

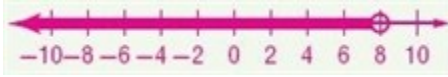
1-5 Solving Inequalities

Solve each inequality. Then graph the solution set on a number line.

1. $b + 6 < 14$

ANSWER:

$$b < 8$$



2. $12 - d > -8$

ANSWER:

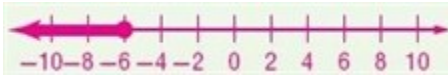
$$d < 20$$



3. $18 \leq -3x$

ANSWER:

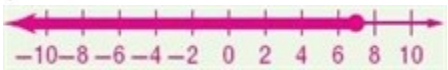
$$x \leq -6$$



4. $-5y \geq -35$

ANSWER:

$$y \leq 7$$



5. $-4w - 13 > -21$

ANSWER:

$$w < 2$$



6. $8z - 9 \geq -15$

ANSWER:

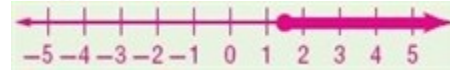
$$z \geq -\frac{3}{4}$$



7. $s \geq \frac{s+6}{5}$

ANSWER:

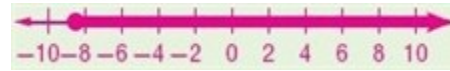
$$s \geq \frac{3}{2}$$



8. $\frac{2x-9}{4} \leq x+2$

ANSWER:

$$x \geq -8.5$$



9. **YARD WORK** Tara is delivering bags of mulch. Each bag weighs 48 pounds, and the push cart weighs 65 pounds. If her flat-bed truck is capable of hauling 2000 pounds, how many bags of mulch can Tara safely take on each trip?

ANSWER:

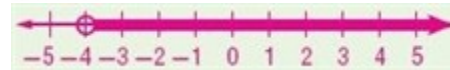
40 bags

Solve each inequality. Then graph the solution set on a number line.

10. $m - 8 > -12$

ANSWER:

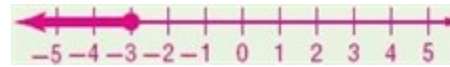
$$m > -4$$



11. $n + 6 \leq 3$

ANSWER:

$$n \leq -3$$



12. $6r < -36$

ANSWER:

$$r < -6$$



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13. $-12t \geq -6$

ANSWER:

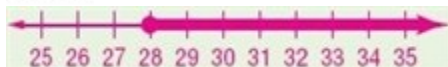
$$t \leq \frac{1}{2}$$



14. $-\frac{w}{4} \leq -7$

ANSWER:

$$w \geq 28$$



15. $\frac{k}{3} - 14 < -5$

ANSWER:

$$k < 27$$



16. $4x - 15 \leq 21$

ANSWER:

$$x \leq 9$$



17. $-6z - 14 > -32$

ANSWER:

$$z < 3$$



18. $-16 \geq 5(2z - 11)$

ANSWER:

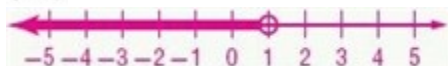
$$z \leq 3.9$$



19. $12 < -4(3c - 6)$

ANSWER:

$$c < 1$$



20. $\frac{3y - 4}{0.2} - 8 > 12$

ANSWER:

$$y > \frac{8}{3}$$



21. $\frac{9z + 5}{4} + 18 < 26$

ANSWER:

$$z < 3$$



22. **GYMNASTICS** In a gymnastics competition, an athlete's final score is calculated by taking 75% of the average technical score and adding 25% of the artistic score. All scores are out of 10, and one gymnast has a 7.6 average technical score. What artistic score does the gymnast need to have a final score of at least 8.0?

ANSWER:

9.2

Define a variable and write an inequality for each problem. Then solve.

23. Twelve less than the product of three and a number is less than 21.

ANSWER:

$$3x - 12 < 21; x < 11$$

24. The quotient of three times a number and 4 is at least -16.

ANSWER:

$$\frac{3x}{4} \geq -16; x \geq -\frac{64}{3}$$

25. The difference of 5 times a number and 6 is greater than the number.

ANSWER:

$$5x - 6 > x; x > 1.5$$

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26. The quotient of the sum of 3 and a number and 6 is less than -2 .

