solution Strategy :** To approach this problem, the student should start by recognizing that both sides of the equation contain the term ' $(x + 9)$ '. The first step is to distribute the coefficients (86 and 36) to the term ' $(x + 9)$ ' on both sides. After simplifying both sides, the student should then rearrange the equation to isolate ' $x$ ' or directly solve for ' $x + 9$ ' by manipulating the equation appropriately.

**Quick Wins :** A helpful tip is to combine like terms after distributing the coefficients. This will make it easier to isolate the variable. Also, consider rewriting the equation in terms of ' $x + 9$ ' directly, which could simplify your calculations. Always double-check your calculations after each step to ensure accuracy.

**Mistake Alert :** Students should be cautious about making errors in distribution and combining like terms. It's easy to miscalculate coefficients or to accidentally drop a term when rearranging the equation. Double-check your work to avoid these common mistakes, especially when dealing with negative numbers or when moving terms from one side of the equation to the other.

**SAT Know-How :** This problem falls under the category of Algebra, specifically focusing on solving linear equations and inequalities through substitution. It assesses the student's skills in distributing terms, combining like terms, and isolating variables. Mastering these techniques is essential for success in SAT math, as it reinforces the foundational skills needed for more complex algebraic concepts.

**Step 1:** Simplify both sides by subtracting  $36(x + 9)$  from both sides of the equation.

$$86(x + 9) - 36(x + 9) = 150$$

Step 2: Combine like terms on the left side.

$$50(x + 9) = 150$$

Step 3: Isolate  $(x + 9)$  by dividing both sides by 50.

$$x + 9 = \frac{150}{50}$$

Step 4: Simplify the fraction.

$$x + 9 = 3$$



4. Based on the table, which equation represents the linear relationship between the number of diplomatic missions,  $d$ , and the associated costs,  $c$ ?

input	output
83	-4870
54	-2985
14	-385

- A.  $c + 65d = 525$
- B.  $c - 65d = -525$
- C.  $c + 65d = -525$
- D.  $c - 65d = 525$

Answer

A

Solution

Concept Check : The question is asking the student to identify a linear equation that represents the relationship between two variables: the number of diplomatic missions ( $d$ ) and the associated costs ( $c$ ). Students need to understand how to interpret data from a table and the concept of linear relationships, which includes recognizing that they can be expressed in the form of a linear equation ( $y = mx + b$ ).

Solution Strategy : To solve this problem, students should examine the values in the table to determine how changes in the number of diplomatic missions ( $d$ ) affect the costs ( $c$ ). They should think about calculating the slope ( $m$ ) of the line using the formula (change in  $c$ )/(change in  $d$ ) based on two points from the table.

Additionally, students should look to identify the  $y$ -intercept ( $b$ ) by establishing the cost when the number of missions is zero, if applicable.

Quick Wins : When examining the table, first identify a pair of ( $d$ ,  $c$ ) values to calculate the slope. If possible, choose values that are far apart to minimize calculation errors. After determining the slope, substitute one of the points back into the linear equation format ( $c = md + b$ ) to solve for  $b$ . Make sure to check for consistency across the table to ensure the equation fits all given points.

Mistake Alert : Be careful not to confuse the variables; ensure you are correctly identifying which value corresponds to  $d$  and which corresponds to  $c$ . Additionally,

pay attention to the scale of the table; sometimes the values can be misleading if they are not in a straightforward numerical sequence. Double-check calculations for slope and intercept to avoid simple arithmetic mistakes.

**SAT Know-How :** This problem is a linear relationship word problem that assesses the student's ability to derive a linear equation from a set of data points. It tests skills in interpreting tables, calculating slopes, and formulating equations. Mastering these concepts is crucial for efficiently solving similar SAT problems and developing a strong foundation in algebra.

