

PRACTICE SET 1: LINEAR EQUATIONS

Solving Linear Equations

An equation is a statement in algebra that says two expressions are equivalent. A *linear equation* is one in which the highest power on any variable is 1. Solving an equation is like solving a puzzle or playing a strategy game. The object of the game is to find the appropriate number value for the variable(s). Like any game, algebra has rules. The rules state that an algebraic equation is like a set of scales that you have to keep balanced at all times. If you want to balance a set of scales, whatever you do to one side you must do to the other. For instance, you have to add or take away the same amount from both sides. The same goes for an algebraic equation.

Many students inadvertently switch on “math autopilot” when solving linear equations, automatically running through the same set of steps on every equation without looking for the best way to solve the question. On the SAT, however, every second counts. You will want to use the most efficient strategy for solving questions. Looking carefully at how questions on the SAT use fractions and decimals can guide your strategy. Here are some examples:

- If the equation in the question has fractions, but the answers don’t, try clearing the fractions in the equation by multiplying by a least common denominator.
- The presence of fractions in the answer choices likely means you’ll need to rely on techniques for combining and simplifying fractions to get to the right answer.
- Seeing decimals in the answer choices likely indicates that using your calculator will save time on Test Day.

Modeling Real-World Scenarios

Linear equations and linear graphs can be used to model relationships and changes, such as those concerning time, temperature, or population. When a linear equation is presented in the context of a “real-world” word problem, it’s up to you to extract and solve an equation. When you’re answering these questions, you’ll need to translate from English into math. The following table shows some of the most common phrases and mathematical equivalents you’re likely to see on the SAT.

Word Problems Translation Table	
English	Math
<i>equals, is, equivalent to, was, will be, has, costs, adds up to the same as, as much as</i>	=
<i>times, of, multiplied by, product of, twice, double, by</i>	×
<i>divided by, per, out of, each, ratio</i>	÷
<i>plus, added to, and, sum, combined, total, increased by</i>	+
<i>minus, subtracted from, smaller than, less than, fewer, decreased by, difference between</i>	-
<i>a number, how much, how many, what</i>	x, n , etc.

Working with Linear Graphs

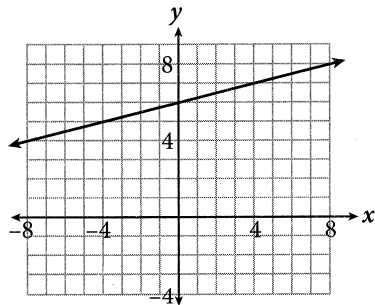
Working with linear equations algebraically is only half the battle. The SAT will also expect you to work with graphs of linear equations. Here are some important facts to remember about graphs of linear equations:

- When a linear equation is written in slope-intercept form, $y = mx + b$, the variable m gives the slope of the line, and b represents the point at which the line intersects the y -axis.
- In a real-world scenario, slope represents a unit rate and the y -intercept represents a starting amount.
- The rate of change (slope) for a linear relationship is constant (does not vary).
- Slope is given by the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, where (x_1, y_1) and (x_2, y_2) are coordinates of points on the line. To help you remember the slope formula, think “rise over run.”
- A line with a positive slope runs up and to the right (“uphill”), and a line with a negative slope runs down and to the right (“downhill”).
- A horizontal line has a slope of 0 (because it does not rise or fall from left to right).
- A vertical line has an undefined slope.
- Parallel lines have the same slope.
- Perpendicular lines have negative reciprocal slopes (for example, 3 and $-\frac{1}{3}$).


To choose a graph that matches a given equation (or vice versa), find the slope of the line and its y -intercept. You can also use this strategy to write the equation of a line given a context, but you may need to translate two data points into ordered pairs before you find the slope.

