3-1 Solving Systems of Equations

Solve each system of equations by using a table.

1. $y = 3x - 4$
   $y = -2x + 11$

   ANSWER:
   (3, 5)

2. $4x - y = 1$
   $5x + 2y = 24$

   ANSWER:
   (2, 7)

Solve each system of equations by graphing.

3. $y = -3x + 6$
   $2y = 10x - 36$

   ANSWER:
   (3, –3)

4. $y = -x - 9$
   $3y = 5x + 5$

   ANSWER:
   (–4, –5)

5. $y = 0.5x + 4$
   $3y = 4x - 3$

   ANSWER:
   (6, 7)

6. $-3y = 4x + 11$
   $2x + 3y = -7$

   ANSWER:
   (–2, –1)

7. $4x + 5y = -41$
   $3y - 5x = 5$

   ANSWER:
   (–4, –5)

8. $8x - y = 50$
   $x + 4y = -2$

   ANSWER:
   (6, –2)

9. **CCSS MODELING** Refer to the table below.

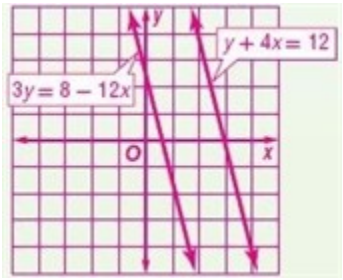
Digital Photos
Online Store $0.15 per photo + $2.70 shipping
Local Store $0.25 per photo

a. Write equations that represent the cost of printing digital photos at each lab.
b. Under what conditions is the cost to print digital photos the same at both stores?
c. When is it best to use the online store and when is it best to use the local store?

ANSWER:
a. $y = 0.15x + 2.70, y = 0.25x$
b. 6.75 for 27 photos
c. You should use the online store if you are printing more than 27 digital photos and the local store if you are printing fewer than 27 photos.

Graph each system of equations and describe it as *consistent and independent, consistent and dependent, or inconsistent.*

10. $y + 4x = 12$
    $3y = 8 - 12x$

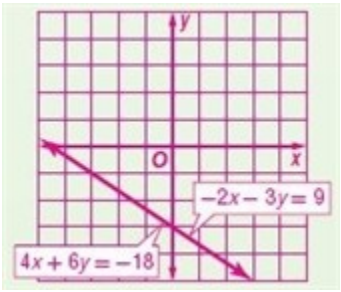
ANSWER:


inconsistent

3-1 Solving Systems of Equations

11. $-2x-3y=9$
$4x+6y=-18$

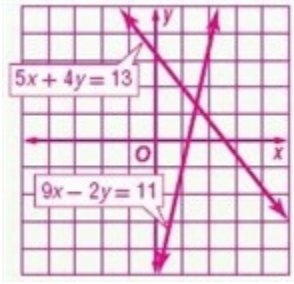
ANSWER:



consistent, dependent

12. $9x-2y=11$
$5x+4y=13$

ANSWER:



consistent, independent.

Solve each system of equations by using substitution.

13. $x+5y=3$
$3x-2y=-8$

ANSWER:
(–2, 1)

14. $y=2x-10$
$y=-4x+8$

ANSWER:
(3, –4)

15. $2a+8b=-8$
$3a-5b=22$

ANSWER:
(4, –2)

16. $a-3b=-22$
$4a+2b=-4$

ANSWER:
(–4, 6)

17. $6x-7y=23$
$8x+4y=44$

ANSWER:
(5, 1)

18. $9c-3d=-33$
$6c+5d=-8$

ANSWER:
(–3, 2)

Solve each system of equations by using elimination.

