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VOLUME 1

ALGEBRA FOUNDATIONS

This volume builds a strong foundation in core algebraic concepts essential for SAT Math success.

- Linear Equations
- Ratios
- Rates
- Proportions

KEY CONCEPTS

1

Key Concepts 2 Identity and Infinite Solutions

An **identity** equation holds **true for all values of the variable**. These equations result in **infinitely many solutions** because **both sides** of the equation simplify to the **same expression**.

① Characteristics of Identity

Infinite Solutions:

Occurs when **both sides** of the equation are **identical after simplification**.

② Compare Both Sides:

If the **resulting expressions are identical**, the equation has infinitely many solutions.

$$ax + b = ax + b$$

016.

$$4x - 36 = b(x - 9)$$

In the given equation, b is a constant. If the equation has infinitely many solutions, what is the value of b ?

017.

$$77x = 77x$$

How many solutions does the given equation have?

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

018.

In the equation $a(4 + x) - b = -2 - 3x$, a and b are constants. If the equation has infinitely many solutions, what are the values of a and b ?

- A) $c = 3$ and $c = 10$
- B) $c = -3$ and $c = 10$
- C) $c = 3$ and $c = -10$
- D) $c = -3$ and $c = -10$

Key Concepts 3 No-Solution Equations

An **equation has no solution** when the **variable terms cancel out**, leaving a statement that is **always false (e.g., $a \neq b$)**. This occurs when the coefficients of the **variable terms are identical**, but **the constant terms differ**.

- ① **Conditions** for No Solution:
The coefficients of the **variable terms** are **equal**, but the **constant terms** are **not**.
- ② General Form:
 $ax + b = ax + c$ (where $b \neq c$)

019.

$$7x - 42kx = -45$$

In the provided equation, k is a constant. The equation has no solution. What is the value of k ?

- A) 0
- B) 6
- C) $-\frac{1}{6}$
- D) $\frac{1}{6}$

020.

$$3(kx - 15) = \frac{45}{17}x - 32$$

In the given equation, k is a constant, and there is no solution that satisfies the equation. What is the value of k ?

021.

The equation $7x + 4 = a(x + b)$, where a and b are constants, has no solutions. Which of the following must be true?

- I. $a = 7$
 II. $b = 4$
 III. $b \neq \frac{4}{7}$
- A) none
- B) I only
- C) I and II only
- D) I and III only

Key Concepts 2 Proportion

① Proportion:

A statement that **two ratios are equal**, expressed as: $\frac{a}{b} = \frac{c}{d}$.

Cross-multiply to solve:

$$\frac{a}{b} = \frac{c}{d} \rightarrow a \cdot d = b \cdot c$$

② Direct Proportion:

When **one quantity increases or decreases directly with another**.

Equation form:

$$y = kx,$$

where k is the constant of proportionality.

③ Area Ratio of Polygons and Circles:

The **ratio of areas** of two polygons or circles is equal to the **square of the ratio of their side lengths or radii**.

$$\frac{\text{area}_1}{\text{area}_2} = \left(\frac{\text{side length}_1}{\text{side length}_2} \right)^2 = \left(\frac{\text{radius}_1}{\text{radius}_2} \right)^2$$

049.

Tiana owns 12 green notebooks and 36 yellow notebooks. What is the ratio of green notebooks to yellow notebooks that Tiana owns?

- A) 1 to 3
- B) 3 to 1
- C) 1 to 4
- D) 4 to 1

050.

For a swimmer x meters from a starting buoy, the time it takes to reach a marker buoy is y seconds. The ratio of x to y is known to be 2 to 7. Based on this ratio, how far is the swimmer from the marker buoy if the time is 35 seconds?

- A) 7 meters
- B) 10 meters
- C) 12 meters
- D) 15 meters

051.

substance	energy in kcal	energy in kJ
substance A	6.0	25.2
substance B	12.0	50.4
substance C	25.0	105.0

The table above shows the typical energy content, per gram, of three substances expressed in both calories and joules. If p calories is equivalent to q joules, which of the following best represents the relationship between p and q ?

