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CHAPTER 2 GRAPHING LINEAR EQUATIONS

2.1 THE RECTANGULAR COORDINATE SYSTEM; EQUATIONS IN TWO VARIABLES

1. $Ax + By = C$

2. ordered pair

3. origin

4. line

5. x-intercept

6. y-intercept

7. vertical

8. horizontal

9. Substitute 0 for y and solve for x.

10. Substitute 0 for x and solve for y.

11. $7(2)-3(-6)=-4$

$14+18=-4$

$32=-4$

No.

12. $2(-6)+9(3)=39$

$-12+27=39$

$15=39$

No.

13. $7=\frac{2}{3}(12)-1$

$7=8-1$

$7=7$

Yes.

14. $-5=\frac{3}{4}(8)-11$

$-5=6-11$

$-5=-5$

Yes.

15. $-3(12)+13(0)=-36$

$-36+0=-36$

$-36=-36$

Yes.

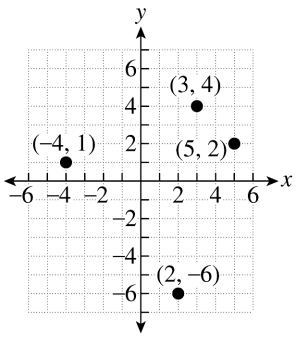
16. $9(0)-4(6)=-24$

$0-24=-24$

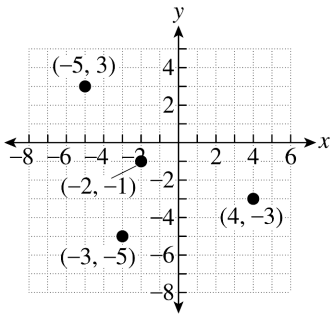
$-24=-24$

Yes.

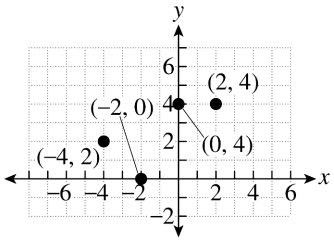
17.



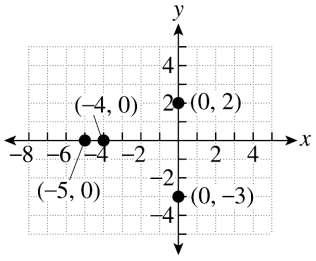
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19.



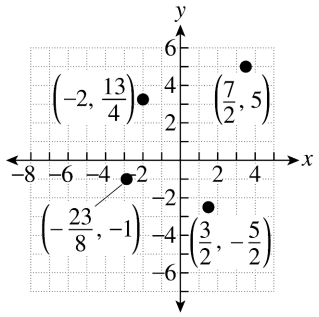
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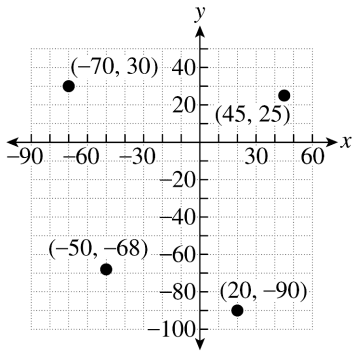
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21.



22.



23. $A(-3,1)$, $B(2,-5)$, $C(-6,-4)$, $D(0,3)$

24. $A(5,1)$, $B(1,5)$, $C(-2,4)$, $D(-4,0)$

25. $A(30,-15)$, $B(-40,0)$, $C(-10,-30)$, $D(-15,15)$

26. $A(-5,0)$, $B\left(-\frac{5}{2},\frac{5}{2}\right)$, $C\left(1,\frac{9}{2}\right)$, $D\left(\frac{3}{2},-3\right)$

27. III

28. II

29. IV

30. I

31. II

32. IV

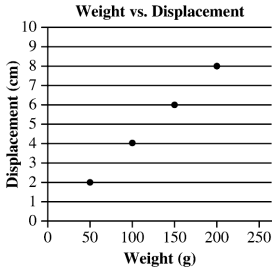
33. I

34. III

35. Given the data

Weight (g)	50	100	150	200
Displacement (cm)	2	4	6	8

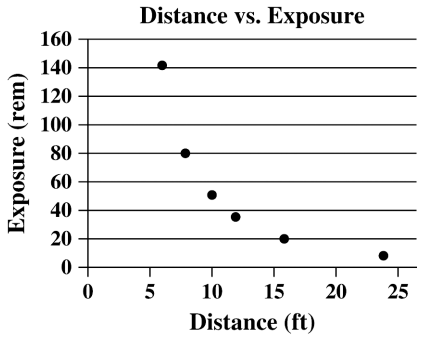
we plot the ordered pairs (50, 2), (100, 4), (150, 6), and (200, 8).



36. Given the data

Distance (ft)	6	8	10	12	16	24
Exposure (rem)	142	80	51	36	20	9

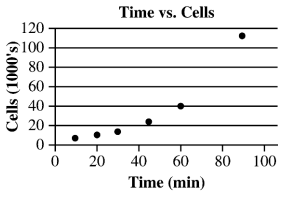
we plot the ordered pairs (6, 142), (8, 80), (10, 51), (12, 36), (16, 20), (24, 9).



37. Given the data

Time (min)	10	20	30	45	60	90
Cells (1000s)	7	10	14	24	40	113

we plot the ordered pairs (10, 7), (20, 10), (30, 14), (45, 24), (60, 40), (90, 113).



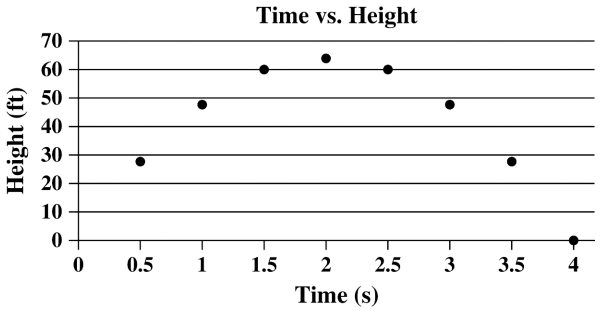
38. Given the data

Time (s)	0.5	1	1.5	2	2.5	3	3.5	4
Height (ft)	28	48	60	64	60	48	28	0

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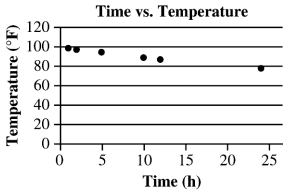
we plot the ordered pairs (0.5, 28), (1, 48), (1.5, 60), (2, 64), (2.5, 60), (3, 48), (3.5, 28), (4, 0).



39. Given the data

Time (h)	1	2	5	10	12	24
Temperature (°F)	98	97	94	89	87	78

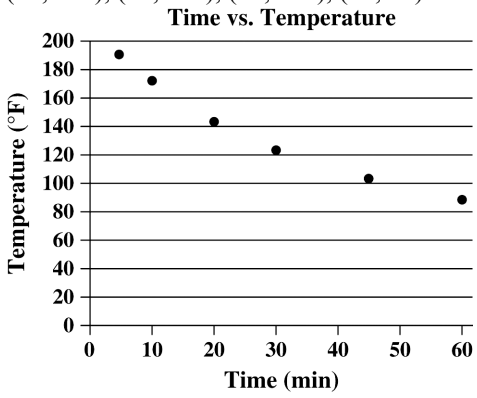
we plot the ordered pairs (1, 98), (2, 97), (5, 94), (10, 89), (12, 87), (24, 78).



40. Given the data

Time (min)	5	10	20	30	45	60
Temperature (°F)	190	172	143	123	102	89

we plot the ordered pairs (5, 190), (10, 172), (20, 143), (30, 123), (45, 102), (60, 89).



41. $5(8)-4y=12$
$40-4y=12$
$-4y=-28$
$y=7$

42. $x+6(3)=31$
$x+18=31$
$x=13$

43. $6x-7(-5)=17$
$6x+35=17$
$6x=-18$
$x=-3$

44. $9(-6)+2y=30$
$-54+2y=30$
$2y=84$
$y=42$

45. $\frac{1}{5}(10)+3y=20$
$2+3y=20$
$3y=18$
$y=6$

46. $6\left(\frac{2}{3}\right)+2y=9$
$4+2y=9$
$2y=5$
$y=\frac{5}{2}$

47. $5x-3y=-12$

When $x=-3$,
$5(-3)-3y=-12$
$-15-3y=-12$
$-3y=3$
$y=-1$

When $x=0$,
$5(0)-3y=-12$
$-3y=-12$
$y=4$

When $x=3$,
$5(3)-3y=-12$
$15-3y=-12$
$-3y=-27$
$y=9$

x	y
−3	−1
0	4
3	9

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48. $-2x+4y=-16$

When $x=-2$,
$-2(-2)+4y=-16$
$4+4y=-16$
$4y=-20$
$y=-5$

When $x=0$
$-2(0)+4y=-16$
$4y=-16$
$y=-4$

When $x=2$,
$-2(2)+4y=-16$
$-4+4y=-16$
$4y=-12$
$y=-3$

x	y
-2	-5
0	-4
2	-3

49. $y=4x-9$

When $x=0$,
$y=4(0)-9$
$y=-9$

When $x=1$,
$y=4(1)-9$
$y=-5$

When $x=\frac{3}{2}$,
$y=4\left(\frac{3}{2}\right)-9$
$y=6-9$
$y=-3$

x	y
0	-9
1	-5
$\frac{3}{2}$	-3

50. $y=-3x+5$

When $x=0$,
$y=-3(0)+5$
$y=5$

When $x=\frac{1}{3}$,
$y=-3\left(\frac{1}{3}\right)+5$
$y=-1+5$
$y=4$

When $x=2$,
$y=-3(2)+5$
$y=-6+5$
$y=-1$

x	y
0	5
$\frac{1}{3}$	4
2	-1

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

When $x=-3$,
$y=\frac{2}{3}(-3)-2$
$y=-2-2$
$y=-4$

When $x=0$,
$y=\frac{2}{3}(0)-2$
$y=-2$

When $x=6$,
$y=\frac{2}{3}(6)-2$
$y=4-2$
$y=2$

x	y
-3	-4
0	-2
6	2

52. $y=\frac{7}{5}x+1$

When $x=-3$,
$y=\frac{2}{3}(-3)-2$
$y=-2-2$
$y=-4$

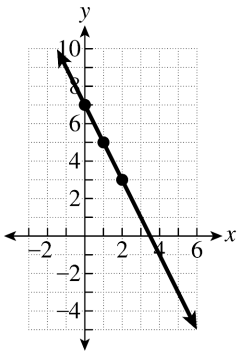
When $x=0$,
$y=\frac{2}{3}(0)-2$
$y=-2$

When $x=6$,
$y=\frac{2}{3}(6)-2$
$y=4-2$
$y=2$

x	y
-3	-4
0	-2
6	2

53. $y=-2x+7$

$x=0$	$x=1$	$x=2$
$y=-2(0)+7$ $y=7$	$y=-2(1)+7$ $y=-2+7$ $y=5$	$y=-2(2)+7$ $y=-4+7$ $y=3$
$(0,7)$	$(1,5)$	$(2,3)$

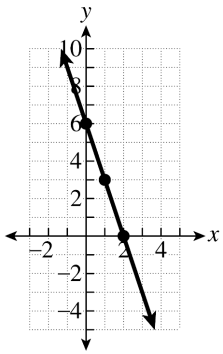


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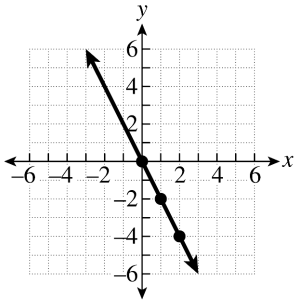
54. $y = -3x + 6$

$x = 0$	$x = 1$	$x = 2$
$y = -3(0) + 6$ $y = 6$	$y = -3(1) + 6$ $y = -3 + 6$ $y = 3$	$y = -3(2) + 6$ $y = -6 + 6$ $y = 0$
$(0, 6)$	$(1, 3)$	$(2, 0)$



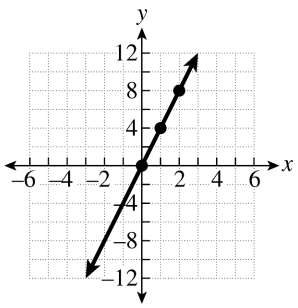
55. $y = -2x$

$x = 0$	$x = 1$	$x = 2$
$y = -2(0)$ $y = 0$	$y = -2(1)$ $y = -2$	$y = -2(2)$ $y = -4$
$(0, 0)$	$(1, -2)$	$(2, -4)$



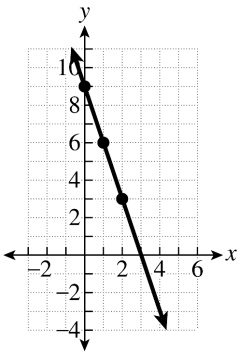
56. $y = 4x$

$x = 0$	$x = 1$	$x = 2$
$y = 4(0)$ $y = 0$	$y = 4(1)$ $y = 4$	$y = 4(2)$ $y = 8$
$(0, 0)$	$(1, 4)$	$(2, 8)$



57. $3x + y = 9$

$x = 0$	$x = 1$	$x = 2$
$3(0) + y = 9$ $y = 9$	$3(1) + y = 9$ $3 + y = 9$ $y = 6$	$3(2) + y = 9$ $6 + y = 9$ $y = 3$
$(0, 9)$	$(1, 6)$	$(2, 3)$

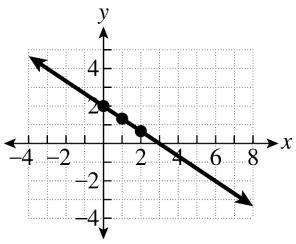


58. $2x + 3y = 6$

$x = 0$	$x = 1$	$x = 2$
$2(0) + 3y = 6$ $3y = 6$ $y = 2$	$2(1) + 3y = 6$ $2 + 3y = 6$ $3y = 4$ $y = \frac{4}{3}$	$2(2) + 3y = 6$ $4 + 3y = 6$ $3y = 2$ $y = \frac{2}{3}$
$(0, 2)$	$\left(1, \frac{4}{3}\right)$	$\left(2, \frac{2}{3}\right)$

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59. x-intercept: $(-3,0)$, y-intercept: $(0,6)$

60. x-intercept: $(3,0)$, y-intercept: $(0,-9)$

61. x-intercept: $(1,0)$, y-intercept: $(0,5)$

62. x-intercept: $(2,0)$, y-intercept: $(0,8)$

63. x-intercept: none, y-intercept: $(0,2)$

64. x-intercept: $(-7,0)$, y-intercept: none

65. $x+y=-5$

x-intercept:
$x+0=-5$
$x=-5$
$(-5,0)$

y-intercept:
$0+y=-5$
$y=-5$
$(0,-5)$

66. $x-y=-6$

x-intercept:
$x-0=-6$
$x=-6$
$(-6,0)$

y-intercept:
$0-y=-6$
$-y=-6$
$y=6$
$(0,6)$

67. $3x+2y=24$

x-intercept:
$3x+2(0)=24$
$3x=24$
$x=8$
$(8,0)$

y-intercept:
$3(0)+2y=24$
$2y=24$
$y=12$
$(0,12)$

68. $4x+5y=-40$

x-intercept:
$4x+5(0)=-40$
$4x=-40$
$x=-10$
$(-10,0)$

y-intercept:
$4(0)+5y=-40$
$5y=-40$
$y=-8$
$(0,-8)$

69. $6x-7y=-126$

x-intercept:
$6x-7(0)=-126$
$6x=-126$
$x=-21$
$(-21,0)$

y-intercept:
$6(0)-7y=-126$
$-7y=-126$
$y=18$
$(0,18)$

70. $-x+8y=16$

x-intercept:
$-x+8(0)=16$
$-x=16$
$x=-16$
$(-16,0)$

y-intercept:
$-(0)+8y=16$
$8y=16$
$y=2$
$(0,2)$

71. $\frac{3}{5}x+\frac{1}{2}y=3$

x-intercept:
$\frac{3}{5}x+\frac{1}{2}(0)=3$
$\frac{3}{5}x=3$
$x=\frac{3}{1}\cdot\frac{5}{3}$
$x=5$
$(5,0)$

y-intercept:
$\frac{3}{5}(0)+\frac{1}{2}y=3$
$\frac{1}{2}y=3$
$y=6$
$(0,6)$

72. $\frac{2}{9}x-\frac{1}{12}y=\frac{2}{3}$

x-intercept:
$\frac{2}{9}x-\frac{1}{12}(0)=\frac{2}{3}$
$\frac{2}{9}x=\frac{2}{3}$
$x=\frac{2}{3}\cdot\frac{9}{2}$
$x=3$
$(3,0)$

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y-intercept:

$$\frac{2}{9}(0)-\frac{1}{12}y=\frac{2}{3}$$
$$-\frac{1}{12}y=\frac{2}{3}$$
$$y=\frac{2}{3}\cdot\left(-\frac{12}{1}\right)$$
$$y=-8$$

$(0,-8)$

73. $y=5x-12$

x-intercept:

$0=5x-12$

$12=5x$

$\frac{12}{5}=x$

$\left(\frac{12}{5},0\right)$

y-intercept:

$y=5(0)-12$

$y=-12$

$(0,-12)$

74. $y=-3x-8$

x-intercept:

$0=-3x-8$

$3x=-8$

$x=-\frac{8}{3}$

$\left(-\frac{8}{3},0\right)$

y-intercept:

$y=-3(0)-8$

$y=-8$

$(0,-8)$

75. $y=-2x$

x-intercept:

$0=-2x$

$0=x$

$(0,0)$

y-intercept:

$y=-2(0)$

$y=0$

$(0,0)$

76. $y=3x$

x-intercept:

$0=3x$

$0=x$

$(0,0)$

y-intercept:

$y=3(0)$

$y=0$

$(0,0)$

77. $x+y=4$

x-intercept:

$x+0=4$

$x=4$

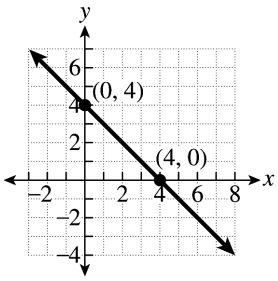
$(4,0)$

y-intercept:

$0+y=4$

$y=4$

$(0,4)$



78. $x-y=6$

x-intercept:

$x-0=6$

$x=6$

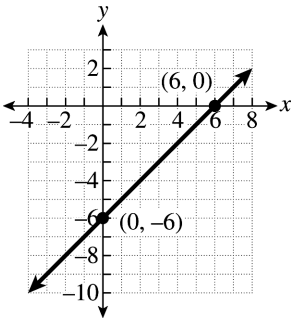
$(6,0)$

y-intercept:

$0-y=6$

$y=-6$

$(0,-6)$



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79. $4x-3y=12$

x-intercept:

$4x-3(0)=12$

$4x=12$

$x=3$

$(3,0)$

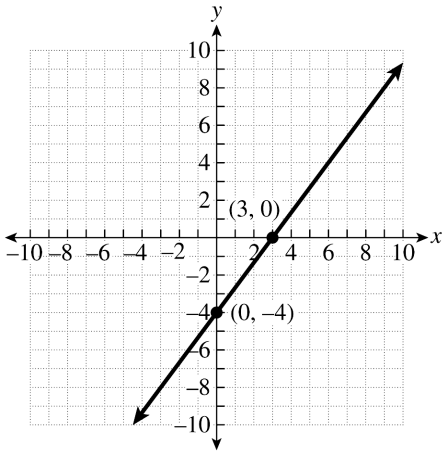
y-intercept:

$4(0)-3y=12$

$-3y=12$

$y=-4$

$(0,-4)$



80. $-6x+2y=18$

x-intercept:

$-6x+2(0)=18$

$-6x=18$

$x=-3$

$(-3,0)$

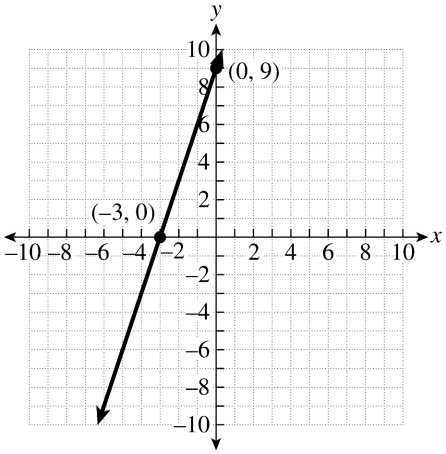
y-intercept:

$-6(0)+2y=18$

$2y=18$

$y=9$

$(0,9)$



81. $2x+5y=-20$

x-intercept:

$2x+5(0)=-20$

$2x=-20$

$x=-10$

$(-10,0)$

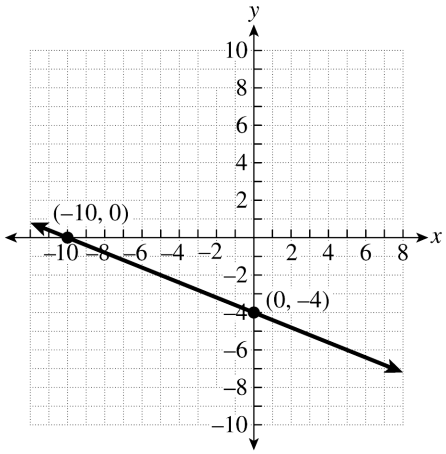
y-intercept:

$2(0)+5y=-20$

$5y=-20$

$y=-4$

$(0,-4)$



82. $x-3y=-9$

x-intercept:

$x-3(0)=-9$

$x=-9$

$(-9,0)$

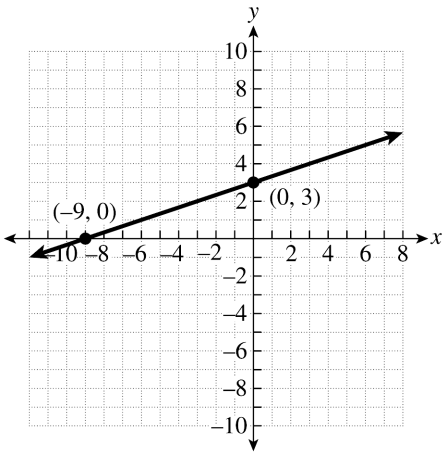
y-intercept:

$0-3y=-9$

$-3y=-9$

$y=3$

$(0,3)$



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83. $-4x+7y=14$

x-intercept:

$-4x+7(0)=14$

$-4x=14$

$x=-\frac{14}{4}$

$x=-\frac{7}{2}$

$\left(-\frac{7}{2},0\right)$

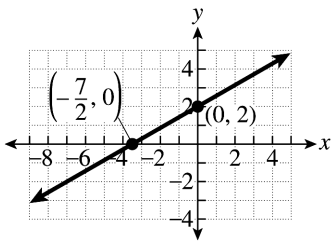
y-intercept:

$-4(0)+7y=14$

$7y=14$

$y=2$

$(0,2)$



84. $3x-4y=18$

x-intercept:

$3x-4(0)=18$

$3x=18$

$x=6$

$(6,0)$

y-intercept:

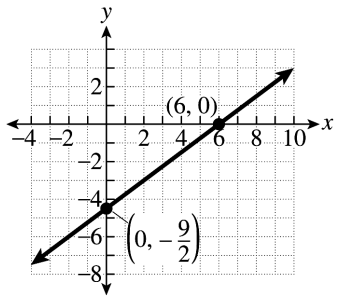
$3(0)-4y=18$

$-4y=18$

$y=\frac{18}{-4}$

$y=-\frac{9}{2}$

$\left(0,-\frac{9}{2}\right)$



85. $y=3x-6$

x-intercept:

$0=3x-6$

$6=3x$

$2=x$

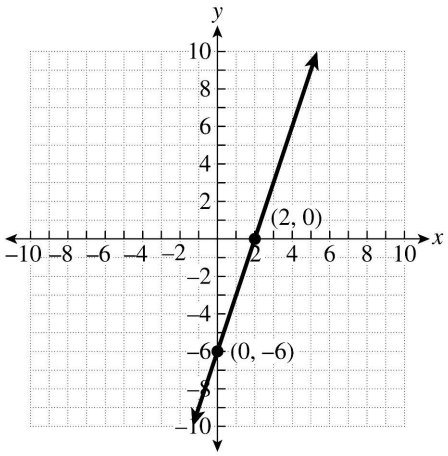
$(2,0)$

y-intercept:

$y=3(0)-6$

$y=-6$

$(0,-6)$



86. $y=-2x-4$

x-intercept:

$0=-2x-4$

$2x=-4$

$x=-2$

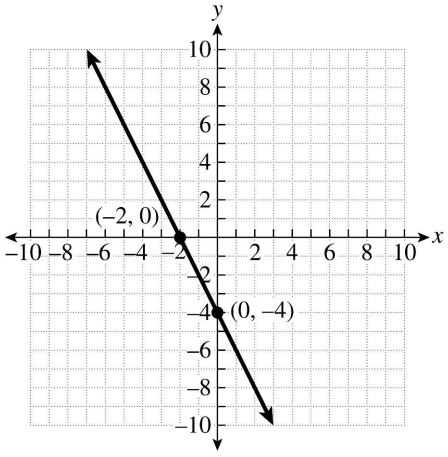
$(-2,0)$

y-intercept:

$y=-2(0)-4$

$y=-4$

$(0,-4)$



87. $y=-6x$

x-intercept:

$0=-6x$

$0=x$

$(0,0)$

y-intercept:

$y=-6(0)$

$y=0$

$(0,0)$

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The line passes through the origin.

2nd point at $x = 1$:

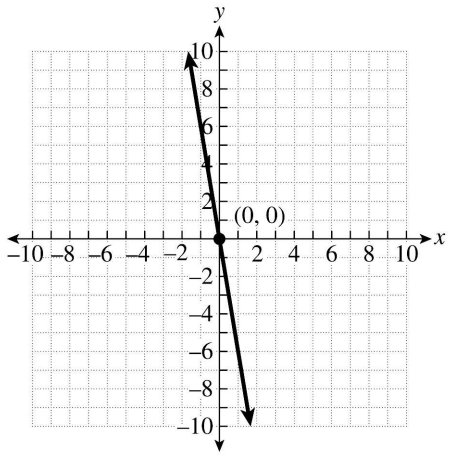
$y = -6(1) = -6$

$(1, -6)$

3rd point at $x = -1$:

$y = -6(-1) = 6$

$(-1, 6)$



88. $y = 2x$

x-intercept:

$0 = 2x$

$0 = x$

$(0, 0)$

y-intercept:

$y = 2(0)$

$y = 0$

$(0, 0)$

The line passes through the origin.

2nd point at $x = 1$:

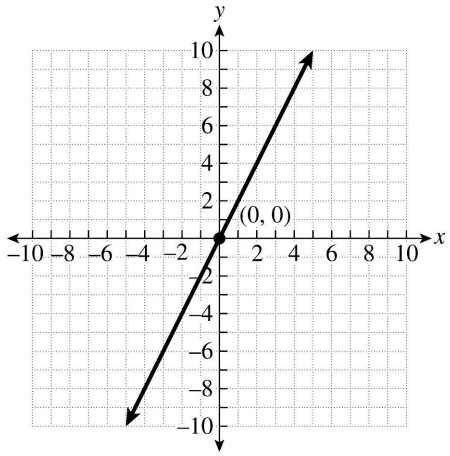
$y = 2(1) = 2$

$(1, 2)$

3rd point at $x = -1$:

$y = 2(-1) = -2$

$(-1, -2)$



89. $2x - 3y = 0$

x-intercept:

$2x - 3(0) = 0$

$2x = 0$

$x = 0$

$(0, 0)$

y-intercept:

$2(0) - 3y = 0$

$-3y = 0$

$y = 0$

$(0, 0)$

The line passes through the origin.

2nd point at $x = 3$:

$2(3) - 3y = 0$

$6 - 3y = 0$

$-3y = -6$

$\frac{-3y}{-3} = \frac{-6}{-3}$

$y = 2$

$(3, 2)$

3rd point at $x = -3$:

$2(-3) - 3y = 0$

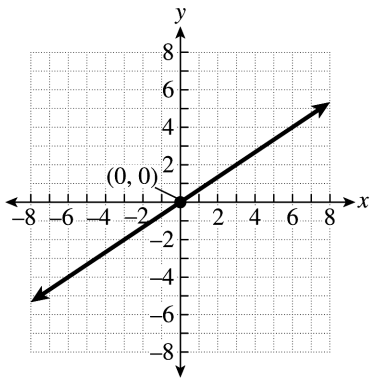
$-6 - 3y = 0$

$-3y = 6$

$\frac{-3y}{-3} = \frac{6}{-3}$

$y = -2$

$(-3, -2)$



90. $3x + 5y = 0$

x-intercept:

$3x + 5(0) = 0$

$3x = 0$

$x = 0$

$(0, 0)$

y-intercept:

$3(0) + 5y = 0$

$5y = 0$

$y = 0$

$(0, 0)$

The line passes through the origin.

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2nd point at $x = 5$:

$3(5) + 5y = 0$

$15 + 5y = 0$

$5y = -15$

$\frac{5y}{5} = \frac{-15}{5}$

$y = -3$

$(5, -3)$

3rd point at $x = -5$:

$3(-5) + 5y = 0$

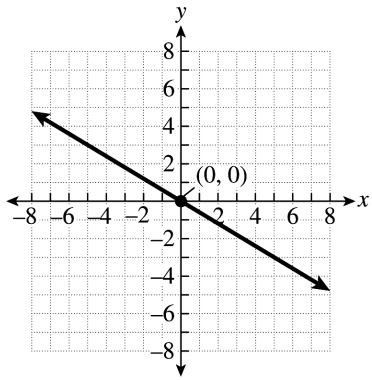
$-15 + 5y = 0$

$5y = 15$

$\frac{5y}{5} = \frac{15}{5}$

$y = 3$

$(-5, 3)$



91. $y = 4$

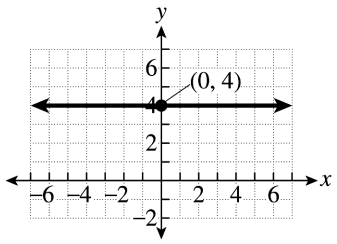
x-intercept:

none

y-intercept:

$y = 4$

$(0, 4)$



92. $y = -6$

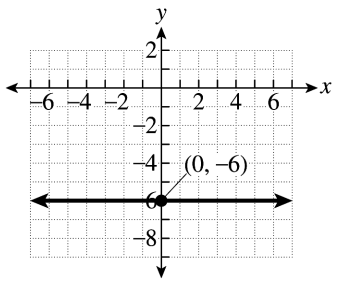
x-intercept:

none

y-intercept:

$y = -6$

$(0, -6)$



93. $x = 3$

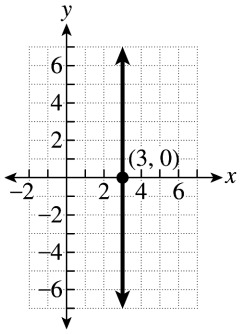
x-intercept:

$x = 3$

$(3, 0)$

y-intercept:

none



94. $x = -8$

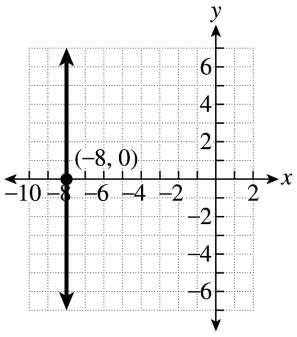
x-intercept:

$x = -8$

$(-8, 0)$

y-intercept:

none



95. a) $y = 12{,}000 - 1500(0)$

$y = 12{,}000$

$(0, 12{,}000)$

The original value of the copy machine is \$12,000.

b) $0 = 12{,}000 - 1500x$

$1500x = 12{,}000$

$x = \frac{12{,}000}{1500}$

$x = 8$

$(8, 0)$

The copy machine has no value after 8 years.

