

TABLE OF CONTENTS

◆ KEY CONCEPTS

01 Linear Function	006
02 System of Linear Equations	025
03 Linear Inequality	033

◆ CHALLENGE QUESTIONS

Difficulty Level 4–5 Questions	039
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◆ ANSWERS & EXPLANATIONS

Detailed Step-by-Step Solutions	071
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VOLUME 2

ALGEBRA APPLICATIONS

Build confidence in interpreting, analyzing, and applying algebraic relationships in SAT Math problems.

- Linear Functions
- Graph Interpretation
- Slope Relationships
- Standard Form Equations
- Function Analysis
- Mathematical Modelling

KEY CONCEPTS

1

01. Linear Equation

Key Concepts 1 Slope-Intercept Form

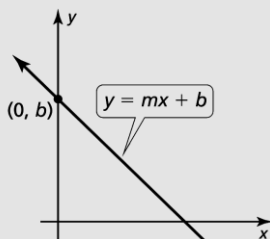
The slope-intercept form of a linear function is expressed as:

$$y = mx + b$$

where:

m is the **slope** of the line, representing the **rate of change**.

b is the **y -intercept**, the point where the line crosses the **y -axis**.



① Steps to Create Slope-Intercept Form

Calculate the Slope (m):

Use **two points**, (x_1, y_1) and (x_2, y_2) :

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute Values:

Choose **one of the points** and **substitute x , y , and m** into **$y = mx + b$** .

Solve for b .

Combine m and b to write the final function.

② Interpreting Slope and Intercept:

The **slope (m)** often represents a **rate of change** (e.g., speed, cost per unit).

The **y -intercept (b)** represents the **starting value** or **initial condition**.

001.

In the xy -plane, a line has a slope of 4 and passes through the point $(0, -5)$. What is the equation of this line?

- A) $y = 4x + 5$
- B) $y = 4x - 5$
- C) $y = 4x + 9$
- D) $y = 4x - 20$

002.

When line m is graphed in the xy -plane, it has an x -intercept of $(-5, 0)$ and a y -intercept of $(0, \frac{75}{4})$. What is the slope of line m ?

- A) $-\frac{13}{5}$
- B) $\frac{15}{4}$
- C) $-\frac{42}{5}$
- D) $\frac{17}{4}$

003.

A carpenter sells rectangular frames. The selling price P , in dollars, of a frame is a linear function of the perimeter f , in inches, as shown in the table below.

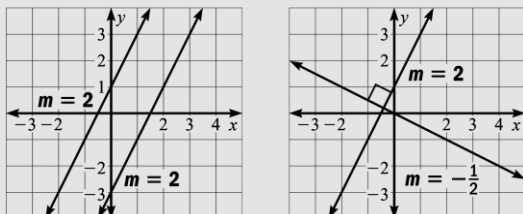
perimeter, f (inches)	Price, P (dollars)
5	7.00
9	14.00
13	21.00

What is the relationship between f and P ?

- A) $y = 5x + 7$
- B) $y = 7x + 7$
- C) $P = \frac{7}{4}f + \frac{7}{4}$
- D) $P = \frac{7}{4}f - \frac{7}{4}$

Key Concepts 2 Slope Relationships

Parallel and perpendicular lines have specific relationships between their slopes, which are fundamental to solving problems involving linear equations.



① Parallel Lines

Lines are **parallel** if and only if **their slopes are equal**: $m_1 = m_2$

If a line is **parallel** to $y = mx + b$ and passes through point (x_1, y_1) :

$$y - y_1 = m(x - x_1)$$

② Perpendicular Lines

Lines are **perpendicular** if the **product of their slopes is -1** :

$$m_1 \cdot m_2 = -1 \text{ or } m_2 = -\frac{1}{m_1}$$

If a line is **perpendicular** to $y = mx + b$ and passes through point (x_1, y_1) :

$$y - y_1 = -\frac{1}{m}(x - x_1)$$

028.

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

For the given function f , the graph of $y = f(x)$ in the xy -plane is parallel to line k . What is the slope of line k ?

029.

Line l is defined by $y = -2x - 8$. Line t is perpendicular to line l in the xy -plane. What is the slope of line t ?

- A) $-\frac{1}{2}$
- B) $\frac{1}{2}$
- C) $-\frac{1}{4}$
- D) $\frac{1}{4}$

030.

What is the equation of the line that passes through the point $(0, 7)$ and is parallel to the graph of $y = 5x - 3$ in the xy -plane?

- A) $y = -\frac{1}{5}x + 4$
- B) $y = -\frac{1}{5}x + 7$
- C) $y = 5x + 4$
- D) $y = 5x + 7$

Key Concepts 5 Solving Word Problems

Linear equations in **word problems** relate real-world scenarios to mathematical representations. These problems typically involve interpreting coefficients, constants, and variables in the context of the situation.

① Standard Form:

$$ax + by = c$$

where:

a, b, c are constants.

x and y represent **variables related to the problem**.

② Slope-Intercept Form:

$$y = mx + b,$$

where:

m is the **rate of change** (slope).

b is the **starting value** or **initial condition**.

③ Interpreting Coefficients and Constants:

Slope (m):

Rate of change or the amount by which y changes for every unit change in x .

y-intercept (b):

Represents the **initial** or base **value of y** when $x = 0$.

057.