19. $-6w-8z=-44$
$3w+6z=36$

ANSWER:
(–2, 7)

20. $4x-3y=29$
$4x+3y=35$

ANSWER:
(8, 1)

21. $3a+5b=-27$
$4a+10b=-46$

ANSWER:
(–4, –3)

22. $8a-3b=-11$
$5a+2b=-3$

ANSWER:
(–1, 1)

23. $5a+15b=-24$
$-2a-6b=28$

ANSWER:
No solution

24. $6x - 4y = 30$
$12x + 5y = -18$

ANSWER:
(1, –6)

25. **MULTIPLE CHOICE** What is the solution of the linear system?
$4x + 3y = 2$
$4x - 2y = 12$

A (8, –10)
B (2, –2)
C (–10, 14)
D no solution

ANSWER:
B

Solve each system of equations by using a table.

26. $y = 5x + 3$
$y = x - 9$

ANSWER:
(–3, –12)

27. $3x - 4y = 16$
$-6x + 5y = -29$

ANSWER:
(4,–1)

28. $2x - 5 = y$
$-3x + 4y = 0$

ANSWER:
(4,3)

29. **FUNDRAISER** To raise money for new uniforms, the band boosters sell T-shirts and hats. The cost and sale price of each item is shown. The boosters spend a total of $2000 on T-shirts and hats. They sell all of the merchandise, and make $3375. How many T-shirts did they sell?

Item	Cost	Sale Price
T-Shirt	$6	$10
Hat	$4	$7

ANSWER:
250 T-shirts

Solve each system of equations by graphing.

30. $-3x + 2y = -6$
$-5x + 10y = 30$

ANSWER:
(6, 6)

31. $4x + 3y = -24$
$8x - 2y = -16$

ANSWER:
(–3,–4)

32. $6x - 5y = 17$
$6x + 2y = 31$

ANSWER:
(4.5, 2)

33. $-3x - 8y = 12$
$12x + 32y = -48$

ANSWER:
Infinite solutions

34. $y - 3x = -29$
$9x - 6y = 102$

ANSWER:
(8,–5)

35. $-10x + 4y = 7$
$2x - 5y = 7$

ANSWER:
(–1.5,–2)

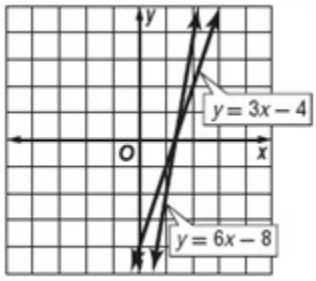
36. **CCSS MODELING** Jerilyn has a $10 coupon and a 15% discount coupon for her favorite store. The store has a policy that only one coupon may be used per purchase. When is it best for Jerilyn to use the $10 coupon, and when is it best for her to use the 15% discount coupon?

ANSWER:
$10 coupon for a purchase less than $66.67 and 15% discount coupon for a purchase over $66.67.

Graph each system of equations and describe it as *consistent and independent, consistent and dependent, or inconsistent.*

37. $y = 3x - 4$
$y = 6x - 8$

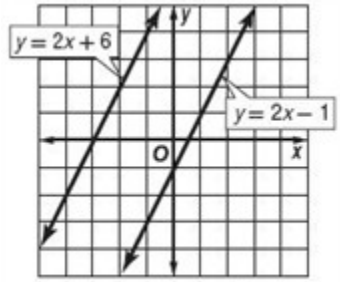
ANSWER:



consistent and independent

38. $y = 2x - 1$
$y = 2x + 6$

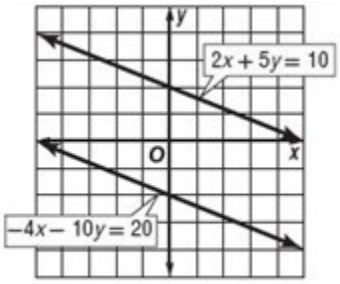
ANSWER:



inconsistent

39. $2x + 5y = 10$
$-4x - 10y = 20$

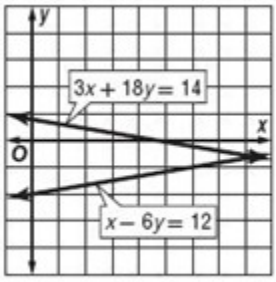
ANSWER:



inconsistent

40. $x - 6y = 12$
$3x + 18y = 14$

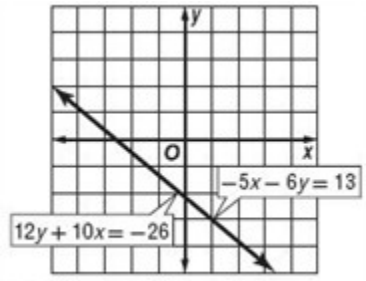
ANSWER:



consistent and independent

41. $-5x - 6y = 13$
$12y + 10x = -26$

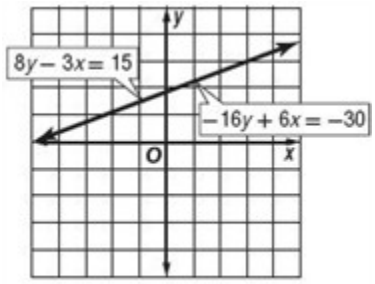
ANSWER:



consistent and dependent

42. $8y - 3x = 15$
$-16y + 6x = -30$

ANSWER:



consistent and dependent

Solve each system of equations by using substitution.

43. $9y + 3x = 18$
$-3y - x = -6$

ANSWER:
Infinite solutions

44. $5x - 20y = 70$
$6x + 5y = -32$

ANSWER:
(–2, –4)

45. $-4x - 16y = -96$
$7x + 3y = 68$

ANSWER:
(8, 4)

46. $-4a - 5b = 14$
$9a + 3b = -48$

ANSWER:
(–6, 2)

47. $-9c - 4d = 31$
$6c + 6d = -24$

ANSWER:
(–3, –1)

48. $8f + 3g = 12$
$-32f - 12g = 48$

ANSWER:
No solution

49. **TENNIS** At a park, there are 38 people playing tennis. Some are playing doubles, and some are playing singles. There are 13 matches in progress. A doubles match requires 4 players, and a singles match requires 2 players.
a. Write a system of two equations that represents the number of singles and doubles matches going on.
b. How many matches of each kind are in progress?

ANSWER:
a. $x + y = 13$ and $4x + 2y = 38$
b. 6 doubles matches and 7 singles matches

Solve each system of equations by using elimination.

50. $8x + y = 27$
$-3x + 4y = 3$

ANSWER:
(3, 3)

51. $2a - 5b = -20$
$2a + 5b = 20$

ANSWER:
(0, 4)

52. $6j + 4k = -46$
$2j + 4k = -26$

ANSWER:
(–5, –4)

53. $3x - 8y = 24$
$-12x + 32y = 96$

ANSWER:
No solution

54. $5a - 2b = -19$
$8a + 5b = -55$

ANSWER:
(–5, –3)

55. $r - 6t = 44$
$9r + 12t = 0$

ANSWER:
(8, –6)

56. $6d + 5f = -32$
$5d - 9f = 26$

ANSWER:
(–2, –4)

57. $11u = 5v + 35$
$8v = -6u + 62$

ANSWER:
(5, 4)

58. $-1.2c + 3.4d = 6$
$6c = -30 + 17d$

ANSWER:
Infinite solutions

Use a graphing calculator to solve each system of equations. Round the coordinates of the intersection to the nearest hundredth.

59. $12y = 5x - 15$
$4.2y + 6.1x = 11$

ANSWER:
(2.07, –0.39)

60. $-3.8x + 2.9y = 19$
$6.6x - 5.4y = -23$

ANSWER:
(–26.01, –27.54)

61. $5.8x - 6.3y = 18$
$-4.3x + 8.8y = 32$

ANSWER:
(15.03, 10.98)

Solve each system of equations.