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c) $y = 12{,}000 - 1500(3)$
$y = 12{,}000 - 4500$
$y = 7500$
\$7500

96. a) $y = 400 - 8(0)$
$y = 400$
$(0, 400)$
The original sentence is 400 hours.

b) $0 = 400 - 8x$
$8x = 400$
$x = \frac{400}{8}$
$x = 50$
$(50, 0)$
After 50 Saturdays, there are no more required hours.

c) $y = 400 - 8(12)$
$y = 400 - 96$
$y = 304$
304 hours

97. a) $y = 300 + 24(0)$
$y = 300$
$(0, 300)$
The cost to belong to the club is \$300.

b) Because the minimum cost is \$300, the cost to a member cannot be \$0.

c) $y = 300 + 24(50)$
$y = 300 + 1200$
$y = 1500$
\$1500

98. a) $y = 185(0) + 200$
$y = 0 + 200$
$y = 200$
$(0, 200)$
This is not possible because a student must be taking some units.

b) The cost for a student cannot be less than \$200.

c) $y = 185(12) + 200$
$y = 2220 + 200$
$y = 2420$
\$2420

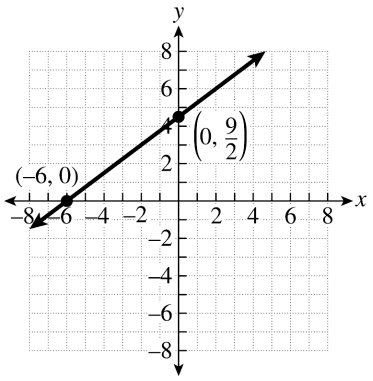
99. Explanations will vary. Example:
Order is important so that the reader will know which is the x-coordinate and which is the y-coordinate. There is a difference between the points (a, b) and (b, a).

100. IV; I; Explanations will vary. Example:
If (a, b) is in quadrant II then (b, a) is in quadrant IV, since a is negative and b is positive. The point $(-a, b)$ is in quadrant I because of the same reasoning.

101. Answers will vary. Example:
$3x - 4y = 18$

x-intercept:
$3x - 4(0) = 18$
$3x = 18$
$x = 6$
$(6, 0)$

y-intercept:
$3(0) - 4y = 18$
$-4y = 18$
$y = -\frac{18}{4}$
$y = -\frac{9}{2}$
$\left(0, -\frac{9}{2}\right)$



102. The only solution of the first equation is the value of x that makes the equation true. The solutions of the second equation are ordered pairs (x, y), and there are infinitely many of them.

103. The ordered pair (2, 5) is 2 units to the right and 5 units above the origin. The ordered pair is 5 units to the right and 2 units above the origin.

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104. To find the x-intercept, substitute 0 for y and solve for x. To find the y-intercept, substitute 0 for x and solve for y.

105. Select a nonzero value to substitute for x and solve the resulting equation for y.

2.2 SLOPE OF A LINE

1. slope

2. positive

3. negative

4. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

5. horizontal

6. vertical

7. slope–intercept

8. y

9. parallel

10. perpendicular

11. negative

12. positive

13. positive

14. negative

15. $-\dfrac{2}{4} = -\dfrac{1}{2}$

16. $\dfrac{3}{6} = \dfrac{1}{2}$

17. $-\dfrac{3}{4}$

18. $-\dfrac{4}{4} = -1$

19. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{13-7}{3-2} = \dfrac{6}{1} = 6$

20. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{1-5}{6-4} = \dfrac{-4}{2} = -2$

21. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-17-3}{-9-(-4)} = \dfrac{-20}{-5} = 4$

22. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{6-(-6)}{-2-1} = \dfrac{12}{-3} = -4$

23. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{14-8}{3-7} = \dfrac{6}{-4} = -\dfrac{3}{2}$

24. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{7-(-3)}{4-(-2)} = \dfrac{10}{6} = \dfrac{5}{3}$

25. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-24-(-4)}{25-17} = \dfrac{-20}{8} = -\dfrac{5}{2}$

26. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{47-45}{12-22} = \dfrac{2}{-10} = -\dfrac{1}{5}$

27. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-8-(-8)}{-9-5} = \dfrac{0}{-14} = 0$

28. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{4-(-4)}{5-5} = \dfrac{8}{0}$ undefined

29. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{98.2-102.7}{5-2} = \dfrac{-4.5}{3} = -1.5$

30. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{71-47.6}{7.6-5.2} = \dfrac{23.4}{2.4} = 9.75$

31. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{\frac{31}{6} - \frac{19}{3}}{\frac{5}{2} - \frac{3}{4}} = \dfrac{\frac{31}{6} - \frac{38}{6}}{\frac{10}{4} - \frac{3}{4}}$

$$= \frac{-\frac{7}{6}}{\frac{7}{4}} = -\frac{7}{6} \cdot \frac{4}{7} = -\frac{4}{6} = -\frac{2}{3}$$

32. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{227{,}000 - 539{,}000}{\frac{3}{5} - \frac{1}{2}}$

$$= \frac{-312{,}000}{\frac{6}{10} - \frac{5}{10}} = \frac{-312{,}000}{\frac{1}{10}}$$

$$= -312{,}000 \cdot \frac{10}{1} = -3{,}120{,}000$$

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33. Let y represent the concentration in moles and let x represent the time in seconds. We can write the ordered pair (0, 2) which represents the initial condition: a concentration of 2 moles after 0 seconds. We can then write the ordered pair (12, 1.4) which represents the concentration after 12 seconds. To find the rate of change of the concentration of this enzyme, find the slope of the line that would pass through the points (0, 2) and (12, 1.4). Using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \frac{1.4 - 2}{12 - 0} = \frac{-0.6}{12} = -0.05$. The rate of change of the enzyme is -0.05 mol/s.

34. Let y represent the voltage in volts and let x represent the current in amps. We can write the ordered pair (4.8, 12) which represents the initial condition: 12 volts at 4.8 amps. We can then write the ordered pair (7.2, 18) which represents 18 volts at 7.2 amps. To find the rate of change of the voltage with respect to the current, find the slope of the line that would pass through the points (4.8, 12) and (7.2, 18). Using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \frac{18 - 12}{7.2 - 4.8} = \frac{6}{2.4} = 2.5$. The rate of change of the voltage with respect to the current is 2.5 V/A.

35. Let y represent the horizontal distance traveled in meters and let x represent the time in seconds. We can write the ordered pair (4, 282.8) which represents the initial condition: 282.8 meters traveled in 4 seconds. We can then write the ordered pair (11, 777.7) which represents a distance of 777.7 meters traveled in 11 seconds. To find the rate of change of the horizontal distance traveled with respect to the time traveled, find the slope of the line that would pass through the points (4, 282.8) and (11, 777.7). Using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \frac{777.7 - 282.8}{11 - 4} = \frac{494.9}{7} = 70.7$. The rate of change of the horizontal distance traveled with respect to time is 70.7 m/s.

36. Let y represent the horizontal distance traveled in feet and let x represent the time in seconds. We can write the ordered pair (1, 69) which represents the initial condition: 69 feet traveled after 1 second. We can then write the ordered pair (1.5, 104) which represents a distance of 104 feet traveled after 1.5 seconds. To find the rate of change of the horizontal distance traveled with respect to the time traveled, find the slope of the line that would pass through the points (1, 69) and (1.5, 104). Using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \frac{104 - 69}{1.5 - 1} = \frac{35}{0.5} = 70$. The rate of change of the horizontal distance traveled with respect to time is 70 ft/s.

37. Let y represent the stopping distance measured in feet and let x represent the speed in miles per hour. We can write the ordered pair (50, 200) which represents the initial condition: a distance of 200 feet needed to stop when traveling 50 miles per hour. We can then write the ordered pair (30, 80) which represents a distance of 80 feet needed to stop when traveling 30 miles per hour. To find the rate of change of the stopping distance for the car with respect to the car's speed, find the slope of the line that would pass through the points (50, 200) and (30, 80). Using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \frac{80 - 200}{30 - 50} = \frac{-120}{-20} = 6$. The rate of change of the stopping distance of the car with respect to the car's speed is 6 ft/mph.

38. Let y represent the velocity in meter per second and x represent the time in seconds. We can write the ordered pair (1.5, 14.5) which is the initial condition: a velocity of 14.5 meters per second after 1.5 seconds. We can then write the ordered pair (2.25, 21.85) which represents a

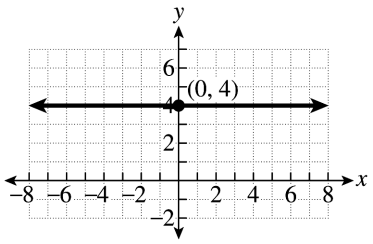
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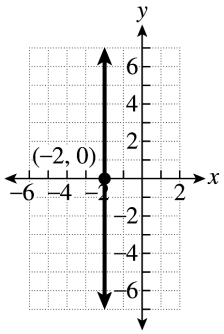
velocity of 21.85 meters per second after 2.25 seconds. To find the rate of change of the velocity with respect to time, find the slope of the line that would pass through the points (1.5, 14.5) and (2.25, 21.85). Using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \frac{21.85 - 14.5}{2.25 - 1.5} = \frac{7.35}{0.75} = 9.8$. The rate of change of the velocity of the falling ball with respect to time is $9.8\,\text{m/s}^2$.

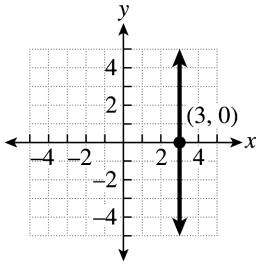
39. y-intercept: $(0,4)$, $m = 0$



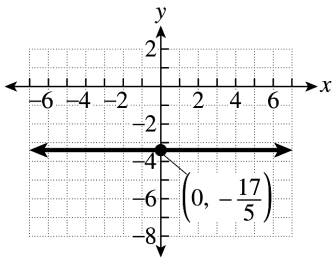
40. x-intercept: $(-2,0)$, m is undefined



41. x-intercept: $(3,0)$, m is undefined



42. y-intercept: $\left(0, -\frac{17}{5}\right)$, $m = 0$



43. $y = 6x - 7$

$m = 6$, y-intercept: $(0,-7)$

44. $y = 4x + 11$

$m = 4$, y-intercept: $(0,11)$

45. $y = -2x + 3$

$m = -2$, y-intercept: $(0,3)$

46. $y = -5x - 8$

$m = -5$, y-intercept: $(0,-8)$

47. $10x + 6y = -18$

$6y = -10x - 18$

$y = -\frac{10}{6}x - \frac{18}{6}$

$y = -\frac{5}{3}x - 3$

$m = -\frac{5}{3}$, y-intercept: $(0,-3)$

48. $3x + 4y = -36$

$4y = -3x - 36$

$y = -\frac{3}{4}x - \frac{36}{4}$

$y = -\frac{3}{4}x - 9$

$m = -\frac{3}{4}$, y-intercept: $(0,-9)$

49. $7x - 8y = 14$

$-8y = -7x + 14$

$y = -\frac{-7}{-8}x + \frac{14}{-8}$

$y = \frac{7}{8}x - \frac{7}{4}$

$m = \frac{7}{8}$, y-intercept: $\left(0, -\frac{7}{4}\right)$

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50. $9x-6y=9$

$-6y=-9x+9$

$y=-\frac{-9}{-6}x+\frac{9}{-6}$

$y=\frac{3}{2}x-\frac{3}{2}$

$m=\frac{3}{2}$, y-intercept: $\left(0,-\frac{3}{2}\right)$

51. $x+3y=12$

$3y=-x+12$

$y=\frac{-1}{3}x+\frac{12}{3}$

$y=-\frac{1}{3}x+4$

$m=-\frac{1}{3}$, y-intercept: $(0,4)$

52. $x-6y=6$

$-6y=-x+6$

$y=\frac{-1}{-6}x+\frac{6}{-6}$

$y=\frac{1}{6}x-1$

$m=\frac{1}{6}$, y-intercept: $(0,-1)$

53. $m=-2$, $b=5$

$y=-2x+5$

54. $m=4$, $b=3$

$y=4x+3$

55. $m=3$, $b=-6$

$y=3x-6$

56. $m=-5$, $b=-2$

$y=-5x-2$

57. $m=0$, $b=-4$

$y=-4$

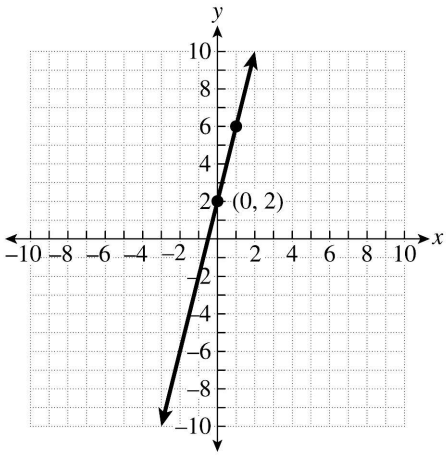
58. $m=0$, $b=1$

$y=1$

59. $y=4x+2$

$m=4$, y-intercept: $(0,2)$

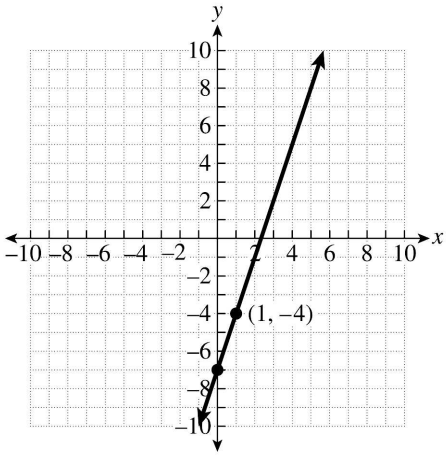
From the y-intercept, count up 4 and right 1 to find the next point, (1, 6).



60. $y=3x-7$

$m=3$, y-intercept: $(0,-7)$

From the y-intercept, count up 3 and right 1 to find the next point, (1, −4).



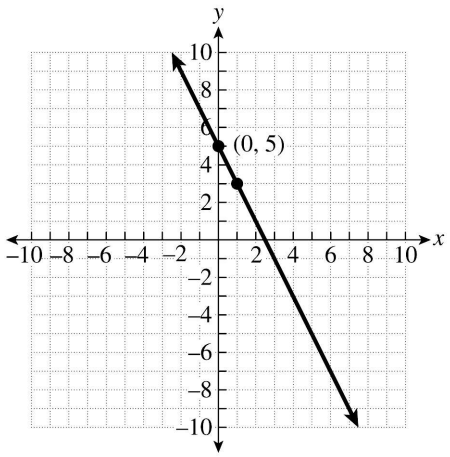
61. $y=-2x+5$

$m=-2$, y-intercept: $(0,5)$

From the y-intercept, count down 2 and right 1 to find the next point, (1, 3).

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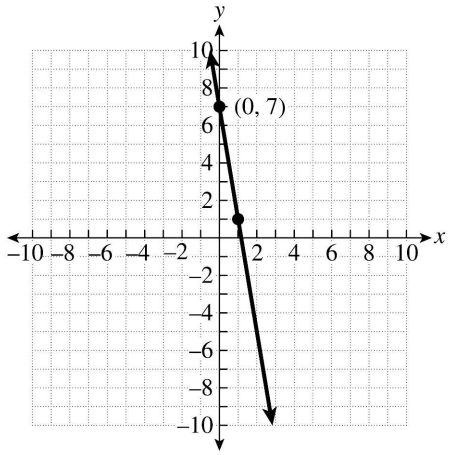
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62. $y = -6x + 7$

$m = -6$, y-intercept: $(0, 7)$

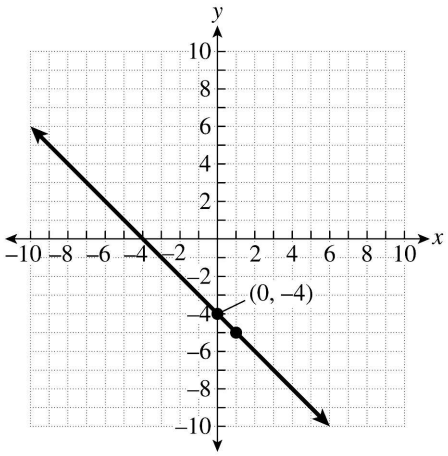
From the y-intercept, count down 6 and right 1 to find the next point, (1, 1).



63. $y = -x - 4$

$m = -1$, y-intercept: $(0, -4)$

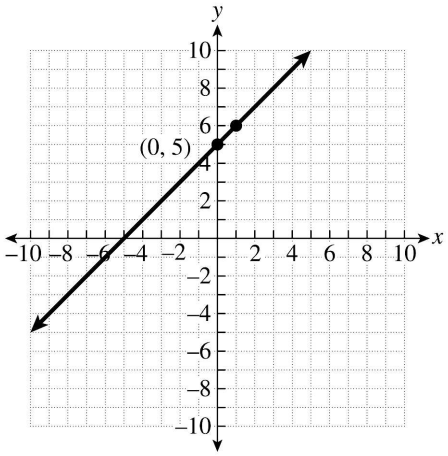
From the y-intercept, count down 1 and right 1 to find the next point, (1, −5).



64. $y = x + 5$

$m = 1$, y-intercept: $(0, 5)$

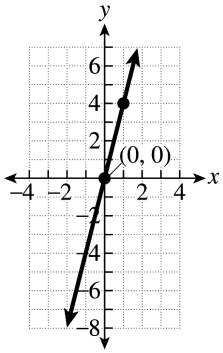
From the y-intercept, count up 1 and right 1 to find the next point, (1, 6).



65. $y = 4x$

$m = 4$, y-intercept: $(0, 0)$

From the y-intercept, count up 4 and right 1 to find the next point, (1, 4).



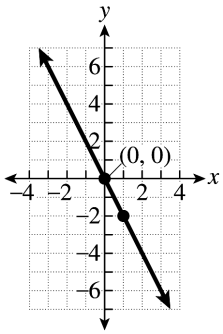
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66. $y = -2x$

$m = -2$, y-intercept: $(0,0)$

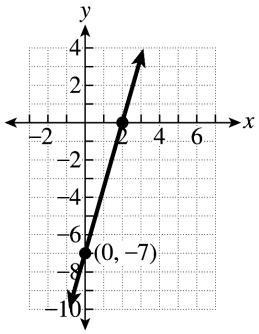
From the y-intercept, count down 2 and right 1 to find the next point, (1, –2).



67. $y = \frac{7}{2}x - 7$

$m = \frac{7}{2}$, y-intercept: $(0,-7)$

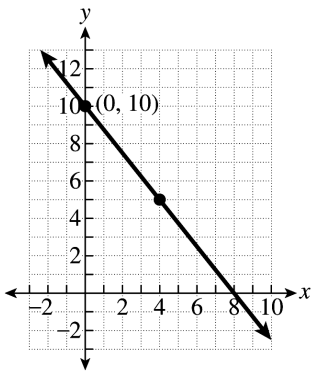
From the y-intercept, count up 7 and right 2 to find the next point, (2, 0).



68. $y = -\frac{5}{4}x + 10$

$m = -\frac{5}{4}$, y-intercept: $(0,10)$

From the y-intercept, count down 5 and right 4 to find the next point, (4, 5).



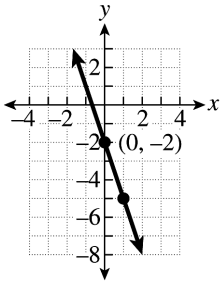
69. $3y = -9x - 6$

$y = -\frac{9}{3}x - \frac{6}{3}$

$y = -3x - 2$

$m = -3$, y-intercept: $(0,-2)$

From the y-intercept, count down 3 and right 1 to find the next point, (1, –5).



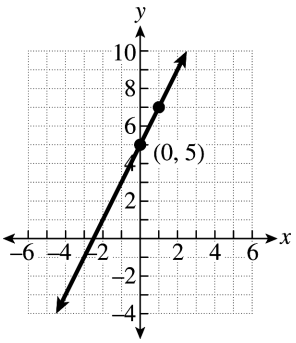
70. $2y = 4x + 10$

$y = \frac{4}{2}x + \frac{10}{2}$

$y = 2x + 5$

$m = 2$, y-intercept: $(0,5)$

From the y-intercept, count up 2 and right 1 to find the next point, (1, 7).



71. $-3x + 4y = 6$

$4y = 3x + 6$

$y = \frac{3}{4}x + \frac{6}{4}$

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

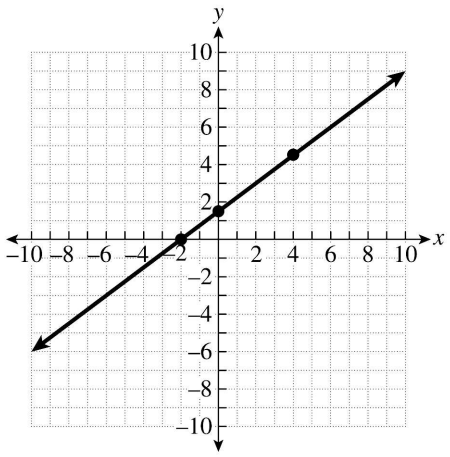
$m = \frac{3}{4}$, y-intercept: $\left(0, \frac{3}{2}\right)$

From the y-intercept, count up 3 and right 4 to

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find the next point, $\left(4,\frac{9}{2}\right)$.



72. $2x-3y=15$

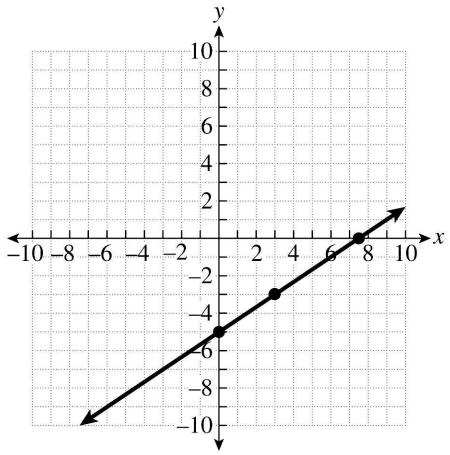
$-3y=-2x+15$

$y=\frac{-2}{-3}x+\frac{15}{-3}$

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

$m=\frac{2}{3}$, y-intercept: $(0,-5)$

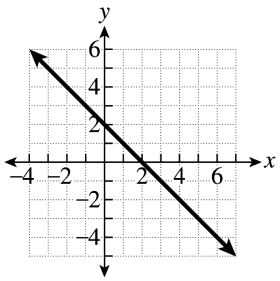
From the y-intercept, count up 2 and right 3 to find the next point, $(3,-3)$.



73. $y=-x+2$

$m=-1$, y-intercept: $(0,2)$

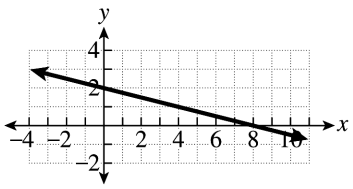
From the y-intercept, count down 1 and right 1 to find the next point, $(1,1)$.



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

$m=-\frac{1}{4}$, y-intercept: $(0,2)$

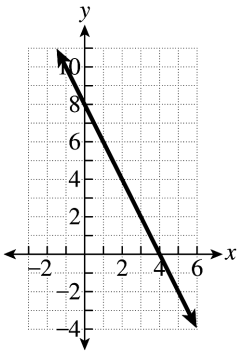
From the y-intercept, count down 1 and right 4 to find the next point, $(4,1)$.



75. $y=-2x+8$

$m=-2$, y-intercept: $(0,8)$

From the y-intercept, count down 2 and right 1 to find the next point, $(1,6)$.



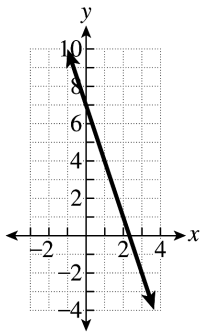
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76. $y = -3x + 7$

$m = -3$, y-intercept: $(0, 7)$

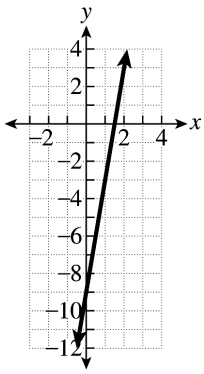
From the y-intercept, count down 3 and right 1 to find the next point, $(1, 4)$.



77. $y = 6x - 9$

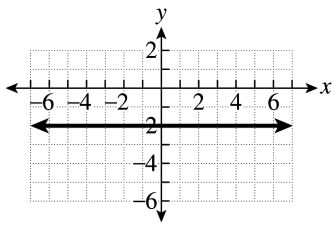
$m = 6$, y-intercept: $(0, -9)$

From the y-intercept, count up 6 and right 1 to find the next point, $(1, -3)$.



78. $y = -2$

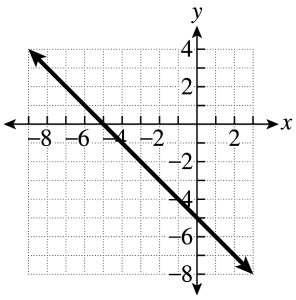
x-intercept: none, y-intercept: $(0, -2)$



79. $y = -x - 5$

$m = -1$, y-intercept: $(0, -5)$

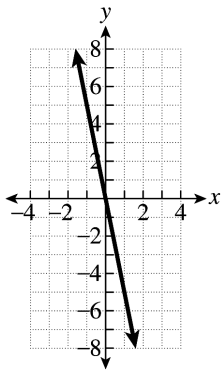
From the y-intercept, count down 1 and right 1 to find the next point, $(1, -6)$.



80. $y = -5x$

$m = -5$, y-intercept: $(0, 0)$

From the y-intercept, count down 5 and right 1 to find the next point, $(1, -5)$.



81. $3x - 2y = -12$

x-intercept:

$3x - 2(0) = -12$

$3x = -12$

$x = -4$

$(-4, 0)$

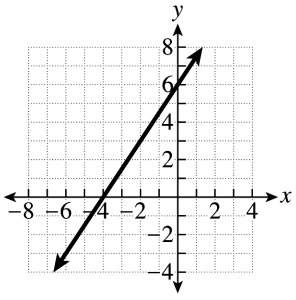
y-intercept:

$3(0) - 2y = -12$

$-2y = -12$

$y = 6$

$(0, 6)$

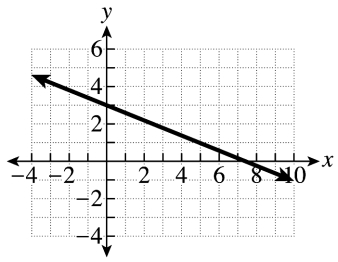


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82. $2x+5y=15$

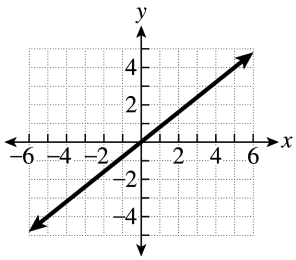
x-intercept:	y-intercept:
$2x+5(0)=15$	$2(0)+5y=15$
$2x=15$	$5y=15$
$x=\frac{15}{2}$	$y=3$
$\left(\frac{15}{2},0\right)$	$(0,3)$



83. $y=\frac{4}{5}x$

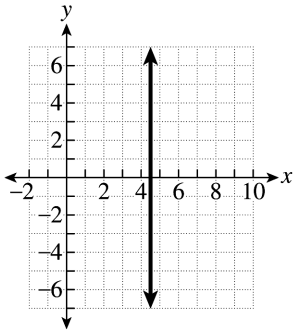
$m=\frac{4}{5}$, y-intercept: $(0,0)$

From the y-intercept, count up 4 and right 5 to find the next point, $(5,4)$.



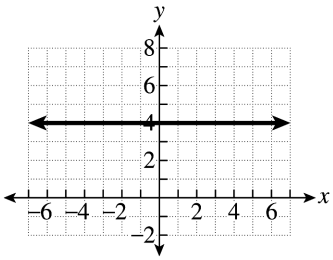
84. $x=\frac{9}{2}$

x-intercept: $\left(\frac{9}{2},0\right)$, y-intercept: none



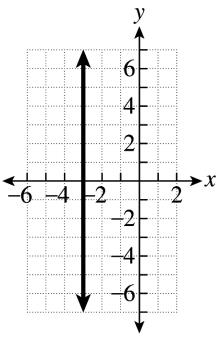
85. $y=4$

x-intercept: none, y-intercept: $(0,4)$



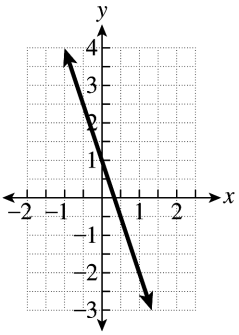
86. $x=-3$

x-intercept: $(-3,0)$, y-intercept: none



87. $3x+y=1$

x-intercept:	y-intercept:
$3x+(0)=1$	$3(0)+y=1$
$3x=1$	$y=1$
$x=\frac{1}{3}$	
$\left(\frac{1}{3},0\right)$	$(0,1)$



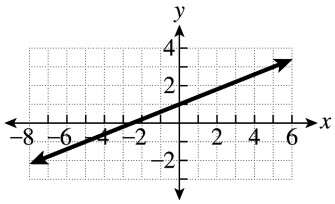
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88. $y = \frac{2}{5}x + 1$

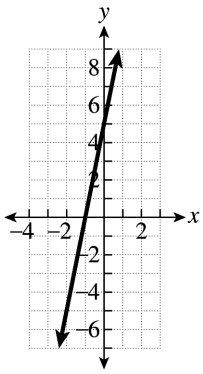
$m = \frac{2}{5}$, y-intercept: $(0,1)$

From the y-intercept, count up 2 and right 5 to find the next point, $(5,3)$.