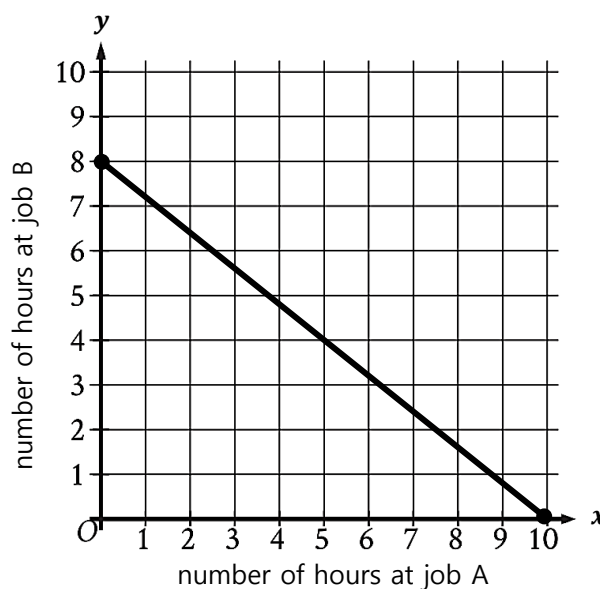
A shipment consists of 3-pound boxes and 7-pound boxes with a total weight of 170 pounds. There are 14, 7-pound boxes in the shipment. How many 3-pound boxes are in the shipment?

- A) 18
- B) 20
- C) 22
- D) 24

058.

On a 295-mile trip, Emily drove at an average speed of 65 miles per hour for the first x hours. She then completed the trip, driving at an average speed of 55 miles per hour for the remaining y hours. If $x = 2$, what is the value of y ?

059.



To save for a vacation, Sam works two part-time jobs: Job A and Job B. He earns \$20 per hour at Job A and \$25 per hour at Job B. In one week, Sam earned a total of t dollars working at both jobs. The graph above shows all possible combinations of hours Sam could have worked at the two jobs to earn t dollars. What is the value of t ?

- A) 160
- B) 180
- C) 200
- D) 220

Key Concepts 6 Distance, Speed and Time

Linear functions can model the relationship between **distance**, **speed**, and **time**.

The general form for these problems is:

$$d = rt, \quad r = \frac{d}{t}, \quad t = \frac{d}{r}$$

where:

d-distance traveled, ***r***-rate or **speed**, and ***t***-time traveled.

① Interpreting Variables:

The **slope (*m*)** represents the **speed**, which is the **rate of change of distance** with respect to time.

The ***y*-intercept (*b*)** may represent an **initial distance**.

② Practical Steps:

Identify given values for speed, time, or distance.

Write a linear functions that connects the variables.

Solve for the unknown quantity, ensuring unit consistency.

067.

$$d = 25t$$

The given equation represents the distance d , in feet, where t represents the number of seconds since a train started moving. Which of the following is the best interpretation of the number 25 in this context?

- A) The train moved a total of 25 feet.
- B) The train moved a total of $25t$ feet.
- C) The train is moving at a rate of $\frac{1}{25}$ feet per second.
- D) The train is moving at a rate of 25 feet per second.

068.

A car is moving at a constant speed on a straight stretch of road. The distance d , in meter from a road marker, that the car will be after t seconds of passing the marker is given by the equation $d = 40t$. Which distance, in feet, will the car be from the marker 4 seconds after passing it?

- A) 80
- B) 100
- C) 120
- D) 160

069.

A car is traveling at a constant speed along a straight road. The equation $d = 40t$ gives the distance d , in meters from a starting point, that the car will be t seconds after passing the point. How many meters from the starting point will the car be 3 seconds after passing the point?

- A) 100
- B) 120
- C) 140
- D) 160

02. System of Linear Equations

Key Concepts 1 Solving Linear Systems

$$\begin{array}{l} \text{Coefficient of } y \\ \left[\begin{array}{l} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{array} \right] \text{ Constant} \\ \text{Coefficient of } x \end{array}$$

① Substitution Method:

Solve one equation for one variable in terms of the other.

Substitute the expression into the other equation to find one variable.

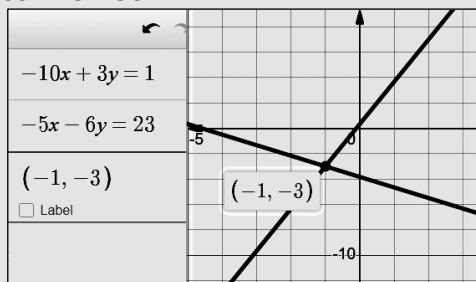
② Elimination Method:

Multiply one or both equations to align coefficients of one variable.

Add or subtract the equations to eliminate one variable.

Solve the resulting single-variable equation and back-substitute.

Or use DESMOS



070.

$$\begin{array}{l} \frac{1}{3}y = 5 \\ x - \frac{2}{3}y = 1 \end{array}$$

The system of equations above has a solution (x, y) . What is the value of x ?

071.

Given the system of equations:

$$\begin{array}{l} y = 2x \\ 4x + y = 16 \end{array}$$

The solution to the system of equations is (x, y) . What is the value of $3x$?

- A) $\frac{8}{3}$
- B) 6
- C) 8
- D) 12

072.

$$\begin{array}{l} 2x + 3y = 7 \\ 10x + 15y = 35 \end{array}$$

Which of the following points lies on the graph of each equation in the xy -plane for every real number r ?

