

33. $x \leq 100y$

34. $y \geq 600x$

41. $y - \frac{7}{2}x \leq 7$

42. $\frac{2}{3}x + 3y \leq 12$

35. $3x - 4y \leq 8$

36. $2x + 5y \geq 10$

43. $x - y < 5$

44. $y - x > -3$

Graph each inequality. Use the test point method of Example 4.

37. $2x - 3y < 6$

38. $x - 4y > 4$

45. $3x - 4y < -12$

46. $4x + 3y > 24$

39. $x - 4y \leq 8$

40. $3y - 5x \geq 15$

47. $x < 5y - 100$

48. $-x > 70 - y$

15. $y > -x + 3$

16. $y < -2x + 1$

23. $x > y - 5$

24. $2x < 3y + 6$

17. $y > \frac{3}{2}x - 3$

18. $y < \frac{1}{2}x + 1$

25. $x - 2y + 4 \leq 0$

26. $2x - y + 3 \geq 0$

19. $y \leq -\frac{5}{3}x + 2$

20. $y \geq -\frac{1}{2}x + 3$

27. $y \geq 2$

28. $y < 7$

29. $x > 9$

30. $x \leq 1$

21. $y - x \geq 0$

22. $x - 2y \leq 0$

31. $x + y \leq 60$

32. $x - y \leq 90$

Find the equation of the line that goes through the given point and has the given slope. Write the answer in slope-intercept form. See Example 1.

13. $(1, 2), 3$

14. $(2, 5), 4$

15. $(2, 4), \frac{1}{2}$

16. $(4, 6), \frac{1}{2}$

17. $(2, 3), \frac{1}{3}$

18. $(1, 4), \frac{1}{4}$

19. $(-2, 5), -\frac{1}{2}$

20. $(-3, 1), -\frac{1}{3}$

21. $(-1, -7), -6$

22. $(-1, -5), -8$

Write each equation in standard form using only integers. See Example 2.

23. $y - 3 = 2(x - 5)$

24. $y + 2 = -3(x - 1)$

25. $y = \frac{1}{2}x - 3$

26. $y = \frac{1}{3}x + 5$

27. $y - 2 = \frac{2}{3}(x - 4)$

28. $y + 1 = \frac{3}{2}(x + 4)$

Find the equation of the line through each given pair of points. Write the answer in standard form using only integers. See Example 2.

29. $(1, 3), (2, 5)$

30. $(2, 5), (3, 9)$

31. $(1, 1), (2, 2)$

32. $(-1, 1), (1, -1)$

33. $(1, 2), (5, 8)$

34. $(3, 5), (8, 15)$

35. $(-2, -1), (3, -4)$

36. $(-1, -3), (2, -1)$

37. $(-2, 0), (0, 2)$

38. $(0, 3), (5, 0)$

39. $(2, 4), (2, 6)$

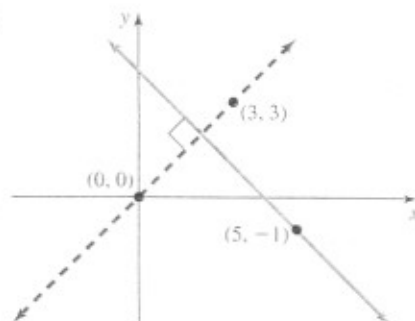
40. $(-3, 5), (-3, -1)$

41. $(-3, 9), (3, 9)$

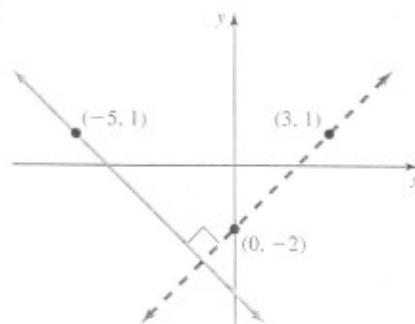
42. $(2, 5), (4, 5)$

The lines in each figure are perpendicular. Find the equation (in slope-intercept form) for the solid line.

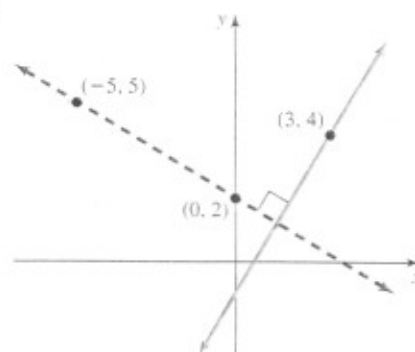
43.