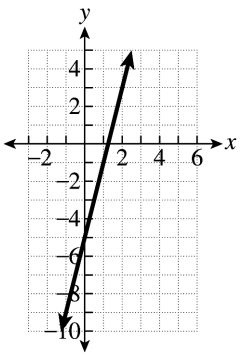
89. $5x - y = -5$

x-intercept:	y-intercept:
$5x - (0) = -5$	$5(0) - y = -5$
$5x = -5$	$-y = -5$
$x = -1$	$y = 5$
$(-1,0)$	$(0,5)$



90. $-8x + 2y = -10$

x-intercept:	y-intercept:
$-8x + 2(0) = -10$	$-8(0) + 2y = -10$
$-8x = -10$	$2y = -10$
$x = \frac{-10}{-8}$	$y = -5$
$x = \frac{5}{4}$	
$\left(\frac{5}{4}, 0\right)$	$(0,-5)$

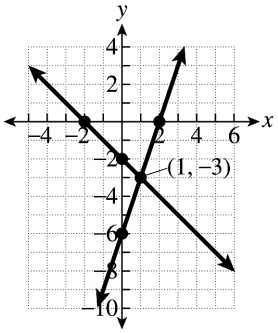


91. $y = 3x - 6$

x-intercept:	y-intercept:
$0 = 3x - 6$	$y = 3(0) - 6$
$-3x = -6$	$y = -6$
$x = 2$	
$(2,0)$	$(0,-6)$

$y = -x - 2$

x-intercept:	y-intercept:
$0 = -x - 2$	$y = -(0) - 2$
$x = -2$	$y = -2$
$(-2,0)$	$(0,-2)$



Point of intersection: $(1,-3)$

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92. $5x-4y=20$

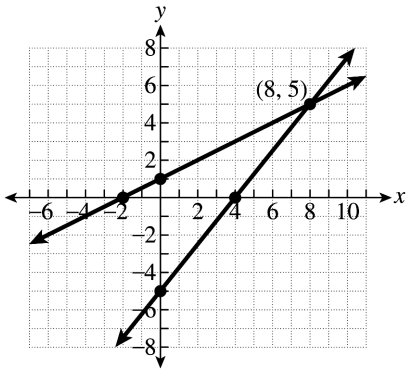
x-intercept: $5x-4(0)=20$, $5x=20$, $x=4$, $(4,0)$

y-intercept: $5(0)-4y=20$, $-4y=20$, $y=-5$, $(0,-5)$

$y=\frac{1}{2}x+1$

x-intercept: $0=\frac{1}{2}x+1$, $-\frac{1}{2}x=1$, $x=-2$, $(-2,0)$

y-intercept: $y=\frac{1}{2}(0)+1$, $y=1$, $(0,1)$



Point of intersection: $(8,5)$

93. $y=4x-3$, $m=4$

$y=-4x+6$, $m=-4$

No, the slopes are not equal, so the lines are not parallel.

94. $y=9x-10$, $m=9$

$y=9x+10$, $m=9$

Yes, the slopes are equal, so the lines are parallel.

95. $3x-2y=20$

$-2y=-3x+20$

$y=\frac{-3}{-2}x+\frac{20}{-2}$

$y=\frac{3}{2}x-10$

$m=\frac{3}{2}$

$-9x+6y=12$

$6y=9x+12$

$y=\frac{9}{6}x+\frac{12}{6}$

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

$m=\frac{3}{2}$

Yes, the slopes are equal, so the lines are parallel.

96. $14y=2x+70$

$y=\frac{2}{14}x+\frac{70}{14}$

$y=\frac{1}{7}x+5$

$m=\frac{1}{7}$

$x+7y=7$

$7y=-x+7$

$y=\frac{-1}{7}x+\frac{7}{7}$

$y=-\frac{1}{7}x+1$

$m=-\frac{1}{7}$

No, the slopes are not equal, so the lines are not parallel.

97. $y=-2x+3$, $m=-2$

$y=\frac{1}{2}x+9$, $m=\frac{1}{2}$

Yes, the slopes are negative reciprocals, so the lines are perpendicular.

98. $y=\frac{4}{5}x+6$, $m=\frac{4}{5}$

$y=\frac{5}{4}x-3$, $m=\frac{5}{4}$

No, the slopes are not negative reciprocals, so the lines are not perpendicular.

99. $8x+6y=-30$

$6y=-8x-30$

$y=\frac{-8}{6}x-\frac{30}{6}$

$y=-\frac{4}{3}x-5$

$m=-\frac{4}{3}$

$9x-12y=24$

$-12y=-9x+24$

$y=\frac{-9}{-12}x+\frac{24}{-12}$

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

$m=\frac{3}{4}$

Yes, the slopes are negative reciprocals, so the lines are perpendicular.

100. $x-y=8$

$-y=-x+8$

$y=x-8$

$m=1$

$x+y=2$

$y=-x+2$

$m=-1$

Yes, the slopes are negative reciprocals, so the lines are perpendicular.

101. $y=\frac{3}{7}x+2$, $m=\frac{3}{7}$

$y=\frac{7}{3}x-5$, $m=\frac{7}{3}$

The slopes are not equal, and they are not negative reciprocals, so the lines are neither parallel nor perpendicular.

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102. $y=\frac{5}{6}x$ $\qquad$ $y=-\frac{5}{6}x+6$

$m=\frac{5}{6}$ $\qquad$ $m=-\frac{5}{6}$

The slopes are not equal, and they are not negative reciprocals, so the lines are neither parallel nor perpendicular.

103. $y=2x-8$ $\qquad$ $y=2x+6$

$m=2$ $\qquad$ $m=2$

The slopes are equal, so the lines are parallel.

104. $y=-\frac{1}{5}x+4$ $\qquad$ $y=5x-3$

$m=5$

$m=-\frac{1}{5}$

The slopes are negative reciprocals, so the lines are perpendicular.

105. $5x-3y=15$ $\qquad$ $6x+10y=-30$

$-3y=-5x+15$ $\qquad$ $10y=-6x-30$

$y=\frac{-5}{-3}x+\frac{15}{-3}$ $\qquad$ $y=\frac{-6}{10}x-\frac{30}{10}$

$y=\frac{5}{3}x-5$ $\qquad$ $y=-\frac{3}{5}x-3$

$m=\frac{5}{3}$ $\qquad$ $m=-\frac{3}{5}$

The slopes are negative reciprocals, so the lines are perpendicular.

106. $3x+2y=0$ $\qquad$ $9x+6y=15$

$2y=-3x$ $\qquad$ $6y=-9x+15$

$y=-\frac{3}{2}x$ $\qquad$ $y=\frac{-9}{6}x+\frac{15}{6}$

$m=-\frac{3}{2}$ $\qquad$ $y=-\frac{3}{2}x+\frac{5}{2}$

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

The slopes are equal, so the lines are parallel.

107. $8x-6y=24$ $\qquad$ $12x+9y=-9$

$-6y=-8x+24$ $\qquad$ $9y=-12x-9$

$y=\frac{-8}{-6}x+\frac{24}{-6}$ $\qquad$ $y=\frac{-12}{9}x-\frac{-9}{9}$

$y=\frac{4}{3}x-4$ $\qquad$ $y=-\frac{4}{3}x+1$

$m=\frac{4}{3}$ $\qquad$ $m=-\frac{4}{3}$

The slopes are not equal, and they are not negative reciprocals, so the lines are neither parallel nor perpendicular.

108. $4y=9x-8$

$y=\frac{9}{4}x-\frac{8}{4}$

$y=\frac{9}{4}x-2$

$m=\frac{9}{4}$

$18x-8y=8$

$-8y=-18x+8$

$y=\frac{-18}{-8}x+\frac{8}{-8}$

$y=\frac{9}{4}x-1$

$m=\frac{9}{4}$

The slopes are equal, so the lines are parallel.

109. $y=-\frac{8}{7}$ $\qquad$ $8y-7=0$

$m=0$ $\qquad$ $8y=7$

$y=\frac{7}{8}$

$m=0$

Both lines are horizontal, so they are parallel.

110. $x=\frac{3}{4}$ $\qquad$ $x=-\frac{4}{3}$

m is undefined $\qquad$ m is undefined

Both lines are vertical, so they are parallel.

111. $x=5$ $\qquad$ $y=-2$

m is undefined $\qquad$ $m=0$

The first line is vertical and the second line is horizontal, so the lines are perpendicular.

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112. $x+y=16$ $\qquad$ $y=x-7$

$y=-x+16$ $\qquad$ $m=1$

$m=-1$

The slopes are negative reciprocals, so the lines are perpendicular.

113. $m=\dfrac{-1-7}{5-3}$ $\qquad$ $y=-4x+11$

$m=-4$

$m=\dfrac{-8}{2}$

$m=-4$

Yes, the slopes are equal, so the lines are parallel.

114. $m=\dfrac{8-2}{4-(-6)}$ $\qquad$ $-3x+5y=15$

$5y=3x+15$

$m=\dfrac{6}{10}$ $\qquad$ $y=\dfrac{3}{5}x+\dfrac{15}{5}$

$m=\dfrac{3}{5}$ $\qquad$ $y=\dfrac{3}{5}x+3$

$m=\dfrac{3}{5}$

Yes, the slopes are equal, so the lines are parallel.

115. $m=\dfrac{9-7}{-1-4}$ $\qquad$ $-10x+4y=8$

$4y=10x+8$

$m=-\dfrac{2}{5}$ $\qquad$ $y=\dfrac{10}{4}x+\dfrac{8}{4}$

$y=\dfrac{5}{2}x+2$

$m=\dfrac{5}{2}$

Yes, the slopes are negative reciprocals, so the lines are perpendicular.

116. $m=\dfrac{7-(-8)}{2-(-3)}$ $\qquad$ $m=\dfrac{7-3}{7-(-5)}$

$m=\dfrac{15}{5}$ $\qquad$ $m=\dfrac{4}{12}$

$m=3$ $\qquad$ $m=\dfrac{1}{3}$

No, the slopes are not negative reciprocals, so the lines are not perpendicular.

117. **a.** To find the slope of the equation $y=0.04x+2.75$, find the coefficient of the term containing x, which is 0.04. The slope is therefore 0.04. This signifies that each year, the number of employed registered nurses will increase by 0.04 million or 40,000.

b. The y-intercept of the equation $y=0.04x+2.75$ is (0, 2.75) because 2.75 is the constant in the equation. This signifies that in 2014, there were approximately 2.75 million employed registered nurses.

c. To predict the number of employed registered nurses in 2022, substitute $2022-2014=8$ for x in the equation $y=0.04x+2.75$ and solve for y.

$y=0.04(8)+2.75$

$y=0.32+2.75$

$y=3.07$

The equation predicts that the number of employed registered nurses in 2022 will be 3.07 million or 3,070,000.

118. **a.** To find the slope of the equation $y=1010x+30,000$, find the coefficient of the term containing x, which is 1010. The slope is therefore 1010. This signifies that each year, the number of employed statisticians will increase by 1010.

b. The y-intercept of the equation $y=1010x+30,000$ is (0, 30,000) because 30,000 is the constant in the equation. This signifies that in 2014, there were approximately 30,000 employed statisticians.

c. To predict the number of employed statisticians in 2020, substitute $2020-2014=6$ for x in the equation $y=1010x+30,000$ and solve for y.

$y=1010(6)+30,000$

$y=6060+30,000$

$y=36,060$

The equation predicts that the number of employed statisticians in 2020 will be 36,060.

119. **a.** To find the slope of the equation $y=1226x+13,900$, find the coefficient of the term containing x, which is 1226. The slope is therefore 1226. This signifies that

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each year, the number of women earning a bachelor's degree in engineering will increase by 1226.

b. The y-intercept of the equation $y = 1226x + 13,900$ is (0, 13,900) because 13,900 is the constant in the equation. This signifies that in 2009, there were approximately 13,900 women who earned a bachelor's degree in engineering.

c. To predict the number of women who earn a bachelor's degree in engineering in 2021, substitute $2021 - 2009 = 12$ for x in the equation $y = 1226x + 13,900$ and solve for y.

$y = 1226(12) + 13,900$

$y = 14,712 + 13,900$

$y = 28,612$

The equation predicts that the number of women who earn a bachelor's degree in engineering in 2021 will be 28,612.

120. a. To find the slope of the equation $y = 12,500x + 52,000$, find the coefficient of the term containing x, which is 12,500. The slope is therefore 12,500. This signifies that each year, the number of students pursuing a graduate degree in computer science will increase by 12,500.

b. The y-intercept of the equation $y = 12,500x + 52,000$ is (0, 52,000) because 52,000 is the constant in the equation. This signifies that in 2012, there were approximately 52,000 students pursuing a graduate degree in computer science.

c. To predict the number of students who will earn a graduate degree in computer science in 2022, substitute $2022 - 2012 = 10$ for x in the equation $y = 12,500x + 52,000$ and solve for y.

$y = 12,500(10) + 52,000$

$y = 125,000 + 52,000$

$y = 177,000$

The equation predicts that the number of students who will earn a graduate degree in computer science in 2022 will be 177,000.

121. a) $m = \dfrac{\text{vertical change}}{\text{horizontal change}} = \dfrac{9}{27} = \dfrac{1}{3}$

b) $m = \dfrac{\text{vertical change}}{\text{horizontal change}} = \dfrac{36}{24} = \dfrac{3}{2}$

122. $m = \dfrac{\text{vertical change}}{\text{horizontal change}}$

Let $v =$ vertical rise of the roof.

$$\frac{1}{3} = \frac{v}{\frac{72}{2}}$$

$$\frac{1}{3} = \frac{v}{36}$$

$3v = 36$

$v = 12$ feet

123. $m = \dfrac{\text{vertical change}}{\text{horizontal change}} = \dfrac{50}{1000} = \dfrac{1}{20}$

124. $m = \dfrac{\text{vertical change}}{\text{horizontal change}} = \dfrac{0.04}{1}$

$5280(0.04) = 211.2$ feet

125. Positive. The unemployment rate (y) increases as the time after the statement (x) increases.

126. Explanations will vary. Example:

It's most efficient to graph $y = -\frac{3}{8}x + 7$ by using the slope and y-intercept, since you can easily find the y-intercept and the slope. It's most efficient to graph $20x - 8y = 320$ by finding the intercepts, since it's difficult to find the slope.

127. Answers will vary. Example:

- Two streets that run east to west are parallel.
- Telephone wires strung from the same poles are parallel.
- Rails on railroad tracks are parallel.

128. Answers will vary. Example:

- A north-south street and an east-west street are perpendicular.
- A vertical wall and a horizontal floor are perpendicular.
- The baseline from first to second base and base line from second to third base are perpendicular.

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129. Explanations will vary. Example:
Find the slope of each line by solving for y. If the two slopes are equal, the lines are parallel.

130. Explanations will vary. Example:
Find the slope of each line by solving for y. If the two slopes are negative reciprocals of one another, then the lines are perpendicular.

131. Answers will vary. Example:

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{-5-5}{1-(-3)}=\frac{-10}{4}=-\frac{5}{2}$$

132. Use the slope formula $m=\dfrac{y_2-y_1}{x_2-x_1}$.

133. Solve the equation for y in terms of x.

134. Plot the y-intercept $(0, b)$, use the slope (m) of the line to find additional points on the line, draw the straight line that passes through the points.

135. $y=\dfrac{3}{4}x-6$, because it is in slope–intercept ($y=mx+b$) form.

136. They are parallel if they have the same slope.

137. They are perpendicular if their slopes are negative reciprocals.

2.3 EQUATIONS OF LINES

1. $y-y_1=m(x-x_1)$

2. Find the slope m of the line passing through the two points; then substitute the slope and the coordinates of one of the points in the point–slope form.

3. $-12x+3y=15$

$$3y=12y+15$$
$$y=\frac{12}{3}x+\frac{15}{3}$$
$$y=4x+5$$

4. $4x+6y=-18$

$$6y=-4x-18$$
$$y=-\frac{4}{6}x-\frac{18}{6}$$
$$y=-\frac{2}{3}x-3$$

5. $x+4y=12$

$$4y=-x+12$$
$$y=-\frac{1}{4}x+\frac{12}{4}$$
$$y=-\frac{1}{4}x+3$$

6. $-6x-8y=-28$

$$-8y=6x-28$$
$$y=\frac{6}{-8}x+\frac{-28}{-8}$$
$$y=-\frac{3}{4}x+\frac{7}{2}$$

7. $5x-y=4$

$$-y=-5x+4$$
$$y=5x-4$$

8. $8x+3y=0$

$$3y=-8x$$
$$y=\frac{-8}{3}x$$
$$y=-\frac{8}{3}x$$

9. $y=-3x+5$

10. $y=2x-4$

11. $y=\dfrac{2}{3}x-3$

12. $y=9$

13. $y=5x+8$

14. $y=-\dfrac{3}{5}x+2$

15. $y-2=5(x-6)$

$$y-2=5x-30$$
$$y=5x-28$$

16. $y-7=-3(x-4)$

$$y-7=-3x+12$$
$$y=-3x+19$$

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17. $y-8=-2\big(x-(-5)\big)$

$y-8=-2(x+5)$

$y-8=-2x-10$

$y=-2x-2$

18. $y-(-13)=-1(x-8)$

$y+13=-x+8$

$y=-x-5$

19. $y-17=\frac{5}{4}\big(x-(-12)\big)$

$y-17=\frac{5}{4}(x+12)$

$y-17=\frac{5}{4}x+15$

$y=\frac{5}{4}x+32$

20. $y-15=\frac{1}{6}(x-18)$

$y-15=\frac{1}{6}x-3$

$y=\frac{1}{6}x+12$

21. Since slope is 0, this is a horizontal line.

$y=5$

22. Since the slope is undefined, this is a vertical line.

23. $y-(-1)=\frac{5}{6}(x-4)$

$y+1=\frac{5}{6}x-\frac{5}{6}(4)$

$y+1=\frac{5}{6}x-\frac{20}{6}$

$y=\frac{5}{6}x-\frac{20}{6}-\frac{6}{6}$

$y=\frac{5}{6}x-\frac{26}{6}$

$y=\frac{5}{6}x-\frac{13}{3}$

24. . $y-(-7)=\frac{3}{8}(x-(-2))$

$y+7=\frac{3}{8}x+\frac{3}{8}(2)$

$y+7=\frac{3}{8}x+\frac{6}{8}$

$y=\frac{3}{8}x+\frac{6}{8}-\frac{56}{8}$

$y=\frac{3}{8}x-\frac{50}{8}$

$y=\frac{3}{8}x-\frac{25}{4}$

25. $y-(-5.4)=-2.5(x-3.2)$

$y+5.4=-2.5x+8$

$y=-2.5x+8-5.4$

$y=-2.5x+2.6$

26. $y-9.2=6.4(x-3.5)$

$y-9.2=6.4x-22.4$

$y=6.4x-13.2$

27. $m=\frac{4-9}{7-2}=\frac{-5}{5}=-1$

$y-4=-1(x-7)$

$y-4=-x+7$

$y=-x+11$

28. $m=\frac{13-7}{5-3}=\frac{6}{2}=3$

$y-7=3(x-3)$

$y-7=3x-9$

$y=3x-2$

29. $m=\frac{7-(-5)}{-5-(-2)}=\frac{12}{-3}=-4$

$y-7=-4\big(x-(-5)\big)$

$y-7=-4(x+5)$

$y-7=-4x-20$

$y=-4x-13$

30. $m=\frac{-3-12}{-3-(-8)}=\frac{-15}{5}=-3$

$y-(-3)=-3\big(x-(-3)\big)$

$y+3=-3(x+3)$

$y+3=-3x-9$

$y=-3x-12$

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31. $m=\dfrac{-20-8}{15-(-6)}=\dfrac{-28}{21}=-\dfrac{4}{3}$

$y-8=-\dfrac{4}{3}(x-(-6))$

$y-8=-\dfrac{4}{3}(x+6)$

$y-8=-\dfrac{4}{3}x-8$

$y=-\dfrac{4}{3}x$

32. $m=\dfrac{-5-5}{-3-3}=\dfrac{-10}{-6}=\dfrac{5}{3}$

$y-5=\dfrac{5}{3}(x-3)$

$y-5=\dfrac{5}{3}x-5$

$y=\dfrac{5}{3}x$

33. $m=\dfrac{-3-(-9)}{-2-(-2)}=\dfrac{6}{0}$

m is undefined.

$x=-2$

34. $m=\dfrac{8-8}{2-(-4)}=\dfrac{0}{6}=0$

$y-8=0(x-2)$

$y-8=0$

$y=8$

35. $m=\dfrac{81-37}{3.3-2.5}=\dfrac{44}{0.8}=55$

$y-37=55(x-2.5)$

$y-37=55x-137.5$

$y=55x-100.5$

36. $m=\dfrac{93.9-51.3}{6.6-4.2}=\dfrac{42.6}{2.4}=17.75$

$y-51.3=17.75(x-4.2)$

$y-51.3=17.75x-74.55$

$y=17.75x-23.25$

37. $m=\dfrac{2-0}{0-6}=\dfrac{2}{-6}=-\dfrac{1}{3}$

$y=-\dfrac{1}{3}x+2$

38. $m=\dfrac{3-0}{0-(-9)}=\dfrac{3}{9}=\dfrac{1}{3}$

$y=\dfrac{1}{3}x+3$

39. $m=\dfrac{-4-0}{0-4}=\dfrac{-4}{-4}=1$

$y=x-4$

40. $m=\dfrac{-2-0}{0-(-10)}=\dfrac{-2}{10}=-\dfrac{1}{5}$

$y=-\dfrac{1}{5}x-2$

41. $m=3$

$y-7=3(x-4)$

$y-7=3x-12$

$y=3x-5$

42. $m=-6$

$y-(-8)=-6(x-6)$

$y+8=-6x+36$

$y=-6x+28$

43. $5x+3y=21$

$3y=-5x+21$

$y=-\dfrac{5}{3}x+7$

$m=-\dfrac{5}{3}$

$y-8=-\dfrac{5}{3}(x-(-3))$

$y-8=-\dfrac{5}{3}(x+3)$

$y-8=-\dfrac{5}{3}x-5$

$y=-\dfrac{5}{3}x+3$

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44. $14x-2y=6$

$-2y=-14x+6$

$y=7x-3$

$m=7$

$y-(-7)=7(x-(-6))$

$y+7=7(x+6)$

$y+7=7x+42$

$y=7x+35$

45. $x=3$

46. $y=-11$

47. $y=\frac{1}{2}x-5$ has a slope of $\frac{1}{2}$.

Perpendicular line has a slope of -2.

$y-5=-2(x-9)$

$y-5=-2x+18$

$y=-2x+23$

48. $y=-4x+15$ has a slope of -4.

Perpendicular line has a slope of $\frac{1}{4}$.

$y-(-10)=\frac{1}{4}(x-(-8))$

$y+10=\frac{1}{4}(x+8)$

$y+10=\frac{1}{4}x+2$

$y=\frac{1}{4}x-8$

49. $3x+7y=-21$

$7y=-3x-21$

$y=-\frac{3}{7}x-3$

Perpendicular line has a slope of $\frac{7}{3}$.

$y-16=\frac{7}{3}(x-(-9))$

$y-16=\frac{7}{3}(x+9)$

$y-16=\frac{7}{3}x+21$

$y=\frac{7}{3}x+37$

50. $5x-3y=18$

$-3y=-5x+18$

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

Perpendicular line has a slope of $-\frac{3}{5}$.

$y-(-21)=-\frac{3}{5}(x-10)$

$y+21=-\frac{3}{5}x+6$

$y=-\frac{3}{5}x-15$

51. $y=13$

52. $x=-16$

53. Slope of the graphed line is 1. Parallel line has a slope of 1 also and passes through $(-4,-1)$.

$y-(-1)=1(x-(-4))$

$y+1=x+4$

$y=x+3$

54. Slope of the graphed line is -1. Parallel line has a slope of -1 also and passes through $(-3,7)$.

$y-7=-1(x-(-3))$

$y-7=-x-3$

$y=-x+4$

55. Slope of the graphed line is 4. Perpendicular line has a slope of $-\frac{1}{4}$ and passes through $(-4,3)$.

$y-3=-\frac{1}{4}(x-(-4))$

$y-3=-\frac{1}{4}(x+4)$

$y-3=-\frac{1}{4}x-1$

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

56. Slope of the graphed line is -2. Perpendicular line has a slope of $\frac{1}{2}$ and passes through

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$(-8,-5)$.

$$y-(-5)=\frac{1}{2}(x-(-8))$$
$$y+5=\frac{1}{2}(x+8)$$
$$y+5=\frac{1}{2}x+4$$
$$y=\frac{1}{2}x-1$$

57. $y-(-8)=-3(x-4)$
$$y+8=-3x+12$$
$$y=-3x+4$$

58. $6x-2y=10$
$$-2y=-6x+10$$
$$y=\frac{-6}{-2}x+\frac{10}{-2}$$
$$y=3x-5$$
$m=3$

A line perpendicular to this line has slope $-\frac{1}{3}$.

$$y-(-3)=-\frac{1}{3}(x-6)$$
$$y+3=-\frac{1}{3}x+2$$
$$y=-\frac{1}{3}x-1$$

59. $5x-3y=-3$
$$-3y=-5x-3$$
$$y=\frac{-5}{-3}x-\frac{3}{-3}$$
$$y=\frac{5}{3}x+1$$
$m=\frac{5}{3}$

A line parallel to this line has slope $\frac{5}{3}$.

$$y-8=\frac{5}{3}(x-(-9))$$
$$y-8=\frac{5}{3}(x+9)$$
$$y-8=\frac{5}{3}x+15$$
$$y=\frac{5}{3}x+23$$

60. $m=\frac{-8-7}{4-(-2)}=\frac{-15}{6}=-\frac{5}{2}$

$$y-(-8)=-\frac{5}{2}(x-4)$$
$$y+8=-\frac{5}{2}x+10$$
$$y=-\frac{5}{2}x+2$$

61. $m=0$
$$y-11=0(x-13)$$
$$y-11=0$$
$$y=11$$

62. $3x+4y=19$
$$4y=-3x+19$$
$$y=-\frac{3}{4}x+\frac{19}{4}$$
$m=-\frac{3}{4}$

A line parallel to this line has slope $-\frac{3}{4}$.

$$y-(-7)=-\frac{3}{4}(x-(-12))$$
$$y+7=-\frac{3}{4}(x+12)$$
$$y+7=-\frac{3}{4}x-9$$
$$y=-\frac{3}{4}x-16$$

63. $x+4y=8$
$$4y=-x+8$$
$$y=\frac{-1}{4}x+\frac{8}{4}$$
$$y=-\frac{1}{4}x+2$$
$m=-\frac{1}{4}$

A line perpendicular to this line has slope 4.

$$y-13=4(x-(-2))$$
$$y-13=4(x+2)$$
$$y-13=4x+8$$
$$y=4x+21$$

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64. $m = \dfrac{-39-14}{-6-(-6)} = \dfrac{-53}{0}$

m is undefined. The line is vertical with the equation $x = -6$.

65. $m = \dfrac{33-(-23)}{5-1} = \dfrac{56}{4} = 14$

$y - 33 = 14(x-5)$

$y - 33 = 14x - 70$

$y = 14x - 37$

66. $y-(-11) = \dfrac{4}{5}(x-(-15))$

$y+11 = \dfrac{4}{5}(x+15)$

$y+11 = \dfrac{4}{5}x+12$

$y = \dfrac{4}{5}x+1$

67. a. We begin by finding the slope of the line that passes through the points (2, 64) and (4.5, 144) by substituting the points into the formula $m = \dfrac{y_2-y_1}{x_2-x_1}$.

$m = \dfrac{144-64}{4.5-2}$

$m = \dfrac{80}{2.5}$

$m = 32$

Now substitute into the point-slope form using either point with $m = 32$.

$y - 64 = 32(x-2)$

$y - 64 = 32x - 64$

$y = 32x$

b. To find the speed of the object after 3 seconds, substitute 3 for x in the equation $y = 32x$ and solve for y.

$y = 32x$

$y = 32 \cdot 3$

$y = 96$

The equation predicts that the speed of the object after 3 seconds will be 96 feet per second.

68. a. We begin by finding the slope of the line that passes through the points (1.5, 66) and (3.25, 143) by substituting the points into the formula $m = \dfrac{y_2-y_1}{x_2-x_1}$.

$m = \dfrac{143-66}{3.25-1.5}$

$m = \dfrac{77}{1.75}$

$m = 44$

Now substitute into the point-slope form using either point with $m = 44$.

$y - 66 = 44(x-1.5)$

$y - 66 = 44x - 66$

$y = 44x$

b. To find the horizontal distance traveled after 2 seconds, substitute 2 for x in the equation $y = 44x$ and solve for y.

$y = 44x$

$y = 44 \cdot 2$

$y = 88$

The equation predicts that the horizontal distance traveled by the projectile after 2 seconds will be 88 feet.

69. a. We let x represent the number of years since 2009, so $x = 0$ for 2009 and $x = 5$ for 2014. Next, we find the slope of the line that passes through the points (0, 8600) and (5, 11,600) by substituting the points into the formula $m = \dfrac{y_2-y_1}{x_2-x_1}$.

$m = \dfrac{11,600-8600}{5-0}$

$m = \dfrac{3000}{5}$

$m = 600$

Now substitute into the point-slope form using either point with $m = 600$.

$y - 8600 = 600(x-0)$

$y - 8600 = 600x$

$y = 600x + 8600$

b. To find the number of women we would expect to earn a Master's degree in engineering in 2021, substitute 12 for x in

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the equation $y = 600x + 8600$ and solve for y.

$y = 600x + 8600$

$y = 600 \cdot 12 + 8600$.

$y = 15,800$

The equation predicts that the number of women we would expect to earn a Master's degree in engineering in 2021 will be 15,800.

70. a. We let x represent the number of years since 2010, so $x = 0$ for 2010 and $x = 4$ for 2014. Next, we find the slope of the line that passes through the points (0, 23,100) and (4, 25,900) by substituting the points into the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$.

$m = \frac{25,900 - 23,100}{4 - 0}$

$m = \frac{2800}{4}$

$m = 700$

Now substitute into the point-slope form using either point with $m = 700$.

$y - 23,100 = 700(x - 0)$

$y - 23,100 = 700x$

$y = 700x + 23,100$

b. To find the number of students we would expect to be pursuing a graduate degree in mathematical sciences in 2023, substitute 13 for x in the equation $y = 700x + 23,100$ and solve for y.

$y = 700x + 23,100$

$y = 700 \cdot 13 + 23,100$

$y = 32,200$

The equation predicts that the number of students we would expect to be pursuing a graduate degree in mathematical sciences in 2023 will be 32,200.

71. a) $m = \frac{5750 - 4100}{175 - 120} = \frac{1650}{55} = 30$

$y - 4100 = 30(x - 120)$

$y - 4100 = 30x - 3600$

$y = 30x + 500$

b) $y = 30(0) + 500 = 500$

$500

c) $m = 30$

$30

d) $y = 30(200) + 500 = 6000 + 500 = 6500$

$6500

72. a) $m = \frac{618.75 - 319.50}{25 - 10} = \frac{299.25}{15} = 19.95$

$y - 319.50 = 19.95(x - 10)$

$y - 319.50 = 19.95x - 199.50$

$y = 19.95x + 120$

b) $y = 19.95(0) + 120 = 120$

$120

c) $m = 19.95$

$19.95

d) $y = 19.95(16) + 120$

$= 319.20 + 120$

$= 439.20$

$439.20

73. Explanations will vary. Example:
Every point on a vertical line will have the same x-coordinate. Hence the equation is $x = a$. Similarly, every point on a horizontal line will have the same y-coordinate. Hence the equation is $y = b$.

74. Explanations will vary. Example:
On the horizontal line, y-coordinates are the same, so utilizing the slope formula, slope is 0. On the vertical line, x-coordinates are the same, so utilizing the slope formula, slope is undefined.

75. Point–slope form: $y - y_1 = m(x - x_1)$

76. Find the slope of the line using the slope formula.

77. Substitute the slope of the parallel line and the coordinates of the point into the point–slope form $y - y_1 = m(x - x_1)$.

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78. $-\frac{1}{m}$

2.4 LINEAR INEQUALITIES

1. solution

2. solid

3. dashed

4. test point

5. $5x+3y \le 22$

a) $5(0)+3(0) \le 22$
$0+0 \le 22$
$0 \le 22$
Yes.

b) $5(8)+3(-4) \le 22$
$40-12 \le 22$
$28 \le 22$
No.

c) $5(2)+3(4) \le 22$
$10+12 \le 22$
$22 \le 22$
Yes.

d) $5(-3)+3(9) \le 22$
$-15+27 \le 22$
$12 \le 22$
Yes.