- A) $\left(r, \frac{2}{3}r - \frac{7}{3}\right)$
- B) $\left(r, -\frac{2}{3}r - \frac{7}{3}\right)$
- C) $\left(\frac{3}{2}r - \frac{7}{2}, r\right)$
- D) $\left(-\frac{3}{2}r + \frac{7}{2}, r\right)$

Key Concepts 2 Solving 1-Variable Inequalities

Solving one-variable linear inequalities involves determining a range of values for the variable that satisfies the inequality.

① Rules for Solving Inequalities

Solve inequality **similarly to** linear equations: Use addition, subtraction, multiplication, or division **to isolate the variable**.

Critical Rule:

If you **multiply** or **divide** both sides **by a negative number**, **reverse the inequality symbol**.

$$\begin{array}{ll} \frac{m}{-3} > 3 & -10t \geq 34 \\ -3 \cdot \frac{m}{-3} < -3 \cdot 3 & \frac{-10t}{-10} \leq \frac{34}{-10} \\ m < -9 & t \leq -3.4 \end{array}$$

② Use DESMOS:



101.

A value x is at most 5 less than 4 times the value of y . If the value of y is -3 , what is the greatest possible value of x ?

102.

A wholesale fruit vendor sells crates of apples. Each crate contains at least 70 apples but no more than 80. Which of the following could be the total number of apples in 5 crates?

- A) 318
- B) 348
- C) 378
- D) 408

103.

A construction company is designing a bicycle parking area. The width of each bicycle parking spot must be at least 3.0 feet and no more than 4.5 feet. The total available length of the designated parking area is 675 feet. The company wants to know how many bicycle parking spots, n , can fit perpendicular to the curb in this space. Which of the following describes all the possible values of n ?

- A) $90 \leq n \leq 150$
- B) $150 \leq n \leq 225$
- C) $225 \leq n \leq 318$
- D) $225 \leq n \leq 450$

104.

A delivery truck can tow a trailer if the combined weight of the trailer and the crates it contains is no more than 5,400 pounds. What is the maximum number of crates this truck can tow in a trailer weighing 800 pounds if each crate weighs 140 pounds?

- A) 30
- B) 32
- C) 34
- D) 36

105.

John is planning to rent a car. The car rental costs \$50 per hour, and he also has to pay for an insurance fee of \$15. John wants to spend no more than \$265 in total for the rental and the insurance. If the car rental is available only in whole-hour increments, what is the maximum number of hours John can rent the car?

106.

$$T = 90r + 50$$

The formula above shows the relationship between a person's target body temperature T , in degrees Fahrenheit, and the relative humidity r during a specific activity. When $r = 0$, the person's body temperature is at a baseline. When $r = 1$, the person experiences their peak body temperature. For training purposes, it's recommended that r remain between 0.4 and 0.75. Which of the following inequalities describes the person's target training body temperature range?

- A) $50 \leq T \leq 117.5$
- B) $86 \leq T \leq 117.5$
- C) $86 \leq T \leq 140$
- D) $50 \leq T \leq 140$

107.

A market researcher set up a study to examine a consumer's preference for the last option when shown a series of choices. During the study, 250 individuals were presented with a set of four product samples in random order. Each participant was asked to select the most appealing sample. Of the initial 125 participants, 42 chose the last sample in the set. Among the remaining 125 participants, p individuals selected the last sample. If more than 25% of all participants chose the last sample in the set, which of the following inequalities best describes the possible values of p ?

- A) $p > 0.25(250 + 42)$, where $p \leq 125$
- B) $p > 0.25(250 - 42)$, where $p \leq 125$
- C) $p + 42 > 0.25(250)$, where $p \leq 125$
- D) $p - 42 > 0.25(250)$, where $p \leq 125$

Key Concepts 3 Creating 2-Variable Inequality
① Definition

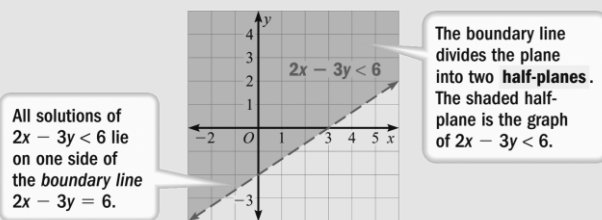
Two-variable linear inequalities express **relationships** involving constraints between two variables. These inequalities often model **real-world scenarios**, such as **budgets**, **production limits**, or **resource allocations**.

② Steps for Creating Two-Variable Inequalities
Identify Variables:

Define each variable based on the problem.

Establish Constraints:

Translate the problem conditions into inequalities.



108.

The lowest value of y is 15 less than 8 times another number m . Which inequality represents the possible values of y ?

- A) $y \leq 15 - 8m$
- B) $y \geq 15 - 8m$
- C) $y \leq 8m - 15$
- D) $y \geq 8m - 15$

109.

A bookstore is holding a sale on novels and notebooks. During the sale, each novel costs \$18, and each notebook costs \$12. Emily can spend at most \$180 at the bookstore. If Emily buys n novels and k notebooks, which of the following must be true?

- A) $12n + 18k \leq 180$
- B) $12n + 18k \geq 180$
- C) $18n + 12k \leq 180$
- D) $18n + 12k \geq 180$

110.

Anna needs to hire at least 12 staff members for a new project. The staff members will be made up of junior managers, who will be paid \$720 per week, and senior managers, who will be paid \$950 per week. Her budget for paying the staff members is no more than \$10,800 per week. She must hire at least 4 junior managers and at least 2 senior managers. Which of the following systems of inequalities represents the conditions described if x is the number of junior managers and y is the number of senior managers?