- A) $q = 4.2p$
- B) $pq = 4.2$
- C) $p = 4.2q$
- D) $\frac{p}{q} = 4.2$

052.

A marine biologist is studying the growth of a coral reef. She recorded the size of a coral at the beginning of a study and the size of the coral each day for the next 10 days. The biologist observed that the coral increased in size by an average of 0.75 square centimeters per day for the 10 days. If the size of the coral on the last day of the study was 25.5 square centimeters, what was the size, in square centimeters, of the coral at the beginning of the study?

053.

Brian is preparing a sports drink by mixing 4 ounces of syrup with 9 ounces of water. He needs to make a second batch using the same ratio of syrup to water as the first batch. If he uses 10 ounces of syrup for the second batch, how much water should he use?

- A) Exactly 20 ounces.
- B) 2.5 times the amount of water used in the first batch.
- C) 2.5 times the amount of syrup used in the second batch.
- D) 6 ounces more than the amount of water used in the first batch.

054.

Julia used a pump to drain water from a swimming pool at a constant rate. The pool contained 18,000 gallons of water when Julia began using the pump. After 4 hours of using the pump, 14,800 gallons of water remained in the pool. If the pump continues to drain water at this rate, what is the total number of hours Julia will have been using the pump when 9,600 gallons of water remain in the pool?

- A) 8.5
- B) 9.5
- C) 10.5
- D) 11.5

055.

The weight of an object on Mars is approximately $\frac{7}{10}$ of its weight on Earth. The weight of an object on Saturn is approximately $\frac{19}{10}$ of its weight on Earth. If an object weighs 120 pounds on Earth, approximately how many more pounds does it weigh on Saturn than it weighs on Mars?

- A) 104
- B) 124
- C) 144
- D) 164

Key Concepts 5 Percent in Real-World

① Key Concepts

Sequential Percentage Changes:
final value

$$= \text{original value} \times \left(1 + \frac{\text{1st change}}{100}\right) \times \dots$$

Net Percentage Change:

$$\text{net change (\%)} = (\text{cumulative factor} - 1) \times 100$$

② Tips for Problem Solving

Carefully **identify** whether the question involves **one-time changes** or **compounded changes**.

Use fractional representations for intermediate calculations to avoid rounding errors in cumulative percentage problems.

In real-life scenarios, validate the logical consistency of the calculated results.

074.

A tour guide charges a commission from each group. On average, the commission is 18% of the group's total fee. At this rate, which of the following is closest to the commission the tour guide can expect when the total fee is \$145.50?

- A) \$20.8
- B) \$22.4
- C) \$24.6
- D) \$26.2

075.

The number p is 60% less than the positive number q . The number r is 50% greater than p . The number r is how many times q ?

076.

For a local election, voters could cast their votes either via an online platform or by mail to choose between two candidates. A candidate would win by receiving more than 50% of the total votes. Of the total voters, approximately 15% participated, and 40% of the votes were cast online. Candidate B secured 80% of the online votes and 30% of the votes submitted by mail. Based on this information, which of the following is a valid conclusion?

- A) If all eligible voters had participated, candidate B would have won.
- B) Voters using the online platform were likely younger than those voting by mail.
- C) If all participants had used the online platform instead of voting by mail, candidate B would have won.
- D) Voters using the online platform were more likely to prefer candidate B compared to those voting by mail.

077.

The number x is 125% greater than the number y . The number y is 85% less than 60. What is the value of x ?

079.

A bookstore purchases books at a wholesale price of \$5.00 each and sets the retail price at 250% of the wholesale price. At the end of the month, unsold books are offered at a 70% discount off the retail price. What is the discounted price of each unsold book, in dollars?

078.

Maria bought a new tablet for her office. At the time of purchase, the tablet was valued at \$1,000. Maria estimates that the tablet's value will decrease by 25% of the previous year's estimated value each year. What is the estimated value of the tablet exactly 2 years after purchase?

- A) \$528.75
- B) \$546.25
- C) \$562.50
- D) \$584.75

080.