6. $2x-4y > 6$

a) $2(0)-4(0) > 6$
$0-0 > 6$
$0 > 6$
No.

b) $2(2)-4(-3) > 6$
$4+12 > 6$
$16 > 6$
Yes.

c) $2(7)-4(2) > 6$
$14-8 > 6$
$6 > 6$
No.

d) $2(5)-4(1) > 6$
$10-4 > 6$
$6 > 6$
No.

7. $y < 6x-11$

a) $8 < 6(5)-11$
$8 < 30-11$
$8 < 19$
Yes.

b) $0 < 6(0)-11$
$0 < 0-11$
$0 < -11$
No.

c) $1 < 6(2)-11$
$1 < 12-11$
$1 < 1$
No.

d) $-13 < 6(-4)-11$
$-13 < -24-11$
$-13 < -35$
No.

8. $x-7y \ge -3$

a) $4-7(1) \ge -3$
$4-7 \ge -3$
$-3 \ge -3$
Yes.

b) $9-7(2) \ge -3$
$9-14 \ge -3$
$-5 \ge -3$
No.

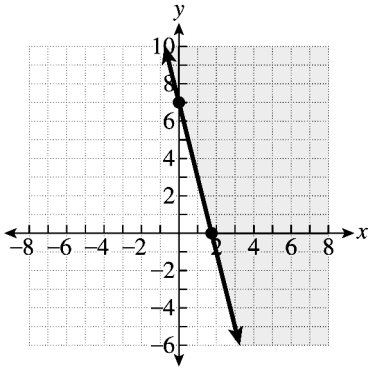
c) $0-7(0) \ge -3$
$0-0 \ge -3$
$0 \ge -3$
Yes.

d) $-16-7(-2) \ge -3$
$-16+14 \ge -3$
$-2 \ge -3$
Yes.

9. **a)** $0 < 7$ Yes. **b)** $6 < 7$ Yes.
c) $10 < 7$ No. **d)** $7 < 7$ No.

10. **a)** $0 \le -2$ No. **b)** $-1 \le -2$ No.
c) $-2 \le -2$ Yes. **d)** $-5 \le -2$ Yes.

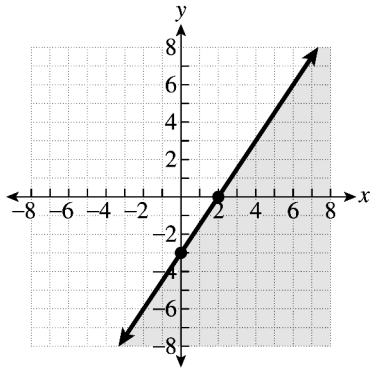
11. Test Point: $(0,0)$
$4(0)+0 \ge 7$
$0 \ge 7$
False. Shade on the side of the line that does not contain the test point.



12. Test Point: $(0,0)$
$-3(0)+2(0) \le -6$
$0 \le -6$
False. Shade on the side of the line that does not contain the test point.

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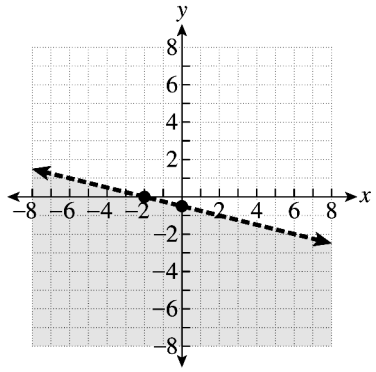


13. Test Point: $(0,0)$

$2(0)+8(0)<-4$

$0<-4$

False. Shade on the side of the line that does not contain the test point.



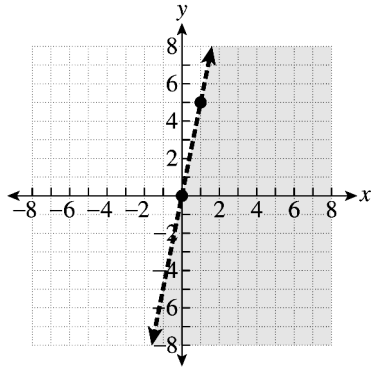
14. Test Point: $(-4,0)$

$10(-4)-2(0)>0$

$-40-0>0$

$-40>0$

False. Shade on the side of the line that does not contain the test point.



15. Test Point: $(0,0)$

$3(0)+4(0)\geq 24$

$0\geq 24$

False.

A

16. Test Point: $(0,-2)$

$-2\leq \frac{1}{8}(0)$

$-2\leq 0$

True.

B

17. Since the inequality is $<$, the line must be dashed.

A

18. Test Point: $(0,0)$

$5(0)-4(0)>20$

$0>20$

False.

A

19. $3x-4y=24$

x-intercept:

$3x-4(0)=24$

$3x=24$

$x=8$

$(8,0)$

y-intercept:

$3(0)-4y=24$

$-4y=24$

$y=-6$

$(0,-6)$

Test Point: $(0,0)$

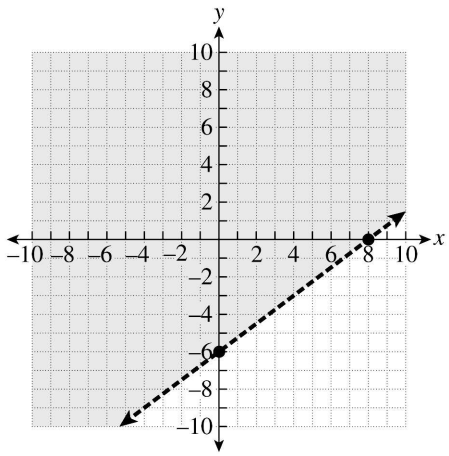
$3(0)-4(0)<24$

$0<24$

True. Shade on the side of the line that contains the test point.

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20. $x+4y=8$

x-intercept:

$x+4(0)=8$

$x=8$

$(8,0)$

y-intercept:

$0+4y=8$

$4y=8$

$y=2$

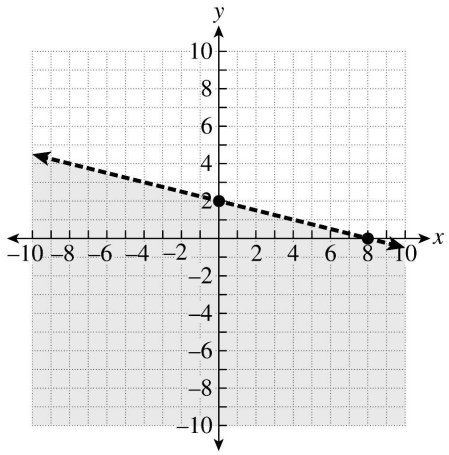
$(0,2)$

Test Point: $(0,0)$

$0+4(0)\le 8$

$0\le 8$

True. Shade on the side of the line that contains the test point.



21. $-9x+4y=0$

x-intercept: $(0,0)$

2^{nd} point:

$-9(4)+4y=0$

$-36+4y=0$

$4y=36$

$y=0$

$(4,9)$

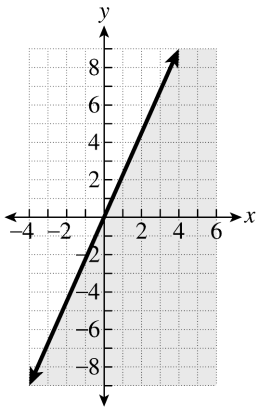
y-intercept: $(0,0)$

Test Point: $(1,0)$

$-9(1)+4(0)\le 0$

$-9\le 0$

True. Shade on the side of the line that contains the test point.



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

$m=-\frac{1}{4}$, y-intercept: $(0,0)$

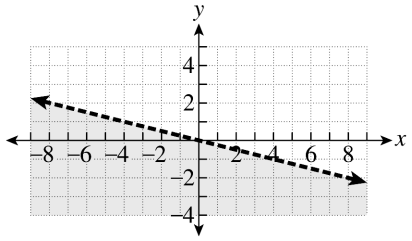
From the y-intercept count down 1 and right 4 to find the next point $(4,-1)$.

Test Point: $(0,3)$

$3<-\frac{1}{4}(0)$

$3<0$

False. Shade on the side of the line that does not contain the test point.



23. $y=3$

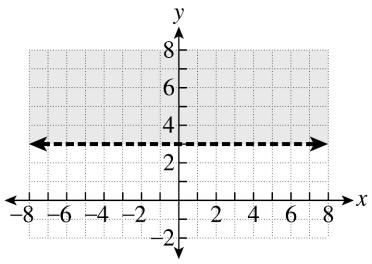
Test Point: $(0,0)$

$0>3$

False. Shade on the side of the line that does not contain the test point.

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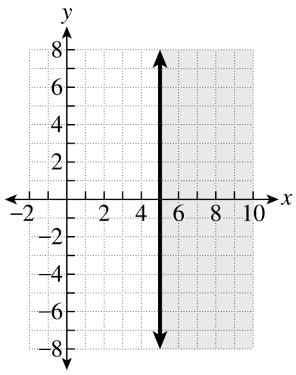


24. $x = 5$

Test Point: $(0,0)$

$0 \geq 5$

False. Shade on the side of the line that does not contain the test point.



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

$m = \frac{3}{4}$, y-intercept: $(0,5)$

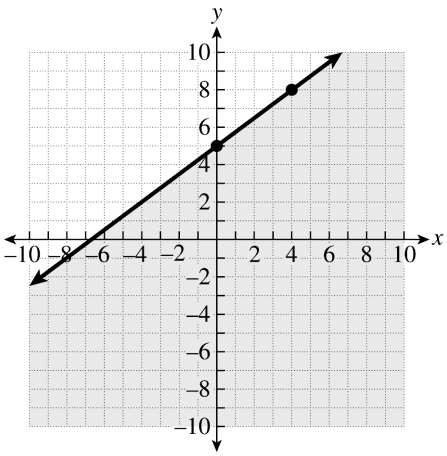
From the y-intercept, count up 3 and right 4 to find the next point, $(4,8)$.

Test Point: $(0,0)$

$0 \leq \frac{3}{4}(0) + 5$

$0 \leq 5$

True. Shade on the side of the line that contains the test point.



26. $y = 2x - 9$

$m = 2$, y-intercept: $(0,-9)$

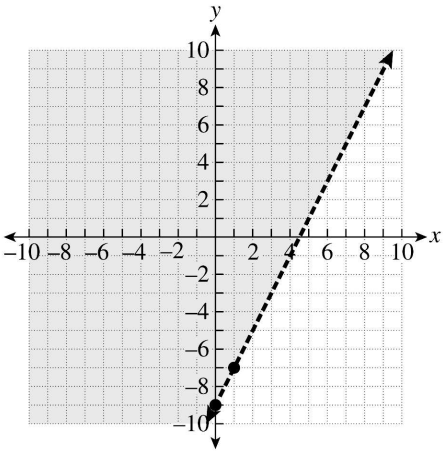
From the y-intercept, count up 2 and right 1 to find the next point, $(1,-7)$.

Test Point: $(0,0)$

$0 > 2(0) - 9$

$0 > -9$

True. Shade on the side of the line that contains the test point.



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27. $y = -3x - 1$

$m = -3$, y-intercept: $(0,-1)$

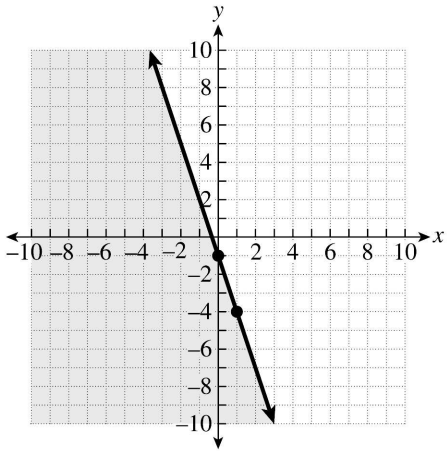
From the y-intercept, count down 3 and right 1 to find the next point, $(1,-4)$.

Test Point: $(0,0)$

$0 \le -3(0) - 1$

$0 \le -1$

False. Shade on the side of the line that does not contain the test point.

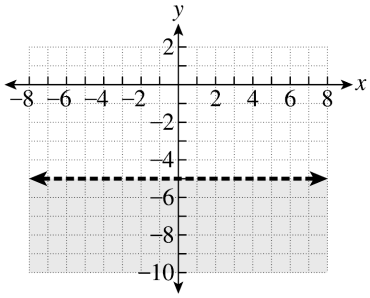


28. $y = -5$

Test Point: $(0,0)$

$0 < -5$

False. Shade on the side of the line that does not contain the test point.



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

$m = -\frac{3}{2}$, y-intercept: $(0,-5)$

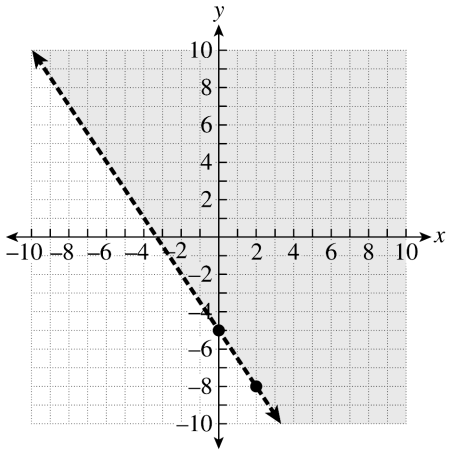
From the y-intercept, count down 3 and right 2 to find the next point, $(2,-8)$.

Test Point: $(0,0)$

$0 > -\frac{3}{2}(0) - 5$

$0 > -5$

True. Shade on the side of the line that contains the test point.



30. $y = \frac{3}{5}x$

$m = \frac{3}{5}$, y-intercept: $(0,0)$

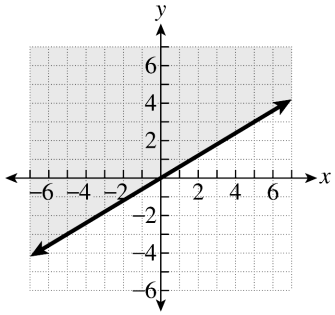
From the y-intercept, count up 3 and right 5 to find the next point, $(5,3)$.

Test Point: $(0,2)$

$2 \ge \frac{3}{5}(0)$

$2 \ge 0$

True. Shade on the side of the line that contains the test point.



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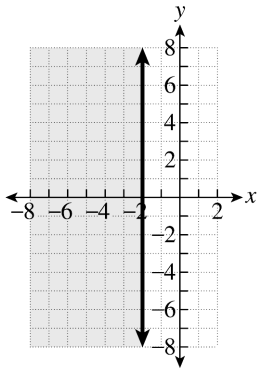
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31. $x = -2$

Test Point: $(0,0)$

$0 \le -2$

False. Shade on the side of the line that does not contain the test point.



32. $y = x$

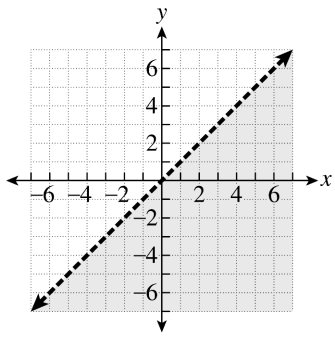
$m = 1$, y-intercept: $(0,0)$

From the y-intercept, count up 1 and right 1 to find the next point, $(1,1)$.

Test Point: $(0,2)$

$2 < 0$

False. Shade on the side of the line that does not contain the test point.



33. $y = -x - 5$

$m = -1$

y-intercept: $(0,-5)$

Test Point: $(-6,0)$

$0 ___ -(-6) - 5$

$0 ___ 6 - 5$

$0 \underline{<} 1$

$y \le -x - 5$

34. $y = x + 6$

$m = 1$

y-intercept: $(0,6)$

Test Point: $(-7,0)$

$0 ___ (-7) + 6$

$0 \underline{>} -1$

$y \ge x + 6$

35. $y = 8x$

$m = 8$

y-intercept: $(0,0)$

Test Point: $(0,2)$

$2 ___ 8(0)$

$2 \underline{>} 0$

$y > 8x$

36. $y = 6$

Test Point: $(0,0)$

$0 \underline{<} 6$

$y \le 6$

37. $-x + 3y = 9$

x-intercept:

$-x + 3(0) = 9$

$-x = 9$

$x = -9$

$(-9,0)$

y-intercept:

$-(0) + 3y = 9$

$3y = 9$

$y = 3$

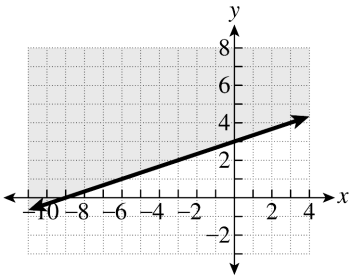
$(0,3)$

Test Point: $(0,0)$

$-(0) + 3(0) \ge 9$

$0 \ge 9$

False. Shade on the side of the line that does not contain the test point.



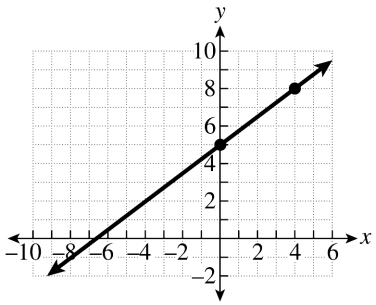
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38. $y = \frac{3}{4}x + 5$

$m = \frac{3}{4}$, y-intercept: $(0,5)$

From the y-intercept, count up 3 and right 4 to find the next point, $(4,8)$.



39. $4x - 3y = 24$

x-intercept:

$4x - 3(0) = 24$

$4x = 24$

$x = 6$

$(6,0)$

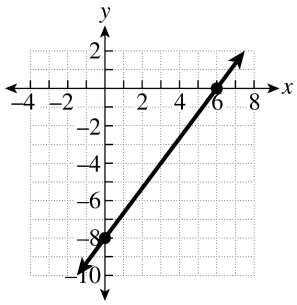
y-intercept:

$4(0) - 3y = 24$

$-3y = 24$

$y = -8$

$(0,-8)$

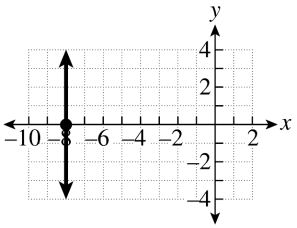


40. $x = -8$

x-intercept: $(-8,0)$

slope: undefined

This is a vertical line. Every point on the line has an x-coordinate of -8.



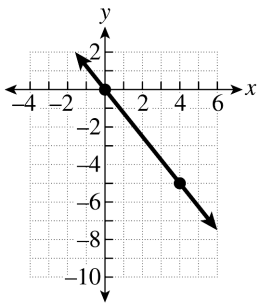
41. $5x + 4y = 0$

$4y = -5x$

$y = -\frac{5}{4}x$

x-intercept and y-intercept are both $(0,0)$.

From the origin, count down 5 and right 4 to find the next point, $(4,-5)$.



42. $y = -x + 15$

$m = -1$, y-intercept: $(0,15)$

x-intercept: $0 = -x + 15$

$x = 15$

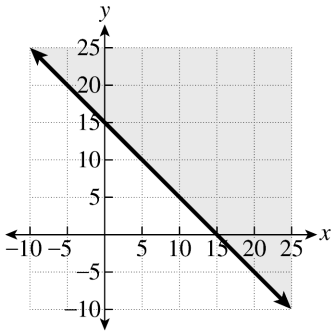
$(15,0)$

Test Point: $(0,0)$

$0 \geq -(0) + 15$

$0 \geq 15$

False. Shade on the side of the line that does not contain the test point.



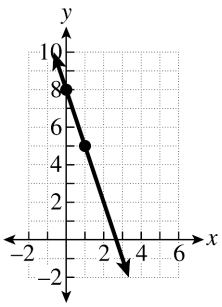
43. $y = -3x + 8$

$m = -3$, y-intercept: $(0,8)$

From the y-intercept, count down 3 and right 1 to find the next point, $(1,5)$.

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44. $7x-2y=-14$

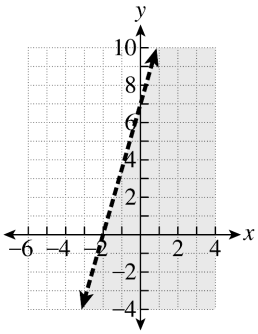
x-intercept:	y-intercept:
$7x-2(0)=-14$	$7(0)-2y=-14$
$7x=-14$	$-2y=-14$
$x=-2$	$y=7$
$(-2,0)$	$(0,7)$

Test Point: $(0,0)$

$7(0)-2(0)>-14$

$0>-14$

True. Shade on the side of the line that contains the test point.



$y=2x-30$

$m=2$, y-intercept: $(0,-30)$

x-intercept: $0=2x-30$

$-2x=-30$

$x=15$

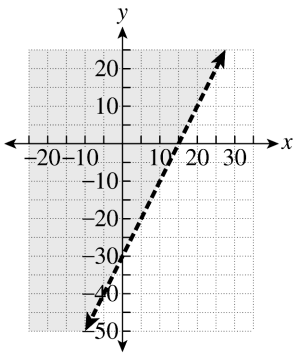
$(15,0)$

Test Point: $(0,0)$

$0>2(0)-30$

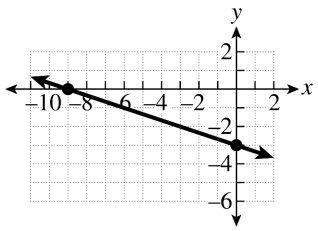
45. $0>-30$

True. Shade on the side of the line that contains the test point.



46. $x+3y=-9$

x-intercept:	y-intercept:
$x+3(0)=-9$	$0+3y=-9$
$x=-9$	$y=-3$
$(-9,0)$	$(0,-3)$



47. Let x represent the number of faculty.
Let y represent the number of students.

$x+y>50$

Graph $x+y=50$.

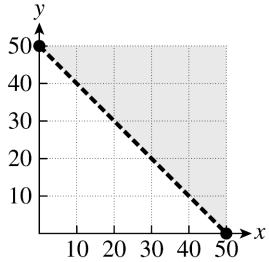
x-intercept:	y-intercept:
$x+(0)=50$	$(0)+y=50$
$x=50$	$y=50$
$(50,0)$	$(0,50)$

Test Point: $(0,0)$

$0+0>50$

$0>50$

False. Shade on the side of the line that does not contain the test point.



48. a) Let x represent the number of adults.
Let y represent the number of children.

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$160x+60y\le 1200$

$160x+60y=1200$

x-intercept:

$160x+60(0)=1200$

$160x=1200$

$x=7.5$

$(7.5,0)$

y-intercept:

$160(0)+60y=1200$

$60y=1200$

$y=20$

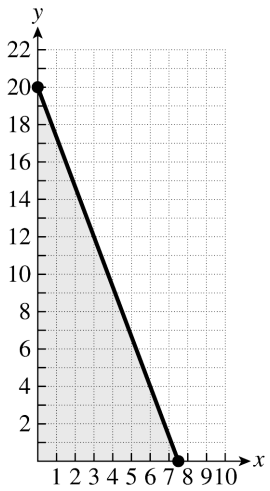
$(0,20)$

Test Point: $(0,0)$

$160(0)+60(0)\le 1200$

$0\le 1200$

True. Shade on the side of the line that contains the test point.



b) No. The point $(2,16)$, which represents two adults and 16 children, is not in the shaded region.

49. There are two unknowns in this problem: the number of homework assignments and the number of quizzes. Let x represent the number of homework assignments and y represent the number of quizzes. Because the total number of points needed to pass the class is at least 200, and each homework assignment is worth 4 points and each quiz 10 points, we know that $4x+10y\ge 200$. Since we cannot have a negative number of points, we know that $x\ge 0$ and $y\ge 0$. To graph the inequality, begin by graphing $4x+10y=200$ as a solid line. We can solve this equation to find the x-intercept and y-intercept.

x-intercept

$4x+10(0)=200$

$4x=200$

$x=50$

y-intercept

$4(0)+10y=200$

$10y=200$

$y=20$

The x-intercept is (50, 0).
The y-intercept is (0, 20).

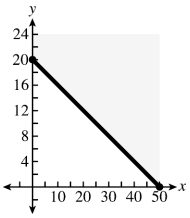
Use the origin as a test point since it is not on the line.

$4x+10y\ge 200$

$4(0)+10(0)\ge 200$.

$0\ge 200$

This is a false statement, so we shade on the side of the line that does not contain the origin.



50. There are two unknowns in this problem: the number of desktop computers and the number of laptop computers. Let x represent the number of desktop computers and y represent the number of laptop computers. Because the total budget to purchase new computers is less than \$30,000, and each desktop computer costs \$600 and each laptop computer costs \$750, we know that $600x+750y\le 30,000$. Since the cost of the computers cannot be negative, we know that $x\ge 0$ and $y\ge 0$. To graph the inequality, begin by graphing $600x+750y=30,000$ as a solid line. We can solve this equation to find the x-intercept and y-intercept.

x-intercept

$600x+750(0)=30,000$

$600x=30,000$

$x=50$

y-intercept

$600(0)+750y=30,000$

$750y=30,000$

$y=40$

The x-intercept is (50, 0).
The y-intercept is (0, 40).

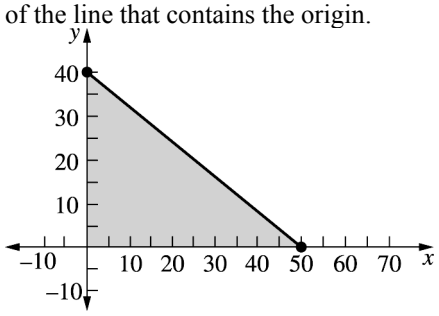
Use the origin as a test point since it is not on the line.

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$$600x + 750y \le 30,000$$
$$600(0) + 750(0) \le 30,000$$
$$0 \le 30,000$$

This is a true statement, so we shade on the side of the line that contains the origin.



51. There are two unknowns in this problem: the number of field goals and the number of touchdowns. Let x represent the number of field goals and y represent the number of touchdowns. Because the coach has set a goal to score at least 550 points, and each field goal scores 3 points and each touchdown scores 7 points, we know that $3x + 7y \ge 550$. Since points scored cannot be negative, we know that $x \ge 0$ and $y \ge 0$. To graph the inequality, begin by graphing $3x + 7y = 550$ as a solid line. We can solve this equation to find the x-intercept and y-intercept.

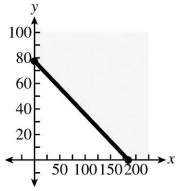
x-intercept	y-intercept
$3x + 7(0) = 550$	$3(0) + 7y = 550$
$3x = 550$	$7y = 550$
$x = 183.33$	$y = 78.57$

The x-intercept is (183.33, 0).
The y-intercept is (0, 78.57).

Use the origin as a test point since it is not on the line.

$$3x + 7y \ge 550$$
$$3(0) + 7(0) \ge 550$$
$$0 \ge 550$$

This is a false statement, so we shade on the side of the line that does not contain the origin.



52. There are two unknowns in this problem: boxes of chocolates and packages of popcorn.

Let x represent the number of boxes of chocolates and y represent the number of packages of popcorn. Because the club wants to raise at least \$2500, and each box of chocolates costs \$6 and each package of popcorn costs \$4, we know that $6x + 4y \ge 2500$. Since the cost of chocolates and popcorn cannot be negative, we know that $x \ge 0$ and $(0, 2)$. To graph the inequality, begin by graphing $f(0) = 2$ as a solid line. We can solve this equation to find the x-intercept and y-intercept.

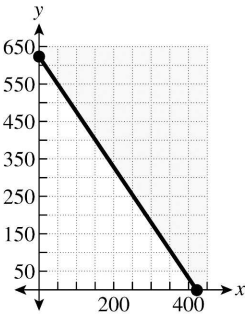
x-intercept	y-intercept
$6x + 4(0) = 2500$	$6(0) + 4y = 2500$
$6x = 2500$	$4y = 2500$
$x = 416.67$	$y = 625$

The x-intercept is (416.67, 0). The y-intercept is (0, 625).

Use the origin as a test point since it is not on the line.

$$6x + 4y \ge 2500$$
$$6(0) + 4(0) \ge 30,000$$
$$0 \ge 30,000$$

This is a false statement, so we shade on the side of the line that does not contain the origin.



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53. $x+y=3$

y-intercept: $(0,3)$

x-intercept: $(3,0)$

Test Point: $(0,0)$

$0+0<3$

$0<3$

True. Shade on the side of the line that contains the test point.

$y=x-7$

y-intercept: $(0,-7)$

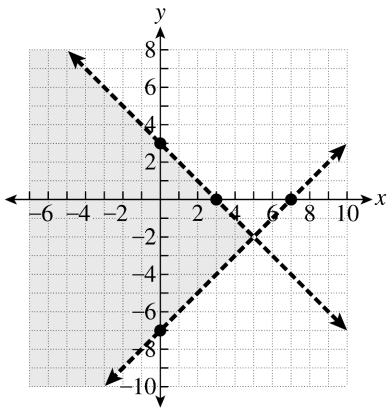
x-intercept: $(7,0)$

Test Point: $(0,0)$

$0>0-7$

$0>-7$

True. Shade on the side of the line that contains the test point.



54. $2x+3y=18$

y-intercept: $(0,6)$

x-intercept: $(9,0)$

Test Point: $(0,0)$

$2(0)+3(0)\le 18$

$0\le 18$

True. Shade on the side of the line that contains the test point.

$2x+y=8$

y-intercept: $(0,8)$

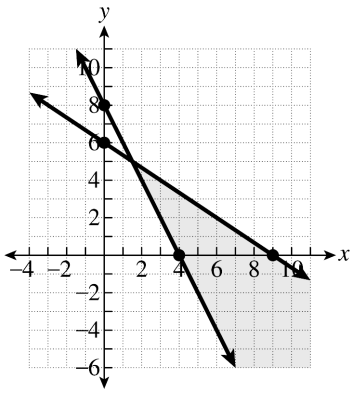
x-intercept: $(4,0)$

Test Point: $(0,0)$

$2(0)+(0)\ge 8$

$0\ge 8$

False. Shade on the side of the line that does not contain the test point.



55. Explanations will vary. Example:
Since points on the line are not solutions when < or > are involved, we use a dashed line when graphing.
Since points on the line are solutions if ≤ or ≥ are involved, we use a solid line when graphing.

56. The solutions of the equation $y=2x-6$ are ordered pairs that lie on a line while the solutions of the inequality $y<2x-6$ are in the half-plane below the line $y=2x-6$.

57. The graph of $y\ge 3x+15$ has a solid line for $y=3x+15$ and the other graph has a dashed line for $y=3x+15$.

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58. Choose a test point not on the line and determine if it is a solution. If it is a solution, shade the half-plane containing the test point. Otherwise, shade the half-plane that does not contain the test point.

59. It is equivalent to an open circle because the points on the dashed line are not solutions to the inequality.

2.5 LINEAR FUNCTIONS

1. function

2. domain

3. range

4. evaluating

5. linear

6. domain

7. No, each state has two senators.

8. Yes, each senator has only one home state.

9. Yes, each person has only one birth mother.

10. No, some women have more than one child.

11. **a)** Yes. **b)** No.

12. **a)** Yes. **b)** Yes.

13. **a)** Yes. **b)** No.

14. **a)** Yes. **b)** Yes.