- A) $x + y \geq 12$
 $720x + 950y \leq 10,800$
 $x \geq 4$
 $y \geq 2$
- B) $x + y \geq 12$
 $720x + 950y \geq 10,800$
 $x \geq 4$
 $y \geq 2$
- C) $x + y \geq 12$
 $720x + 950y \geq 10,800$
 $x \geq 4$
 $y \leq 2$
- D) $x + y \geq 12$
 $720x + 950y \leq 10,800$
 $x \leq 4$
 $y \geq 2$

Key Concepts 4 Solving 2-Variables Inequality
Steps for Graphing 2-Variable Linear Inequalities
① Graph the Boundary Line:

Replace the inequality symbol with "=" to find the equation of the boundary line.

Use a solid line for inequalities $\geq$ or $\leq$.

Use a dashed line for inequalities $>$ or $<$.

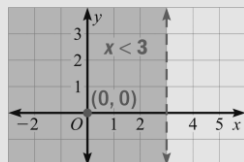
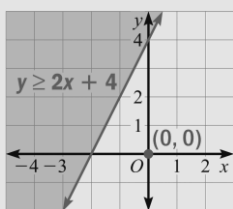
② Test a Point:

Choose a test point **not on the boundary line, often $(0, 0)$** , unless the line passes through it.

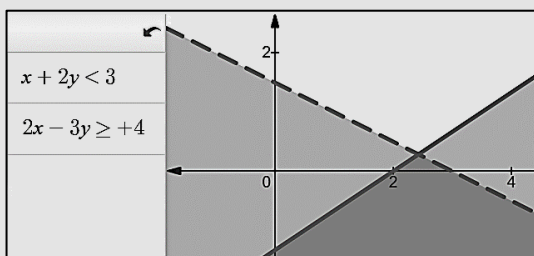
Substitute the test point into the inequality:

If the **test point satisfies the inequality**, **shade the half-plane containing the point**.

If not, shade the other half-plane.



Or use DESMOS:


III.

$$y < 25$$

$$4x + y > 87$$

The point $(x, 23)$ is a solution to the system of inequalities in the xy -plane. Which of the following could be the value of x ?

- A) 8
B) 9
C) 16
D) 18

112.

$$y > 12x - 15$$

For which of the following tables are all values of x and their corresponding values of y solutions to this inequality?

A)

x	y
4	32
7	72
10	105

B)

x	y
4	34
7	79
10	105

C)

x	y
4	34
7	68
10	105

D)

x	y
4	34
7	70
10	110

113.

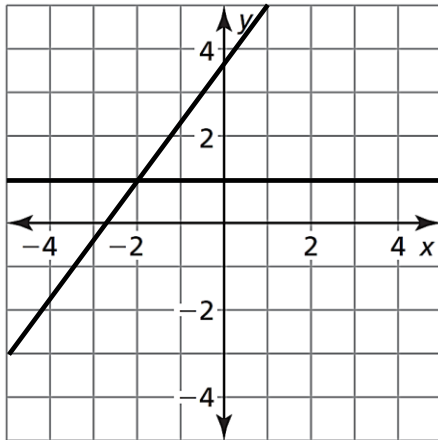
A local baker allocates \$1,800 for purchasing ingredients. The baker needs to buy at least 230 units of ingredients to qualify for a wholesale discount. If the baker pays \$3.80 per unit for flour and \$9.50 per unit for sugar, what is the maximum number of sugar units (in whole number) the baker can purchase while staying within the budget and qualifying for the discount?

CHALLENGE QUESTIONS



CHALLENGE QUESTIONS

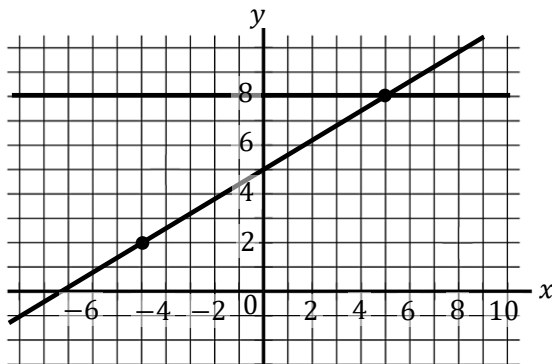
197.



If a new graph of three linear equations is created using the system of equations shown and the equation $2x - 3y = -10$, how many solutions (x, y) will the resulting system of three equations have?

- A) zero
- B) exactly one
- C) exactly two
- D) infinitely many

198.



If a new graph of three linear equations is created using the system of equations shown and the equation $-x + 5y = -20$, how many solutions (x, y) will the resulting system of three equations have?

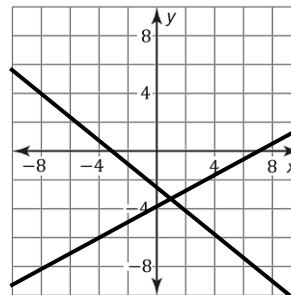
- A) zero
- B) exactly one
- C) exactly three
- D) infinitely many

199.

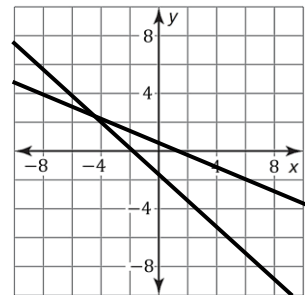
$$\begin{aligned} x - 3y &= 6 \\ 2x + y &= 8 \end{aligned}$$

Which of the following graphs in the xy -plane could represent the solution to the given system of equations?