62. $11p + 3q = 6$
$-0.75q - 2.75p = -1.5$

ANSWER:
Infinite solutions

63. $8r - 5t = -60$
$6r + 3t = -18$

ANSWER:
(–5, 4)

64. $10t + 4v = 13$
$-4t - 7v = 11$

ANSWER:
(2.5, –3)

65. $6w = 12 - 4x$
$6x = -9w + 18$

ANSWER:
infinite solutions

66. $\frac{3}{2}y + z = 3$
$-y - \frac{2}{3}z = -2$

ANSWER:
infinite solutions

67. $\frac{5}{2}a - \frac{3}{4}b = 46$
$-\frac{7}{8}a - 3b = 10$

ANSWER:
(16, –8)

68. **ROWING** Allison can row a boat 1 mile upstream (against the current) in 24 minutes. She can row the same distance downstream in 13 minutes. Assume that both the rowing speed and the speed of the current are constant.
a. Find the speed at which Allison is rowing and the speed of the current.
b. If Allison plans to meet her friends 3 miles upstream one hour from now, will she be on time? Explain.

ANSWER:
a. 3.56 mph;1.06 mph
b. No; she will be 12 minutes late.

69. **CCSS MODELING** The table shows the winning times in seconds for the 100-meter dash at the Olympics between 1964 and 2008.

Years Since 1964, x	Men's Gold Medal Time	Women's Gold Medal Time
0	10.0	11.4
4	9.90	11.0
8	10.14	11.07
12	10.06	11.08
16	10.25	11.06
20	9.99	10.97
24	9.92	10.54
28	9.96	10.82
32	9.84	10.94
36	9.87	10.75
40	9.85	10.93
44	9.69	10.78

a. Write equations that represent the winning times for men and women since 1964.Assume that both times continue along the same trend.
b. Graph both equations. Estimate when the women's performance will catch up to the men's performance. Do you think that your prediction is reasonable? Explain.

ANSWER:

a. Sample answer for men using (0, 10) and (44, 9.69):
$y_m = -0.00705x + 10$; sample answer for women using (0, 11.4) and (44, 10.78):
$y_w = -0.01409x + 11.4$
b.

Based on these data, the women's performance will catch up to the men's performance 198 years after 1964, or in the year 2162. The next Olympic year would be 2164; this prediction is not reasonable. It is unlikely that women's times will ever catch up to men's times because the times cannot continue to increase and decrease infinitely.

70. **JOBS** Levi has a job offer in which he will receive \$800 per month plus a commission of 2% of the total price of cars he sells. At his current job, he receives \$1200 per month plus a commission of 1.5% of his total sales. How much must he sell per month to make the new job a better deal?

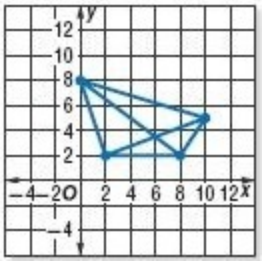
ANSWER:
more than \$80,000

71. **TRAVEL** A youth group went on a trip to an amusement park, travelling in two vans. The number of people in each van and the total cost of admission are shown in the table. Find the adult price and student price of admission.

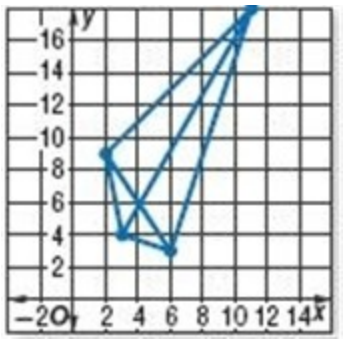
	Adults	Students	Total Cost
Van A	2	5	\$77
Van B	2	7	\$95

ANSWER:
adult: \$16; student: \$9

GEOMETRY Find the point at which the diagonals of the quadrilaterals intersect.

72. 

ANSWER:
(6, 3.5)

73. 

ANSWER:

$\left(\frac{53}{13}, \frac{153}{26}\right)$

74. **ELECTIONS** In the election for student council, Candidate A received 55% of the total votes, while Candidate B received 1541 votes. If Candidate C received 40% of the votes that Candidate A received, how many total votes were cast?