PRACTICE SET

Easy




- Which of the following equations represents the line shown in the graph?
 - $y = 6x + \frac{1}{4}$
 - $y = \frac{x}{4} + 6$
 - $y = 4x + 6$
 - $y = 6x + 4$
- A lemonade stand's profit is given by the equation $p = 2c - 8.5$. Which of the following does the number 2 most likely represent?
 - The price of one cup of lemonade
 - The profit generated from the sale of one cup of lemonade
 - The minimum number of cups of lemonade that must be sold to earn a profit
 - The costs that must be recuperated before the lemonade stand earns any profits

- 
 Darien needs to buy several white dress shirts for his new job. He finds one he likes for \$35 that is on sale for 40% off. He also likes a blue tie that costs \$21. Which of the following represents the total cost, not including tax, if Darien buys x of the white shirts that are on sale and two of the blue ties?

- $C = 14x + 42$
- $C = 21x + 21$
- $C = 21x + 42$
- $C = 35x + 42$

$$\frac{z}{6} \left(\frac{3}{2} \right) - 7 = -2(3z - 4)$$

- What value of z satisfies the equation above?
 - $-\frac{12}{5}$
 - $-\frac{4}{25}$
 - $\frac{4}{25}$
 - $\frac{12}{5}$

- 
 Line L passes through the coordinate points $\left(-\frac{7}{2}, 3\right)$ and $\left(-\frac{3}{2}, 5\right)$. What is the slope of line L ?

- -1
- $-\frac{2}{5}$
- $\frac{2}{5}$
- 1

$$17(6x - 50) = 204 \left(\frac{7}{24} x \right)$$

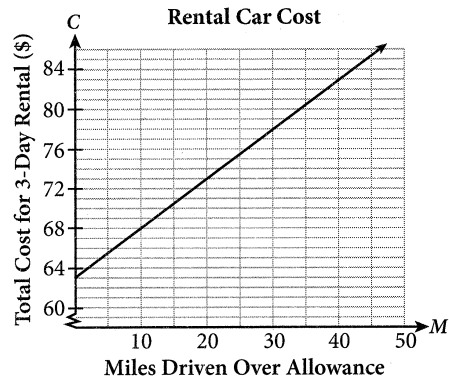
6. For what value of x is the equation above true?



	7	7	
	6	6	6
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Medium

7. Line L has an undefined slope. Line M is perpendicular to line L . Which of the following could be the equation of line M ?
- A) $x = y$
 B) $y = 7$
 C) $x = -3$
 D) $xy = 4$
8. A line in the xy -plane that passes through the coordinate points $(3, -6)$ and $(-7, -4)$ will never intersect a line that is represented by which of the following equations?
- A) $x + 5y = 6$
 B) $x + \frac{y}{2} = 7$
 C) $y - 2x = -9$
 D) $2y - x = -8$



9. A car rental agency charges a per day rental fee which includes a daily mileage allowance plus a certain amount per mile driven over the allowance. The graph above compares the miles driven over the allowance and the total cost for a 3-day rental. What does the C -intercept most likely represent in this scenario?
- A) The per day rental fee for renting the car
 B) The number of miles a renter may drive the car per day
 C) The penalty a renter must pay if the daily mileage allowance is exceeded
 D) The total cost of a 3-day rental assuming the car is not driven over the allowance

$$\frac{2}{3}x + cy = 2$$

10. If the slope of the equation shown above is 6, what is the value of c ?
- A) -4
 B) $-\frac{1}{9}$
 C) $\frac{1}{3}$
 D) 4

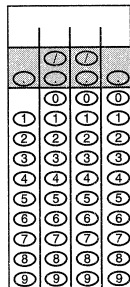
11. Anneke is competing in a 500-meter freestyle swim event, which consists of swimming the length of a pool 20 times. If Anneke averages 26.4 seconds per length of the pool, which of the following equations could be used to determine the number of meters (m) Anneke has left in the event after swimming for s seconds?

- A) $m = 500 - \frac{25s}{26.4}$
 B) $m = 500 - 25s$
 C) $m = \frac{25s}{26.4}$
 D) $m = 500 - 20s$

12. If the graph of the equation $y = 5x + 3$ is shifted down 4 units, what is the x -intercept of the new line?

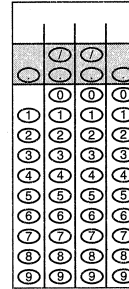
- A) -1
 B) $\frac{1}{5}$
 C) 1
 D) $\frac{5}{4}$

13. A new color copier purchased for \$8,500 is expected to depreciate (lose value) according to the equation $y = -1,250x + 8,500$, where y is the value of the copier x years after it was purchased. The company that bought the copier plans to sell it when the value is \$1,000 and upgrade to a new one. How many years after the copier is purchased will the company sell it?