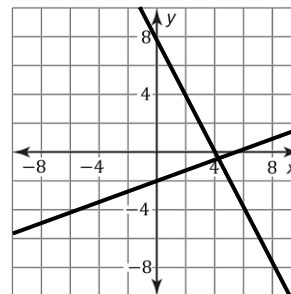
A)



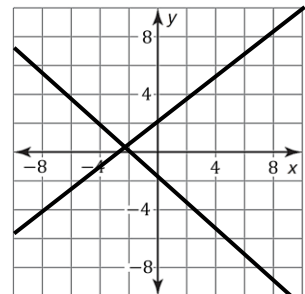
B)



C)



D)



200.

Given the system of equations:

$$\begin{aligned} 3x - 5y &= 8y + 1 \\ ty &= \frac{1}{4} + 3x \end{aligned}$$

In the given system of equations, t is a constant. If the system has no solution, what is the value of t ?

CHALLENGE QUESTIONS

201.

Given the system of equations:

$$\begin{aligned}\frac{2}{3}x - \frac{1}{5}y &= \frac{1}{2} - \frac{3}{5}y \\ \frac{1}{3}x + 4 &= qy + \frac{7}{3}\end{aligned}$$

In the given system of equations, q is a constant. If the system has no solution, what is the value of q ?

202.

In the system of equations below, p and k are constants:

$$\begin{aligned}\frac{2}{5}x + \frac{1}{4}y &= \frac{1}{10} \\ px + 2y &= k\end{aligned}$$

If the system of equations has an infinite number of solutions (x, y) , what is the value of p ?

- A) $-\frac{4}{5}$
- B) 0
- C) $\frac{4}{5}$
- D) $\frac{16}{5}$

203.

The equations are given as follows:

$$\begin{aligned}36x - 54y &= -15y + 18 \\ py &= \frac{1}{4} - 12x\end{aligned}$$

In the given system of equations, p is a constant. If the system has no solution, what is the value of p ?

204.

$$18x - 30y = 72$$

One of the two equations in a system of linear equations is given. The system has infinitely many solutions. Which of the following could be the second equation in the system?

- A) $12x + 20y = 48$
- B) $12x + 20y = -48$
- C) $-12x + 20y = 48$
- D) $-12x + 20y = -48$

CHALLENGE QUESTIONS

230.

A marine tourism company offering dolphin-watching tours takes groups of 24 people at once. The company's revenue is 60 dollars per adult and 40 dollars per child. If the company's revenue for one group consisting of adults and children was 1,320 dollars, how many people in the group were adults?

- A) 6
- B) 10
- C) 14
- D) 18

231.

A company spends an average of \$5,238 annually on electricity. To reduce costs, they plan to invest \$30,000 in solar panels. The estimated annual electricity cost after installation is expected to be \$3,105. Which of the following inequalities represents the minimum number of years, t , needed for the energy savings to surpass the cost of the solar panel installation?

- A) $30,000 > \frac{5,238}{3,105}t$
- B) $30,000 - 5,238 < 3,105t$
- C) $30,000 > (5,238 - 3,105)t$
- D) $30,000 < (5,238 - 3,105)t$

232.

A construction company is designing a bicycle parking area. The width of each bicycle parking spot must be at least 3.0 feet and no more than 4.5 feet. The total available length of the designated parking area is 675 feet. The company wants to know how many bicycle parking spots, n , can fit perpendicular to the curb in this space. Which of the following describes all the possible values of n ?

- A) $90 \leq n \leq 150$
- B) $150 \leq n \leq 225$
- C) $225 \leq n \leq 318$
- D) $225 \leq n \leq 450$

233.

A local swimming facility offers a monthly membership for \$85, which allows unlimited visits. Individual day passes cost \$4.50, \$5.50, or \$6.50, depending on the amenities used. What is the minimum number of visits per month for which the monthly membership would be cheaper than paying for individual day passes?

234.

$$T = 90r + 50$$

The formula above shows the relationship between a person's target body temperature T , in degrees Fahrenheit, and the relative humidity r during a specific activity. When $r = 0$, the person's body temperature is at a baseline. When $r = 1$, the person experiences their peak body temperature. For training purposes, it's recommended that r remain between 0.4 and 0.75. Which of the following inequalities describes the person's target training body temperature range?

- A) $50 \leq T \leq 117.5$
- B) $86 \leq T \leq 117.5$
- C) $86 \leq T \leq 140$
- D) $50 \leq T \leq 140$

235.

A company's total annual revenue consists of a base income of b dollars, plus an additional income of 12% of the total sales generated during the year. This year, the company aims for the total revenue to be at least 4 times and at most 6 times the base income. Which of the following inequalities represents all possible values of total sales s , in dollars, that the company can achieve this year to meet the revenue goal?

- A) $4b \leq s \leq 6b$
- B) $33b \leq s \leq 50b$
- C) $33b \leq s \leq \frac{125b}{3}$
- D) $25b \leq s \leq \frac{125b}{3}$

236.

A market researcher set up a study to examine a consumer's preference for the last option when shown a series of choices. During the study, 250 individuals were presented with a set of four product samples in random order. Each participant was asked to select the most appealing sample. Of the initial 125 participants, 42 chose the last sample in the set. Among the remaining 125 participants, p individuals selected the last sample. If more than 25% of all participants chose the last sample in the set, which of the following inequalities best describes the possible values of p ?