ANSWER:

$$\frac{x+3}{6} < -2; x < -15$$

27. **HIKING** Danielle can hike 3 miles in an hour, but she has to take a one-hour break for lunch and a one-hour break for dinner. If Danielle wants to hike at least 18 miles, solve $3(x-2) \geq 18$ to determine how many hours the hike should take.

ANSWER:

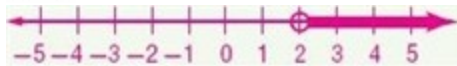
at least 8 hours

Solve each inequality. Then graph the solution set on a number line.

28. $18 - 3x < 12$

ANSWER:

$$x > 2$$



29. $-8(4x + 6) < -24$

ANSWER:

$$x > -\frac{3}{4}$$



30. $\frac{1}{4}n + 12 \geq \frac{3}{4}n - 4$

ANSWER:

$$n \leq 32$$



31. $0.24y - 0.64 > 3.86$

ANSWER:

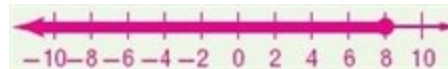
$$y > 18.75$$



32. $10x - 6 \leq 4x + 42$

ANSWER:

$$x \leq 8$$



33. $-6v + 8 > -14v - 28$

ANSWER:

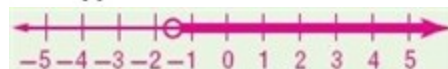
$$v > -4.5$$



34. $n > \frac{-3n-15}{8}$

ANSWER:

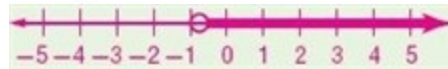
$$n > -\frac{15}{11}$$



35. $-2r < \frac{6-2r}{5}$

ANSWER:

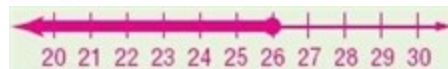
$$r > -\frac{3}{4}$$



36. $\frac{9z-4}{5} \leq \frac{7z+2}{4}$

ANSWER:

$$z \leq 26$$



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37. **MONEY** Jin is selling advertising space in *Central City Magazine* to local businesses. Jin earns 3% commission for every advertisement he sells plus a salary of \$250 a week. If the average amount of money that a business spends on an advertisement is \$500, how many advertisements must he sell each week to make a salary of at least \$700 that week?
- Write an inequality to describe this situation.
 - Solve the inequality and interpret the solution.

ANSWER:

- $250 + 0.03(500a) \geq 700$
- $a \geq 30$; He must sell at least 30 advertisements.

Define a variable and write an inequality for each problem. Then solve.

38. One third of the sum of 5 times a number and 3 is less than one fourth the sum of six times that number and 5.

ANSWER:

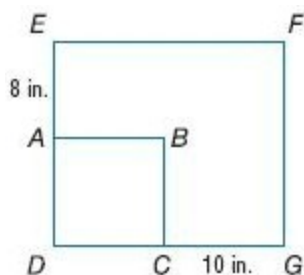
$$\frac{5n+3}{3} < \frac{6n+5}{4}n < 1.5$$

39. The sum of one third a number and 4 is at most the sum of twice that number and 12.

ANSWER:

$$\frac{x}{3} + 4 \leq 2x + 12; x \geq -4.8$$

40. **SENSE-MAKING** The sides of square $ABCD$ are extended to form rectangle $DEFG$. If the perimeter of the rectangle is at least twice the perimeter of the square, what is the maximum length of a side of square $ABCD$?



ANSWER:

9 in.

41. **MARATHONS** Jamie wants to be able to run at least the standard marathon distance of 26.2 miles. A good rule for training is that runners generally have enough endurance to finish a race that is up to 3 times his or her average daily distance.
- If the length of her current daily run is 5 miles, write an inequality to find the amount by which she needs to increase her daily run to have enough endurance to finish a marathon.
 - Solve the inequality and interpret the solution.

ANSWER:

$$a. 3(5 + d) \geq 26.2$$

- $d \geq 3.73$; In order to have enough endurance to run a marathon, Jamie should increase the distance of her average daily run by at least 3.73 miles.

42. **MODELING** The costs for renting a car from Ace Car Rental and from Basic Car Rental are shown in the table. For what mileage does Basic have the better deal? Use the inequality $38 + 0.1x > 42 + 0.05x$. Explain why this inequality works.