The value of a rare trading card increased by 125% from the start of 2023 to the start of 2024 and then decreased by 15% from the start of 2024 to the start of 2025. What was the net percentage increase in the value of the trading card from the start of 2023 to the start of 2025?

- A) 91.25%
- B) 115.00%
- C) 191.25%
- D) 215.00%

CHALLENGE QUESTIONS



CHALLENGE QUESTIONS

090.

In the equation

$$4(kx + n) = -\frac{24}{15}x - \frac{40}{17},$$

k and n are constants, and $n > 1$. The equation has no solution. What is the value of k ?

091.

Given the equation $-5x + 12px = 60$, where p is a constant. The equation has no solution. What is the value of p ?

- A) 0
- B) 5
- C) -12
- D) $\frac{5}{12}$

092.

The equation $7x + 4 = a(x + b)$, where a and b are constants, has no solutions. Which of the following must be true?

- I. $a = 7$
- II. $b = 4$
- III. $b \neq \frac{4}{7}$

- A) none
- B) I only
- C) I and II only
- D) I and III only

093.

A company produces a certain gadget that costs them \$80 to manufacture. The gadget is sold by an agent who earns a commission of 15% of the sales price. The company's profit per unit is the sales price minus the sum of the manufacturing cost and the commission. If the sales price of the gadget is \$150, which of the following equations gives the number of units, u , the company must sell to achieve a total profit of \$10,500?

- A) $0.85(100) - 80u = 10,500$
- B) $(0.15(100) + 80)u = 10,500$
- C) $(150(1 - 0.15) - 80)u = 10,500$
- D) $(150 - 80)(1 - 0.15)u = 10,500$

094.

A bakery sells a certain type of bread that costs them \$10 to make. The bread is sold by a delivery agent who earns a commission that is 10% of the sales price. The bakery's profit per unit is the sales price minus both the production cost and the agent's commission. If the sales price of each loaf of bread is \$20, which of the following equations represents how many loaves x the bakery must sell to make a total profit of \$1,000?

- A) $(0.1(20) + 10)x = 1,000$
- B) $0.9(20) - 10x = 1,000$
- C) $(20 - 10)(1 - 0.1)x = 1,000$
- D) $(20(1 - 0.1) - 10)x = 1,000$

CHALLENGE QUESTIONS

095.

A chef is preparing 6 cooking stations in a kitchen. Each station will either require ingredients *A* or ingredients *B*, but not both. Ingredients *A* requires 8 ounces of sugar, and ingredients *B* requires 5 ounces of sugar. If x is the number of stations that will be set up for ingredients *A*, and the remaining stations will be set up for ingredients *B*, which of the following expressions represents the total number of ounces of sugar required?

- A) $8x$
- B) $13x$
- C) $13x - 30$
- D) $3x + 30$

096.

$$3n + 5 = 20$$

A plant had a height of 5 inches when it was planted. The equation above can be used to determine how many years, n , it took the plant to grow to a height of 20 inches. Which of the following is the best interpretation of the number 3 in this context?

- A) The average number of feet that the tree grew per year.
- B) The number of years it took the tree to triple its height.
- C) The height, in feet, of the tree when the tree was 1 year old.
- D) The average number of years it takes similar trees to grow 20 feet.

097.

During a 6-second time interval, the average acceleration a , in meters per second squared, of a car with an initial speed of 10 meters per second, is given by the equation:

$$a = \frac{v_f - 10}{6}$$

where v_f is the car's final speed in meters per second. If the equation is rewritten in the form $v_f = xa + y$, where x and y are constants, what is the value of x ?

098.

A fruit store offers two different-sized containers of strawberries. The store's sales of these strawberries totaled 1,032.45 dollars last month. This situation is represented by the equation $3.75S + 7.15L = 1,032.45$, where S is the number of smaller containers sold, and L is the number of larger containers sold. Based on the equation, what is the dollar price of each larger container?

099.

How many liters of a 30% saline solution must be added to 5 liters of a 12% saline solution to obtain a 20% saline solution?

CHALLENGE QUESTIONS

137.