15. Yes.

16. No, some x-coordinates are associated with more than one y-coordinate.
Example: $(2,-2)$ and $(2,2)$

17. No, some x-coordinates are associated with more than one y-coordinate.
Example: $(5,3)$ and $(5,-2)$

18. Yes.

19. No, some x-coordinates are associated with more than one y-coordinate.
Example: $(2,-5)$ and $(2,-1)$

20. Yes.

21. **a)** $F(x)=\frac{9}{5}x+32$

b) $F(0)=\frac{9}{5}(0)+32=0+32=32^\circ\text{F}$

$F(100)=\frac{9}{5}(100)+32=180+32=212^\circ\text{F}$

$F(30)=\frac{9}{5}(30)+32=54+32=86^\circ\text{F}$

$F(-10)=\frac{9}{5}(-10)+32=-18+32=14^\circ\text{F}$

$F(-40)=\frac{9}{5}(-40)+32=-72+32=-40^\circ\text{F}$

22. $C(x)=\frac{5}{9}(x-32)$

23. **a)** $f(x)=300x+1500$

b) $f(14)=300(14)+1500$
$=4200+1500$
$=5700$
\$5700

24. **a)** $f(x)=80x+350$

b) $f(200)=80(200)+350$
$=16{,}000+350$
$=16{,}350$
\$16,350

25. $f(x)=4x+3$

26. $f(x)=5x-9$

27. $f(x)=-3x-4$

28. $f(x)=-\frac{1}{2}x+\frac{2}{3}$

29. $f(x)=6$

30. $f(x)=0$

31. $f(x)=x+17$
$f(35)=35+17=52$

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32. $f(x)=6x$

$f(-13)=6(-13)=-78$

33. $g(x)=9x-60$

$g(-8)=9(-8)-60=-72-60=-132$

34. $h(x)=209-46x$

$h(-19)=209-46(-19)=209+874=1083$

35. $f(x)=-\frac{3}{4}x+15$

$f(24)=-\frac{3}{4}(24)+15=-18+15=-3$

36. $f(x)=\frac{11}{6}x-30$

$f(-18)=\frac{11}{6}(-18)-30=-33-30=-63$

37. $f(0)=9(0)-25=0-25=-25$

38. $f(0)=6(0)+13=0+13=13$

39. $g\left(\frac{2}{3}\right)=3\left(\frac{2}{3}\right)-1=2-1=1$

40. $g\left(\frac{9}{5}\right)=5\left(\frac{9}{5}\right)+7=9+7=16$

41. $f(a)=3(a)+4=3a+4$

42. $f(b)=2(b)-3=2b-3$

43. $f(a+3)=7(a+3)-2=7a+21-2=7a+19$

44. $f(a-7)=5(a-7)+9=5a-35+9=5a-26$

45. $f(x)=400-7x$

$$\begin{aligned} f(5a-8) &= 400-7(5a-8) \\ &= 400-35a+56 \\ &= -35a+456 \end{aligned}$$

46. $f(x)=32-9x$

$$\begin{aligned} f(3a+11) &= 32-9(3a+11) \\ &= 32-27a-99 \\ &= -27a-67 \end{aligned}$$

47. $f(x)=8x-35$

$f(x+h)=8(x+h)-35=8x+8h-35$

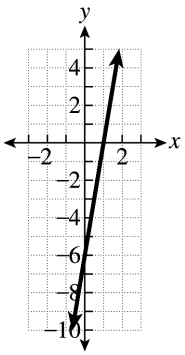
48. $f(x)=10x+72$

$f(x+h)=10(x+h)+72=10x+10h+72$

49. $f(x)=6x-6$

$m=6$, y-intercept: $(0,-6)$

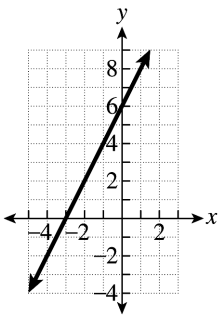
From the y-intercept, count up 6 and right 1 to find the next point, $(1,0)$.



50. $f(x)=2x+6$

$m=2$, y-intercept: $(0,6)$

From the y-intercept, count up 2 and right 1 to find the next point, $(1,8)$.



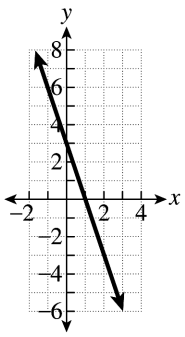
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51. $f(x) = -3x + 3$

$m = -3$, y-intercept: $(0, 3)$

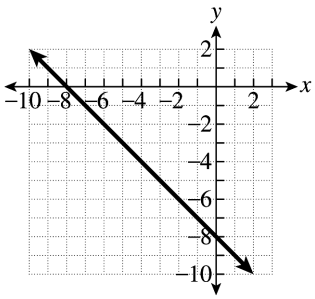
From the y-intercept, count down 3 and right 1 to find the next point, $(1, 0)$.



52. $f(x) = -x - 8$

$m = -1$, y-intercept: $(0, -8)$

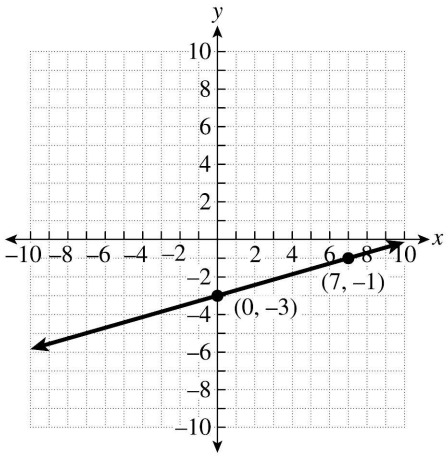
From the y-intercept, count down 1 and right 1 to find the next point, $(1, -9)$.



53. $f(x) = \frac{2}{7}x - 3$

$m = \frac{2}{7}$, y-intercept: $(0, -3)$

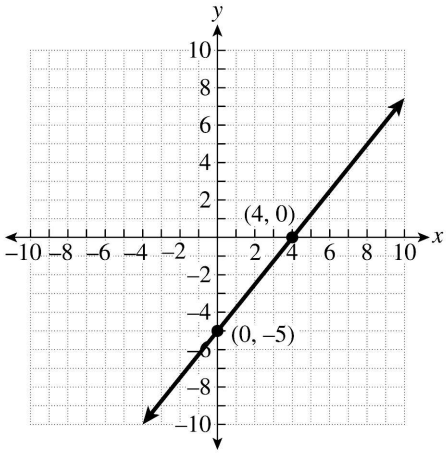
From the y-intercept, count up 2 and right 7 to find the next point $(7, -1)$.



54. $f(x) = \frac{5}{4}x - 5$

$m = \frac{5}{4}$, y-intercept: $(0, -5)$

From the y-intercept, count up 5 and right 4 to find the next point $(4, 0)$.

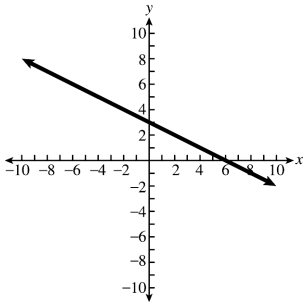


55. First graph the y-intercept (0, 3). The slope of the line is $-\frac{1}{2}$ so beginning at the point (0, 3), we move 1 unit down and 2 units to the right to find the next point (2, 2). We can also move 2 units to the left and 1 unit up to find another

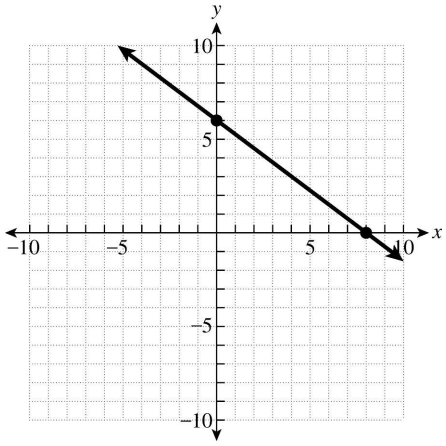
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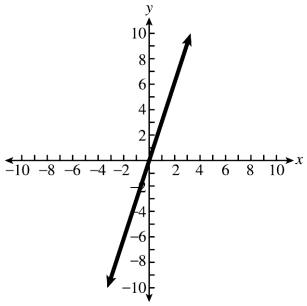
point $(-2, 4)$ to form a line.



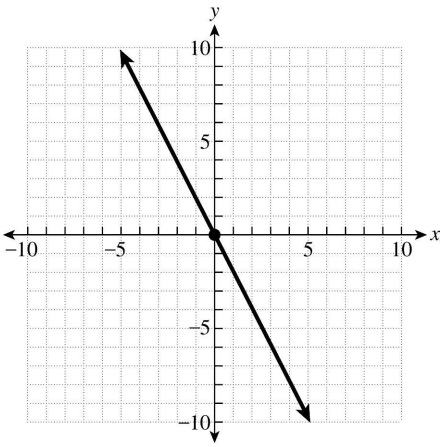
56. First graph the y-intercept $(0, 6)$. The slope of the line is $-\frac{3}{4}$ so beginning at the point $(0, 6)$, we move 3 units down and 4 units to the right to find the next point $(4, 3)$. We can also move 4 units to the left and 3 units up to find another point $(-4, 9)$ to form a line.



57. First graph the y-intercept $(0, 0)$. The slope of the line is 3 so beginning at the point $(0, 0)$, we move 3 units up and 1 unit to the right to find the next point $(1, 3)$. We can also move 1 unit to the left and 3 units down to find another point $(-1, -3)$ to form a line.



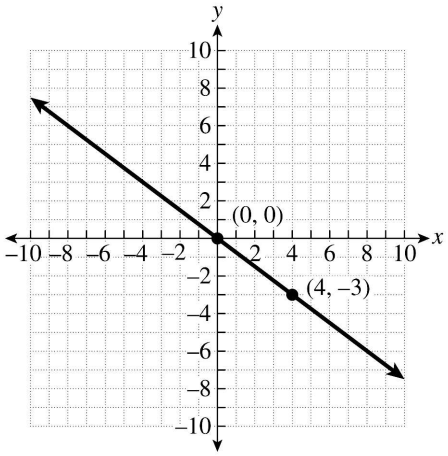
58. First graph the y-intercept $(0, 0)$. The slope of the line is -2 so beginning at the point $(0, 0)$, we move 2 units down and 1 unit to the right to find the next point $(1, -2)$. We can also move 1 unit to the left and 2 units up to find another point $(-1, 2)$ to form a line.



59. $f(x) = -\frac{3}{4}x$

$m = -\frac{3}{4}$, y-intercept: $(0, 0)$

From the y-intercept, count down 3 and right 4 to find the next point $(4, -3)$.



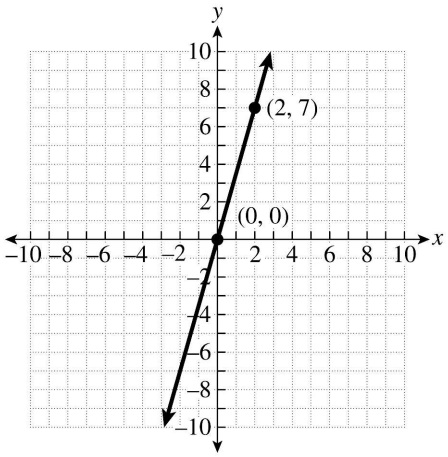
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60. $f(x)=\frac{7}{2}x$

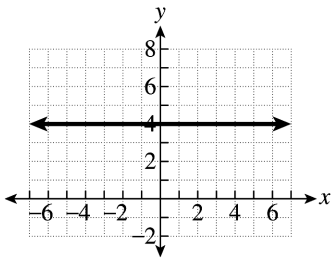
$m=\frac{7}{2}$, y-intercept: $(0,0)$

From the y-intercept, count up 7 and right 2 to find the next point $(2,7)$.



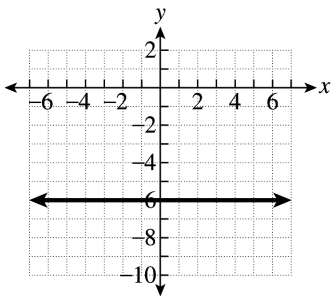
61. $f(x)=4$

$m=0$, y-intercept: $(0,4)$

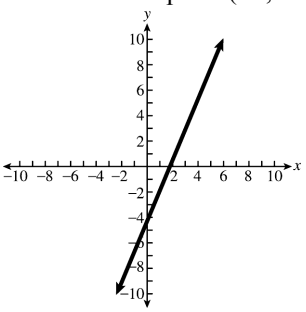


62. $f(x)=-6$

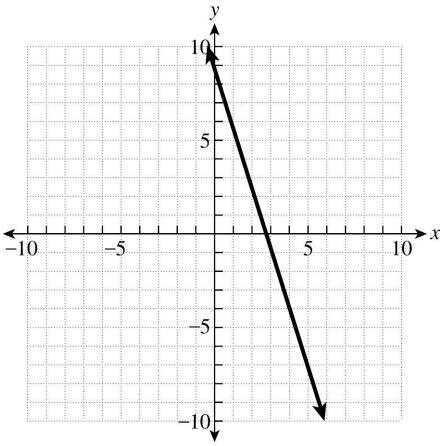
$m=0$, y-intercept: $(0,-6)$



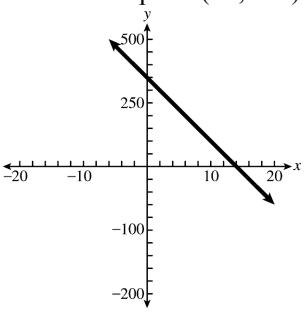
63. First graph the y-intercept $(0,-4.5)$. The slope of the line is 2.5 so beginning at the point $(0,-4.5)$, we move 2.5 units up and 1 unit to the right to find the next point (1, −2). We can also move 2.5 units down and 1 unit to the left to find another point (−1, −7) to form a line.



64. First graph the y-intercept $(0,8.8)$. The slope of the line is -3.2 so beginning at the point $(0,8.8)$, we move 3.2 units down and 1 unit to the right to find the next point (1, 5.6). We can also move 3.2 units up and 1 unit to the left to find another point (−1, 12) to form a line.



65. First graph the y-intercept $(0,350)$. The slope of the line is -25 so beginning at the point $(0,350)$, we move 25 units down and 1 unit to the right find the next point (1, 325). We can also move 25 units up and 1 unit to the left to find another point (−1, 375) to form a line.

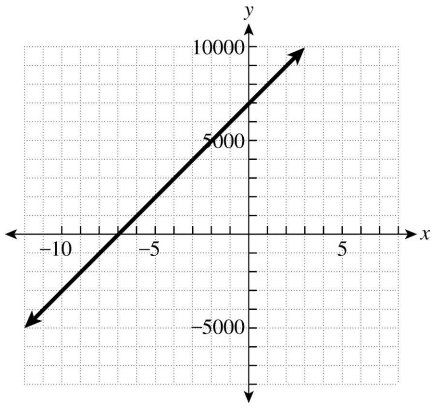


66. First graph the y-intercept $(0,7000)$. The slope of the line is 1000 so beginning at the point $(0,7000)$, we move 1000 units up and 1 unit to the right to find the next point (1, 8000). We

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can also move 1000 units down and 1 unit to the left to find another point $(-1, 6000)$ to form a line.



67. First find $f(x+h)$.

$$\begin{aligned} f(x+h) &= 5(x+h)+8 \\ &= 5x+5h+8 \end{aligned}$$

Now replace $f(x+h)$ by $5x+5h+8$ and $f(x)$ by $5x+8$ in the difference quotient.

$$\begin{aligned} \frac{f(x+h)-f(x)}{h} &= \frac{5x+5h+8-(5x+8)}{h} \\ &= \frac{5x+5h+8-5x-8}{h} \\ &= \frac{5h}{h} \\ &= 5 \end{aligned}$$

The difference quotient is equal to 5. Since the difference quotient does not contain the variable x, the rate of change for the function is 5 for any value of x.

68. First find $f(x+h)$.

$$\begin{aligned} f(x+h) &= 3(x+h)+11 \\ &= 3x+3h+11 \end{aligned}$$

Now replace $f(x+h)$ by $3x+3h+11$ and $f(x)$ by $3x+11$ in the difference quotient.

$$\begin{aligned} \frac{f(x+h)-f(x)}{h} &= \frac{3x+3h+11-(3x+11)}{h} \\ &= \frac{3x+3h+11-3x-11}{h} \\ &= \frac{3h}{h} \\ &= 3 \end{aligned}$$

The difference quotient is equal to 3. Since the difference quotient does not contain the variable x, the rate of change for the function is 3 for any value of x.

69. First find $f(x+h)$.

$$\begin{aligned} f(x+h) &= 7(x+h)-18 \\ &= 7x+7h-18 \end{aligned}$$

Now replace $f(x+h)$ by $7x+7h-18$ and $f(x)$ by $7x-18$ in the difference quotient.

$$\begin{aligned} \frac{f(x+h)-f(x)}{h} &= \frac{7x+7h-18-(7x-18)}{h} \\ &= \frac{7x+7h-18-7x+18}{h} \\ &= \frac{7h}{h} \\ &= 7 \end{aligned}$$

The difference quotient is equal to 7. Since the difference quotient does not contain the variable x, the rate of change for the function is 7 for any value of x.

70. First find $f(x+h)$.

$$\begin{aligned} f(x+h) &= 12(x+h)-29 \\ &= 12x+12h-29 \end{aligned}$$

Now replace $f(x+h)$ by $12x+12h-29$ and $f(x)$ by $12x-29$ in the difference quotient.

$$\begin{aligned} \frac{f(x+h)-f(x)}{h} &= \frac{12x+12h-29-(12x-29)}{h} \\ &= \frac{12x+12h-29-12x+29}{h} \\ &= \frac{12h}{h} \\ &= 12 \end{aligned}$$

The difference quotient is equal to 12. Since the difference quotient does not contain the variable x, the rate of change for the function is 12 for any value of x.

71. First find $f(x+h)$.

$$\begin{aligned} f(x+h) &= -4(x+h)-32 \\ &= -4x-4h-32 \end{aligned}$$

Now replace $f(x+h)$ by $-4x-4h-32$ and $f(x)$ by $-4x-32$ in the difference quotient.

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$$\frac{f(x+h)-f(x)}{h} = \frac{-4x-4h-32-(-4x-32)}{h}$$
$$= \frac{-4x-4h-32+4x+32}{h}$$
$$= \frac{-4h}{h}$$
$$= -4$$

The difference quotient is equal to −4. Since the difference quotient does not contain the variable x, the rate of change for the function is −4 for any value of x.

72. First find $f(x+h)$.

$$f(x+h) = -6(x+h)+1000$$
$$= -6x-6h+1000$$

Now replace $f(x+h)$ by $-6x-6h+1000$ and $f(x)$ by $-6x+1000$ in the difference quotient.

$$\frac{f(x+h)-f(x)}{h}$$
$$= \frac{-6x-6h+1000-(-6x+1000)}{h}$$
$$= \frac{-6x-6h+1000+6x-1000}{h}$$
$$= \frac{-6h}{h}$$
$$= -6$$

The difference quotient is equal to −6. Since the difference quotient does not contain the variable x, the rate of change for the function is −6 for any value of x.

73. First find $f(x+h)$.

$$f(x+h) = -8(x+h)+225$$
$$= -8x-8h+225$$

Now replace $f(x+h)$ by $-8x-8h+225$ and $f(x)$ by $-8x+225$ in the difference quotient.

$$\frac{f(x+h)-f(x)}{h}$$
$$= \frac{-8x-8h+225-(-8x+225)}{h}$$
$$= \frac{-8x-8h+225+8x-225}{h}$$
$$= \frac{-8h}{h}$$
$$= -8$$

The difference quotient is equal to −8. Since the difference quotient does not contain the variable x, the rate of change for the function is −8 for any value of x.

74. First find $f(x+h)$.

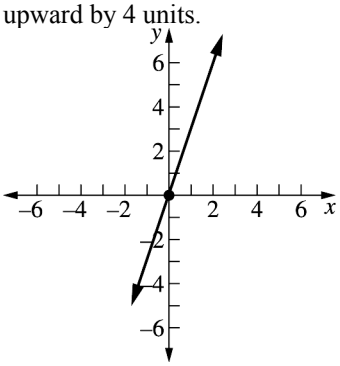
$$f(x+h) = -26(x+h)-375$$
$$= -26x-26h-375$$

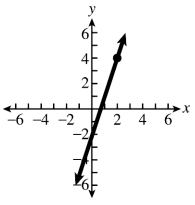
Now replace $f(x+h)$ by $-26x-26h-375$ and $f(x)$ by $-26x-375$ in the difference quotient.

$$\frac{f(x+h)-f(x)}{h}$$
$$= \frac{-26x-26h-375-(-26x-375)}{h}$$
$$= \frac{-26x-26h-375+26x+375}{h}$$
$$= \frac{-26h}{h}$$
$$= -26$$

The difference quotient is equal to −26. Since the difference quotient does not contain the variable x, the rate of change for the function is −26 for any value of x.

75. The slope of the line is $m = 3$. The value of h is 2, and the value of k is 4. Begin by graphing a line of slope 3 that passes through the origin and then shift the graph 2 units to the right and upward by 4 units.



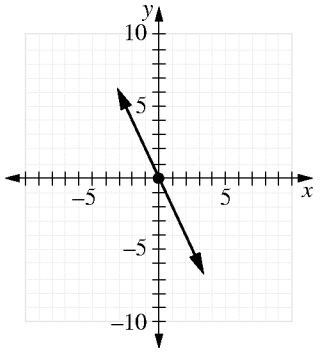


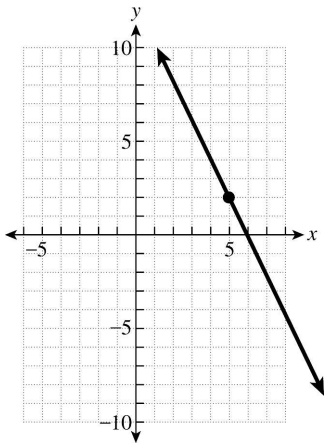
76. The slope of the line is $m = -2$. The value of h is 5, and the value of k is 2. Begin by graphing a line of slope -2 that passes through the

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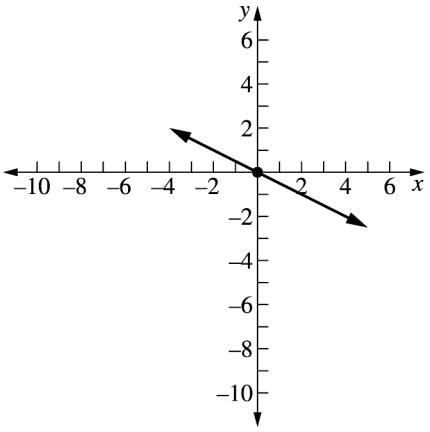
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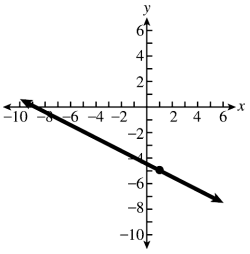
origin and then shift the graph 5 units to the right and upward by 2 units.



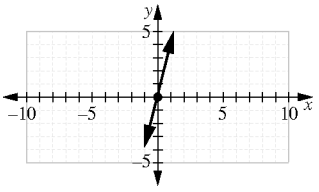


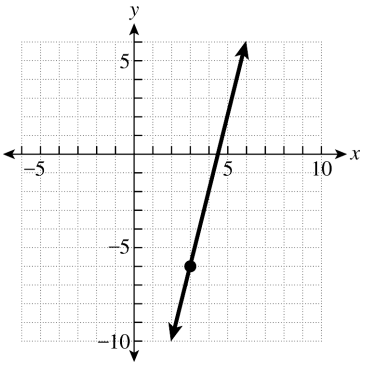
77. The slope of the line is $m = -\frac{1}{2}$. The value of h is 1, and the value of k is -5. Begin by graphing a line of slope $-\frac{1}{2}$ that passes through the origin and then shift the graph 1 unit to the right and downward by 5 units.





78. The slope of the line is $m = 4$. The value of h is 3, and the value of k is -6. Begin by graphing a line of slope 4 that passes through the origin and then shift the graph 3 units to the right and downward by 6 units.

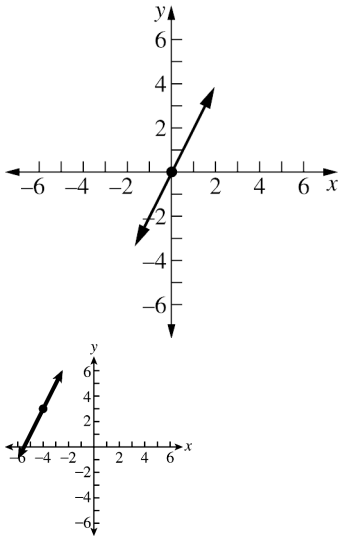




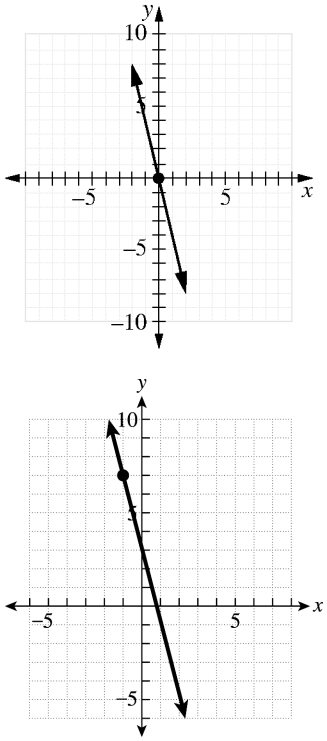
79. The slope of the line is $m = 2$. The value of h is -4, and the value of k is 3. Begin by graphing a line of slope 2 that passes through the origin and then shift the graph 4 units to the left and upward by 3 units.

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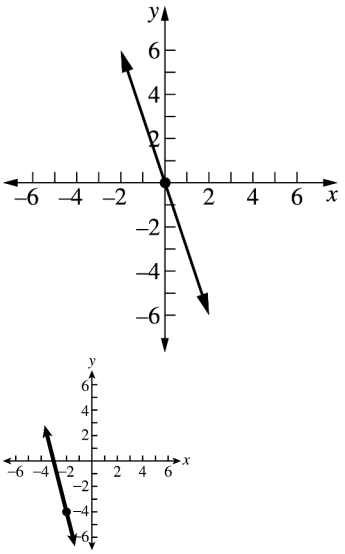
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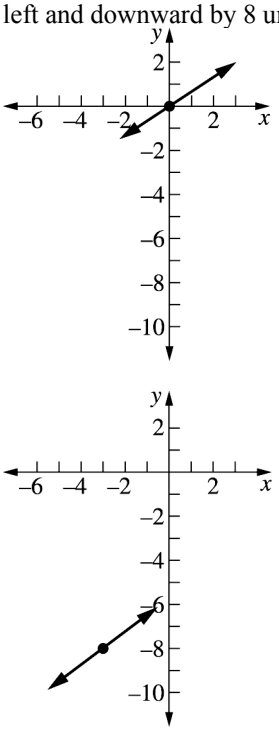
80. The slope of the line is $m = -4$. The value of h is -1, and the value of k is 7. Begin by graphing a line of slope -4 that passes through the origin and then shift the graph 1 units to the left and upward by 7 units.



81. The slope of the line is $m = -3$. The value of h is -2, and the value of k is -4. Begin by graphing a line of slope -3 that passes through the origin and then shift the graph 2 units to the left and downward by 4 units.



82. The slope of the line is $m = \frac{3}{4}$. The value of h is -3, and the value of k is -8. Begin by graphing a line of slope $\frac{3}{4}$ that passes through the origin and then shift the graph 3 units to the left and downward by 8 units.



83. **a)** $f(5) = 4$

b) If $f(a) = -8$, then $a = -1$.

c) Domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$

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84. **a)** $g(-4) = -5$

b) If $f(a) = -2$, then $a = -7$.

c) Domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$

85. **a)** $f(2) = 3$

b) If $f(a) = 9$, then $a = -2$.

c) Domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$

86. **a)** $f(-1) = 4$

b) If $f(a) = -8$, then $a = -4$.

c) Domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$

87. **a)** $f(4) = 5$

b) Domain: $(-\infty, \infty)$; range: $\{5\}$

88. **a)** $f(-3) = -2$

b) Domain: $(-\infty, \infty)$; range: $\{-2\}$

89. Since the slope is 4, we know that $m = 4$ and that $f(x)$ is of the form $f(x) = 4x + b$. We also know that the graph passes through the point $(2, 5)$ since we know $f(2) = 5$. We will use this to find b.

$f(2) = 5$
$4(2) + b = 5$
$8 + b = 5$
$b = -3$
Since the value of b is -3, the function is $f(x) = 4x - 3$.

90. Since the slope is 2, we know that $m = 2$ and that $f(x)$ is of the form $f(x) = 2x + b$. We also know that the graph passes through the point $(7, -9)$ since we know $f(7) = -9$. We will use this to find b.

$f(7) = -9$
$2(7) + b = -9$
$14 + b = -9$
$b = -23$
Since the value of b is -23, the function is $f(x) = 2x - 23$.

91. Since the slope is -3, we know that $m = -3$ and that $f(x)$ is of the form $f(x) = -3x + b$. We also know that the graph passes through the point $(-1, 8)$ since we know $f(-1) = 8$. We will use this to find b.

$f(-1) = 8$
$-3(-1) + b = 8$
$3 + b = 8$
$b = 5$
Since the value of b is 5, the function is $f(x) = -3x + 5$.

92. Since the slope is -1, we know that $m = -1$ and that $f(x)$ is of the form $f(x) = -x + b$. We also know that the graph passes through the point $(-5, -13)$ since we know $f(-5) = -13$. We will use this to find b.

$f(-5) = -13$
$-1(-5) + b = -13$
$5 + b = -13$
$b = -18$
Since the value of b is -18, the function is $f(x) = -x - 18$.

93. Since the slope is $\frac{2}{3}$, we know that $m = \frac{2}{3}$ and that $f(x)$ is of the form $f(x) = \frac{2}{3}x + b$. We also know that the graph passes through the point $(6, -4)$ since we know $f(6) = -4$. We will use this to find b.

$f(6) = -4$
$\frac{2}{3}(6) + b = -4$
$4 + b = -4$
$b = -8$
Since the value of b is -8, the function is $f(x) = \frac{2}{3}x - 8$.

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94. Since the slope is $-\frac{3}{5}$, we know that $m = -\frac{3}{5}$ and that $f(x)$ is of the form $f(x) = -\frac{3}{5}x + b$.

We also know that the graph passes through the point $(-10, -9)$ since we know $f(-10) = -9$. We will use this to find b.

$$f(-10) = -9$$
$$-\frac{3}{5}(-10) + b = -9$$
$$6 + b = -9$$
$$b = -15$$

Since the value of b is -15, the function is $f(x) = -\frac{3}{5}x - 15$.

95. Since the slope is 6.4, we know that $m = 6.4$ and that $f(x)$ is of the form $f(x) = 6.4x + b$. We also know that the graph passes through the point $(4, 14.4)$ since we know $f(4) = 14.4$. We will use this to find b.

$$f(4) = 14.4$$
$$6.4(4) + b = 14.4$$
$$25.6 + b = 14.4$$
$$b = -11.2$$

Since the value of b is -11.2, the function is $f(x) = 6.4x - 11.2$.