Rental Car Costs		
Company	Cost per Day	Cost per Mile
Ace	\$38	\$0.10
Basic	\$42	\$0.05

ANSWER:

Basic has the better deal as long as you are traveling more than 80 miles. Yes, this is the correct inequality to use. Sample explanation: It works because the inequality finds the mileage at which Ace's charge is greater than Basic's charge.

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43. **MULTIPLE REPRESENTATIONS** In this exercise, you will explore graphing inequalities on a coordinate plane.

a. **TABULAR** Organize the following into a table.

Substitute 5 points into the inequality $y \geq -\frac{1}{2}x + 3$.

State whether the resulting statement is *true* or *false*.

b. **GRAPHICAL** Graph $y = -\frac{1}{2}x + 3$. Also graph

the 5 points from the table. Label all points that resulted in a true statement with a T. Label all points that resulted in a false statement with an F.

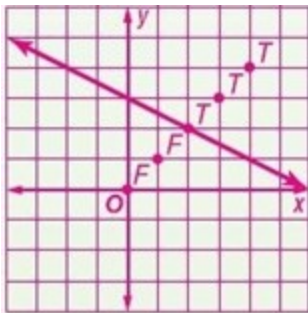
c. **VERBAL** Describe the pattern produced by the points you have labeled. Make a conjecture about which points on the coordinate plane would result in true and false statements.

ANSWER:

a. **Sample answer:**

Point	Resulting Statement	True or False
(0, 0)	$0 \geq 3$	False
(1, 1)	$1 \geq \frac{5}{2}$	False
(2, 2)	$2 \geq 2$	True
(3, 3)	$3 \geq \frac{3}{2}$	True
(4, 4)	$4 \geq 1$	True

b. **Sample answer:**



c. **Sample answer:** The points on or above the line result in true statements, and the points below the line result in false statements. This is true for all points on the coordinate plane.

44. **CHALLENGE** If $-4 < x < 5$ and $0.25 < y < 4$, then

$$a < \frac{x}{y} < b. \text{ What is } a + b?$$

ANSWER:

$$(a + b) < 4$$

45. **ERROR ANALYSIS** Madlynn and Emilie were comparing their homework. Is either of them correct? Explain your reasoning.

<p style="text-align: center; margin: 0;">Madlynn</p> $\frac{4x + 5}{-2} - 1 > -3$ $\frac{4x + 5}{-2} < -2$ $4x + 5 > 4$ $4x > -1$ $x > -\frac{1}{4}$	<p style="text-align: center; margin: 0;">Emilie</p> $\frac{4x + 5}{-2} - 1 > -3$ $\frac{4x + 5}{-2} > -2$ $4x + 5 > 4$ $4x > -1$ $x > -\frac{1}{4}$
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ANSWER:

No; sample answer: Madlynn reversed the inequality sign when she added 1 to each side. Emilie did not reverse the inequality sign at all.

46. **REASONING** Determine whether the following statement is sometimes, always, or never true.

Explain your reasoning.

The opposite of the absolute value of a negative number is less than the opposite of that number.

ANSWER:

Sample answer: Always; the opposite of the absolute value of a negative number will always be a negative value, while the opposite of a negative number will always be a positive value. A negative value will always be less than a positive value.

1-5 Solving Inequalities

47. **CHALLENGE** Given $\triangle ABC$ with sides $AB = 3x + 4$, $BC = 2x + 5$, and $AC = 4x$, determine the values of x such that $\triangle ABC$ exists.

ANSWER:

Using the Triangle Inequality Theorem, we know that the sum of the lengths of any 2 sides of a triangle must be greater than the length of the remaining side. This generates 3 inequalities to examine.

$$\begin{array}{l} 3x + 4 + 2x + 5 > 4x \\ \qquad \qquad \qquad x > -9 \\ 3x + 4 + 4x > 2x + 5 \\ \qquad \qquad \qquad x > 0.2 \\ 2x + 5 + 4x > 3x + 4 \\ \qquad \qquad \qquad x > -\frac{1}{3} \end{array}$$

In order for all 3 conditions to be true, x must be greater than 0.2.

48. **OPEN ENDED** Write an inequality for which the solution is all real numbers in the form $ax + b > c(x + d)$. Explain how you know this.