The following data shows the number of tickets sold by a movie theater over two consecutive years:

year	ticket sold
2024	7,200
2025	7,560

The theater manager observed the data above and predicted that the percent increase from 2024 to 2025 would be twice the percent increase from 2025 to 2026. How many tickets did the manager expect would be sold in 2026?

- A) 7,658
- B) 7,749
- C) 7,983
- D) 8,316

138.

The revenue of Store B increased by 12% from 2024 to 2025. If the 2025 revenue is k times the 2024 revenue, what is the value of k ?

- A) 0.12
- B) 0.88
- C) 1.02
- D) 1.12

139.

A customer's monthly electricity bill was \$120.50. Due to a rate increase, their monthly bill is now \$132.55. To the nearest tenth of a percent, by what percent did the amount of the customer's electricity bill increase?

- A) 6.6%
- B) 8.8%
- C) 10%
- D) 12%

140.

class	attended	absent	total days
class A	16	2	18
class B	22	1	23
class C	15	5	20
class D	17	4	21
total	70	12	82

A teacher analyzed attendance records for four classes. According to the table, to the nearest whole percent, what percentage of class A's total days were marked as "absent"?

CHALLENGE QUESTIONS

141.

According to safety regulations, a certain chemical mixture can contain a maximum of 0.002% lead by mass. If a sample of this mixture has a mass of 250 grams, what is the maximum mass, in grams, of lead the sample can contain to comply with these regulations?

142.

The Math club has a total of 65 students. A sample of the Math club students was selected at random and asked whether they intend to enroll in a new study program. Of those surveyed, 40% responded that they intend to enroll in the study program. Based on this survey, which of the following is the best estimate of the total number of Math club students who intend to enroll in the study program?

- A) 24
- B) 26
- C) 28
- D) 30

143.

In 2021, Edward earned 15% more than in 2020, and in 2022 Edward earned 5% more than in 2021. If Edward earned n times as much in 2022 as in 2020, what is the value of n ?

- A) 1.2075
- B) 1.3125
- C) 1.7025
- D) 2.0000

144.

The population of Bonsu City increased by 25% from 2020 to 2030. If the 2020 population is p times the 2030 population, what is the value of p ?

- A) 0.25
- B) 25
- C) 1.25
- D) 12.5

145.

The number p is 60% less than the positive number q . The number r is 50% greater than p . The number r is how many times q ?

CHALLENGE QUESTIONS

152.

The regular price of a backpack at a store is \$15.00. The sale price of the backpack is 70% less than the regular price, and the sale price is 25% greater than the store's cost for the backpack. What was the store's cost, in dollars, for the backpack? (Disregard the \$ sign when entering your answer. For example, if your answer is \$3.75, enter 3.75.)

153.

45% of the employees in a company are managers. Of those, 30% are in the sales department. Of the managers in the sales department, 40% are also team leaders. Which of the following is closest to the percentage of employees in the company who are not team leader sales managers?

- A) 83.2%
- B) 87.4%
- C) 92.8%
- D) 94.6%

154.

The number x is 50% greater than the positive number y . The number z is 30% less than x . The number z is how many times y ?

155.

The value of a rare trading card increased by 125% from the start of 2023 to the start of 2024 and then decreased by 15% from the start of 2024 to the start of 2025. What was the net percentage increase in the value of the trading card from the start of 2023 to the start of 2025?

- A) 91.25%
- B) 115.00%
- C) 191.25%
- D) 215.00%

156.

240 is $x\%$ greater than 40. What is the value of x ?

CHALLENGE QUESTIONS

157.

Which expression represents the result of decreasing a positive quantity z by 28%?

- A) $0.28z$
- B) $0.72z$
- C) $1.28z$
- D) $1.72z$

158.

Which of the following represents the result of decreasing the quantity x by 18%, where $x > 0$?

- A) $0.18x$
- B) $0.82x$
- C) $1.18x$
- D) $1.82x$

159.

The number m is 25% greater than 80. If m is the product of 80 and t , what is the value of t ?

- A) 0.25
- B) 0.75
- C) 1.25
- D) 20.0

160.