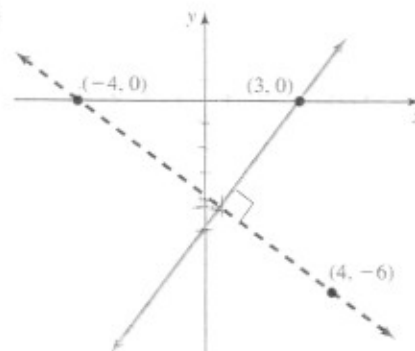
44.



45.



46.



Warm-Ups ▼

True or false?

Explain your answer.

1. The formula $y = m(x - x_1)$ is the point-slope form for a line.
2. It is impossible to find the equation of a line through $(2, 5)$ and $(-3, 1)$.
3. The point-slope form will not work for the line through $(3, 4)$ and $(3, 6)$.
4. The equation of the line through the origin with slope 1 is $y = x$.
5. The slope of the line $5x + y = 4$ is 5.
6. The slope of any line perpendicular to the line $y = 4x - 3$ is $-\frac{1}{4}$.
7. The slope of any line parallel to the line $x + y = 1$ is -1 .
8. The line $2x - y = -1$ goes through the point $(-2, -3)$.
9. The lines $2x + y = 4$ and $y = -2x + 7$ are parallel.
10. The equation of the line through $(0, 0)$ perpendicular to $y = x$ is $y = -x$.

3.4 Exercises

Boost your GRADE at mathzone.com!

MathZone 

- ▶ Practice Problems
- ▶ Self-Tests
- ▶ Videos
- ▶ Net Tutor
- ▶ e-Professors

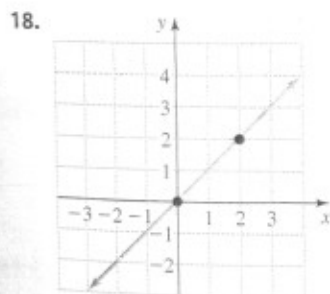
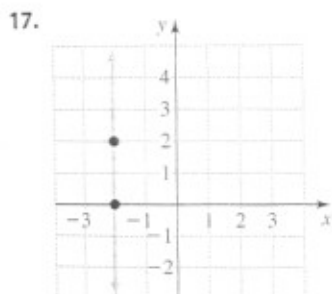
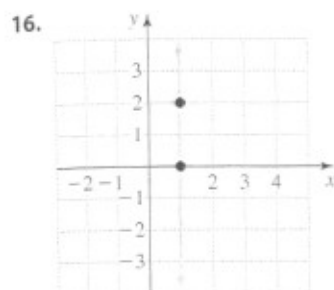
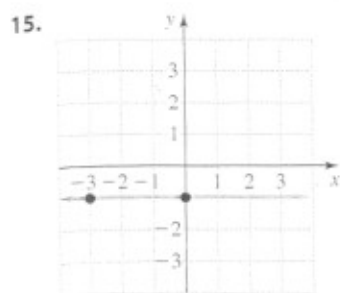
Reading and Writing After reading this section, write out the answers to these questions. Use complete sentences.

1. What is the point-slope form for the equation of a line?
2. For what is the point-slope form used?
3. What is the procedure for finding the equation of a line when given two points on the line?
4. How can you find the slope of a line when given the equation of the line?

5. What is the relationship between the slopes of parallel lines?
6. What is the relationship between the slopes of perpendicular lines?

Write each equation in slope-intercept form. See Example 1.

7. $y - 1 = 5(x + 2)$
8. $y + 3 = -3(x - 6)$
9. $3x - 4y = 80$
10. $2x + 3y = 90$
11. $y - \frac{1}{2} = \frac{2}{3}\left(x - \frac{1}{4}\right)$
12. $y + \frac{2}{3} = -\frac{1}{2}\left(x - \frac{2}{5}\right)$



Find the slope and y-intercept for each line that has a slope and y-intercept. See Example 2.