ANSWER:

Sample answer: $4x + 5 > 4(x + 1)$; This has a solution set of all real numbers because it simplifies to $4x + 5 > 4x + 4$ or $5 > 4$. This indicates that for any real value of x the inequality is equivalent to $1 > 0$, that is the left side will always be 1 greater than the right side.

49. **WRITING IN MATH** Why does the inequality symbol need to be reversed when multiplying or dividing by a negative number?

ANSWER:

Sample answer: When one number is greater than another number, it is either more positive or less negative than that number. When these numbers are multiplied by a negative value, their roles are reversed. That is, the number that was more positive is now more negative than the other number. Thus, it is now less than that number and the inequality symbol needs to be reversed.

50. **SHORT RESPONSE** Rogelio found a cookie recipe that requires $\frac{3}{4}$ cup of sugar and 2 cups of flour. How many cups of sugar would he need if he used 6 cups of flour?

ANSWER:

$$2\frac{1}{4}$$

51. **STATISTICS** The mean score for Samantha's first six algebra quizzes was 88. If she scored a 95 on her next quiz, what will her mean score be for all 7 quizzes?

A 89 C 91
B 90 D 92

ANSWER:

A

52. **SAT/ACT** The average of five numbers is 9. The average of 7 other numbers is 8. What is the average of all 12 numbers?

F $8\frac{5}{12}$

G $8\frac{1}{2}$

H $8\frac{7}{12}$

J $8\frac{3}{4}$

K $8\frac{11}{12}$

ANSWER:

F

53. What is the complete solution of the equation

$$|8 - 4x| = 40 ?$$

A $x = 8$; $x = 12$

B $x = 8$; $x = -12$

C $x = -8$; $x = -12$

D $x = -8$; $x = 12$

ANSWER:

D

1-5 Solving Inequalities

Solve each equation. Check your solutions.

54. $|x - 5| = 12$

ANSWER:

$$\{-7, 17\}$$

55. $7|3y - 4| = 35$

ANSWER:

$$\left\{-\frac{1}{3}, 3\right\}$$

56. $|a + 6| = a$

ANSWER:

$$\emptyset$$

57. **ASTRONOMY** Pluto travels in a path that is not circular. Pluto's farthest distance from the Sun is 4539 million miles, and its closest distance is 2756 million miles. Write an equation that can be solved to find the minimum and maximum distances from the Sun to Pluto.

ANSWER:

$$|r - 3647.5| = 891.5$$

58. **POPULATION** In 2005, the population of Bay City was 19,611. For each of the next five years, the population decreased by an average of 715 people per year.

a. What was the population in 2010?

b. If the population continues to decline at the same rate as from 2005 to 2010, what would you expect the population to be in 2025?

ANSWER:

a. 16,036

b. 5311

59. **GEOMETRY** The formula for the surface area of a cylinder is $SA = 2\pi r^2 + 2\pi r h$.

a. Use the Distributive Property to rewrite the formula by factoring out the greatest common factor of the two terms.

b. Find the surface area for a cylinder with radius 3 centimeters and height 10 centimeters using both formulas. Leave the answer in terms of π .

c. Which formula do you prefer? Explain your reasoning.

ANSWER:

a. $SA = 2\pi r(r + h)$

b. $78\pi \text{ cm}^2$

c. Sample answer: The formula in part **b** is quicker.

60. **CONSTRUCTION** The Sawyers are adding a family room to their house. The dimensions of the room are 26 feet by 28 feet. Show how to use the Distributive Property to mentally calculate the area of the room.

ANSWER:

$$26 \cdot 28 = 26(20 + 8) = 520 + 208 = 728$$

Solve each equation. Check your solutions.

61. $|x| = 9$

ANSWER:

$$\{-9, 9\}$$

62. $|x + 3| = 10$

ANSWER:

$$\{-13, 7\}$$

63. $|4y - 15| = 13$

ANSWER:

$$\left\{\frac{1}{2}, 7\right\}$$

64. $18 = |3x - 9|$

ANSWER:

$$\{-3, 9\}$$

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65. $16 = 4|w + 2|$

ANSWER:

$$\{-6, 2\}$$

66. $|y + 3| + 4 = 20$

ANSWER:

$$\{-19, 13\}$$