**Step 1:** Calculate the slope ( $m$ ) using any two points from the table.

Using points (83, -4870) and (54, -2985):

$$\text{Slope } (m) = \frac{c_2 - c_1}{d_2 - d_1} = \frac{-2985 - (-4870)}{54 - 83} = \frac{1885}{-29} = -65.$$

**Step 2:** Use the slope-intercept form  $c = md + b$  with one point to find  $b$ .

Using point (83, -4870) and  $m = -65$ :

$$-4870 = -65(83) + b \rightarrow -4870 = -5395 + b \rightarrow b = -4870 + 5395 = 525.$$

**Step 3:** Write the equation in the form  $c = md + b$ .

The equation of the line is  $c = -65d + 525$ .

**Step 4:** Rearrange the equation to match the format of the options.

Rearrange  $c = -65d + 525$  to  $c + 65d = 525$ .

5. The graph of a linear function  $g(x)$  is given by the equation  $g(x) = 3f(x - 5) + 5$ . what is the y-intercept of the linear function  $f$  in the  $xy$ -plane?

$x$	$g(x)$
0	-25
5	20
8	47

- A. (0, -10)
- B. (0, 0)
- C. (0, 5)
- D. (0, 10)

Answer

C

Solution

Concept Check : The question asks students to understand the relationship between a linear function and its transformation. Students are expected to know how to manipulate functions and determine key characteristics, such as the y-intercept, through given values of the transformed function.

Solution Strategy : To solve this problem, students should first analyze the transformation given in the function  $g$ . They need to substitute the values of  $g(0)$ ,  $g(5)$ , and  $g(8)$  into the equation to find corresponding values of  $f$ . This will involve solving for  $f(x)$  based on how  $g$  alters the input and output of  $f$ . Students should isolate the function  $f$  and determine its form to find the y-intercept.

Quick Wins : Start by substituting the known values of  $g$  into the transformation equation. This will yield equations in terms of  $f(x)$ . Once you have those, solve for  $f(x)$  in each case. If you can express  $f(x)$  in the form of  $y = mx + b$ , you can directly identify the y-intercept as  $b$ . Also, remember that the y-intercept occurs when  $x = 0$ .

Mistake Alert : Be careful with the transformations. The function  $g$  involves shifting the input  $(x - 5)$  and scaling the output by 3 while also adding 5. Make sure to correctly apply these transformations when substituting values. Additionally, watch out for sign errors when simplifying the equations. Double-check your calculations to avoid misinterpreting the value of  $f$ .

SAT Know-How : This problem falls under the category of Algebra, specifically focusing on the graphs of linear equations and functions. It assesses the student's ability to manipulate and understand functions and their transformations, ultimately leading to finding the y-intercept of a linear function. Mastery of function transformations and solving for y-intercepts is crucial for success in SAT math problems.

Step 1: Determine the slope of  $g(x)$ .

Using  $g(5) = 20$  and  $g(0) = -25$ :

$$\text{Slope} = \frac{20 - (-25)}{5 - 0} = \frac{45}{5} = 9.$$

Step 2: Determine the equation of  $g(x)$  using one point  $(x, g(x)) = (5, 20)$ :

We use the point-slope form:  $g(x) = 9(x - 5) + 20$ .

$$g(x) = 9x - 45 + 20 = 9x - 25.$$

Step 3: Compare  $g(x)$  definition with given transformation  $g(x) = 3f(x - 5) + 5$ .

$$9x - 25 = 3f(x - 5) + 5.$$

$$9x - 30 = 3f(x - 5).$$

$$f(x - 5) = \frac{9x - 30}{3} = 3x - 10.$$

$$f(x) = 3(x + 5) - 10 = 3x + 15 - 10 = 3x + 5.$$

Step 4: The y-intercept of  $f(x)$  is found by setting  $x = 0$ .

$$f(0) = 3(0) + 5 = 5.$$

Thus, the y-intercept of function  $f$  is  $(0, 5)$ .



6. A space research organization is planning a mission that involves launching two types of satellites. The total cost of launching  $x$  number of communication satellites and  $y$  number of observation satellites is represented by the equation  $65.6x + 287.0y = 7052$ . How much more does it cost to launch one observation satellite than one communication satellite?