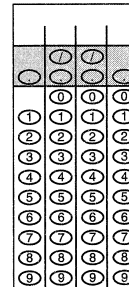


$$\frac{3(h+2)-4}{6} = \frac{h(7 \times 2 - 5)}{2}$$

14. In the equation above, what is the value of h ?

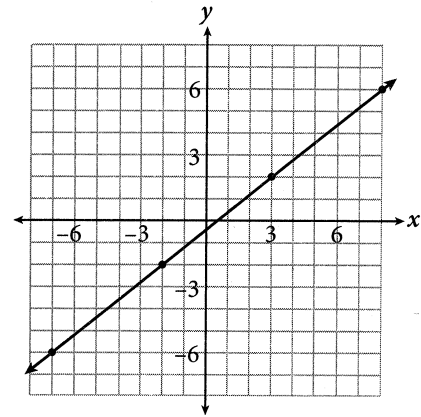
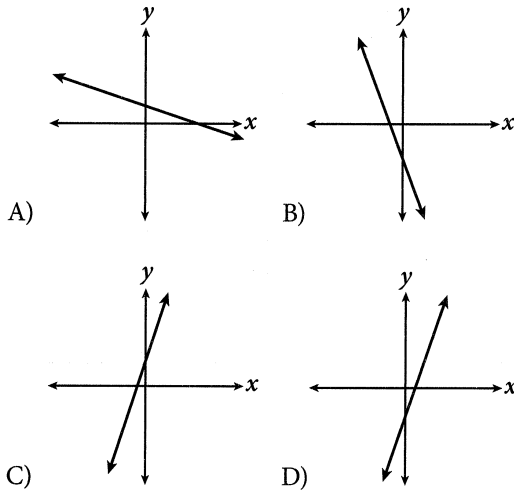


15. If $\frac{2}{3}j - \frac{1}{4}k = \frac{5}{2}$, what is the value of $8j - 3k$?



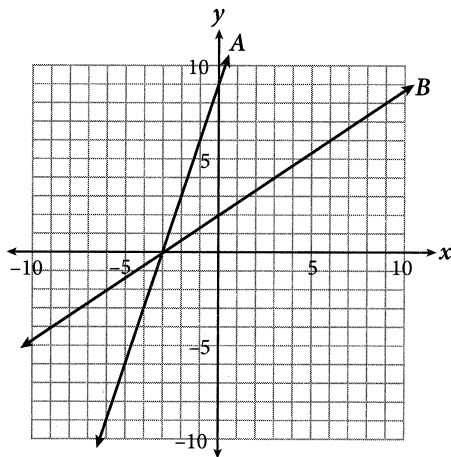
Hard

16. If w is an integer less than -1 , which of the following could be the graph of $x + wy = wx - y - 3$?




18. If the equation of the line shown on the graph is written in standard form, $Ax + By = C$, and $A = 3$, what is the value of B ?

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



17. If the equation of line A shown on the graph is given by $y = mx + b$, and the equation of line B is given by $y = k(mx + b)$, what is the value of k ?

- A) $\frac{1}{6}$
- B) $\frac{2}{9}$
- C) 6
- D) 9

19.  Two garages each charge a fixed amount, plus an hourly rate, to service a car. The garage on Main Street charged one customer \$153 for a 2-hour service appointment, and it charged a second customer \$315 for a 5-hour service appointment. The garage on 2nd Street charges \$5 less per hour than the garage on Main Street and \$10 more for the fixed amount. How much would the garage on 2nd Street charge for a 3-hour service appointment?

- A) \$157
- B) \$174
- C) \$181
- D) \$202

$$\frac{1}{2}(6x - 4) - (3 - x) = ax + x + b$$

20. If the equation above has infinitely many solutions, what is the value of $a - b$?

	0	0	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9