96. Since the slope is 15.5, we know that $m = 15.5$ and that $f(x)$ is of the form $f(x) = 15.5x + b$. We also know that the graph passes through the point $(228.4, 2867.3)$ since we know $f(228.4) = 2867.3$. We will use this to find b.

$$f(228.4) = 2867.3$$
$$15.5(228.4) + b = 2867.3$$
$$3540.2 + b = 2867.3$$
$$b = -672.9$$

Since the value of b is -672.9, the function is $f(x) = 15.5x - 672.9$.

97. Since $f(1) = 3$ and $f(4) = 9$, we know the graph passes through the points (1, 3) and (4, 9). We can use these points to find the slope.

$$m = \frac{9-3}{4-1}$$
$$= \frac{6}{3}$$
$$= 2$$

The function is of the form $f(x) = 2x + b$.

Use either $f(1) = 3$ or $f(4) = 9$ to find b.

$$f(1) = 3$$
$$2(1) + b = 3$$
$$2 + b = 3$$
$$b = 1$$

The function is $f(x) = 2x + 1$.

98. Since $f(2) = 7$ and $f(6) = -9$, we know the graph passes through the points (2, 7) and $(6, -9)$. $\frac{\Delta y}{\Delta x}$. We can use these points to find the slope.

$$m = \frac{-9-7}{6-2}$$
$$= \frac{-16}{4}$$
$$= -4$$

The function is of the form $f(x) = -4x + b$.

Use either $f(2) = 7$ or $x < -5$ to find b.

$$f(2) = 7$$
$$-4(2) + b = 7$$
$$-8 + b = 7$$
$$b = 15$$

The function is $f(x) = -4x + 15$.

99. Since $x \geq -5$ and $f(5) = -14$, we know the graph passes through the points $(-3, -6)$ and $(5, -14)$. We can use these points to find the slope.

$$m = \frac{-14-(-6)}{5-(-3)}$$
$$= \frac{-8}{8}$$
$$= -1$$

The function is of the form $f(x) = -x + b$.

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Use either $f(-3)=-6$ or $f(5)=-14$ to find b.

$f(-3)=-6$
$-(-3)+b=-6$
$3+b=-6$
$b=-9$
The function is $f(x)=-x-9$.

100. Since $f(-4)=1$ and $f(2)=-17$, we know the graph passes through the points $(-4,1)$ and $(2,-17)$. We can use these points to find the slope.

$$m=\frac{-17-1}{2-(-4)}=\frac{-18}{6}=-3$$

The function is of the form $f(x)=-3x+b$.

Use either $f(-4)=1$ or $f(2)=-17$ to find b.

$f(-4)=1$
$-3(-4)+b=1$
$12+b=1$
$b=-11$

The function is $f(x)=-3x-11$.

101. Since $f(-3)=-10$ and $f(6)=2$, we know the graph passes through the points $(-3,-10)$ and $(6,2)$. We can use these points to find the slope.

$$m=\frac{2-(-10)}{6-(-3)}=\frac{12}{9}=\frac{4}{3}$$

The function is of the form $f(x)=\frac{4}{3}x+b$.

Use either $f(-3)=-10$ or $f(6)=2$ to find b.

$f(-3)=-10$
$\frac{4}{3}(-3)+b=-10$
$-4+b=-10$
$b=-6$
The function is $f(x)=\frac{4}{3}x-6$.

102. Since $f(-8)=22$ and $f(-2)=13$, we know the graph passes through the points $(-8,22)$ and $(-2,13)$. We can use these points to find the slope.

$$m=\frac{13-22}{-2-(-8)}=\frac{-9}{6}=-\frac{3}{2}$$

The function is of the form $f(x)=-\frac{3}{2}x+b$.

Use either $f(-8)=22$ or $f(-2)=13$ to find b.

$f(-8)=22$
$-\frac{3}{2}(-8)+b=22$
$12+b=22$
$b=10$
The function is $f(x)=-\frac{3}{2}x+10$.

103. Since $f(3.2)=-30.4$ and $f(-1.5)=-2.2$, we know the graph passes through the points $(3.2,-30.4)$ and $(-1.5,-2.2)$. We can use these points to find the slope.

$$m=\frac{-2.2-(-30.4)}{-1.5-(3.2)}=\frac{28.2}{-4.7}=-6$$

The function is of the form $f(x)=-6x+b$.

Use either $f(3.2)=-30.4$ or $f(-1.5)=-2.2$ to find b.

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$f(3.2) = -30.4$
$-6(3.2) + b = -30.4$
$-19.2 + b = -30.4$
$b = -11.2$

The function is $f(x) = -6x - 11.2$.

104. Since $f(-5.4) = -29.1$ and $f(13.8) = 47.7$, we know the graph passes through the points $(-5.4, -29.1)$ and $(13.8, 47.7)$. We can use these points to find the slope.

$$m = \frac{47.7 - (-29.1)}{13.8 - (-5.4)}$$
$$= \frac{76.8}{19.2}$$
$$= 4$$

The function is of the form $f(x) = 4x + b$.

Use either $f(-5.4) = -29.1$ or $f(13.8) = 47.7$ to find b.

$f(-5.4) = -29.1$
$4(-5.4) + b = -29.1$
$-21.6 + b = -29.1$
$b = -7.5$

The function is $f(x) = 4x - 7.5$.

105. Answers will vary. Example:
A: people
B: $[1, \ldots, 12]$
The rule that takes a person as its input value and gives a birth month as its output value is a function; each person has only one birth month. The rule that takes a number in set B as its input value and gives a person with that birth month as its output value is not a function; there is more than one person born in each month.

106. Substitute 7 for x and simplify the expression.

107. For $f(x) = 5x - 9$, find $f(6)$.

108. The domain is the set of all possible input values and the range is the set of all possible output values.

109. Plot the y-intercept $(0, b)$, use the slope (m) of the line to find additional points on the line, draw the straight line that passes through the points.

2.6 ABSOLUTE VALUE FUNCTIONS

1. absolute value function

2. V

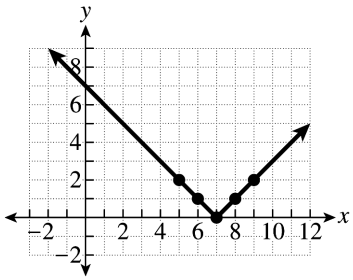
3. y-intercept

4. x-intercept

5. $x - 7 = 0$
$x = 7$

x	$f(x) = \lvert x - 7 \rvert$	$(x, f(x))$
5	$f(5) = \lvert 5 - 7 \rvert = 2$	$(5, 2)$
6	$f(6) = \lvert 6 - 7 \rvert = 1$	$(6, 1)$
7	$f(7) = \lvert 7 - 7 \rvert = 0$	$(7, 0)$
8	$f(8) = \lvert 8 - 7 \rvert = 1$	$(8, 1)$
9	$f(9) = \lvert 9 - 7 \rvert = 2$	$(9, 2)$

Domain: $(-\infty, \infty)$; range: $[0, \infty)$



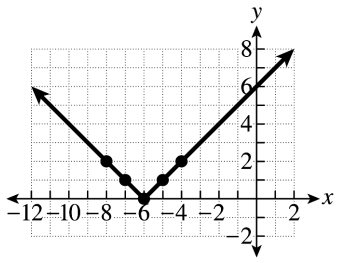
6. $x + 6 = 0$
$x = -6$

x	$f(x) = \lvert x + 6 \rvert$	$(x, f(x))$
−8	$f(-8) = \lvert -8 + 6 \rvert = 2$	$(-8, 2)$
−7	$f(-7) = \lvert -7 + 6 \rvert = 1$	$(-7, 1)$
−6	$f(-6) = \lvert -6 + 6 \rvert = 0$	$(-6, 0)$
−5	$f(-5) = \lvert -5 + 6 \rvert = 1$	$(-5, 1)$
−4	$f(-4) = \lvert -4 + 6 \rvert = 2$	$(-4, 2)$

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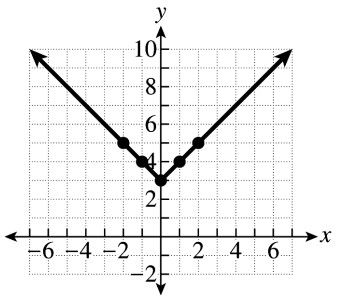
Domain: $(-\infty,\infty)$; range: $[0,\infty)$



7.

x	$f(x)=\lvert x\rvert+3$	$(x,f(x))$
−2	$f(-2)=\lvert-2\rvert+3=5$	$(-2,5)$
−1	$f(-1)=\lvert-1\rvert+3=4$	$(-1,4)$
0	$f(0)=\lvert0\rvert+3=3$	$(0,3)$
1	$f(1)=\lvert1\rvert+3=4$	$(1,4)$
2	$f(2)=\lvert2\rvert+3=5$	$(2,5)$

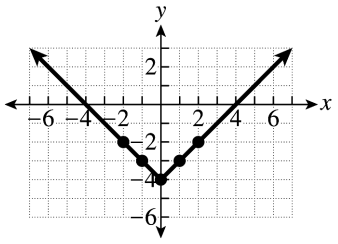
Domain: $(-\infty,\infty)$; range: $[3,\infty)$



8.

x	$f(x)=\lvert x\rvert-4$	$(x,f(x))$
−2	$f(-2)=\lvert-2\rvert-4=-2$	$(-2,-2)$
−1	$f(-1)=\lvert-1\rvert-4=-3$	$(-1,-3)$
0	$f(0)=\lvert0\rvert-4=-4$	$(0,-4)$
1	$f(1)=\lvert1\rvert-4=-3$	$(1,-3)$
2	$f(2)=\lvert2\rvert-4=-2$	$(2,-2)$

Domain: $(-\infty,\infty)$; range: $[-4,\infty)$

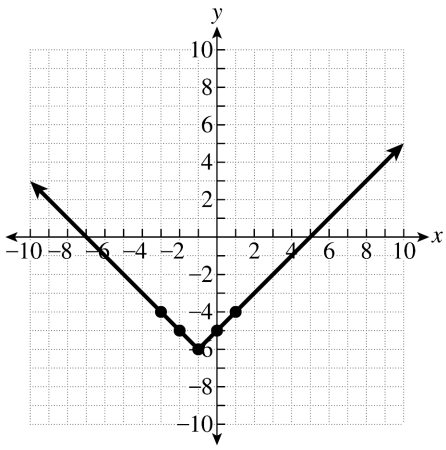


9. $x+1=0$

$x=-1$

x	$f(x)=\lvert x+1\rvert-6$	$(x,f(x))$
−3	$f(-3)=\lvert-3+1\rvert-6=2-6=-4$	$(-3,-4)$
−2	$f(-2)=\lvert-2+1\rvert-6=1-6=-5$	$(-2,-5)$
−1	$f(-1)=\lvert-1+1\rvert-6=0-6=-6$	$(-1,-6)$
0	$f(0)=\lvert0+1\rvert-6=1-6=-5$	$(0,-5)$
1	$f(1)=\lvert1+1\rvert-6=2-6=-4$	$(1,-4)$

Domain: $(-\infty,\infty)$; range: $[-6,\infty)$



10. $x+4=0$

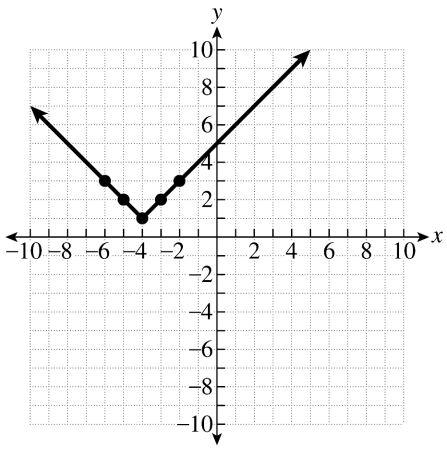
$x=-4$

x	$f(x)=\lvert x+4\rvert+1$	$(x,f(x))$
−6	$f(-6)=\lvert-6+4\rvert+1=2+1=3$	$(-6,3)$
−5	$f(-5)=\lvert-5+4\rvert+1=1+1=2$	$(-5,2)$
−4	$f(-4)=\lvert-4+4\rvert+1=0+1=1$	$(-4,1)$
−3	$f(-3)=\lvert-3+4\rvert+1=1+1=2$	$(-3,2)$
−2	$f(-2)=\lvert-2+4\rvert+1=2+1=3$	$(-2,3)$

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Domain: $(-\infty,\infty)$; range: $[1,\infty)$

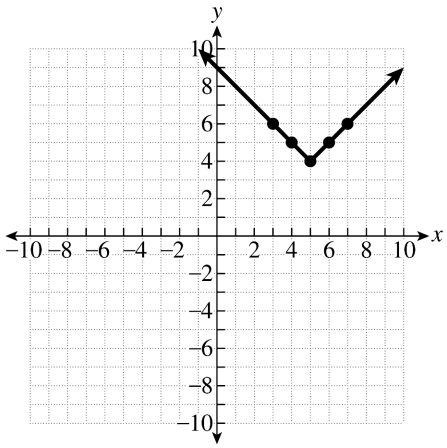


11. $x-5=0$

$x=5$

x	$f(x)=\lvert x-5\rvert+4$	$(x,f(x))$
3	$f(3)=\lvert 3-5\rvert+4=2+4=6$	$(3,6)$
4	$f(4)=\lvert 4-5\rvert+4=1+5=5$	$(4,5)$
5	$f(5)=\lvert 5-5\rvert+4=0+4=4$	$(5,4)$
6	$f(6)=\lvert 6-5\rvert+4=1+5=5$	$(6,5)$
7	$f(7)=\lvert 7-5\rvert+4=2+4=6$	$(7,6)$

Domain: $(-\infty,\infty)$; range: $[4,\infty)$

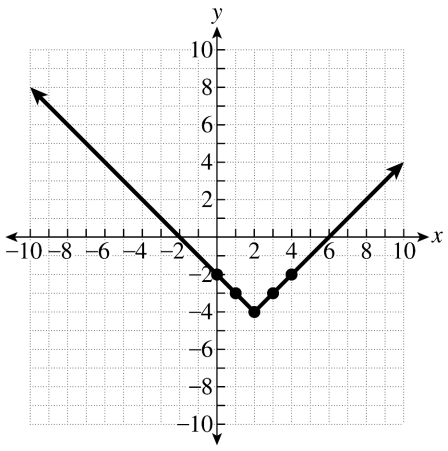


12. $x-2=0$

$x=2$

x	$f(x)=\lvert x-2\rvert-4$	$(x,f(x))$
0	$f(0)=\lvert 0-2\rvert-4=2-4=-2$	$(0,-2)$
1	$f(1)=\lvert 1-2\rvert-4=1-4=-3$	$(1,-3)$
2	$f(2)=\lvert 2-2\rvert-4=0-4=-4$	$(2,-4)$
3	$f(3)=\lvert 3-2\rvert-4=1-4=-3$	$(3,-3)$
4	$f(4)=\lvert 4-2\rvert-4=2-4=-2$	$(4,-2)$

Domain: $(-\infty,\infty)$; range: $[-4,\infty)$

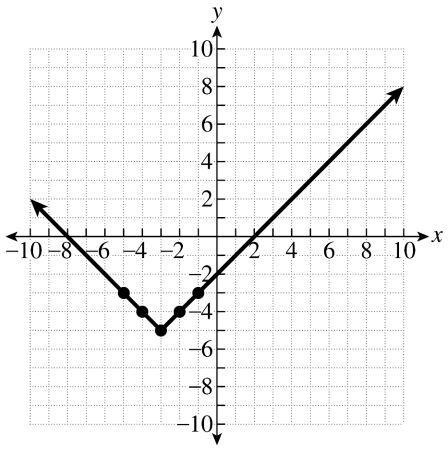


13. $x+3=0$

$x=-3$

x	$f(x)=\lvert x+3\rvert-5$	$(x,f(x))$
-5	$f(-5)=\lvert -5+3\rvert-5=2-5=-3$	$(-5,-3)$
-4	$f(-4)=\lvert -4+3\rvert-5=1-5=-4$	$(-4,-4)$
-3	$f(-3)=\lvert -3+3\rvert-5=0-5=-5$	$(-3,-5)$
-2	$f(-2)=\lvert -2+3\rvert-5=1-5=-4$	$(-2,-4)$
-1	$f(-1)=\lvert -1+3\rvert-5=2-5=-3$	$(-1,-3)$

Domain: $(-\infty,\infty)$; range: $[-5,\infty)$



14. $x-1=0$

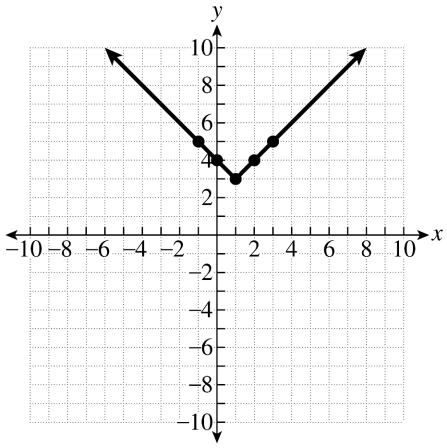
$x=1$

x	$f(x)=\lvert x-1\rvert+3$	$(x,f(x))$
-1	$f(-1)=\lvert -1-1\rvert+3=2+3=5$	$(-1,5)$
0	$f(0)=\lvert 0-1\rvert+3=1+3=4$	$(0,4)$
1	$f(1)=\lvert 1-1\rvert+3=0+3=3$	$(1,3)$
2	$f(2)=\lvert 2-1\rvert+3=1+3=4$	$(2,4)$
3	$f(3)=\lvert 3-1\rvert+3=2+3=5$	$(3,5)$

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Domain: $(-\infty,\infty)$; range: $[3,\infty)$



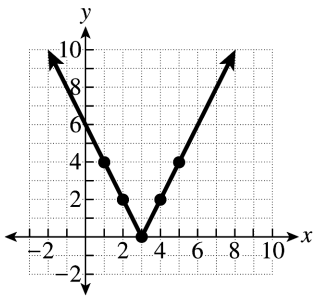
15. $2x-6=0$

$2x=6$

$x=3$

x	$f(x)=\lvert 2x-6\rvert$	$(x,f(x))$
1	$f(1)=\lvert 2(1)-6\rvert=4$	$(1,4)$
2	$f(2)=\lvert 2(2)-6\rvert=2$	$(2,2)$
3	$f(3)=\lvert 2(3)-6\rvert=0$	$(3,0)$
4	$f(4)=\lvert 2(4)-6\rvert=2$	$(4,2)$
5	$f(5)=\lvert 2(5)-6\rvert=4$	$(5,4)$

Domain: $(-\infty,\infty)$; range: $[0,\infty)$



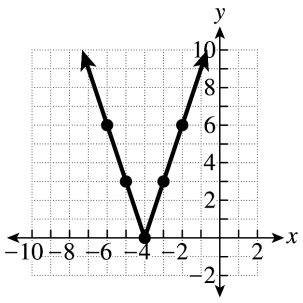
16. $3x+12=0$

$3x=-12$

$x=-4$

x	$f(x)=\lvert 3x+12\rvert$	$(x,f(x))$
-6	$f(-6)=\lvert 3(-6)+12\rvert=6$	$(-6,6)$
-5	$f(-5)=\lvert 3(-5)+12\rvert=3$	$(-5,3)$
-4	$f(-4)=\lvert 3(-4)+12\rvert=0$	$(-4,0)$
-3	$f(-3)=\lvert 3(-3)+12\rvert=3$	$(-3,3)$
-2	$f(-2)=\lvert 3(-2)+12\rvert=6$	$(-2,6)$

Domain: $(-\infty,\infty)$; range: $[0,\infty)$



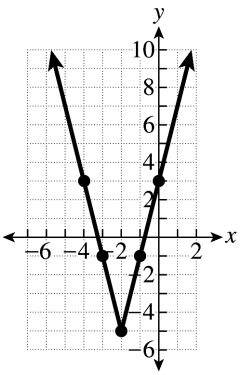
17. $4x+8=0$

$4x=-8$

$x=-2$

x	$f(x)=\lvert 4x+8\rvert-5$	$(x,f(x))$
-4	$f(-4)=\lvert 4(-4)+8\rvert-5=3$	$(-4,3)$
-3	$f(-3)=\lvert 4(-3)+8\rvert-5=-1$	$(-3,-1)$
-2	$f(-2)=\lvert 4(-2)+8\rvert-5=-5$	$(-2,-5)$
-1	$f(-1)=\lvert 4(-1)+8\rvert-5=-1$	$(-1,-1)$
0	$f(0)=\lvert 4(0)+8\rvert-5=3$	$(0,3)$

Domain: $(-\infty,\infty)$; range: $[-5,\infty)$



18. $5x-10=0$

$5x=10$

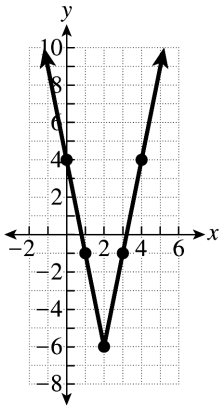
$x=2$

x	$f(x)=\lvert 5x-10\rvert-6$	$(x,f(x))$
0	$f(0)=\lvert 5(0)-10\rvert-6=4$	$(0,4)$
1	$f(1)=\lvert 5(1)-10\rvert-6=-1$	$(1,-1)$
2	$f(2)=\lvert 5(2)-10\rvert-6=-6$	$(2,-6)$
3	$f(3)=\lvert 5(3)-10\rvert-6=-1$	$(3,-1)$
4	$f(4)=\lvert 5(4)-10\rvert-6=4$	$(4,4)$

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Domain: $(-\infty,\infty)$; range: $[-6,\infty)$

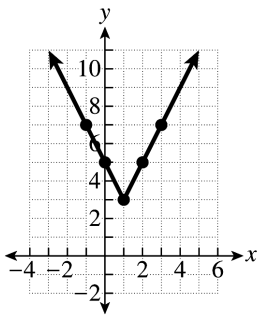


19. $x-1=0$

$x=1$

x	$f(x)=2\lvert x-1\rvert+3$	$(x,f(x))$
-1	$f(-1)=2\lvert -1-1\rvert+3=7$	$(-1,7)$
0	$f(0)=2\lvert 0-1\rvert+3=5$	$(0,5)$
1	$f(1)=2\lvert 1-1\rvert+3=3$	$(1,3)$
2	$f(2)=2\lvert 2-1\rvert+3=5$	$(2,5)$
3	$f(3)=2\lvert 3-1\rvert+3=7$	$(3,7)$

Domain: $(-\infty,\infty)$; range: $[3,\infty)$

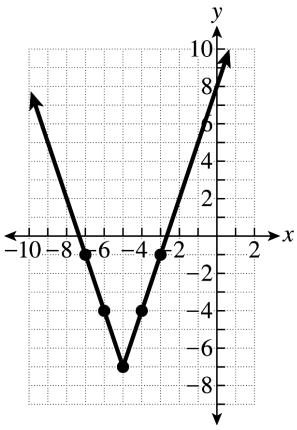


20. $x+5=0$

$x=-5$

x	$f(x)=3\lvert x+5\rvert-7$	$(x,f(x))$
-7	$f(-7)=3\lvert -7+5\rvert-7=-1$	$(-7,-1)$
-6	$f(-6)=3\lvert -6+5\rvert-7=-4$	$(-6,-4)$
-5	$f(-5)=3\lvert -5+5\rvert-7=-7$	$(-5,-7)$
-4	$f(-4)=3\lvert -4+5\rvert-7=-4$	$(-4,-4)$
-3	$f(-3)=3\lvert -3+5\rvert-7=-1$	$(-3,-1)$

Domain: $(-\infty,\infty)$; range: $[-7,\infty)$

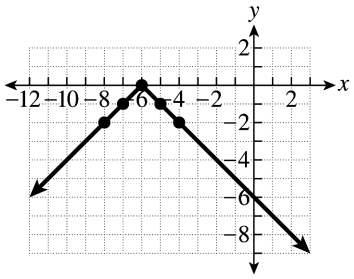


21. $x+6=0$

$x=-6$

x	$f(x)=-\lvert x+6\rvert$	$(x,f(x))$
-8	$f(-8)=-\lvert -8+6\rvert=-2$	$(-8,-2)$
-7	$f(-7)=-\lvert -7+6\rvert=-1$	$(-7,-1)$
-6	$f(-6)=-\lvert -6+6\rvert=0$	$(-6,0)$
-5	$f(-5)=-\lvert -5+6\rvert=-1$	$(-5,-1)$
-4	$f(-4)=-\lvert -4+6\rvert=-2$	$(-4,-2)$

Domain: $(-\infty,\infty)$; range: $(-\infty,0]$



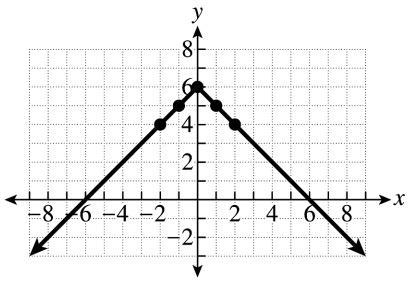
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22.

x	$f(x)=-\lvert x\rvert+6$	$(x, f(x))$
-2	$f(-2)=-\lvert -2\rvert+6=4$	$(-2,4)$
-1	$f(-1)=-\lvert -1\rvert+6=5$	$(-1,5)$
0	$f(0)=-\lvert 0\rvert+6=6$	$(0,6)$
1	$f(1)=-\lvert 1\rvert+6=5$	$(1,5)$
2	$f(2)=-\lvert 2\rvert+6=4$	$(2,4)$

Domain: $(-\infty,\infty)$; range: $(-\infty,6]$

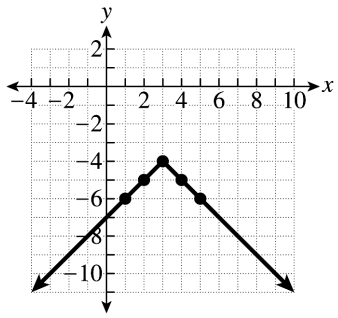


23. $x-3=0$

$x=3$

x	$f(x)=-\lvert x-3\rvert-4$	$(x, f(x))$
1	$f(1)=-\lvert 1-3\rvert-4=-6$	$(1,-6)$
2	$f(2)=-\lvert 2-3\rvert-4=-5$	$(2,-5)$
3	$f(3)=-\lvert 3-3\rvert-4=-4$	$(3,-4)$
4	$f(4)=-\lvert 4-3\rvert-4=-5$	$(4,-5)$
5	$f(5)=-\lvert 5-3\rvert-4=-6$	$(5,-6)$

Domain: $(-\infty,\infty)$; range: $(-\infty,-4]$

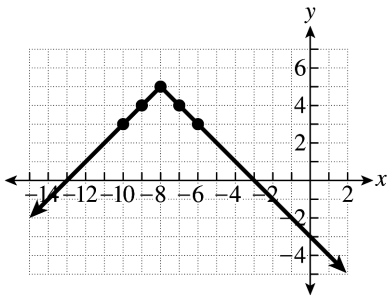


24. $x+8=0$

$x=-8$

x	$f(x)=-\lvert x+8\rvert+5$	$(x, f(x))$
-10	$f(-10)=-\lvert -10+8\rvert+5=3$	$(-10,3)$
-9	$f(-9)=-\lvert -9+8\rvert+5=4$	$(-9,4)$
-8	$f(-8)=-\lvert -8+8\rvert+5=5$	$(-8,5)$
-7	$f(-7)=-\lvert -7+8\rvert+5=4$	$(-7,4)$
-6	$f(-6)=-\lvert -6+8\rvert+5=3$	$(-6,3)$

Domain: $(-\infty,\infty)$; range: $(-\infty,5]$

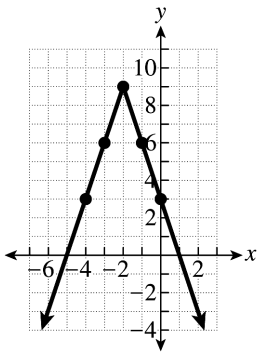


25. $x+2=0$

$x=-2$

x	$f(x)=-3\lvert x+2\rvert+9$	$(x, f(x))$
-4	$f(-4)=-3\lvert -4+2\rvert+9=3$	$(-4,3)$
-3	$f(-3)=-3\lvert -3+2\rvert+9=6$	$(-3,6)$
-2	$f(-2)=-3\lvert -2+2\rvert+9=9$	$(-2,9)$
-1	$f(-1)=-3\lvert -1+2\rvert+9=6$	$(-1,6)$
0	$f(0)=-3\lvert 0+2\rvert+9=3$	$(0,3)$

Domain: $(-\infty,\infty)$; range: $(-\infty,9]$



26. $x-4=0$

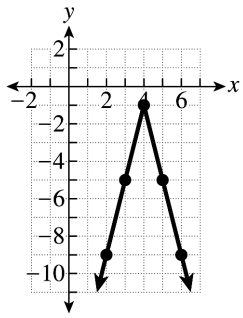
$x=4$

x	$f(x)=-4\lvert x-4\rvert-1$	$(x, f(x))$
2	$f(2)=-4\lvert 2-4\rvert-1=-9$	$(2,-9)$
3	$f(3)=-4\lvert 3-4\rvert-1=-5$	$(3,-5)$
4	$f(4)=-4\lvert 4-4\rvert-1=-1$	$(4,-1)$
5	$f(5)=-4\lvert 5-4\rvert-1=-5$	$(5,-5)$
6	$f(6)=-4\lvert 6-4\rvert-1=-9$	$(6,-9)$

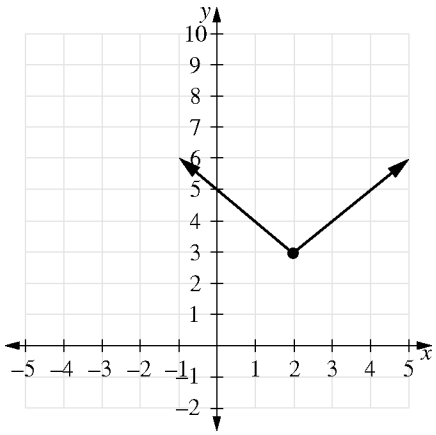
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Domain: $(-\infty,\infty)$; range: $(-\infty,-1]$



27. To graph the function $f(x)=|x-2|+3$ we shift the graph of the function $f(x)=|x|$ 2 units to the right and up by 3 units. The graph of this function passes through the point (2, 3).



The slope of the left branch line, where $x<2$ is -1. We can then write

$$\begin{aligned} f(x) &= -1(x-2)+3 \\ &= -x+2+3 \\ &= -x+5 \end{aligned}$$

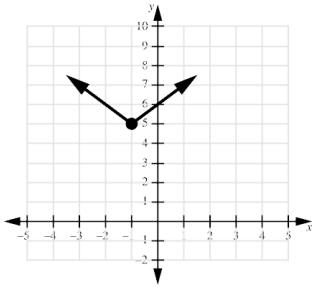
The slope of the right branch, where $x\geq 2$ is 1. We can then write

$$\begin{aligned} f(x) &= 1(x-2)+3 \\ &= x-2+3 \\ &= x+1 \end{aligned}$$

So as a piecewise function, $f(x)=|x-2|+3$ can be expressed as

$$f(x)=\begin{cases} -x+5 & \text{if } x<2 \\ x+1 & \text{if } x\geq 2 \end{cases}$$

28. To graph the function $f(x)=|x+1|+5$ we shift the graph of the function $f(x)=|x|$ 1 unit to the left and up by 5 units. The graph of this function passes through the point $(-1,5)$.