19. $y = 3x - 9$

20. $y = -5x + 4$

21. $y = -\frac{1}{2}x + 3$

22. $y = \frac{1}{4}x + 2$

23. $y = 4$

24. $y = -5$

25. $y = -3x$

26. $y = 2x$

27. $x + y = 5$

28. $x - y = 4$

29. $x - 2y = 4$

30. $x + 2y = 3$

31. $2x - 5y = 10$

32. $2x + 3y = 9$

33. $2x - y + 3 = 0$

34. $3x - 4y - 8 = 0$

35. $x = -3$

36. $\frac{2}{3}x = 4$

Write each equation in standard form using only integers. See Example 3.

37. $y = -x + 2$

38. $y = 3x - 5$

39. $y = \frac{1}{2}x + 3$

40. $y = \frac{2}{3}x - 4$

41. $y = \frac{3}{2}x - \frac{1}{3}$

42. $y = \frac{4}{5}x + \frac{2}{3}$

43. $y = -\frac{3}{5}x + \frac{7}{10}$

44. $y = -\frac{2}{3}x - \frac{5}{6}$

45. $\frac{3}{5}x + 6 = 0$

46. $\frac{1}{2}x - 9 = 0$

47. $\frac{3}{4}y = \frac{5}{2}$

48. $\frac{2}{3}y = \frac{1}{9}$

49. $\frac{x}{2} = \frac{3y}{5}$

50. $\frac{x}{8} = -\frac{4y}{5}$

51. $y = 0.02x + 0.5$

52. $0.2x = 0.03y - 0.1$

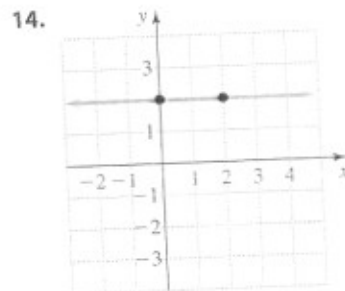
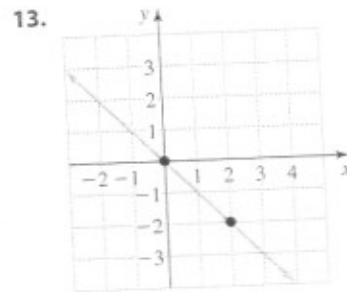
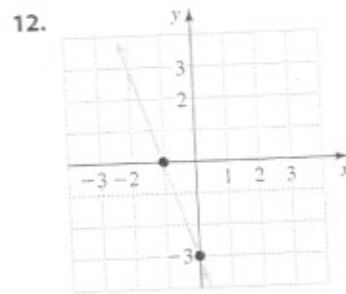
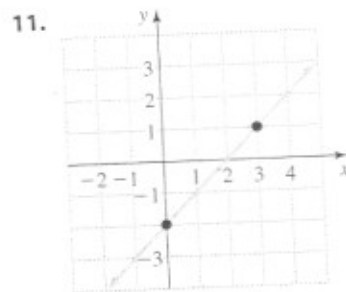
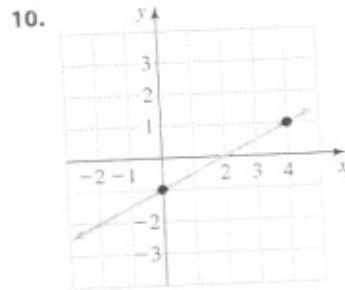
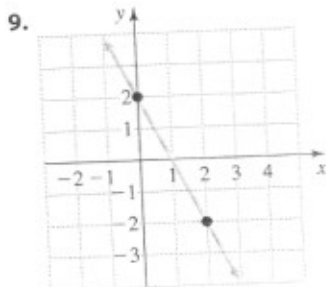
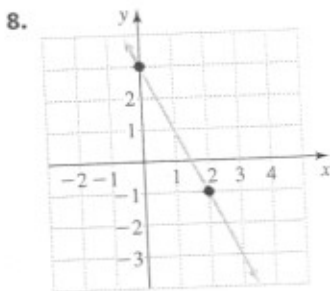
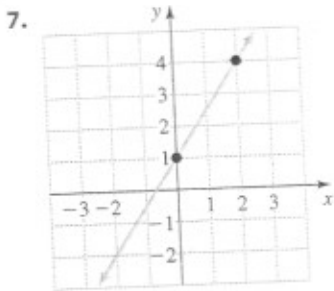
Draw the graph of each line using its y-intercept and its slope. See Examples 4 and 5.