### Answer

221.4

### Solution

**Concept Check :** The question aims to assess the student's understanding of linear equations and their ability to analyze cost relationships in a real-world context. Students are expected to recognize how the coefficients in the equation represent costs associated with each type of satellite.

**Solution Strategy :** To solve the problem, students should focus on the coefficients of  $x$  and  $y$  in the given equation, which represent the cost per satellite for communication and observation satellites, respectively. The goal is to determine the difference in costs between launching one observation satellite and one communication satellite, which can be found by subtracting the coefficient of  $x$  from the coefficient of  $y$ .

**Quick Wins :** Pay close attention to the coefficients in the equation. Since the equation is in the form of total cost based on the number of satellites, the numbers in front of  $x$  and  $y$  will directly give you the cost per type of satellite. A good strategy is to clearly identify these coefficients and perform the subtraction to find the cost difference.

**Mistake Alert :** Be careful not to confuse the variables  $x$  and  $y$  with their coefficients. It's important to remember that  $x$  represents the number of communication satellites and  $y$  represents the number of observation satellites. Also, ensure that you are subtracting the correct coefficients to find the cost difference.

**SAT Know-How :** This problem falls under the category of algebra, specifically linear relationships in word problems. It tests the student's ability to interpret a linear equation in terms of real-world applications and to analyze costs associated with different variables. Mastering this type of problem helps develop skills in understanding linear relationships and applying algebraic concepts to practical situations, which is a key component of SAT problem-solving.

**Step 1:** Identify the cost of launching one observation satellite and one communication satellite from the equation coefficients.

**Step 2:** The cost of launching one communication satellite is \$65.6.

Step 3: The cost of launching one observation satellite is \$287. 0.

Step 4: Calculate the difference in cost by subtracting the cost of one communication satellite from the cost of one observation satellite.

Step 5: *Difference* =  $287.0 - 65.6 = 221.4$ .



7. A solar panel's energy output is modeled by the function  $f$ , which gives the estimated energy output in watts,  $x$  years after the panel was first installed. Based on the equation  $f(x) = 4x + 55$ , what does 55 represent in this context?

- A. The solar panel will be producing 55 watts each year.
- B. The solar panel's energy output will reach 55 watts after 2 years.
- C. The estimated energy output of the solar panel was 55 watts when it was first installed.
- D. The solar panel is expected to stop working after 55 years.

### Answer

C

### Solution

**Concept Check :** The intent of the question is to assess the student's understanding of linear functions and their components, specifically identifying the meaning of the y-intercept in the context of a real-world scenario.

**Solution Strategy :** To approach this problem, the student should recognize that the given equation  $f(x) = 4x + 55$  is in slope-intercept form, which is generally represented as  $y = mx + b$ , where  $m$  is the slope and  $b$  is the y-intercept. The student should focus on the value of 55, which is the constant term, and interpret its significance in the context of the problem, considering what it represents in relation to the solar panel's energy output.

**Quick Wins :** A useful tip is to remember that the y-intercept (the constant term) represents the value of the function when  $x$  is zero. In this context, think about what happens at the start, when the solar panel has just been installed. Additionally, consider the relationship between the  $x$  variable (time in years) and the output; this can help clarify the meaning of the constant.

**Mistake Alert :** Be careful not to confuse the slope with the y-intercept. The slope (4 in this case) indicates how much the energy output increases each year, while the y-intercept (55) shows the initial output. Misinterpreting these values can lead to incorrect conclusions about the solar panel's performance.

**SAT Know-How :** This problem belongs to the category of algebra, specifically focusing on linear equations and their interpretation in real-world scenarios. It assesses the student's ability to analyze and understand the components of a linear equation, particularly the significance of the y-intercept in context. Mastering these concepts is essential for solving SAT problems efficiently and accurately.

The function given is  $f(x) = 4x + 55$ .

The term  $4x$  represents the change in energy output per year.

The constant 55 is the y-intercept of the function.

The y-intercept indicates the value of  $f(x)$  when  $x = 0$  years.

