1-3 Solving Equations

Write an algebraic expression to represent each verbal expression.

1. the product of 12 and the sum of a number and negative 3

ANSWER:

$12[x+(-3)]$

2. the difference between the product of 4 and a number and the square of the number

ANSWER:

$4x - x^2$

Write a verbal sentence to represent each equation.

3. $5x+7=18$

ANSWER:

The sum of five times a number and 7 equals 18.

4. $x^2-9=27$

ANSWER:

The difference between the square of a number and 9 is 27.

5. $5y-y^3=12$

ANSWER:

The difference between five times a number and the cube of that number is 12.

6. $\frac{x}{4}+8=-16$

ANSWER:

Eight more than the quotient of a number and four is –16.

Name the property illustrated by each statement.

7. $(8x-3)+12=(8x-3)+12$

ANSWER:

Reflexive Property

8. If $a=-3$ and $-3=d$, then $a=d$.

ANSWER:

Transitive Property

Solve each equation. Check your solution.

9. $z-19=34$

ANSWER:

53

10. $x+13=7$

ANSWER:

–6

11. $-y=8$

ANSWER:

–8

12. $-6x=42$

ANSWER:

–7

13. $5x-3=-33$

ANSWER:

–6

14. $-6y-8=16$

ANSWER:

–4

15. $3(2a+3)-4(3a-6)=15$

ANSWER:

3

16. $5(c-8)-3(2c+12)=-84$

ANSWER:

8

17. $-3(-2x+20)+8(x+12)=92$

ANSWER:

4

18. $-4(3m-10)-6(-7m-6)=-74$

ANSWER:

–5

Solve each equation or formula for the specified variable.

19. $8r-5q=3$, for q

ANSWER:

$q=\frac{8r-3}{5}$

20. $Pv=nrt$, for n

ANSWER:

$\frac{Pv}{rt}=n$

21. **MULTIPLE CHOICE** If $\frac{y}{5}+8=7$, what is the value of $\frac{y}{5}-2$?

A –10
B –3
C 1
D 5

ANSWER:

B

Write an algebraic expression to represent each verbal expression.

22. the difference between the product of four and a number and 6

ANSWER:

$4n-6$

23. the product of the square of a number and 8

ANSWER:

$8x^2$

24. fifteen less than the cube of a number

ANSWER:

$x^3 - 15$

25. five more than the quotient of a number and 4

ANSWER:

$\frac{x}{4}+5$

Write a verbal sentence to represent each equation.

26. $8x-4=16$

ANSWER:

Four less than 8 times a number is 16.

27. $\frac{x+3}{4}=5$

ANSWER:

The quotient of the sum of 3 and a number and 4 is 5.

28. $4y^2-3=13$

ANSWER:

Three less than four times the square of a number is 13.

29. **BASEBALL** During a recent season, Miguel Cabrera and Mike Jacobs of the Florida Marlins hit a combined total of 46 home runs. Cabrera hit 6 more home runs than Jacobs. How many home runs did each player hit? Define a variable, write an equation, and solve the problem.

ANSWER:

n = number of home runs Jacobs hit; $n + 6$ = number of home runs Cabrera hit; $2n + 6 = 46$; Jacobs: 20 home runs, Cabrera: 26 home runs.

Name the property illustrated by each statement.

30. If $x + 9 = 2$, then $x + 9 – 9 = 2 – 9$

ANSWER:

30. Subtr. (=)

31. If $y = –3$, then $7y = 7(–3)$

ANSWER:

Subst.

32. If $g = 3h$ and $3h = 16$, then $g = 16$

ANSWER:
Transitive Property

33. If $-y = 13$, then $-(-y) = -13$

ANSWER:
Mult. (=)

34. **MONEY** Aiko and Kendra arrive at the state fair with $32.50. What is the total number of rides they can go on if they each pay the entrance fee?

ANSWER:
n = number of rides; 2(7.50) + n(2.50) = 32.50; 7

Solve each equation. Check your solution.

35. $3y + 4 = 19$

ANSWER:
5

36. $-9x - 8 = 55$

ANSWER:
–7

37. $7y - 2y + 4 + 3y = -20$

ANSWER:
–3

38. $5g + 18 - 7g + 4g = 8$

ANSWER:
–5

39. $5(-2x - 4) - 3(4x + 5) = 97$

ANSWER:
–6

40. $-2(3y - 6) + 4(5y - 8) = 92$

ANSWER:
8

41. $\frac{2}{3}(6c - 18) + \frac{3}{4}(8c + 32) = -18$

ANSWER:
–3

42. $\frac{3}{5}(15d + 20) - \frac{1}{6}(18d - 12) = 38$

ANSWER:
4

43. **GEOMETRY** The perimeter of a regular pentagon is 100 inches. Find the length of each side.

ANSWER:
s = length of a side; 5s = 100; 20 in.

44. **MEDICINE** For Nina's illness her doctor gives her a prescription for 28 pills. The doctor says that she should take 4 pills the first day and then 2 pills each day until her prescription runs out. For how many days does she take 2 pills?