53. $y = 2x - 1$

54. $y = 3x - 2$

- How can you determine the slope and y-intercept from the slope-intercept form?
- What is the standard form for the equation of a line?
- How can you graph a line when the equation is in slope-intercept form?
- What form is used in this section to write an equation of a line from a description of the line?
- What makes lines look perpendicular on a graph?

Write an equation for each line. Use slope-intercept form if possible. See Example 1.



48. Draw any line l_1 with slope -1 . What is the slope of any line perpendicular to l_1 ? Draw any line l_2 perpendicular to l_1 .
52. Draw l_1 through $(0, -3)$ and $(3, 0)$. What is the slope of any line perpendicular to l_1 ? Draw l_2 through the origin so that it is perpendicular to l_1 .

49. Draw l_1 through $(-2, -3)$ and $(4, 0)$. What is the slope of any line parallel to l_1 ? Draw l_2 through $(1, 2)$ so that it is parallel to l_1 .

50. Draw l_1 through $(-4, 0)$ and $(0, 6)$. What is the slope of any line parallel to l_1 ? Draw l_2 through the origin and parallel to l_1 .

51. Draw l_1 through $(-2, 4)$ and $(3, -1)$. What is the slope of any line perpendicular to l_1 ? Draw l_2 through $(1, 3)$ so that it is perpendicular to l_1 .

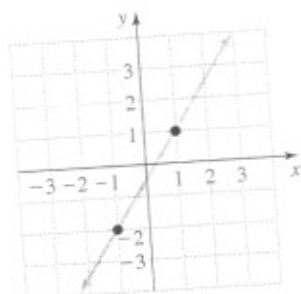
In each case, determine whether the lines l_1 and l_2 are parallel, perpendicular, or neither.

53. Line l_1 goes through $(3, 5)$ and $(4, 7)$. Line l_2 goes through $(11, 7)$ and $(12, 9)$.
54. Line l_1 goes through $(-2, -2)$ and $(2, 0)$. Line l_2 goes through $(-2, 5)$ and $(-1, 3)$.
55. Line l_1 goes through $(-1, 4)$ and $(2, 6)$. Line l_2 goes through $(2, -2)$ and $(4, 1)$.
56. Line l_1 goes through $(-2, 5)$ and $(4, 7)$. Line l_2 goes through $(2, 4)$ and $(3, 1)$.
57. Line l_1 goes through $(-1, 4)$ and $(4, 6)$. Line l_2 goes through $(-7, 0)$ and $(3, 4)$.
58. Line l_1 goes through $(1, 2)$ and $(1, -1)$. Line l_2 goes through $(4, 4)$ and $(3, 3)$.
59. Line l_1 goes through $(3, 5)$ and $(3, 6)$. Line l_2 goes through $(-2, 4)$ and $(-3, 4)$.
60. Line l_1 goes through $(-3, 7)$ and $(4, 7)$. Line l_2 goes through $(-5, 1)$ and $(-3, 1)$.

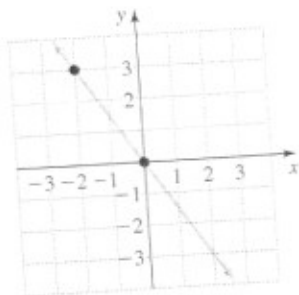
Solve each problem. See Examples 8 and 9.

61. **Super cost.** The average cost of 30-second ad during the 1998 Super Bowl was \$1.3 million, and in 2004 it was \$2.4 million (www.adage.com).
- a) Find the slope of the line through $(1998, 1.3)$ and $(2004, 2.4)$ and interpret your result.

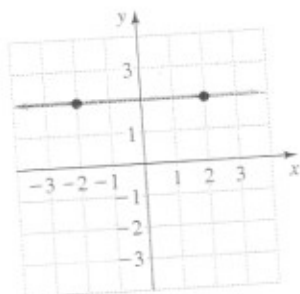
11.



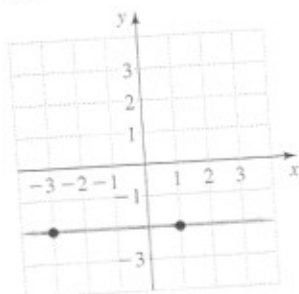
12.