ANSWER:

6700 votes

75. **MULTIPLE REPRESENTATIONS** In this problem, you will explore systems of equations with three linear equations and two variables.

$3y + x = 16$

$y - 2x = -4$

$y + 5x = 10$

a. **TABULAR** Make a table of x and y-values for each equation.

b. **ANALYTICAL** Which values from the table indicate intersections? Is there a solution that satisfies all three equations?

c. **GRAPHICAL** Graph the three equations on a single coordinate plane.

d. **VERBAL** What conditions must be met for a system of three equations with two variables to have a solution? What conditions result in no solution?

ANSWER:

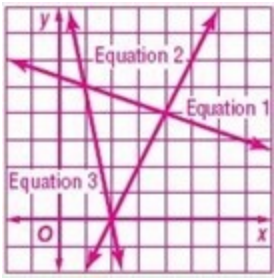
a.

Equation 1		Equation 2	
x	y	x	y
0	$\frac{16}{3}$	0	−4
1	5	1	−2
2	$\frac{14}{3}$	2	0
3	$\frac{13}{3}$	3	2
4	4	4	4

Equation 3	
x	y
0	10
1	5
2	0
3	−5
4	−10

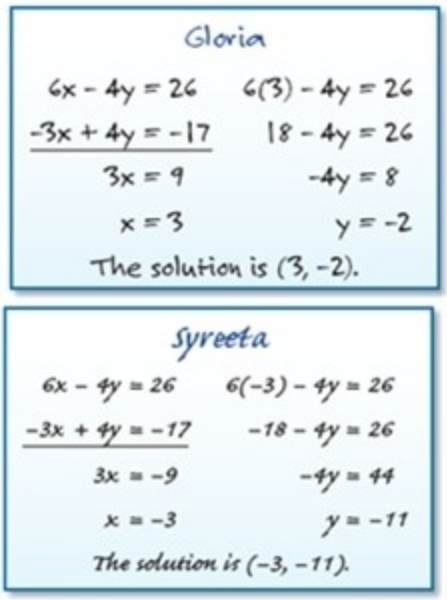
b. Equations 1 and 2 intersect at (4, 4), equations 2 and 3 intersect at (2, 0), and equations 1 and 3 intersect at (1, 5); there is no solution that satisfies all three equations.

c.



d. If all three lines intersect at the same point, then the system has a solution. The system has no solution if the lines intersect at 3 different points, or if two or three lines are parallel.

76. **CCSS CRITIQUE** Gloria and Syreeta are solving the system $6x - 4y = 26$ and $-3x + 4y = -17$. Is either of them correct? Explain your reasoning.



ANSWER:

Sample answer: Gloria; Syreeta subtracted 26 from 17 instead of 17 from 26 and got $3x = –9$ instead of $3x = 9$. She proceeded to get a value of $–11$ for y. She would have found her error if she substituted the solution into the original equations.

77. **CHALLENGE** Find values of a and b for which the following system has a solution of $(b - 1, b - 2)$.

$$-8ax + 4ay = -12a$$
$$2bx - by = 9$$

ANSWER:

$a \neq 0, b = 3$

78. **REASONING** If a is consistent and dependent with b, b is inconsistent with c, and c is consistent and independent with d, then a will sometimes, always, or never be consistent and independent with d. Explain your reasoning.

ANSWER:

Sample answer: Always; a and b are the same line. b is parallel to c, so a is also parallel to c. Since c and d are consistent and independent, then c is not parallel to d and, thus, intersects d. Since a and c are parallel, then a cannot be parallel to d, so, a must intersect d and must be consistent and independent with d.

79. **OPEN ENDED** Write a system of equations in which one equation needs to be multiplied by 3 and the other needs to be multiplied by 4 in order to solve the system with elimination. Then solve your system.