ANSWER:
x = the number of days she takes 2 pills; 4 + 2x = 28; 12 days

Solve each equation or formula for the specified variable.

45. $E = mc^2$, for m

ANSWER:
$m = \frac{E}{c^2}$

46. $c(a + b) - d = f$, for a

ANSWER:
$a = \frac{f + d}{c} - b$

47. $z = \pi q^3 h$, for h

ANSWER:

$h = \frac{z}{\pi q^3}$

48. $\frac{x+y}{z} - a = b$, for y

ANSWER:

$y = z(a+b) - x$

49. $y = ax^2 + bx + c$, for a

ANSWER:

$a = \frac{y - bx - c}{x^2}$

50. $wx + yz = bc$, for z

ANSWER:

$z = \frac{bc - wx}{y}$

51. **GEOMETRY** The formula for the volume of a cylinder with radius r and height h is πtimes the radius times the height.
a. Write this as an algebraic expression.
b. Solve the expression in part **a** for h.

ANSWER:

a. $V = \pi \times r \times r \times h$
b. $h = \frac{V}{\pi r^2}$

52. **AWARDS BANQUET** A banquet room can seat a maximum of 69 people. The coach, principal, and vice principal have invited the award-winning girls' tennis team to the banquet. If the tennis team consists of 22 girls, how many guests can each student bring?

ANSWER:

n = number of guests that each student can bring; $22n + 25 = 69$; 2 guests

Solve each equation. Check your solution.

53. $5x - 9 = 11x + 3$

ANSWER:

–2

54. $\frac{1}{x} + \frac{1}{4} = \frac{7}{12}$

ANSWER:

3

55. $5.4(3k - 12) + 3.2(2k + 6) = -136$

ANSWER:

–4

56. $8.2p - 33.4 = 1.7 - 3.5p$

ANSWER:

3

57. $\frac{4}{9}y + 5 = -\frac{7}{9}y - 8$

ANSWER:

$-\frac{117}{11}$

58. $\frac{3}{4}z - \frac{1}{3} = \frac{2}{3}z + \frac{1}{5}$

ANSWER:

$\frac{32}{5}$

59. **FINANCIAL LITERACY** Benjamin spent $10,734 on his living expenses last year. Most of these expenses are listed at the right. Benjamin's only other expense last year was rent. If he paid rent 12 times last year, how much is Benjamin's rent each month?

Expense	Annual Cost
Electric	$622
Gas	$428
Water	$240
Renter's Insurance	$144

ANSWER:

x = the cost of rent each month; 622 + 428 + 240 + 144 + 12x = 10,734; $775 per month

60. **BRIDGES** The Sunshine Skyway Bridge spans Tampa Bay, Florida. Suppose one crew began building south from St. Petersburg, and another crew began building north from Bradenton. The two crews met 10,560 feet south of St. Petersburg approximately 5 years after construction began.

a. Suppose the St. Petersburg crew built an average of 176 feet per month. Together the two crews built 21,120 feet of bridge. Determine the average number of feet built per month by the Bradenton crew.

b. About how many miles of bridge did each crew build?

c. Is this answer reasonable? Explain.

ANSWER:

a. 176 ft

b. 2 mi

c. Yes; it seems reasonable that two crews working 4 miles apart would be able to complete the same amount of miles in the same amount of time.

61. **MULTIPLE REPRESENTATIONS** The absolute value of a number describes the distance of the number from zero.

a. GEOMETRIC Draw a number line. Label the integers from –5 to 5.

b. TABULAR Create a table of the integers on the number line and their distance from zero.

c. GRAPHICAL Make a graph of each integer x and its distance from zero y using the data points in the table.

d. VERBAL Make a conjecture about the integer and its distance from zero. Explain the reason for any changes in sign.

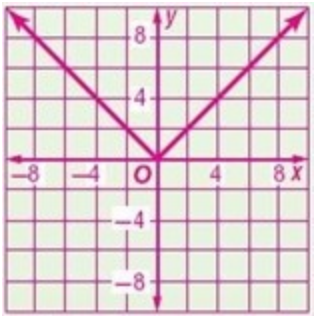
ANSWER:

a.

b.

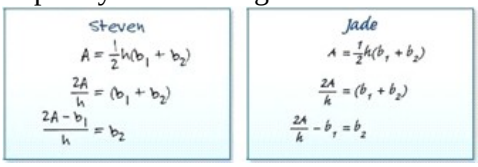
Integer	Distance from Zero
–5	5
–4	4
–3	3
–2	2
–1	1
0	0
1	1
2	2
3	3
4	4
5	5

c.



d. For positive integers, the distance from zero is the same as the integer. For negative integers, the distance is the integer with the opposite sign because distance is always positive.

62. **ERROR ANALYSIS** Steven and Jade are solving $A = \frac{1}{2}h(b_1 + b_2)$ for b_2. Is either of them correct? Explain your reasoning.