According to a 2025 Census, the total population of citizens in Bonsu City is 600,000. In the same year, a survey was conducted among a randomly chosen sample of citizens regarding their preference for either public transport or personal vehicles. The table below summarizes the survey results:

source	public transport	personal vehicles	no preference	total
18-30 years old	225	190	35	450
31-45 years old	180	175	45	400
46-60 years old	190	165	45	400
greater than 60 years	130	80	40	250
total	725	610	165	1,500

Which of the following is closest to the difference between the percentage of citizens aged 18–45 who preferred public transport and the percentage of citizens aged 46 or older who preferred public transport?

- A) 0.8%
- B) 1.6%
- C) 2.4%
- D) 3.2%

CHALLENGE QUESTIONS

161.

David drinks an energy drink called PowerMax. The label states that one serving of the drink is $\frac{2}{3}$ cup and contains 180 calories, 40 of which are from sugar. Each serving also provides 250 milligrams of sodium, which is 10% of the recommended daily limit for adults. If p percent of an adult's daily sodium limit is provided by x servings of PowerMax per day, which of the following expresses p in terms of x ?

- A) $p = 0.1x$
- B) $p = 10x$
- C) $p = (0.1)^x$
- D) $p = (1.1)^x$

162.

For a local election, voters could cast their votes either via an online platform or by mail to choose between two candidates. A candidate would win by receiving more than 50% of the total votes. Of the total voters, approximately 15% participated, and 40% of the votes were cast online. Candidate B secured 80% of the online votes and 30% of the votes submitted by mail. Based on this information, which of the following is a valid conclusion?

- A) If all eligible voters had participated, candidate B would have won.
- B) Voters using the online platform were likely younger than those voting by mail.
- C) If all participants had used the online platform instead of voting by mail, candidate B would have won.
- D) Voters using the online platform were more likely to prefer candidate B compared to those voting by mail.

163.

$$d = 60t$$

The equation above can be used to calculate the distance d , in kilometers, traveled by a cyclist moving at a speed of 60 km/h over a period of t hours. For any positive constant m , the distance the cyclist would have traveled after $12m$ hours is how many times the distance the cyclist would have traveled after $4m$ hours?

- A) 2
- B) 3
- C) $2m$
- D) $3m$

164.

Minjee's walking speed is 2 miles per hour, and her running speed is 5 miles per hour. She walks for w hours and runs for r hours, covering a total distance of 12 miles. Which of the following equations best describes this situation?

- A) $\frac{w}{2} + \frac{r}{5} = 1$
- B) $\frac{w}{2} + \frac{r}{5} = 12$
- C) $2w + 5r = 12$
- D) $7(w + r) = 12$

SAT Math Question Bank ANSWER EXPLANATIONS

084. Explanation and Answer

We **treat** $x + 7$ as a **single variable** (z), which simplifies the process of solving this equation.

Let's define a new variable, say z , where: $x + 7 = z$.

$$\frac{x+7}{4} = \frac{x+7}{15} \rightarrow \frac{z}{4} = \frac{z}{15}$$

To eliminate the fractions, multiply both sides of the equation by the least common denominator (LCD), which is **60**:

$$\frac{z}{4} = \frac{z}{15} \rightarrow 60 \times \frac{z}{4} = \frac{z}{15} \times 60 \rightarrow 15z = 4z$$

Now subtract $4z$ from both sides to bring all the terms involving z to one side and solving for z :

$$15z = 4z \rightarrow 15z - 4z = 0 \rightarrow 11z = 0 \rightarrow z = 0$$

Since we **defined** $z = x + 7$, substitute back into the equation: $z = 0 \rightarrow x + 7 = 0$

Since $x + 7 = 0$, we can state that the value of $x + 7$ **lies exactly at 0**, and hence it is **between the values -4 and 7** .

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

085. Explanation and Answer

First, distribute c to both terms inside the parentheses:

$$\begin{aligned} c(4 - y) - d &= -3 - 3y &\rightarrow 4c - cy - d &= -3 - 3y \\ & &\rightarrow -cy + 4c - d &= -3y - 3 \end{aligned}$$

Now, compare both sides of the equation. For the equation to **have infinitely many solutions**, both sides must be **identical**, meaning the **coefficients of y** and the **constant terms** must be equal.