The slope of the left branch line, where $x<-1$ is -1. We can then write

$$\begin{aligned} f(x) &= -1(x+1)+5 \\ &= -x-1+5 \\ &= -x+4 \end{aligned}$$

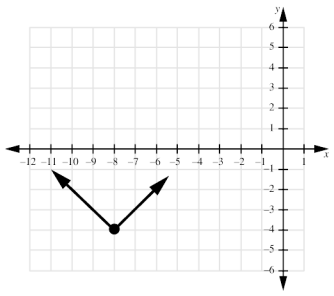
The slope of the right branch, where $x\geq -1$ is 1. We can then write

$$\begin{aligned} f(x) &= 1(x+1)+5 \\ &= x+1+5 \\ &= x+6 \end{aligned}$$

So as a piecewise function, $f(x)=|x+1|+5$ can be expressed as

$$f(x)=\begin{cases} -x+4 & \text{if } x<-1 \\ x+6 & \text{if } x\geq -1 \end{cases}$$

29. To graph the function $f(x)=|x+8|-4$ we shift the graph of the function $f(x)=|x|$ 8 units to the left and down by 4 units. The graph of this function passes through the point $(-8,-4)$.



The slope of the left branch line, where $x<-8$ is -1. We can then write

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$$\begin{aligned} f(x) &= -1(x+8)-4 \\ &= -x-8-4 \\ &= -x-12 \end{aligned}$$

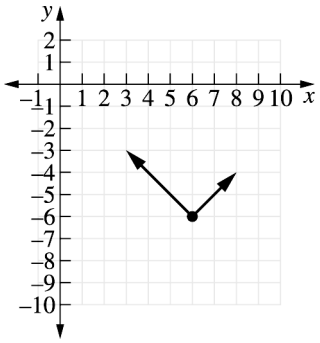
The slope of the right branch, where $x \geq -8$ is 1. We can then write

$$\begin{aligned} f(x) &= 1(x+8)-4 \\ &= x+8-4 \\ &= x+4 \end{aligned}$$

So as a piecewise function, $f(x) = |x+8|-4$ can be expressed as

$$f(x) = \begin{cases} -x-12 & \text{if } x < -8 \\ x+4 & \text{if } x \geq -8 \end{cases}$$

30. To graph the function $f(x) = |x-6|-6$ we shift the graph of the function $f(x) = |x|$ 6 units to the right and down by 6 units. The graph of this function passes through the point $(6,-6)$.



The slope of the left branch line, where $x < 6$ is -1. We can then write

$$\begin{aligned} f(x) &= -1(x-6)-6 \\ &= -x+6-6 \\ &= -x \end{aligned}$$

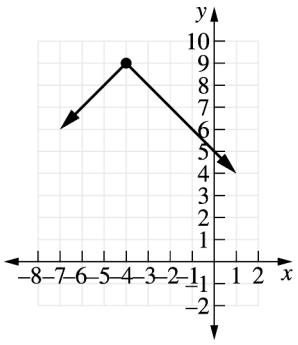
The slope of the right branch, where $x \geq 6$ is 1. We can then write

$$\begin{aligned} f(x) &= 1(x-6)-6 \\ &= x-6-6 \\ &= x-12 \end{aligned}$$

So as a piecewise function, $f(x) = |x-6|-6$ can be expressed as

$$f(x) = \begin{cases} -x & \text{if } x < 6 \\ x-12 & \text{if } x \geq 6 \end{cases}$$

31. To graph the function $f(x) = -|x+4|+9$ we reflect the graph of the function $f(x) = |x|$ over the x-axis and shift it 4 units to the left and up by 9 units. The graph of this function passes through the point $(-4,9)$.



The slope of the left branch line, where $x < -4$ is 1. We can then write

$$\begin{aligned} f(x) &= 1(x+4)+9 \\ &= x+4+9 \\ &= x+13 \end{aligned}$$

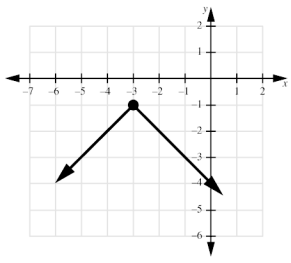
The slope of the right branch, where $x \geq -4$ is -1. We can then write

$$\begin{aligned} f(x) &= -1(x+4)+9 \\ &= -x-4+9 \\ &= -x+5 \end{aligned}$$

So as a piecewise function, $f(x) = -|x+4|+9$ can be expressed as

$$f(x) = \begin{cases} x+13 & \text{if } x < -4 \\ -x+5 & \text{if } x \geq -4 \end{cases}$$

32. To graph the function $f(x) = -|x+3|-1$ we reflect the graph of the function $f(x) = |x|$ over the x-axis and shift it 3 units to the left and down by 1 unit. The graph of this function passes through the point $(-3,-1)$.



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The slope of the left branch line, where $x<-3$ is 1. We can then write

$$\begin{aligned} f(x) &= 1(x+3)-1 \\ &= x+3-1 \\ &= x+2 \end{aligned}$$

The slope of the right branch, where $x \geq -3$ is -1. We can then write

$$\begin{aligned} f(x) &= -1(x+3)-1 \\ &= -x-3-1 \\ &= -x-4 \end{aligned}$$

So as a piecewise function, $f(x)=-|x+3|-1$ can be expressed as

$$f(x)=\begin{cases} x+2 & \text{if } x<-3 \\ -x-4 & \text{if } x \geq -3 \end{cases}$$

33. Given the piecewise function

$$f(x)=\begin{cases} -x-22 & \text{if } x<-8 \\ x-6 & \text{if } x \geq -8 \end{cases}$$

we know that the graph of the function passes through the point with x-coordinate -8. If we substitute the value of -8 for x in either expression of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(-8) &= -8-6 \\ &= -14 \end{aligned}$$

Therefore, we know the graph of the function passes through the point $(-8,-14)$. Since the left branch of the function has a slope of -1 and the right branch of the function has a slope of 1, we know the function opens up and so we can write $f(x)=|x+8|-14$.

34. Given the piecewise function

$$f(x)=\begin{cases} -x+21 & \text{if } x<9 \\ x+3 & \text{if } x \geq 9 \end{cases}$$

we know that the graph of the function passes through the point with x-coordinate 9. If we substitute the value of 9 for x in either expression of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(9) &= 9+3 \\ &= 12 \end{aligned}$$

Therefore, we know the graph of the function passes through the point $(9,12)$. Since the left branch of the function has a slope of -1 and the right branch of the function has a slope of 1, we know the function opens up and so we can write $f(x)=|x-9|+12$.

35. Given the piecewise function

$$f(x)=\begin{cases} x-32 & \text{if } x<13 \\ -x-6 & \text{if } x \geq 13 \end{cases}$$

we know that the graph of the function passes through the point with x-coordinate 13. If we substitute the value of 13 for x in either expression of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(13) &= -13-6 \\ &= -19 \end{aligned}$$

Therefore, we know the graph of the function passes through the point $(13,-19)$. Since the left branch of the function has a slope of 1 and the right branch of the function has a slope of -1, we know the function opens down and so we can write $f(x)=-|x-13|-19$.

36. Given the piecewise function

$$f(x)=\begin{cases} x+50 & \text{if } x<-20 \\ -x+10 & \text{if } x \geq -20 \end{cases}$$

we know that the graph of the function passes through the point with x-coordinate -20. If we substitute the value of -20 for x in either expression of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(-20) &= -(-20)+10 \\ &= 30 \end{aligned}$$

Therefore, we know the graph of the function passes through the point $(-20,30)$. Since the left branch of the function has a slope of 1 and the right branch of the function has a slope of -1, we know the function opens down and so we can write $f(x)=-|x+20|+30$.

37. To graph the function $f(x)=\begin{cases} 2x+3 & \text{if } x<2 \\ -x+9 & \text{if } x \geq 2 \end{cases}$ we can first find the turning point. We know that the graph of the function passes through the turning point with x-coordinate 2. If we substitute the value of 2 for x in either expression of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(2) &= -2+9 \\ &= 7 \end{aligned}$$

So the turning point of the graph is $(2,7)$.

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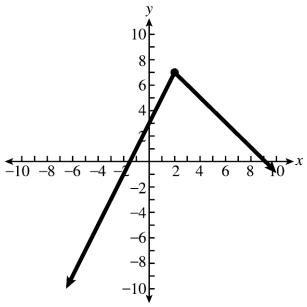
We can then find points to the left of the turning point by substituting values of $x < 2$ for x in the expression $2x + 3$. We can then generate a table of values such as:

x	$f(x)$
0	3
1	5

This branch of the graph has positive slope 2. Similarly, we can generate a table of values by substituting values of $x \geq 2$ for x in the expression $-x + 9$.

x	$f(x)$
3	6
4	5

This branch of the graph has negative slope 1. We can now construct the graph.



38. To graph the function

$$f(x) = \begin{cases} -\frac{3}{2}x + 6 & \text{if } x < 4 \\ 2x - 8 & \text{if } x \geq 4 \end{cases}$$

we can first find the turning point. We know that the graph of the function passes through the turning point with x-coordinate 4. If we substitute the value of 4 for x in either expression of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(4) &= 2(4) - 8 \\ &= 0 \end{aligned}$$

So the turning point of the graph is $(4, 0)$. We can then find points to the left of the turning point by substituting values of $x < 4$ for x in the expression $-\frac{3}{2}x + 6$. We can then generate a table of values such as:

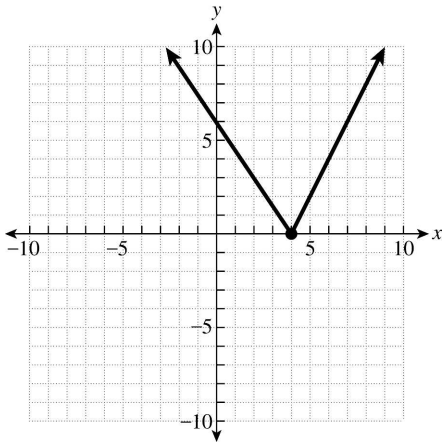
x	$f(x)$
0	6
1	$\frac{9}{2}$

This branch of the graph has negative slope $\frac{3}{2}$.

Similarly, we can generate a table of values by substituting values of $x \geq 4$ for x in the expression $2x - 8$.

x	$f(x)$
5	2
7	6

This branch of the graph has positive slope 2. Now we can construct the graph.



39. To graph the function

$$f(x) = \begin{cases} 3x + 2 & \text{if } x < 1 \\ -4x + 9 & \text{if } 1 \leq x < 3 \\ x - 6 & \text{if } x \geq 3 \end{cases}$$

we can first find the turning points. We know a portion of the graph passes through a turning point with x-coordinate 1. If we substitute the value of 1 for x in either of the first two expressions of the piecewise function, we can find the value of the y-coordinate.

$$\begin{aligned} f(1) &= 3(1) + 2 \\ &= 5 \end{aligned}$$

So the first turning point of the graph is $(1, 5)$.

We know that another portion of the graph passes through a turning point with x-coordinate 3. If we substitute the value of 3 for x in either of the last two expressions of the piecewise function, we can find the value of the y-coordinate.

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$f(3) = 3 - 6$
$= -3$
So the second turning point of the graph is $(3, -3)$.

For the branch of the graph that is left of the turning point $(1, 5)$ we can substitute values of $x < 1$ for x in the expression $3x + 2$. We can then generate a table of values such as:

x	$f(x)$
0	2
-1	-1

This branch of the graph has positive slope of 3.
Similarly, we can generate a table of values by substituting values of $1 \le x < 3$ for x in the expression $-4x + 9$:

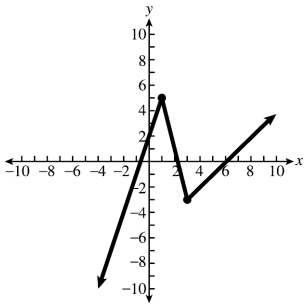
x	$f(x)$
1	5
2	1

This branch of the graph has negative slope 4.

Finally we can generate a table of values by substituting values of $x \ge 3$ for x in the expression $x - 6$:

x	$f(x)$
3	-3
4	-2

This branch of the graph has positive slope 1.
Now we can construct the graph.



40. To graph the function

$$f(x) = \begin{cases} -x - 7 & \text{if } x < -2 \\ -5 & \text{if } -2 \le x < 4 \\ -2x + 3 & \text{if } x \ge 4 \end{cases}$$

we can first find the turning points. We know a portion of the graph passes through a turning point with x-coordinate -2. If we substitute the value of -2 for x in either of the first two expressions of the piecewise function, we can find the value of the y-coordinate.

$f(-2) = -5$
So the first turning point of the graph is $(-2, -5)$.

We know that another portion of the graph passes through a turning point with x-coordinate 4. If we substitute the value of 4 for x in either of the last two expressions of the piecewise function, we can find the value of the y-coordinate.

$f(4) = -5$
So the second turning point of the graph is $(4, -5)$.

For the branch of the graph that is left of the turning point $(-2, -5)$ we can substitute values of $x < -2$ for x in the expression $-x - 7$. We can then generate a table of values such as:

x	$f(x)$
-3	-4
-5	-2

This branch of the graph has negative slope 1.
Similarly, we can generate a table of values by substituting values of $-2 \le x < 4$ for x in the expression -5:

x	$f(x)$
-2	-5
0	-5

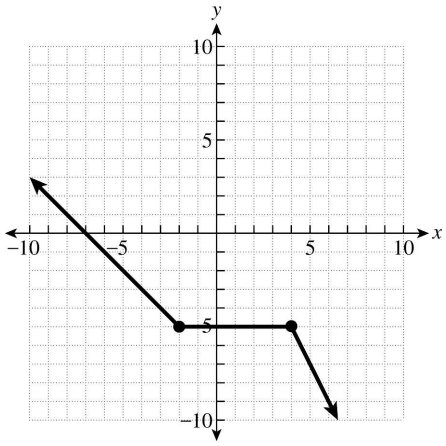
Since the y-coordinate of all ordered pairs in this branch of the graph is -5, this branch of the graph is a horizontal line segment. Finally we can generate a table of values by substituting values of $x \ge 4$ for x in the expression $-2x + 3$:

x	$f(x)$
4	-5
5	-7

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This branch of the graph has negative slope 2. We can now construct the graph.



41. x-intercept: Let $f(x)=0$.

$|x-1|-9=0$

$|x-1|=9$

$x-1=-9$ or $x-1=9$

$x=-8$ or $x=10$

$(-8,0),(10,0)$

y-intercept: Let $x=0$.

$f(0)=|0-1|-9=-8$

$(0,-8)$

42. x-intercept: Let $f(x)=0$.

$|x+6|-3=0$

$|x+6|=3$

$x+6=-3$ or $x+6=3$

$x=-9$ or $x=-3$

$(-9,0),(-3,0)$

y-intercept: Let $x=0$.

$f(0)=|0+6|-3=3$

$(0,3)$

43. x-intercept: Let $f(x)=0$.

$|x|-5=0$

$|x|=5$

$x=-5$ or $x=5$

$(-5,0),(5,0)$

y-intercept: Let $x=0$.

$f(0)=|0|-5=-5$

$(0,-5)$

44. x-intercept: Let $f(x)=0$.

$|x-5|=0$

$x-5=0$

$x=5$

$(5,0)$

y-intercept: Let $x=0$.

$f(0)=|0-5|=5$

$(0,5)$

45. x-intercept: Let $f(x)=0$.

$|x-7|+2=0$

$|x-7|=-2$

There is no number whose absolute value is equal to -7. Therefore there is no x-intercept.

y-intercept: Let $x=0$.

$f(0)=|0-7|+2=7+2=9$

$(0,9)$

46. x-intercept: Let $f(x)=0$.

$|x-4|+8=0$

$|x-4|=-8$

There is no number whose absolute value is equal to -8. Therefore there is no x-intercept.

y-intercept: Let $x=0$.

$f(0)=|0-4|+8=4+8=12$

$(0,12)$

47. x-intercept: Let $f(x)=0$.

$-|x+2|+3=0$

$-|x+2|=-3$

$|x+2|=3$

$x+2=-3$ or $x+2=3$

$x=-5$ or $x=1$

$(-5,0),(1,0)$

y-intercept: Let $x=0$.

$f(0)=-|0+2|+3=-2+3=1$

$(0,1)$

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48. x-intercept: Let $f(x)=0$.

$$-|x-10|+13=0$$
$$-|x-10|=-13$$
$$|x-10|=13$$
$$x-10=-13 \quad \text{or} \quad x-10=13$$
$$x=-3 \quad \text{or} \quad x=23$$

$(-3,0),(23,0)$

y-intercept: Let $x=0$.

$f(0)=-|0-10|+13=-10+13=3$

$(0,3)$

49. To find any x-intercepts of $f(x)=|x-7|-5$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$|x-7|-5=0$$
$$|x-7|=5$$
$$x-7=5 \text{ or } x-7=-5$$

We know that the absolute value function has two x-intercepts since we can solve both equations for x.

50. To find any x-intercepts of $f(x)=|x+4|+4$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$|x+4|+4=0$$
$$|x+4|=-4$$

We know that the absolute value function has zero x-intercepts, since an absolute value is never equal to a negative number.

51. To find any x-intercepts of $f(x)=|x-3|$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$|x-3|=0$$

We know that the absolute value function has one x-intercept since there is only one value of x that sets the absolute value equal to 0.

52. To find any x-intercepts of $f(x)=|x+6|-1$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$|x+6|-1=0$$
$$|x+6|=1$$
$$x+6=1 \text{ or } x+6=-1$$

We know that the absolute value function has two x-intercepts since we can solve both equations for x.

53. To find any x-intercepts of $f(x)=-|x+6|-9$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$-|x+6|-9=0$$
$$-|x+6|=9$$
$$|x+6|=-9$$

We know that the absolute value function has zero x-intercepts since an absolute value is never equal to a negative number.

54. To find any x-intercepts of $f(x)=-|x-7|+4$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$-|x-7|+4=0$$
$$-|x-7|=-4$$
$$|x-7|=4$$
$$x-7=4 \text{ or } x-7=-4$$

We know that the absolute value function has two x-intercepts since we can solve both equations for x.

55. To find any x-intercepts of $f(x)=-|x|+32$, we set the function equal to 0 and solve for x. Since we can write

$$f(x)=0$$
$$-|x|+32=0$$
$$-|x|=-32$$
$$|x|=32$$
$$x=32 \text{ or } x=-32$$

We know that the absolute value function has two x-intercepts since we can solve both equations for x.

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56. To find any x-intercepts of $f(x)=-|x+32|$, we set the function equal to 0 and solve for x. Since we can write

$$\begin{aligned} f(x)&=0\\ -|x+32|&=0\\ -(x+32)&=0 \end{aligned}$$

We know that the absolute value function has one x-intercept since there is only one value of x that sets the absolute value equal to 0.

57. The turning point is $(-6,0)$.
Its x-coordinate is -6, so $x+6$ is inside the absolute value bars.
Its y-coordinate is 0, so there is no constant term.
$f(x)=a|x+6|$
Another point on the graph is $(0,6)$.
$6=a|0+6|$
$6=6a$
$1=a$
$f(x)=|x+6|$

58. The turning point is $(0,6)$.
Its x-coordinate is 0 so x is inside the absolute value bars.
Its y-coordinate is 6, so add 6 to the absolute value.
$f(x)=a|x|+6$
Another point on the graph is $(1,7)$.
$7=a|1|+6$
$7=a+6$
$1=a$
$f(x)=|x|+6$

59. The turning point is $(-1,3)$.
Its x-coordinate is -1, so $x+1$ is inside the absolute value bars.
Its y-coordinate is 3, so add 3 to the absolute value.
$f(x)=a|x+1|+3$
Another point on the graph is $(0,4)$.
$4=a|0+1|+3$
$4=a+3$
$1=a$
$f(x)=|x+1|+3$

60. The turning point is $(2,-2)$.
Its x-coordinate is 2 so $x-2$ is inside the absolute value bars.
Its y-coordinate is -2, so subtract 2 from the absolute value.
$f(x)=a|x-2|-2$
Another point on the graph is $(0,0)$.
$0=a|0-2|-2$
$0=2a-2$
$2=2a$
$1=a$
$f(x)=|x-2|-2$

61. The turning point is $(-2,5)$.
Its x-coordinate is -2 so $x+2$ is inside the absolute value bars.
Its y-coordinate is 5, so add 5 to the absolute value.
$f(x)=a|x+2|+5$
Another point on the graph is $(0,3)$.
$3=a|0+2|+5$
$3=2a+5$
$-2=2a$
$-1=a$
$f(x)=-|x+2|+5$

62. The turning point is $(1,-4)$.
Its x-coordinate is 1 so $x-1$ is inside the absolute value bars.
Its y-coordinate is -4, so subtract 4 from the absolute value.
$f(x)=a|x-1|-4$
Another point on the graph is $(0,-5)$.
$-5=a|0-1|-4$
$-5=a-4$
$-1=a$
$f(x)=-|x-1|-4$

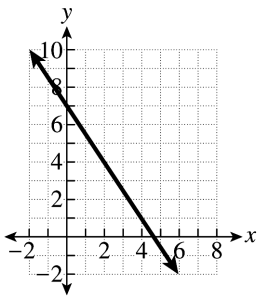
63. $y=-\frac{3}{2}x+7$

y-intercept: $(0,7)$, slope: $-\frac{3}{2}$
Starting at the y-intercept, move 3 units down and 2 units to the right to find a second point,

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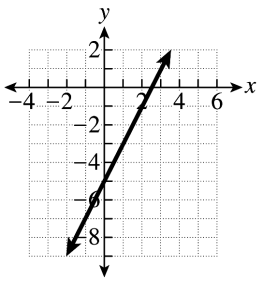
$(2,4)$.



64. $f(x)=2x-5$

y-intercept: $(0,-5)$, slope: 2

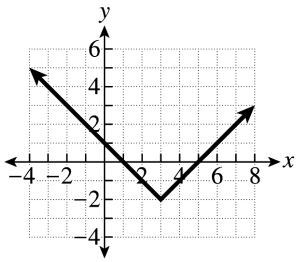
Starting at the y-intercept, move 2 units up and 1 unit to the right to find a second point, $(1,-3)$.



65. $x-3=0$

$x=3$

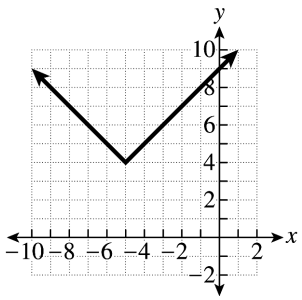
x	$f(x)=\lvert x-3\rvert-2$	$(x,f(x))$
1	$f(1)=\lvert 1-3\rvert-2=0$	$(1,0)$
2	$f(2)=\lvert 2-3\rvert-2=-1$	$(2,-1)$
3	$f(3)=\lvert 3-3\rvert-2=-2$	$(3,-2)$
4	$f(4)=\lvert 4-3\rvert-2=-1$	$(4,-1)$
5	$f(5)=\lvert 5-3\rvert-2=0$	$(5,0)$



66. $x+5=0$

$x=-5$

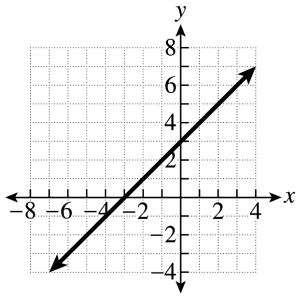
x	$f(x)=\lvert x+5\rvert+4$	$(x,f(x))$
-7	$f(-7)=\lvert -7+5\rvert+4=6$	$(-7,6)$
-6	$f(-6)=\lvert -6+5\rvert+4=5$	$(-6,5)$
-5	$f(-5)=\lvert -5+5\rvert+4=4$	$(-5,4)$
-4	$f(-4)=\lvert -4+5\rvert+4=5$	$(-4,5)$
-3	$f(-3)=\lvert -3+5\rvert+4=6$	$(-3,6)$



67. $y=x+3$

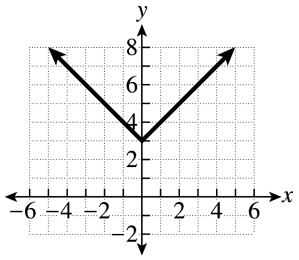
y-intercept: $(0,3)$, slope: 1

Starting at the y-intercept, move 1 unit up and 1 unit to the right to find a second point, $(1,4)$.



68.

x	$f(x)=\lvert x\rvert+3$	$(x,f(x))$
-2	$f(-2)=\lvert -2\rvert+3=5$	$(-2,5)$
-1	$f(-1)=\lvert -1\rvert+3=4$	$(-1,4)$
0	$f(0)=\lvert 0\rvert+3=3$	$(0,3)$
1	$f(1)=\lvert 1\rvert+3=4$	$(1,4)$
2	$f(2)=\lvert 2\rvert+3=5$	$(2,5)$



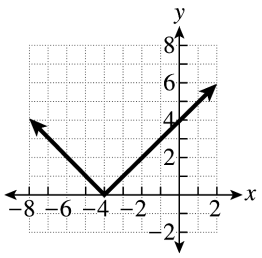
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69. $x+4=0$

$x=-4$

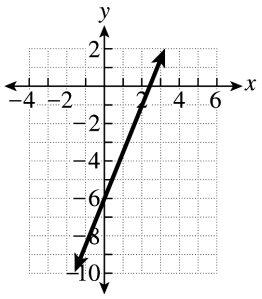
x	$f(x)=\lvert x+4\rvert$	$(x, f(x))$
-6	$f(-6)=\lvert -6+4\rvert=2$	$(-6,2)$
-5	$f(-5)=\lvert -5+4\rvert=1$	$(-5,1)$
-4	$f(-4)=\lvert -4+4\rvert=0$	$(-4,0)$
-3	$f(-3)=\lvert -3+4\rvert=1$	$(-3,1)$
-2	$f(-2)=\lvert -2+4\rvert=2$	$(-2,2)$



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

y-intercept: $(0,-6)$, slope: $\frac{5}{2}$

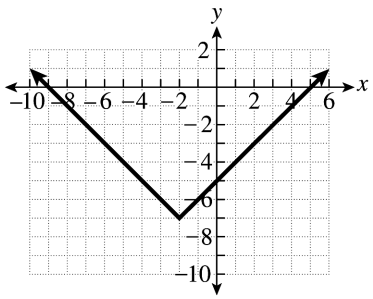
Starting at the y-intercept, move 5 units up and 2 units to the right to find a second point, $(2,-1)$.



71. $x+2=0$

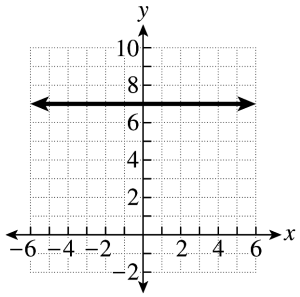
$x=-2$

x	$f(x)=\lvert x+2\rvert-7$	$(x, f(x))$
-4	$f(-4)=\lvert -4+2\rvert-7=-5$	$(-4,-5)$
-3	$f(-3)=\lvert -3+2\rvert-7=-6$	$(-3,-6)$
-2	$f(-2)=\lvert -2+2\rvert-7=-7$	$(-2,-7)$
-1	$f(-1)=\lvert -1+2\rvert-7=-6$	$(-1,-6)$
0	$f(0)=\lvert 0+2\rvert-7=-5$	$(0,-5)$



72. $f(x)=7$

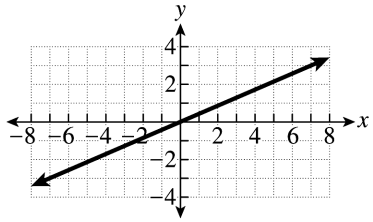
Since slope is 0, the function is a horizontal line at $y=7$.



73. $y=\frac{3}{7}x$

y-intercept: $(0,0)$, slope: $\frac{3}{7}$

Starting at the y-intercept, move 3 units up and 7 units to the right to find a second point, $(7,3)$.



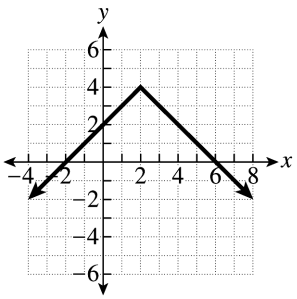
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74. $x-2=0$

$x=2$

x	$f(x)=-\lvert x-2\rvert+4$	$(x, f(x))$
0	$f(0)=-\lvert 0-2\rvert+4=2$	$(0,2)$
1	$f(1)=-\lvert 1-2\rvert+4=3$	$(1,3)$
2	$f(2)=-\lvert 2-2\rvert+4=4$	$(2,4)$
3	$f(3)=-\lvert 3-2\rvert+4=3$	$(3,3)$
4	$f(4)=-\lvert 4-2\rvert+4=2$	$(4,2)$



75. No; explanations will vary. Example: To generate a complete accurate graph, the student should evaluate the function at values to the left and to the right of the turning point, $x=5$.

76. Answers will vary.

77. To choose values of x when graphing an absolute value function by plotting points first use the expression inside the absolute value bars and set it equal to 0 to solve for x. In addition to that value of x, select two values that are less than it and two others that are greater than it.

78. To graph an absolute value function by shifting, determine the values of h and k. Shift the graph of $f(x)=\lvert x\rvert$ horizontally by h units and vertically by k units. Reflect the graph about the x-axis if there is a negative sign in front of the absolute value.

79. To find the x-intercepts of an absolute value function, set $f(x)=0$ and solve for x. To find the y-intercept, evaluate the function for $x=0$.

80. The graph of an absolute value function is V-shaped, not a line, and you have to find the point where the graph changes from decreasing to increasing.