ANSWER:

Sample answer: Jade; in the last step, when Steven subtracted b_1 from each side, he mistakenly put the $-b_1$ in the numerator instead of after the entire fraction.

63. **CHALLENGE** Solve $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ for y_1

ANSWER:

$y_1 = y_2 - \sqrt{d^2 - (x_2 - x_1)^2}$

64. **REASONING** Use what you have learned in this lesson to explain why the following number trick works.

- Take any number.
- Multiply it by ten.
- Subtract 30 from the result.
- Divide the new result by 5.
- Add 6 to the result.
- Your new number is twice your original.

ANSWER:

Translating this number trick into an expression yields:

$$\frac{(10x - 30)}{5} + 6 = 2x$$
$$\frac{(10x - 30)}{5} = 2x - 6$$
$$(2x - 6) + 6 = 2x$$

65. **OPEN ENDED** Provide one example of an equation involving the Distributive Property that has no solution and another example that has infinitely many solutions.

ANSWER:

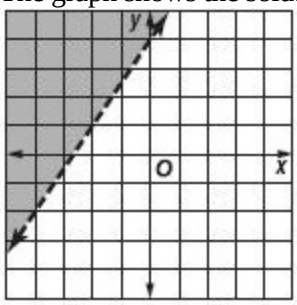
Sample answer: $3(x - 4) = 3x + 5$; $2(3x - 1) = 6x - 2$

66. **WRITING IN MATH** Compare and contrast the Substitution Property of Equality and the Transitive Property of Equality.

ANSWER:

Sample answer: The Transitive Property utilizes the Substitution Property. While the Substitution Property is done with two values, that is, one being substituted for another, the Transitive Property deals with three values, determining that since two values are equal to a third value, then they must be equal.

67. The graph shows the solution of which inequality?



A. $y < \frac{2}{3}x + 4$ **C.** $y < \frac{3}{2}x + 4$

B. $y > \frac{2}{3}x + 4$ **D.** $y > \frac{3}{2}x + 4$

ANSWER:

D

68. **SAT/ACT** What is $1\frac{1}{3}$ subtracted from its reciprocal?

F $-2\frac{2}{3}$

G $-\frac{7}{12}$

H $-\frac{1}{12}$

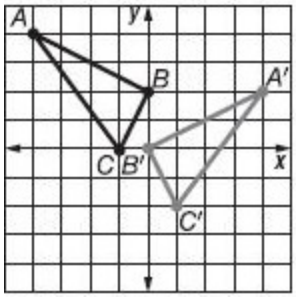
J $\frac{1}{4}$

K $\frac{3}{4}$

ANSWER:

G

69. **GEOMETRY** Which of the following describes the transformation of ΔABC to $\Delta A'B'C'$?



A. a reflection across the y-axis and a translation down 2 units
B. a reflection across the x-axis and a translation down 2 units
C. a rotation $90°$ to the right and a translation down 2 units
D. a rotation $90°$ to the right and a translation right 2 units

ANSWER:
A

70. **SHORT RESPONSE** A local theater sold 1200 tickets during the opening weekend of a movie. On the following weekend, 840 tickets were sold. What was the percent decrease of tickets sold?

ANSWER:
30%

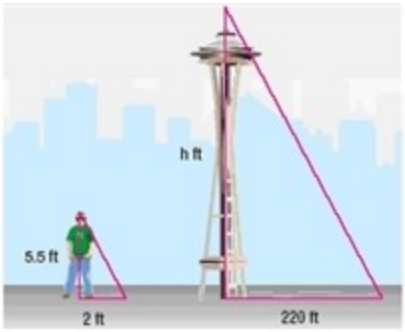
71. Simplify $3x + 8y + 5z - 2y - 6x + z$.

ANSWER:
$-3x + 6y + 6z$

72. **BAKING** Tamera is making two types of bread. The first type of bread needs $2\frac{1}{2}$ cups of flour, and the second needs $1\frac{3}{4}$ cups of flour. Tamera wants to make 2 loaves of the first recipe and 3 loaves of the second recipe. How many cups of flour does she need?

ANSWER:
$10\frac{1}{4}$c

73. **LANDMARKS** Suppose the Space Needle in Seattle, Washington, casts a 220-foot shadow at the same time a nearby tourist casts a 2-foot shadow. If the tourist is $5\frac{1}{2}$ feet tall, how tall is the Space Needle?



ANSWER:
605 ft

74. Evaluate $a - \left[c(b - a)\right]$, if $a = 5$, $b = 7$, and $c = 2$.

ANSWER:
1

Identify the additive inverse for each number or expression.

75. $-4\frac{1}{5}$

ANSWER:
$4\frac{1}{5}$

76. 3.5

ANSWER:
-3.5

77. $-2x$

ANSWER:
$2x$

78. $6 - 7y$

ANSWER:
$-6 + 7y$

79. $3\frac{2}{3}$

ANSWER:

$-3\frac{2}{3}$

80. -1.25

ANSWER:

1.25

81. $5x$

ANSWER:

$-5x$

82. $4-9x$

ANSWER:

$-4+9x$