The coefficient of y on the left-hand side is $-c$, and on the right-hand side, it is -3 . So we equate these coefficients and solving this, we get:

$$-c = -3 \rightarrow c = 3$$

The constant term on the left-hand side is $4c - d$, and on the right-hand side, it is -3 . **Substitute $c = 3$ into the equation** and **solving for d** :

$$\begin{aligned} 4c - d &= -3 &\rightarrow 4(3) - d &= -3 &\rightarrow 12 - d &= -3 &\rightarrow -d &= -15 \\ & & & & & &\rightarrow d &= 15 \end{aligned}$$

Therefore, the **values of c and d** that satisfy the condition for the equation to have **infinitely many solutions** are $c = 3$ and $d = 15$ and the correct answer is **A**.

086. Explanation and Answer

First, distribute a to both terms inside the parentheses:

$$\begin{aligned} a(4 + x) - b &= -2 - 3x &\rightarrow 4a + ax - b &= -2 - 3x \\ & &\rightarrow ax + 4a - b &= -3x - 2 \end{aligned}$$

Now, compare both sides of the equation. For the equation to **have infinitely many solutions**, both sides must be **identical**, meaning the **coefficients of x** and the **constant terms** must be equal.

The coefficient of x on the left-hand side is a , and on the right-hand side, it is -3 . So we equate these coefficients and solving this, we get: $a = -3$

The constant term on the left-hand side is $4a - b$, and on the right-hand side, it is -2 . **Substitute $a = -3$ into the equation** and **solving for b** :

$$\begin{aligned} 4a - b &= -2 &\rightarrow 4(-3) - b &= -2 &\rightarrow -12 - b &= -2 &\rightarrow -b &= 10 \\ & & & & & &\rightarrow b &= -10 \end{aligned}$$

Therefore, the **values of a and b** that satisfy the condition for the equation to have **infinitely many solutions** are $a = -3$ and $b = -10$ and the correct answer is **D**.

087. Explanation and Answer

Distribute the constants on both sides and solve for x :

$$\begin{aligned} 4(2x - 3) &= 4(2x + 7) &\rightarrow 8x - 12 &= 8x + 28 \\ & &\rightarrow 8x - 8x - 12 &= 8x - 8x + 28 \\ & &\rightarrow -12 &= 28 (?) \end{aligned}$$

SAT Math Question Bank ANSWER EXPLANATIONS

This is a **contradiction** because -12 does not equal 28 ($-12 \neq 28$), which means the equation **has no solution**. Since the equation **results in a false statement** (a contradiction), **there is no value of x** that will satisfy the equation.

Therefore, the **equation has zero solutions** and the correct answer is **A**.

088. Explanation and Answer

First, apply the **distributive property** on the left-hand side:

$$3(kx - 15) = \frac{45}{17}x - 32 \rightarrow 3kx - 45 = \frac{45}{17}x - 32$$

To understand when the **equation has no solution**, we need to **focus on the coefficients of x** . Subtract $3kx$ and $\frac{45}{17}x$ from both sides to get:

$$\begin{aligned} 3kx - 45 = \frac{45}{17}x - 32 &\rightarrow 3kx - \frac{45}{17}x = -32 + 45 \\ &\rightarrow \left(3k - \frac{45}{17}\right)x = 13 \end{aligned}$$

For a linear equation to **have no solution**, the **coefficients of x must be equal**, but the constants must differ. Here, for the equation to have no solution, the coefficient of x on both sides must be equal, meaning:

$$3k = \frac{45}{17} \rightarrow k = \frac{45}{17} \div 3 \rightarrow k = \frac{15}{17}$$

Therefore, the value of k that makes the equation **have no solution** is $k = \frac{15}{17}$ or approximately 0.8824 and the correct answer is $\frac{15}{17}$ (or 0.8824).

089. Explanation and Answer

This type of problem requires comparing coefficients and constants to identify the conditions that make the equation unsolvable. When the **coefficients of x are equal but the constants differ**, the equation **has no solution**.