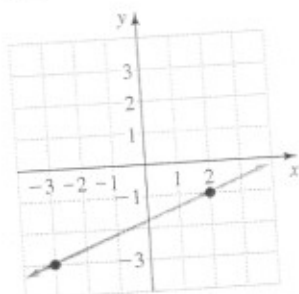
13.



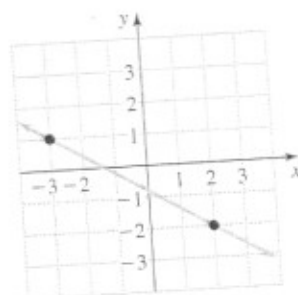
14.



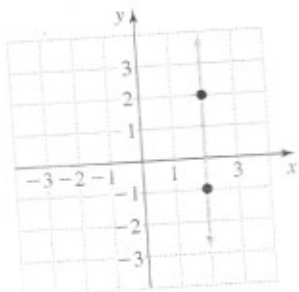
15.



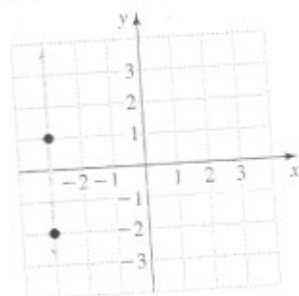
16.



17.



18.



Find the slope of the line that goes through each pair of points.
See Examples 3 and 4.

19. $(1, 2), (3, 6)$
 20. $(2, 5), (6, 10)$
 21. $(2, 4), (5, -1)$
 22. $(3, 1), (6, -2)$
 23. $(-2, 4), (5, 9)$
 24. $(-1, 3), (3, 5)$
 25. $(-2, -3), (-5, 1)$
 26. $(-6, -3), (-1, 1)$
 27. $(-3, 4), (3, -2)$
 28. $(-1, 3), (5, -2)$
 29. $(\frac{1}{2}, 2), (-1, \frac{1}{2})$
 30. $(\frac{1}{3}, 2), (-\frac{1}{3}, 1)$
 31. $(2, 3), (2, -9)$
 32. $(-3, 6), (8, 6)$
 33. $(-2, -5), (9, -5)$
 34. $(4, -9), (4, 6)$
 35. $(0.3, 0.9), (-0.1, -0.3)$
 36. $(-0.1, 0.2), (0.5, 0.8)$

Graph the line with the given point and slope. See Example 5.

37. The line through $(1, 1)$ with slope $\frac{2}{3}$

38. The line through $(2, 3)$ with slope $\frac{1}{2}$

Warm-Ups ▼


True or false?

Explain your answer.

- Slope is a measurement of the steepness of a line.
- Slope is rise divided by run.
- Every line in the coordinate plane has a slope.
- The line through the point $(1, 1)$ and the origin has slope 1.
- Slope can never be negative.
- A line with slope 2 is perpendicular to any line with slope -2 .
- The slope of the line through $(0, 3)$ and $(4, 0)$ is $\frac{3}{4}$.
- Two different lines cannot have the same slope.
- The line through $(1, 3)$ and $(-5, 3)$ has zero slope.
- Slope can have units such as feet per second.

3.2 Exercises

Boost your GRADE at mathzone.com!

MathZone 

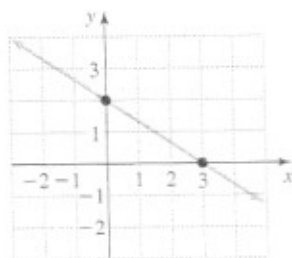
- ▶ Practice Problems ▶ Net Tutor
- ▶ Self-Tests ▶ e-Professors
- ▶ Videos

Reading and Writing After reading this section, write out the answers to these questions. Use complete sentences.

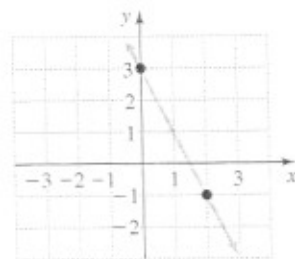
- What is the slope of a line?
- What is the difference between rise and run?
- For which lines is slope undefined?
- Which lines have zero slope?
- What is the difference between lines with positive slope and lines with negative slope?
- What is the relationship between the slopes of perpendicular lines?

In Exercises 7–18, find the slope of each line. See Examples 1 and 2.