Therefore,  $f(0) = 4(0) + 55 = 55$ .

This means that when the solar panel was first installed ( $x = 0$ ), the estimated energy output was 55 watts.



8. A certain school has a total of 46 students enrolled in a club. The number of students in the club is at least 32 more than the number of students who have signed up for a volunteer activity. If we let  $x$  represent the number of students signed up for the volunteer activity, which inequality represents this situation?

- A.  $x + 32 \leq 46$
- B.  $x + 46 \geq 32$
- C.  $x + 32 \geq 46$
- D.  $x + 46 \leq 32$

### Answer

A

### Solution

**Concept Check :** The intent of the question is to assess the student's understanding of linear inequalities, particularly in the context of a real-world scenario. The student is expected to be familiar with how to translate verbal descriptions into mathematical inequalities and understand the relationship between the total number of students in the club and those signed up for a volunteer activity.

**Solution Strategy :** To approach this problem, the student should focus on identifying the key components of the situation presented. The total number of students in the club is 46, and there is a relationship described between the number of students in the club and those signed up for the volunteer activity. The student should express this relationship as an inequality, taking into account that the number of students in the club (which is 46) is at least 32 more than the number of students signed up (represented by  $x$ ). This leads to the formulation of an inequality that captures this relationship.

**Quick Wins :** When translating word problems to inequalities, it is helpful to break down the problem into smaller parts. Identify what you know (in this case, the total number of students and the relationship described) and define your variable clearly. Use phrases like 'at least' to recognize that you will use greater than or equal to ( $\geq$ ) in your inequality. Remember to carefully consider the direction of the inequality based on the wording of the problem.

**Mistake Alert :** Be careful with the mathematical symbols and terms used in the problem. Phrases like 'at least' indicate that you should use a greater than or equal to symbol ( $\geq$ ), while 'more than' would use a greater than symbol ( $>$ ). Additionally, ensure you correctly interpret the relationship between the total number of students and those signed up for the volunteer activity to avoid misformulating the

inequality.

**SAT Know-How :** This problem belongs to the Algebra category, specifically focusing on linear inequality word problems. It assesses the student's ability to interpret a real-world scenario and convert it into a mathematical inequality. Understanding how to extract relevant information and translate it accurately into inequalities is a critical skill for the SAT, and practicing this will aid in developing problem-solving proficiency.

**Identify the given relationship:** The number of students in the club (46) is at least 32 more than  $x$ .

**Express this relationship mathematically:** 46 is at least  $x + 32$ .

**This can be transformed into an inequality:**  $46 \geq x + 32$ .

**Rearrange the terms to find the correct inequality:**  $x + 32 \leq 46$ .

**Therefore, the inequality representing the situation is**  $x + 32 \leq 46$ .



9. What is the y-coordinate of the y-intercept of the graph of  $y = g(x)$  in the xy-plane?  $g(x) = f(x) - 8$ , where  $f(x) = 7(74x - 22)$

- A. -176
- B. -170
- C. -162
- D. -154

Answer

C

Solution

Concept Check : The intent of the question is to assess the student's understanding of composite functions and their ability to find the y-intercept of a linear function. Students are expected to know how to manipulate functions and understand the concept of y-intercepts, which is found by evaluating the function at  $x = 0$ .

Solution Strategy : To solve this problem, the student should first substitute  $x = 0$  into the function  $g(x)$  to find the y-coordinate of the y-intercept. Since  $g(x)$  is defined in terms of  $f(x)$ , the student will need to evaluate  $f(0)$  first, then apply the transformation defined by  $g(x) = f(x) - 8$ . This involves calculating  $f(0)$ , subtracting 8, and arriving at the y-coordinate of the y-intercept for  $g(x)$ .

Quick Wins : Remember that the y-intercept occurs where  $x = 0$ . Therefore, always start by substituting  $x = 0$  into the function you are analyzing. For the given functions, carefully compute  $f(0)$  first, and then apply any transformations to find  $g(0)$ . Also, keep track of the order of operations when substituting and calculating values.