Distribute the 3 on the left-hand side:

$$3(mx - p) = -\frac{21}{10}x - \frac{25}{8} \rightarrow 3mx - 3p = -\frac{21}{10}x - \frac{25}{8}$$

To **have no solution**, the **coefficients of x on both sides must be equal**:

$$3m = -\frac{21}{10}$$

Solving for m , **divide both sides by 3**:

$$3m = -\frac{21}{10} \rightarrow m = -\frac{21}{10} \div 3 \rightarrow m = -\frac{7}{10}$$

Therefore, the **value of m** that leads to **no solution** is $m = -\frac{7}{10}$ and the correct answer is $-\frac{7}{10}$ or -0.7 .

090. Explanation and Answer

For the equation to **have no solution**, the **coefficients of x on both sides must be equal**, but the **constant terms must be different**. This would lead to a contradiction.

Start by **distributing the 2** on the left-hand side:

$$4(kx + n) = -\frac{24}{15}x - \frac{40}{17} \rightarrow 4kx + 4n = -\frac{24}{15}x - \frac{40}{17}$$

The coefficient of x on the left-hand side is $4k$, and on the right-hand side, it is $-\frac{24}{15}$. **To have no solution**, these must **be equal** so, solving for k :

$$4k = -\frac{24}{15} \rightarrow k = -\frac{24}{15} \div 4 \rightarrow k = -\frac{6}{15}$$

Therefore, the **value of k** that **leads to no solution** is $k = -\frac{6}{15}$ or $k = -0.4$ and the correct answer is $-\frac{6}{15}$ or -0.4 .

SAT Math Question Bank ANSWER EXPLANATIONS

091. Explanation and Answer

In this type of problem, we are asked to determine the value of p that results in the equation having no solution. For a **linear equation** to have **no solution**, both sides of the equation must have the **same variable term**, but the **constant terms must not be equal**.

We are given: $-5x + 12px = 60$ so, **factor out x** on the left-hand side:

$$-5x + 12px = 60 \quad \rightarrow \quad x(-5 + 12p) = 60$$

For an equation **to have no solution**, the **coefficient of x must be zero** (so there is no variable term left), and the remaining constant term must not equal the constant on the right-hand side of the equation. Thus, the coefficient of x must satisfy and solve for p :

$$-5 + 12p = 0 \quad \rightarrow \quad 12p = 5 \quad \rightarrow \quad p = \frac{5}{12}$$

Therefore, the equation **has no solution when $p = \frac{5}{12}$** and the correct answer is **D**.

092. Explanation and Answer

We are given the equation $7x + 4 = a(x + b)$, and we know the equation has **no solutions**. For an equation to have no solutions, the **variable terms on both sides must be the same**, but the **constant terms must differ**.

The equation is: $7x + 4 = a(x + b) \quad \rightarrow \quad 7x + 4 = ax + ab$

The term on the left, $7x$, must correspond to the variable term ax on the right side. For this equation to have no solutions, the **coefficient of $7x$ must be equal to the coefficient of ax** . So, $a = 7$. This means statement **I is true**.

The **constant** term on the **left is 4**, and the constant on the **right is ab** . For there to be no solutions, these **constant terms cannot be equal**. So, we must have:

$$4 \neq ab \quad \rightarrow \quad 4 \neq 7b \quad \rightarrow \quad b \neq \frac{4}{7}$$

So, statement **III is true**.

However, **if $b = 4$** , then the **constants** on both sides would **not be equal**, as $ab = 7 \times 4 = 28$ would **not match the constant** on the left-hand side (which is 4). This does **not lead to a contradiction** in the equation, but it does not specifically cause no solutions. So, **statement II is not necessarily true**.

Therefore statement **I** is true: $a = 7$. Statement **II** is false: $b = 4$ does not ensure no solutions. Statement **III** is true: $b \neq \frac{4}{7}$, and the correct answer is **D**.