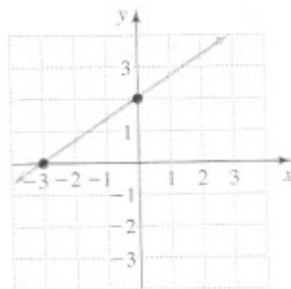
7.



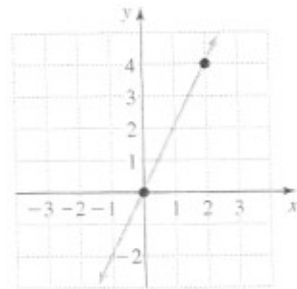
8.



9.



10.



51. $y = -3$

52. $y = 2$

61. $y = 0.36x + 0.4$

62. $y = 0.27x - 0.42$

53. $x = 2$

54. $x = -4$

For each point, name the quadrant in which it lies or the axis on which it lies.

63. $(-3, 45)$

64. $(-33, 47)$

65. $(-3, 0)$

66. $(0, -9)$

67. $(-2.36, -5)$

68. $(89.6, 0)$

69. $(3.4, 8.8)$

70. $(4.1, 44)$

71. $\left(-\frac{1}{2}, 50\right)$

72. $\left(-6, -\frac{1}{2}\right)$

73. $(0, -99)$

74. $(\pi, 0)$

55. $2x + y = 5$

56. $3x + y = 5$

Graph each equation. Plot at least five points for each equation. Use graph paper. See Example 6. If you have a graphing calculator, use it to check your graphs.

75. $y = x + 1200$

76. $y = 2x - 3000$

57. $x + 2y = 4$

58. $x - 2y = 6$

59. $x - 3y = 6$


60. $x + 4y = 5$

77. $y = 50x - 2000$

78. $y = -300x + 4500$

3.1 Exercises

Boost your GRADE at mathzone.com!

MathZone 

- ▶ Practice Problems ▶ Net Tutor
- ▶ Self-Tests ▶ e-Professors
- ▶ Videos

Reading and Writing After reading this section, write out the answers to these questions. Use complete sentences.

1. What is an ordered pair?
2. What is the rectangular coordinate system?
3. What name is given to the point of intersection of the x -axis and the y -axis?
4. What is the graph of an equation?
5. What is a linear equation in two variables?
6. What are intercepts?

Complete each ordered pair so that it satisfies the given equation. See Example 1.

7. $y = 3x + 9$: $(0, \quad)$, $(\quad, 24)$, $(2, \quad)$

8. $y = 2x + 5$: $(8, \quad)$, $(-1, \quad)$, $(\quad, -1)$

9. $y = -3x - 7$: $(0, \quad)$, $(\frac{1}{3}, \quad)$, $(\quad, -5)$

10. $y = -5x - 3$: $(-1, \quad)$, $(-\frac{1}{2}, \quad)$, $(\quad, -2)$

11. $y = 1.2x + 54.3$: $(0, \quad)$, $(10, \quad)$, $(\quad, 54.9)$

12. $y = 1.8x + 22.6$: $(1, \quad)$, $(-10, \quad)$, $(\quad, 22.6)$

13. $2x - 3y = 6$: $(3, \quad)$, $(\quad, -2)$, $(12, \quad)$

14. $3x + 5y = 0$: $(-5, \quad)$, $(\quad, -3)$, $(10, \quad)$

15. $0 \cdot y + x = 5$: $(\quad, -3)$, $(\quad, 5)$, $(\quad, 0)$

16. $0 \cdot x + y = -6$: $(3, \quad)$, $(-1, \quad)$, $(4, \quad)$

Plot the points on a rectangular coordinate system. See Example 2.

17. $(1, 5)$

18. $(4, 3)$

19. $(-2, 1)$

20. $(-3, 5)$

21. $(3, -\frac{1}{2})$

22. $(2, -\frac{1}{3})$

23. $(-2, -4)$

24. $(-3, -5)$

25. $(0, 3)$

26. $(0, -2)$

27. $(-3, 0)$

28. $(5, 0)$

29. $(\pi, 1)$

30. $(-2, \pi)$

31. $(1.4, 4)$

32. $(-3, 0.4)$

Use the given equations to find the missing coordinates in the following tables.

33. $y = -2x + 5$

x	y
-2	
0	
2	
	-3
	-7

34. $y = -x + 4$

x	y
-2	
0	
2	
	0
	-2