- A) $p > 0.25(250 + 45)$, where $p \leq 125$
- B) $p > 0.25(250 - 45)$, where $p \leq 125$
- C) $p + 45 > 0.25(250)$, where $p \leq 125$
- D) $p - 45 > 0.25(250)$, where $p \leq 125$

237.

According to the triangle inequality theorem, the combined lengths of any two sides of a triangle must exceed the length of the remaining side. Given a triangle with sides measuring 5 and 15, which inequality describes the possible values for the length c of the third side?

- A) $c < 20$
- B) $c > 20$
- C) $10 < c < 20$
- D) $c < 10$ or $c > 20$

SAT Math Question Bank ANSWER EXPLANATIONS

006. Explanation and Answer

Start by plotting the y -intercept $(0, -3)$ on the graph. Then, use the slope $m = 2$, which means rise 2 units up and run 1 unit to the right to find another point on the line.

For example:

Starting from $(0, -3)$, **move up 2 units and right 1 unit** to **arrive at $(1, -1)$** .

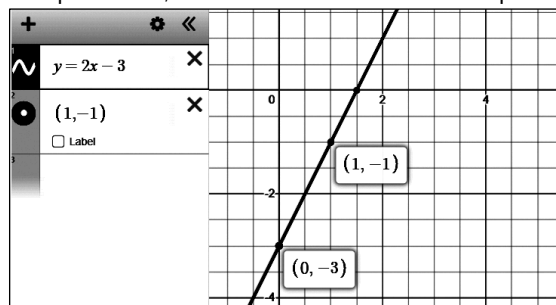
Draw the Line

Once the points are plotted, draw a straight line through them.

This line will represent the graph of $y = 2x - 3$.

Or use a GDC:

Therefore, the correct answer is **C**.



007. Explanation and Answer

The slope m of a line passing through two points (x_1, y_1) and (x_2, y_2) is given by the formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute the coordinates into the slope formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{20 - 5}{10 - 3} = \frac{15}{7}$$

Therefore, the **slope of the line** is $\frac{15}{7}$ and the correct answer is $\frac{15}{7}$.

008. Explanation and Answer

The line passes through **two points: $(0, -4)$ and $(-8, 0)$** .

And a linear equation can be written in the form $y = mx + b$, where **m is the slope** and **b is the y -intercept**.

Since the line passes through the point $(0, -4)$, the **y -intercept b is -4** .

Calculate the slope m using the slope formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - (-4)}{-8 - 0} = -\frac{1}{2} = -0.5$$

Substitute the slope **$m = -0.5$** and the y -intercept **$b = -4$** into the slope-intercept form:

$$y = mx + b \rightarrow y = (-0.5)x + (-4) \rightarrow y = -0.5x - 4$$

The equation that correctly represents the line shown on the graph is **$y = -0.5x - 4$** .

Therefore, the correct answer is **B**.

009. Explanation and Answer

This problem involves writing the equation of a line using the slope-intercept form $y = mx + b$, where **m is the slope** and **b is the y -intercept**.

The function $f(x)$ contains the points **$(0, 9)$ and $(8, 57)$** . The point **$(0, 9)$ tells us** that the **y -intercept $b = 9$** . We need to determine the slope m of the line that passes through these two points.

The slope m is calculated using the formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{57 - 9}{8 - 0} = \frac{48}{8} = 6$$

We know the **slope $m = 6$** and the **y -intercept $b = 9$** , so the equation of the line is:

$$\begin{aligned} y = mx + b &\rightarrow y = (6)x + (9) &\rightarrow y = 6x + 9 \\ &&\rightarrow f(x) = 6x + 9 \end{aligned}$$

Therefore, the **equation would be $f(x) = 6x + 9$** and the correct answer is **B**.

SAT Math Question Bank ANSWER EXPLANATIONS

076. Explanation and Answer

To solve this system, the elimination method is used. This involves aligning and manipulating the two equations to **eliminate one variable**, simplifying the system into a single-variable equation.

We are given the system of equations: $5x + 9y = 36$ (1) and $3x + 3y = 20$ (2)

Eliminate y :

Multiply the (2) by 3 so the coefficients of y match in both equations:

$$3 \times 3x + 3 \times 3y = 3 \times 20 \rightarrow 9x + 9y = 60 \quad (3)$$

Subtract (3) from (1):

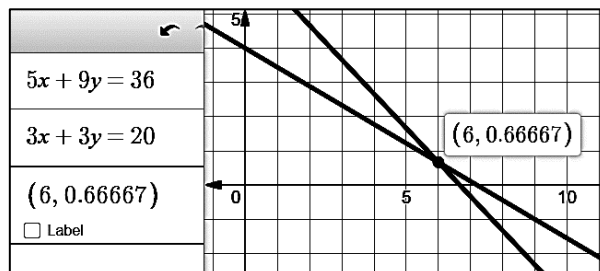
$$\begin{aligned} (3) - (1): \quad 9x + 9y - (5x + 9y) &= 60 - 36 &\rightarrow 4x &= 24 \\ & &\rightarrow x &= 6 \end{aligned}$$

Substitute $x = 6$ into (2):

$$\begin{aligned} 3x + 3y &= 20 &\rightarrow 3(6) + 3y &= 20 &\rightarrow 3y &= 2 \\ & & & &\rightarrow y &= \frac{2}{3} \end{aligned}$$

Or use DESMOS:

Therefore, **the value of y is $\frac{2}{3}$** , and the correct answer is **B**.