093. Explanation and Answer

The total profit is calculated based on the profit earned from each unit sold. The company's profit per unit is determined by:

the **sales price**: \$150

the **cost to produce each unit**: \$80

the **salesperson's commission**, which is 15% of the sales price

After the commission is deducted from the sales price, the **amount the company retains** is:

$$\begin{aligned} \text{company retained amount per unit} &= \text{sales price} - \text{salesperson's commission} \\ &= 150 - 150 \times 0.15 \\ &= 150(1 - 0.15) \end{aligned}$$

The **company's profit per unit** is the retained amount minus the production cost:

$$\begin{aligned} \text{company's profit per unit} &= \text{company retained amount per unit} - \text{production cost per unit} \\ &= 150(1 - 0.15) - 80 \end{aligned}$$

The company **wants to make a total profit of \$10,500**. To find how many **units u** they need to sell, we can set up the equation by multiplying the profit per unit by the number of units sold:

$$\begin{aligned} \text{company's profit per unit} \times u \text{ units} &= \$10,500 \\ \rightarrow (150(1 - 0.15) - 80)u &= 10,500 \end{aligned}$$

Therefore, the equation is $(150(1 - 0.15) - 80)u = 10,500$ and the correct answer is **C**.

SAT Math Question Bank ANSWER EXPLANATIONS

094. Explanation and Answer

Identify the Components of Profit Calculation:

the **sales price of each** loaf of bread is \$20

the **cost to produce each** loaf is \$10

the **commission is 10%** of the sales price

The **commission** earned by the delivery agent is **10% of** the sales price: $\$20 \times 0.1$

After the commission is deducted from the sales price, the **bakery retains**:

$$\$20 - \$20 \times 0.1 = 20(1 - 0.1)$$

The **profit** per loaf is the **retained amount minus the production cost**: $20(1 - 0.1) - 10$

To achieve a total profit of \$1,000, the equation for the **number of loaves x the bakery must sell** is:

$$(20(1 - 0.1) - 10)x = 1,000$$

Therefore, the **equation** representing the bakery's situation is $(20(1 - 0.1) - 10)x = 1,000$ and correct answer is **D**.

095. Explanation and Answer

Analyze the problem and identify the key components:

the **total** number of **stations is 6**

each station for ingredients **A uses 8** ounces of sugar

each station for ingredients **B uses 5** ounces of sugar

x is the number of stations **using** ingredients **A**, so **$6 - x$** is the number of stations **using** ingredients **B**.

The **total sugar** required for the x stations using Ingredients **A is $8x$** .

The **total sugar** required for the $6 - x$ stations using Ingredients **B is $5(6 - x)$** .

Write the equation for the total amount of sugar:

$$\begin{aligned} \text{total sugar: } 8x + 5(6 - x) &= 8x + 30 - 5x \\ &= 3x + 30 \end{aligned}$$

Therefore, the **total number of ounces of sugar required is $3x + 30$** and the correct answer is **D**.

096. Explanation and Answer

The problem gives the **initial height** of a tree as **5 feet**, and it asks for the interpretation of the number 3 in the context of the tree's growth equation. The tree grew to **a height of 20 feet over a certain number of years**.

The equation **relates the number of years, n** , and the tree's height as a linear relationship. The general form of this linear equation is:

$$\text{height} = \text{initial height} + \text{growth rate per year} \times n \text{ years}$$

In this case, the equation provided in the problem involves the **coefficient 3**, which represents **how much the tree grew each year after being planted**.

The number **3** in the equation represents the **average number of feet the tree grew per year**. This means that **every year, the tree grows an additional 3 feet**.

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

097. Explanation and Answer

The initial equation is:

$$a = \frac{v_f - 10}{6}.$$

Isolate v_f in terms of a :

Multiply both sides by 6 to eliminate the denominator and add 10 to both sides to isolate v_f :

$$a = \frac{v_f - 10}{6} \rightarrow 6a = v_f - 10 \rightarrow v_f = 6a + 10$$

Comparing $v_f = 6a + 10$ with $v_f = xa + y$, we see that $x = 6$ and $y = 10$.

Therefore, **the value of x is 6** and the correct answer is **6**.