Mistake Alert : Be cautious while calculating the value of  $f(0)$ ; it is easy to make arithmetic mistakes, especially when dealing with coefficients and constants. Ensure that you are applying the subtraction in  $g(x)$  correctly after evaluating  $f(0)$  to avoid errors in the final result. Additionally, double-check your calculations to prevent misreading the function definitions.

SAT Know-How : This problem falls under the category of Algebra, specifically focusing on the graphs of linear equations and functions. It tests the student's ability to evaluate composite functions and find y-intercepts, which are essential skills for understanding linear relationships in the SAT. Mastering this type of problem enhances your problem-solving skills and prepares you for similar questions on the exam.

1. Substitute  $x = 0$  into  $f(x)$  to find  $f(0)$ :

$$f(x) = 7(74x - 22)$$

$$f(0) = 7(74(0) - 22) = 7(-22) = -154$$

2. Use the result from  $f(0)$  to find  $g(0)$ :

$$g(x) = f(x) - 8$$

$$g(0) = f(0) - 8 = -154 - 8 = -162$$

3. Therefore, the y-coordinate of the y-intercept is -162.





10. A company produces eco-friendly products. The total revenue of the company in the year 2023 is represented by the equation  $831 = 71 + 76(x - 8)$ , where  $x$  represents the number of years since 2015. If the revenue is expected to reach 831 dollars in 2023, how many years since 2015 has the company been operating?

- A. 10 years
- B. 15 years
- C. 18 years
- D. 20 years

### Answer

C

### Solution

**Concept Check :** The intent of the question is to assess the student's ability to interpret a linear equation in the context of a real-life scenario. Students are expected to understand how to manipulate and solve linear equations, and they should be familiar with the concepts of revenue, time variables, and how to relate them in the context of the problem.

**Solution Strategy :** To approach this problem, students should first identify what the variable ' $x$ ' represents in the context of the problem, which is the number of years since 2015. Then, they should recognize that the equation given can be rearranged to isolate ' $x$ '. This will require applying algebraic principles, such as distributing terms, combining like terms, and solving for the variable. It's essential to keep track of the relationships between the years and the revenue stated in the equation.

**Quick Wins :** A helpful tip is to break down the equation step-by-step. Start by simplifying the right side and isolating ' $x$ ' on one side of the equation. It can also be beneficial to convert the equation into a more familiar linear form. Additionally, double-check your calculations at each step to ensure accuracy. Finally, remember to interpret the final value of ' $x$ ' in the context of the problem to ensure it makes sense.

**Mistake Alert :** Students should be careful not to make common mistakes such as misreading the equation or mistakenly adding or subtracting terms incorrectly. Additionally, pay attention to the meaning of the variable ' $x$ ' to avoid misinterpreting what the solution represents. It's also important to check that the context of the problem aligns with the solution you arrive at, ensuring that it is a reasonable answer in terms of the years since the company began operating.

**SAT Know-How :** This problem falls under the category of Algebra, specifically

focusing on linear equation word problems. It assesses the student's skills in interpreting, manipulating, and solving linear equations in real-world contexts. Mastery of these skills is essential for success on the SAT, as it demonstrates the ability to connect mathematical concepts to practical situations.

1. Begin by simplifying the equation:  $831 = 71 + 76(x - 8)$ .
2. Distribute 76 in the term  $76(x - 8)$ :  $76x - 608$ .
3. The equation becomes:  $831 = 71 + 76x - 608$ .
4. Combine like terms on the right side:  $71 - 608 = -537$ .
5. The equation now is:  $831 = 76x - 537$ .
6. Add 537 to both sides to isolate the term with x:  $831 + 537 = 76x$ .
7. This simplifies to:  $1368 = 76x$ .
8. Divide both sides by 76 to solve for x:  $x = \frac{1368}{76}$ .
9. Calculate the division:  $x = 18$ .
10. Therefore, the company has been operating for 18 years since 2015.