077. Explanation and Answer

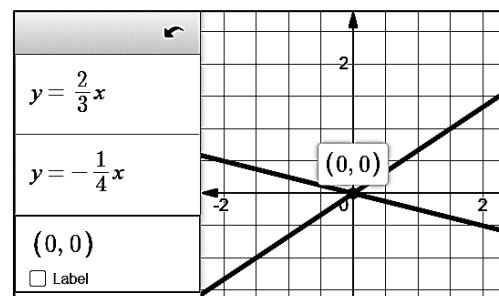
This problem requires solving a system of two linear equations by substitution. We are tasked with finding the x -coordinate where the two lines intersect.

Since both equations represent y , equate the two expressions for y :

$$\begin{aligned} \frac{2}{3}x &= -\frac{1}{4}x &\rightarrow \frac{2}{3}x + \frac{1}{4}x &= 0 \\ & &\rightarrow \frac{8}{12}x + \frac{3}{12}x &= 0 \\ & &\rightarrow \frac{11}{12}x &= 0 \\ & &\rightarrow x &= 0 \end{aligned}$$

Or use DESMOS:

Therefore, **the value of x is 0** and the correct answer is **C**.



078. Explanation and Answer

The graphs of $y = x + 5$ and $y = 3x - 11$ **intersect at the point (a, b)** . We need to find the value of a , which corresponds to the **x -coordinate of the intersection point**.

Set the equations equal:

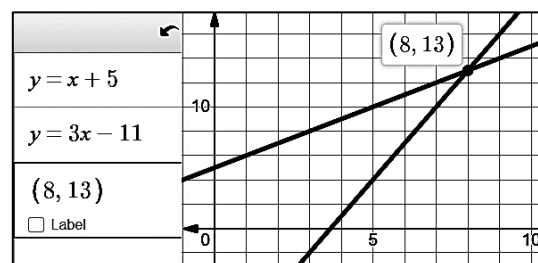
Since y is equal for both equations at the intersection, set:

$$\begin{aligned} x + 5 &= 3x - 11 &\rightarrow x - 3x &= -11 - 5 \\ & &\rightarrow -2x &= -16 \\ & &\rightarrow x &= 8 \end{aligned}$$

The **x -coordinate** of the intersection point is **$a = 8$** .

Or use DESMOS:

Therefore, **the value of a is 8** and the correct answer is **C**.



SAT Math Question Bank ANSWER EXPLANATIONS

090. Explanation and Answer

From the given equations: $4x - 6y = 15$ and $-16x + 24y = -60$

Divide the second equation by -4 :

$$-16x + 24y = -60 \rightarrow \frac{-16x}{-4} + \frac{24y}{-4} = \frac{-60}{-4} \rightarrow 4x - 6y = 15$$

The **second** equation **simplifies to the first** equation. So, **both** equations represent the **same line** in the xy -plane.

Rewrite the equation: We start with the given equation: $4x - 6y = 15$.

Solve for x in terms of y :

$$4x - 6y = 15 \rightarrow 4x = 6y + 15 \rightarrow x = \frac{6}{4}y + \frac{15}{4} \rightarrow x = \frac{3}{2}y + \frac{15}{4}$$

Any point (x, y) on this line must satisfy the relationship $x = \frac{3}{2}y + \frac{15}{4}$.

Substitute $y = t$ into the relationship:

$$y = t \rightarrow x = \frac{3}{2}t + \frac{15}{4}$$

So, the point is $(\frac{3}{2}t + \frac{15}{4}, t)$.

Solve for y in terms of x :

$$4x - 6y = 15 \rightarrow -6y = -4x + 15 \rightarrow y = \frac{-4}{-6}x + \frac{15}{-6} \rightarrow y = \frac{2}{3}x - \frac{5}{2}$$

Any point (x, y) on this line must satisfy the relationship $y = -\frac{5}{4}x + \frac{5}{2}$.

Substitute $x = t$ into the relationship:

$$x = t \rightarrow y = -\frac{5}{4}t + \frac{5}{2}$$

So, the point is $(t, -\frac{5}{4}t + \frac{5}{2})$.

Clearly, this satisfies the equation, so **option C**, point lies on the graph.

Therefore, the correct answer is **C**.

091. Explanation and Answer

This problem involves creating a system of linear equations to model the given scenario and solving it.

define variables to represent the number of items purchased

create two equations: one based on the **total number of items**, and the other based on the **total cost**

Let c represent the **number of candles** Noah purchased, and **g** represent the **number of greeting cards** he purchased.

Write the system of equations

Noah purchased a **total of 12 candles and greeting cards**: $c + g = 12$ (1)

The **combined cost** of the items was \$36.

Each **candle costs** \$5, and each **greeting card costs** \$2: $5c + 2g = 36$ (2)

Solve the system of equations

Solve the first equation for g :

$$c + g = 12 \rightarrow g = 12 - c$$

Substitute $g = 12 - c$ into the (2) and solve for c :

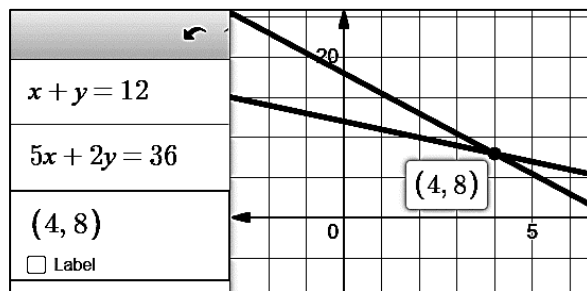
$$5c + 2g = 36 \rightarrow 5c + 2(12 - c) = 36 \rightarrow 3c = 12 \rightarrow c = 4$$

Substitute $c = 4$ into $g = 12 - c$ to find g :

$$g = 12 - c \rightarrow g = 12 - 4 = 8$$

Or use DESMOS

Therefore, **Noah purchased 4 candles** and the correct answer is **B**.