ANSWER:

Sample answer:
$4x + 5y = 21$ and $3x - 2y = 10$;
(4, 1)

80. **WRITING IN MATH** Why is substitution sometimes more helpful than elimination, and vice versa?

ANSWER:

Sample answer: It is more helpful to use substitution when one of the variables has a coefficient of 1 or if a coefficient can be reduced to 1 without turning other coefficients into fractions. Otherwise, elimination is more helpful because it will avoid the use of fractions in solving the system.

81. **SHORT RESPONSE** Simplify $3y(4x + 6y - 5)$

ANSWER:

$12xy + 18y^2 - 15y$

82. **ACT/SAT** Which of the following best describes the graph of the equations?

$$4y = 3x + 8$$
$$-6x = -8y + 24$$

A The lines are parallel**.**
B The lines are perpendicular**.**
C The lines have the same x-intercept.
D The lines have the same y-intercept.
E The lines are the same.

ANSWER:
A

83. **GEOMETRY** Which set of dimensions corresponds to a triangle similar to the one shown at the right?

F 1 unit, 2 units, 3 units
G 7 units, 11 units, 12 units
H 10 units, 23 units, 24 units
J 20 units, 48 units, 52 units

ANSWER:
J

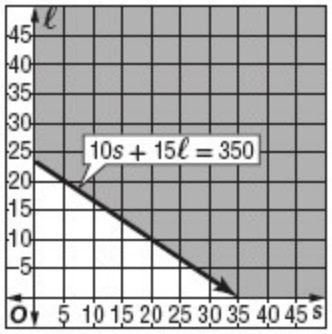
84. Move-A-Lot Rentals will rent a moving truck for $100 plus $0.10 for every mile it is driven. Which equation can be used to find C, the cost of renting a moving truck and driving it for m miles?

A $C = 0.1(100 + m)$
B $C = 100 + 0.1m$
C $C = 100m + 0.1$
D $C = 100(m + 0.1)$

ANSWER:
B

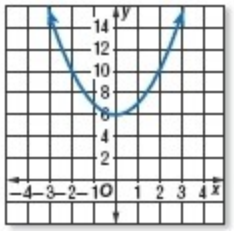
85. **CRAFTS** Priscilla sells stuffed animals at a local craft show. She charges $10 for the small ones and $15 for the large ones. To cover her expenses, she needs to sell at least $350.
a. Write an inequality for this situation.
b. Graph the inequality.
c. If she sells 10 small and 15 large animals, will she cover her expenses?

ANSWER:
a. $10s + 15l \geq 350$
b.

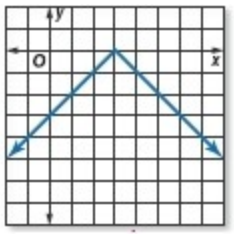


c. no

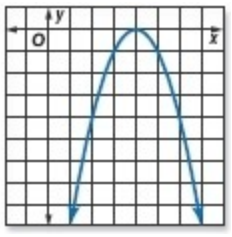
Write an equation for each function.

86. 

ANSWER:
$y = x^2 + 6$

87. 

ANSWER:
$y = -|x - 3|$

88. 

ANSWER:

$y = -(x-4)^2$

Solve each equation. Check your solution.

89. $2p = 14$

ANSWER:

7

90. $-14 + n = -6$

ANSWER:

8

91. $7a - 3a + 2a - a = 16$

ANSWER:

3.2

92. $x + 9x - 6x + 4x = 20$

ANSWER:

2.5

93. $27 = -9(y + 5) + 6(y + 8)$

ANSWER:

–8

94. $-7(p + 7) + 3(p - 4) = -17$

ANSWER:

–11

Determine whether the given point satisfies each inequality.

95. $4x + 5y \le 15; (2, -2)$

ANSWER:

yes

96. $3x + 5y \ge 8; (1, 1)$

ANSWER:

yes

97. $6x + 9y < -1; (0, 0)$

ANSWER:

no