SAT Math Question Bank ANSWER EXPLANATIONS

Solve for the **maximum s value**.

Rearrange $f + s \geq 230$ to $f \geq 230 - s$.

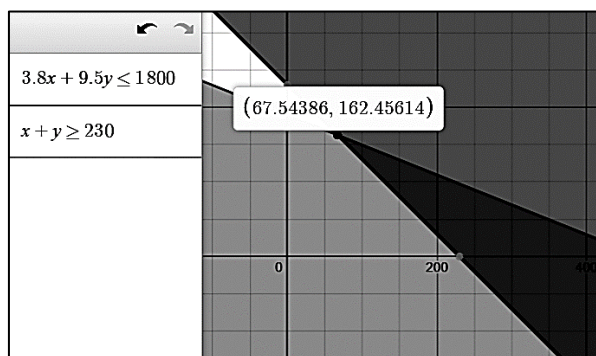
Substitute $f = 230 - s$ into the cost inequality:

$$\begin{aligned} 3.8f + 9.5s &\leq 1800 &\rightarrow& 3.8(230 - s) + 9.5s \leq 1800 \\ &&\rightarrow& 874 - 3.8s + 9.5s \leq 1800 \\ &&\rightarrow& 5.7s \leq 926 \\ &&\rightarrow& s \leq 162.456 \dots \end{aligned}$$

Or use DESMOS:

Thus, the **largest whole number for s is 162**.

Therefore, the correct answer is **162**.



114. Explanation and Answer

The inequality given is $y < 3x - 6$.

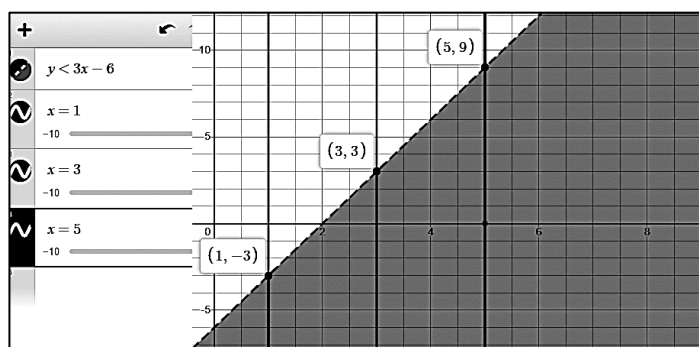
For **any value of x , y must be less than** the value calculated by **substituting x into $3x - 6$** .

Substituting values:

$$\begin{aligned} \text{for } x = 1, \quad y &< 3(1) - 6 &\rightarrow& y < -3 \\ \text{for } x = 3, \quad y &< 3(3) - 6 &\rightarrow& y < 3 \\ \text{for } x = 5, \quad y &< 3(5) - 6 &\rightarrow& y < 9 \end{aligned}$$

Or use DESMOS

Therefore, the correct answer is **D**.



115. Explanation and Answer

We have two inequalities: $y \geq x - 6$ and $y \leq -3x + 4$.

So, we need to find a point (x, y) that satisfies both inequalities.

The first inequality $y \geq x - 6$ represents

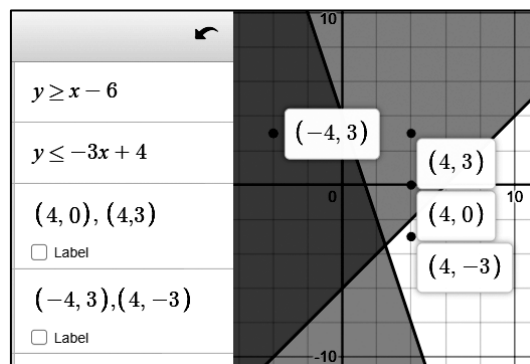
all points on or above the line $y = x - 6$.

The second inequality $y \leq -3x + 4$ represents

all points on or below the line $y = -3x + 4$.

Or using a DESMOS:

Therefore, the correct answer is **C**.



116. Explanation and Answer

To find the answer, **substitute each ordered pair** into both inequalities and check if both conditions are satisfied.

Option **A**: $(0, 5)$

$$\text{For } y \geq 2x - 3: \quad 5 \geq 2(0) - 3 \quad \rightarrow \quad 5 \geq -3 \quad (\text{true})$$

$$\text{For } x + y < 4: \quad 0 + 5 < 4 \quad \rightarrow \quad 5 < 4 \quad (\text{false})$$

This point **does not satisfy** both inequalities.

Option **B**: $(1, -1)$

$$\text{For } y \geq 2x - 3: \quad -1 \geq 2(1) - 3 \quad \rightarrow \quad -1 \geq -1 \quad (\text{true})$$

$$\text{For } x + y < 4: \quad 1 + (-1) < 4 \quad \rightarrow \quad 0 < 4 \quad (\text{true})$$

Both inequalities are satisfied.

Or use DESMOS:

Therefore, the correct answer is **B**.