CHAPTER 2 REVIEW

1. x-intercept:

$2x-8(0)=-40$

$2x=-40$

$x=-20$

$(-20,0)$

y-intercept:

$2(0)-8y=-40$

$-8y=-40$

$y=5$

$(0,5)$

2. x-intercept:

$5x-(0)=-15$

$5x=-15$

$x=-3$

$(-3,0)$

y-intercept:

$5(0)-y=-15$

$-y=-15$

$y=15$

$(0,15)$

3. x-intercept:

$3x-7(0)=0$

$3x=0$

$x=0$

$(0,0)$

y-intercept:

$3(0)-7y=0$

$-7y=0$

$y=0$

$(0,0)$

4. x-intercept:

$4x-7(0)=14$

$4x=14$

$x=\frac{7}{2}$

$\left(\frac{7}{2},0\right)$

y-intercept:

$4(0)-7y=14$

$-7y=14$

$y=-2$

$(0,-2)$

5. x-intercept:

$-3x+2(0)=12$

$-3x=12$

$x=-4$

$(-4,0)$

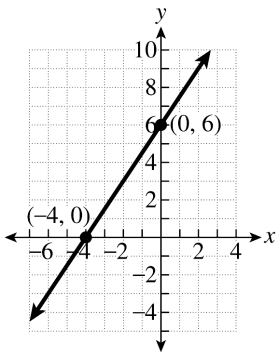
y-intercept:

$-3(0)+2y=12$

$2y=12$

$y=6$

$(0,6)$



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6. x-intercept:

$x-4(0)=-8$

$x=-8$

$(-8,0)$

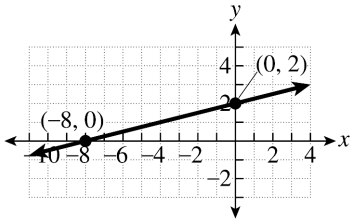
y-intercept:

$(0)-4y=-8$

$-4y=-8$

$y=2$

$(0,2)$



7. x-intercept:

$2x+3(0)=0$

$2x=0$

$x=0$

$(0,0)$

y-intercept:

$2(0)+3y=0$

$3y=0$

$y=0$

$(0,0)$

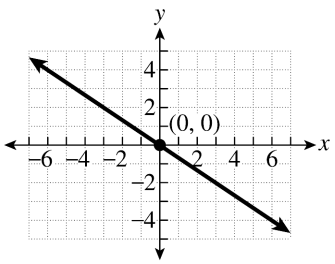
When $x=1$: $\left(1,-\frac{2}{3}\right)$

$2(1)+3y=0$

$2+3y=0$

$3y=-2$

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



8. x-intercept:

$4x+3(0)=-6$

$4x=-6$

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

$\left(-\frac{3}{2},0\right)$

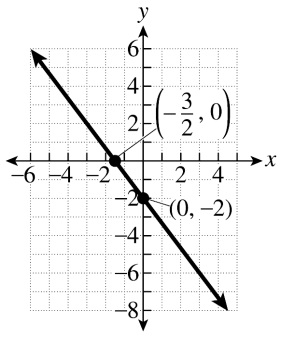
y-intercept:

$4(0)+3y=-6$

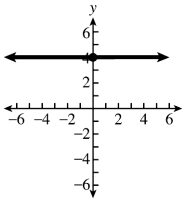
$3y=-6$

$y=-2$

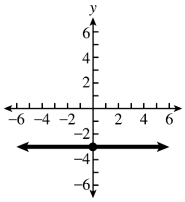
$(0,-2)$



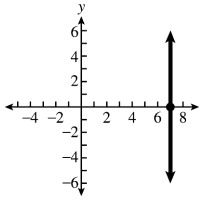
9. The graph of $y=4$ is a horizontal line with y-intercept (0, 4). Plot the point (0,4). Then draw a horizontal line through the point.



10. The graph of $y=-3$ is a horizontal line with y-intercept $(0,-3)$. Plot the point $(0,-3)$. Then draw a horizontal line through the point.



11. The graph of $x=7$ is a vertical line with x-intercept $(7,0)$. Plot the point (7, 0). Then draw a vertical line through the point.

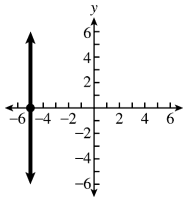


12. The graph of $x=-5$ is a vertical line with x-intercept $(-5,0)$. Plot the point $(-5,0)$. Then

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draw a vertical line through the point.



13. $m = \dfrac{9-3}{-3-(-5)} = \dfrac{6}{2} = 3$

14. $m = \dfrac{10-(-2)}{3-6} = \dfrac{12}{-3} = -4$

15. $m = \dfrac{-3-(-8)}{8-3} = \dfrac{5}{5} = 1$

16. $m = \dfrac{-7-(-7)}{7-2} = \dfrac{0}{5} = 0$

17. Let y represent the concentration in moles and let x represent the time in seconds. We can write the ordered pair (0, 3) which represents the initial condition: a concentration of 3 moles after 0 seconds. We can then write the ordered pair (15, 2.4) which represents the concentration after 15 seconds. To find the rate of change of the concentration of this enzyme, find the slope of the line that would pass through the points (0, 3) and (15, 2.4). Using the formula $m = \dfrac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \dfrac{2.4-3}{15-0} = \dfrac{-0.6}{15} = -0.04$. The rate of change of the enzyme is -0.04 mol/s.

18. Let y represent the horizontal distance traveled in feet and let x represent the time in seconds. We can write the ordered pair (2.5, 187.5) which represents the initial condition: 187.5 feet traveled in 2.5 seconds. We can then write the ordered pair (4.5, 337.5) which represents a distance of 337.5 feet traveled in 4.5 seconds. To find the rate of change of the horizontal distance traveled with respect to the time traveled, find the slope of the line that would pass through the points (2.5, 187.5) and (4.5, 337.5). Using the formula $m = \dfrac{y_2 - y_1}{x_2 - x_1}$, substitute the values of the ordered pairs and then simplify the numerator and the denominator.

$m = \dfrac{337.5-187.5}{4.5-2.5} = \dfrac{150}{2} = 75$. The rate of change of the horizontal distance traveled with respect to time is 75 ft/s.

19. $m = -2$, y-intercept: $(0, 7)$

20. $m = 4$, y-intercept: $(0, -6)$

21. $4x - 2y = 9$

$-2y = -4x + 9$

$y = \dfrac{-4}{-2}x + \dfrac{9}{-2}$

$y = 2x - \dfrac{9}{2}$

$m = 2$, y-intercept: $\left(0, -\dfrac{9}{2}\right)$

22. $5x + 3y = 18$

$3y = -5x + 18$

$y = \dfrac{-5}{3}x + \dfrac{18}{3}$

$y = -\dfrac{5}{3}x + 6$

$m = -\dfrac{5}{3}$, y-intercept: $(0, 6)$

23. $m = 3$, y-intercept: $(0, -6)$

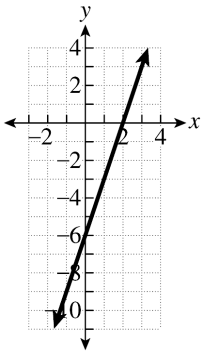
From the y-intercept, count up 3 and right 1 to find the next point, $(1, -3)$.

x-intercept: $0 = 3x - 6$

$6 = 3x$

$2 = x$

$(2, 0)$



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24. $m=-5$, y-intercept: $(0,-5)$

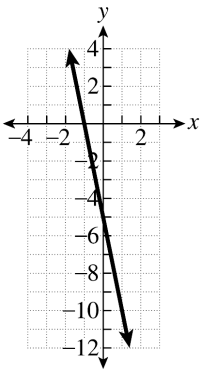
From the y-intercept, count 5 down and 1 right to find the next point, $(1,-10)$.

x-intercept: $0=-5x-5$

$5x=-5$

$x=-1$

$(-1,0)$



25. $m=-\frac{7}{3}$, y-intercept: $(0,3)$

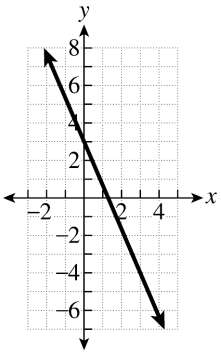
From the y-intercept, count down 7 and right 3 to find the next point, $(3,-4)$.

x-intercept: $0=-\frac{7}{3}x+3$

$\frac{7}{3}x=3$

$x=\frac{9}{7}$

$\left(\frac{9}{7},0\right)$



26. $m=\frac{1}{2}$, y-intercept: $\left(0,\frac{3}{2}\right)$

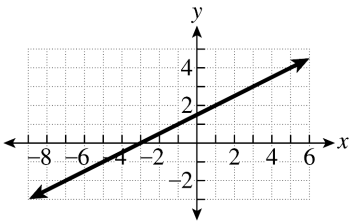
From the y-intercept, count up 1 and right 2 to find the next point, $\left(2,\frac{5}{2}\right)$.

x-intercept: $0=\frac{1}{2}x+\frac{3}{2}$

$-\frac{3}{2}=\frac{1}{2}x$

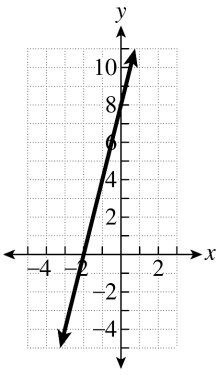
$-3=x$

$(-3,0)$



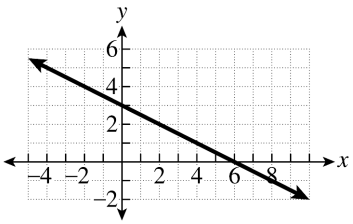
27. $m=4$, y-intercept: $(0,8)$

From the y-intercept, count up 4 and right 1 to find the next point, $(1,12)$.



28. $m=-\frac{1}{2}$, y-intercept: $(0,3)$

From the y-intercept, count down 1 and right 2 to find the next point, $(2,2)$.

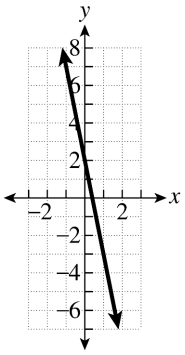


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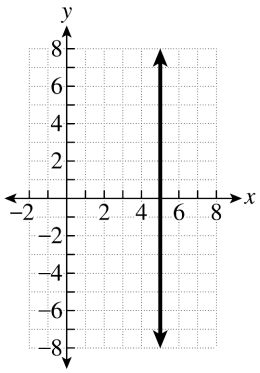
29. $m=-5$, y-intercept: $(0,2)$

From the y-intercept, count down 5 and right 1 to find the next point, $(1,-3)$.



30. This is a vertical line.

x-intercept: $(5,0)$



31. x-intercept:

$3x-4(0)=24$

$3x=24$

$x=8$

$(8,0)$

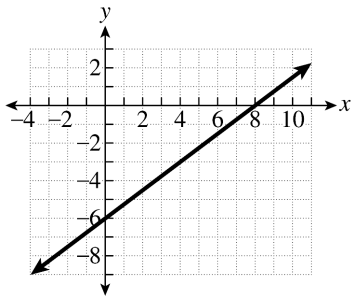
y-intercept:

$3(0)-4y=24$

$-4y=24$

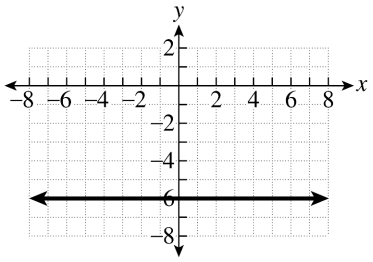
$y=-6$

$(0,-6)$



32. This is a horizontal line.

y-intercept: $(0,-6)$



33. $y=2x-9$ $\qquad$ $y=-2x+9$

$m=2$ $\qquad$ $m=-2$

The slopes are not equal, and they are not negative reciprocals, so the lines are neither parallel nor perpendicular.

34. $4x+y=11$ $\qquad$ $y=\frac{1}{4}x+\frac{5}{2}$

$y=-4x+11$

$m=-4$ $\qquad$ $m=\frac{1}{4}$

The slopes are negative reciprocals, so the lines are perpendicular.

35. $12x-9y=17$ $\qquad$ $-8x+6y=10$

$-9y=-12x+17$ $\qquad$ $6y=8x+10$

$y=\frac{-12}{-9}x+\frac{17}{-9}$ $\qquad$ $y=\frac{8}{6}x+\frac{10}{6}$

$y=\frac{4}{3}x-\frac{17}{9}$ $\qquad$ $y=\frac{4}{3}x+\frac{5}{3}$

$m=\frac{4}{3}$ $\qquad$ $m=\frac{4}{3}$

The slopes are equal, so the lines are parallel.

36. $y=-4x-2$

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

38. $y-(-2)=1(x-4)$

$y+2=x-4$

$y=x-6$

39. $y-3=-5(x-1)$

$y-3=-5x+5$

$y=-5x+8$

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40. $y-9=-\frac{3}{2}\left(x-(-4)\right)$

$y-9=-\frac{3}{2}(x+4)$

$y-9=-\frac{3}{2}x-6$

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

41. $m=\frac{-7-1}{2-(-2)}=\frac{-8}{4}=-2$

$y-(-7)=-2(x-2)$

$y+7=-2x+4$

$y=-2x-3$

42. $m=\frac{7-(-5)}{2-(-6)}=\frac{12}{8}=\frac{3}{2}$

$y-7=\frac{3}{2}(x-2)$

$y-7=\frac{3}{2}x-3$

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

43. $m=\frac{3-3}{-9-5}=\frac{0}{-14}=0$

$y-3=0(x-3)$

$y-3=0$

$y=3$

44. Use points $(-2,3)$ and $(2,9)$.

$m=\frac{9-3}{2-(-2)}=\frac{6}{4}=\frac{3}{2}$

y-intercept: $(0,6)$

$y=\frac{3}{2}x+6$

45. Use points $(1,3)$ and $(2,6)$.

$m=\frac{6-3}{2-1}=\frac{3}{1}=3$

y-intercept: $(0,0)$

$y=3x$

46. The slope of the line is $\frac{4}{3}$ since it is perpendicular to the line $y=-\frac{3}{4}x+7$.

Substitute this slope for m, -6 for x_1, and 11 for y_1 into the point-slope form. After substituting, solve the equation for y.

$y-11=\frac{4}{3}(x-(-6))$

$y-11=\frac{4}{3}x+8$

$y=\frac{4}{3}x+19$

47. First find the slope of the line $2x-5y=15$ by solving for y.

$2x-5y=15$

$-5y=15-2x$

$y=-\frac{15}{5}+\frac{2}{5}x$

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

The slope of the line is therefore $\frac{2}{5}$ since it is parallel to the line $2x-5y=15$.

Now substitute this slope for m, 10 for x_1, and -9 for y_1 into the point-slope form. After substituting, solve the equation for y.

$y-(-9)=\frac{2}{5}(x-10)$

$y+9=\frac{2}{5}x-4$

$y=\frac{2}{5}x-13$

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48. $3x+y=-9$

$y=-3x-9$

y-intercept: $(0,-9)$

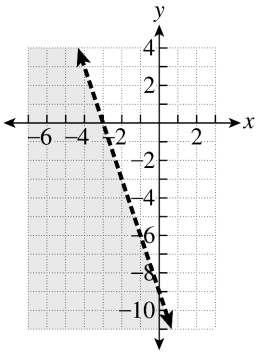
From the y-intercept, count down 3 and right 1 to find the next point, $(1,-12)$.

Test Point: $(0,0)$

$3(0)+0<-9$

$0<-9$

False. Shade on the side of the line that does not contain the test point.



49. $2x+7y=14$

x-intercept: $2x+7(0)=14$, $2x=14$, $x=7$, $(7,0)$

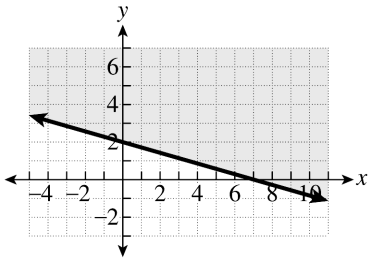
y-intercept: $2(0)+7y=14$, $7y=14$, $y=2$, $(0,2)$

Test Point: $(0,0)$

$2(0)+7(0)\geq 14$

$0\geq 14$

False. Shade on the side of the line that does not contain the test point.

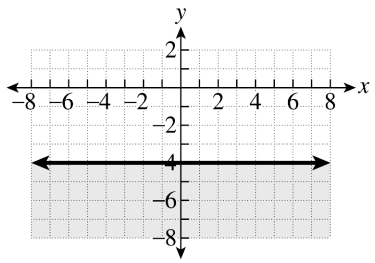


50. $y=-4$

Test Point: $(0,0)$

$0\leq -4$

False. Shade on the side of the line that does not contain the test point.



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

$m=\frac{3}{2}$, y-intercept: $(0,5)$

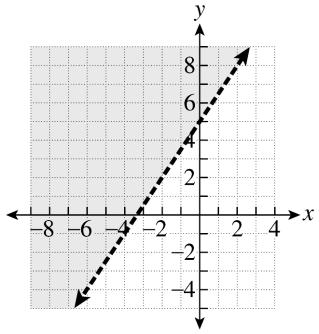
From the y-intercept, count up 3 and right 2 to find the next point, $(2,8)$.

Test Point: $(0,0)$

$0>\frac{3}{2}(0)+5$

$0>5$

False. Shade on the side of the line that does not contain the test point.



52. a) $f(x)=720+50x$

b) $f(11)=720+50(11)=720+550=1270$

$1270

c) $2750=720+50x$

$2030=50x$

$40.6=x$

$41\approx x$

41 months

53. $f(-2)=9(-2)+7=-18+7=-11$

54. $g(-5)=3-8(-5)=3+40=43$

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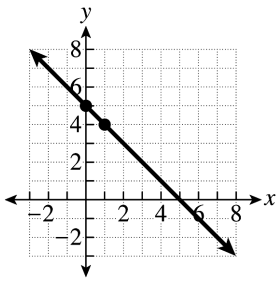
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55. $f(5a-1)=3(5a-1)+7$
$=15a-3+7$
$=15a+4$

56. $f(x)=-x+5$

y-intercept: $(0,5)$, slope: -1

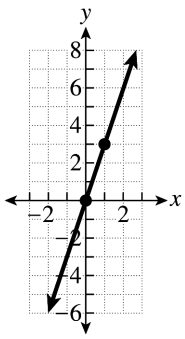
Starting at the y-intercept, move 1 unit down and 1 unit to the right to find a second point, $(1,4)$.



57. $f(x)=3x$

y-intercept: $(0,0)$, slope: 3

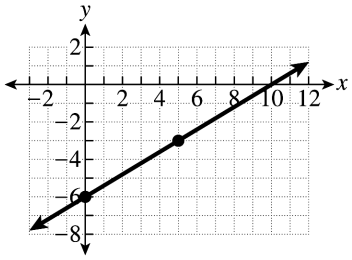
Starting at the y-intercept, move 3 units up and 1 unit to the right to find a second point, $(1,3)$.



58. $f(x)=\frac{3}{5}x-6$

y-intercept: $(0,-6)$, slope: $\frac{3}{5}$

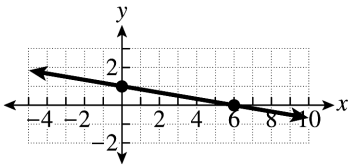
Starting at the y-intercept, move 3 units up and 5 units to the right to find a second point, $(5,-3)$.



59. $f(x)=-\frac{1}{6}x+1$

y-intercept: $(0,1)$, slope: $-\frac{1}{6}$

Starting at the y-intercept, move 1 unit down and 6 units to the right to find a second point, $(6,0)$.



60. First find $f(x+h)$.

$f(x+h)=6(x+h)-7$
$=6x+6h-7$

Now replace $f(x+h)$ by $6x+6h-7$ and $f(x)$ by $6x-7$ in the difference quotient.

$$\frac{f(x+h)-f(x)}{h}=\frac{6x+6h-7-(6x-7)}{h}$$
$$=\frac{6x+6h-7-6x+7}{h}$$
$$=\frac{6h}{h}$$
$$=6$$

The difference quotient is equal to 6. Since the difference quotient does not contain the variable x, the rate of change for the function is 6 for any value of x.

61. First find $f(x+h)$.

$f(x+h)=-4(x+h)+11$
$=-4x-4h+11$

Now replace $f(x+h)$ by $-4x-4h+11$ and $f(x)$ by $-4x+11$ in the difference quotient.

$$\frac{f(x+h)-f(x)}{h}$$
$$=\frac{-4x-4h+11-(-4x+11)}{h}$$
$$=\frac{-4x-4h+11+4x-11}{h}$$
$$=\frac{-4h}{h}$$
$$=-4$$

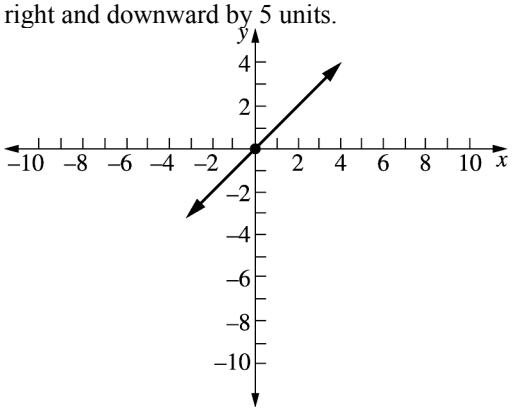
The difference quotient is equal to −4. Since

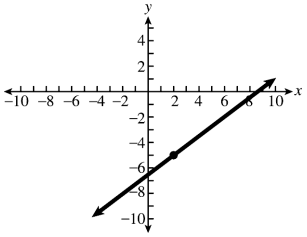
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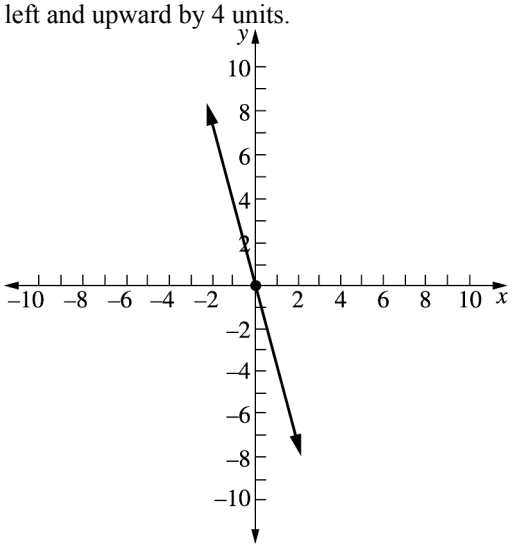
the difference quotient does not contain the variable x, the rate of change for the function is -4 for any value of x.

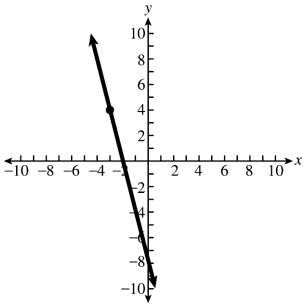
62. The slope of the line is $m = \frac{3}{4}$. The value of h is 2 and the value of k is -5. Begin by graphing a line of slope $\frac{3}{4}$ that passes through the origin and then shift the graph 2 units to the right and downward by 5 units.





63. The slope of the line is $m = -4$. The value of h is -3, and the value of k is 4. Begin by graphing a line of slope -4 that passes through the origin and then shift the graph 3 units to the left and upward by 4 units.





64. **a)** $f(-2) = -7$ **b)** $x = 6$

c) $(-\infty, \infty)$ **d)** $(-\infty, \infty)$

65. Since the slope is -3, we know that $m = -3$ and that $f(x)$ is of the form $f(x) = -3x + b$. We also know that $f(4) = 1$ so we can write:

$$\begin{aligned} -3(4) + b &= 1 \\ -12 + b &= 1 \\ b &= 13 \end{aligned}$$

Since the value of b is 13, the function is $f(x) = -3x + 13$.

66. Since the slope is $\frac{2}{3}$, we know that $m = \frac{2}{3}$ and that $f(x)$ is of the form $f(x) = \frac{2}{3}x + b$. We also know that $f(9) = -17$ so we can write:

$$\begin{aligned} \frac{2}{3}(9) + b &= -17 \\ 6 + b &= -17. \\ b &= -23 \end{aligned}$$

Since the value of b is -23, the function is $f(x) = \frac{2}{3}x - 23$.

67. Given $f(-2) = -5$ and $f(3) = 15$ we know that two points on the line are $(-2, -5)$ and $(3, 15)$. We can substitute these two points into the slope formula to find the slope.

$$\begin{aligned} m &= \frac{15 - (-5)}{3 - (-2)} \\ &= \frac{20}{5} \\ &= 4 \end{aligned}$$

The function is of the form $f(x) = 4x + b$.

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Since we know $f(3)=15$ we can use this fact (or $f(-2)=-5$) to find b.

$$\begin{aligned} f(3)&=15\\ 4(3)+b&=15\\ 12+b&=15\\ b&=3\end{aligned}$$

The function is $f(x)=4x+3$.

68. Given $f(-8)=-2$ and $f(20)=-23$ we know that two points on the line are $(-8,-2)$ and $(20,-23)$. We can substitute these two points into the slope formula to find the slope.

$$\begin{aligned} m&=\frac{-23-(-2)}{20-(-8)}\\ &=-\frac{21}{28}\\ &=-\frac{3}{4}\end{aligned}$$

The function is of the form $f(x)=-\frac{3}{4}x+b$.

Since we know $f(-8)=-2$ we can use this fact (or $f(20)=-23$) to find b.

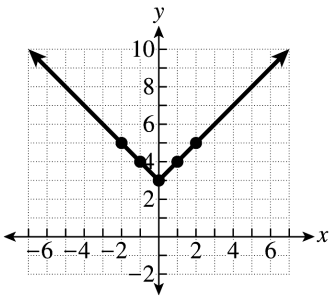
$$\begin{aligned} f(-8)&=-2\\ -\frac{3}{4}(-8)+b&=-2\\ 6+b&=-2\\ b&=-8\end{aligned}$$

The function is $f(x)=-\frac{3}{4}x-8$.

69.

x	$f(x)=\lvert x\rvert+3$	$(x,f(x))$
-2	$f(-2)=\lvert-2\rvert+3=5$	$(-2,5)$
-1	$f(-1)=\lvert-1\rvert+3=4$	$(-1,4)$
0	$f(0)=\lvert0\rvert+3=3$	$(0,3)$
1	$f(1)=\lvert1\rvert+3=4$	$(1,4)$
2	$f(2)=\lvert2\rvert+3=5$	$(2,5)$

Domain: $(-\infty,\infty)$; range: $[3,\infty)$

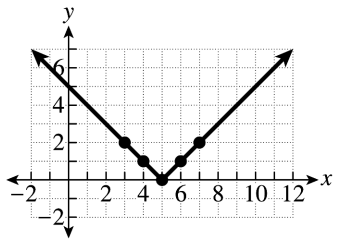


70. $x-5=0$

$x=5$

x	$f(x)=\lvert x-5\rvert$	$(x,f(x))$
3	$f(3)=\lvert3-5\rvert=2$	$(3,2)$
4	$f(4)=\lvert4-5\rvert=1$	$(4,1)$
5	$f(5)=\lvert5-5\rvert=0$	$(5,0)$
6	$f(6)=\lvert6-5\rvert=1$	$(6,1)$
7	$f(7)=\lvert7-5\rvert=2$	$(7,2)$

Domain:$(-\infty,\infty)$; range: $[0,\infty)$



71. $x+2=0$

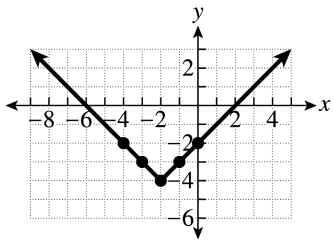
$x=-2$

x	$f(x)=\lvert x+2\rvert-4$	$(x,f(x))$
-4	$f(-4)=\lvert-4+2\rvert-4=-2$	$(-4,-2)$
-3	$f(-3)=\lvert-3+2\rvert-4=-3$	$(-3,-3)$
-2	$f(-2)=\lvert-2+2\rvert-4=-4$	$(-2,-4)$
-1	$f(-1)=\lvert-1+2\rvert-4=-3$	$(-1,-3)$
0	$f(0)=\lvert0+2\rvert-4=-2$	$(0,-2)$

Domain: $(-\infty,\infty)$; range: $[-4,\infty)$

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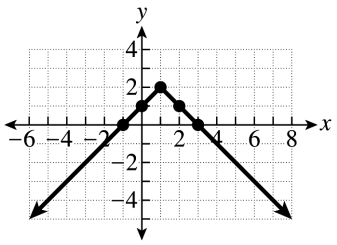


72. $x-1=0$

$x=1$

x	$f(x)=-\lvert x-1\rvert+2$	$(x, f(x))$
-1	$f(-1)=-\lvert -1-1\rvert+2=0$	$(-1,0)$
0	$f(0)=-\lvert 0-1\rvert+2=1$	$(0,1)$
1	$f(1)=-\lvert 1-1\rvert+2=2$	$(1,2)$
2	$f(2)=-\lvert 2-1\rvert+2=1$	$(2,1)$
3	$f(3)=-\lvert 3-1\rvert+2=0$	$(3,0)$

Domain: $(-\infty,\infty)$; range: $(-\infty,2]$



73. The turning point of the graph is $(-3,-7)$. Since the x-coordinate is -3, the expression $x + 3$ must be inside the absolute value bars. The y-coordinate of the turning point is -7 which tells us that 7 is subtracted from the absolute value. The function is of the form $f(x)=a\lvert x+3\rvert-7$. To determine the value of a we need to use the coordinates of another point on the graph, such as the y-intercept $(0,-4)$. This point tells us that $f(0)=-4$. We will use this to find a.

$$\begin{aligned} f(0)&=-4\\ a\lvert 0+3\rvert-7&=-4\\ 3a-7&=-4\\ 3a&=3\\ a&=1\end{aligned}$$

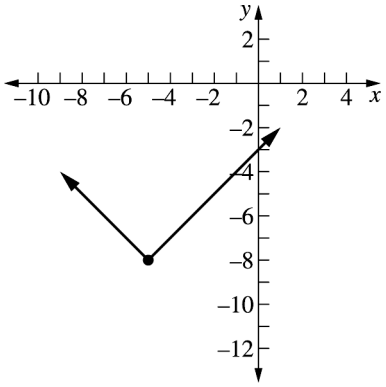
Substituting 1 for a, the function is $f(x)=\lvert x+3\rvert-7$.

74. The turning point of the graph is $(2,4)$. Since the x-coordinate is 2, the expression $x-2$ must be inside the absolute value bars. The y-coordinate of the turning point is 4 which tells us that 4 is added to the absolute value. The function is of the form $f(x)=a\lvert x-2\rvert+4$. To determine the value of a we need to use the coordinates of another point on the graph, such as the y-intercept $(0,2)$. This point tells us that $f(0)=2$. We will use this to find a.

$$\begin{aligned} f(0)&=2\\ a\lvert 0-2\rvert+4&=2\\ 2a+4&=2\\ 2a&=-2\\ a&=-1\end{aligned}$$

Substituting -1 for a, the function is $f(x)=-\lvert x-2\rvert+4$.

75. Given the function $f(x)=\lvert x+5\rvert-8$ we shift the graph of the function $f(x)=\lvert x\rvert$ 5 units to the left and down by 8 units. The turning point of this function is therefore $(-5,-8)$.



Since the slope of the absolute value function is positive, the graph turns up. If we consider the branch where $x<-5$, we know its slope is -1 so we can write

$$\begin{aligned} f(x)&=-1(x+5)-8\\ &=-x-5-8\\ &=-x-13\end{aligned}$$

If we consider the branch where $x\ge -5$, we know its slope is 1 so we can write

$$\begin{aligned} f(x)&=1(x+5)-8\\ &=x+5-8\\ &=x-3\end{aligned}$$

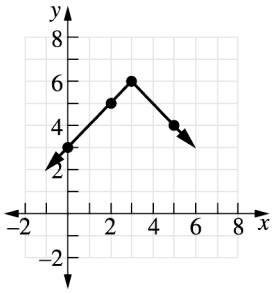
We can now write

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$$f(x)=\begin{cases}-x-13 & \text{if } x<-5\\ x-3 & \text{if } x\ge -5\end{cases}.$$

76. Given the function $f(x)=-|x-3|+6$ we know we reflect the graph of the function $f(x)=|x|$ over the x-axis and then shift it 3 units to the right and up by 6 units. The turning point of this function is therefore $(3,6)$.



Since the slope of the absolute value function is negative, the graph turns down.

If we consider the branch where $x<3$, we know its slope is 1 so we can write

$$\begin{aligned}f(x)&=1(x-3)+6\\&=x-3+6\\&=x+3\end{aligned}.$$

If we consider the branch where $x\ge 3$, we know its slope is -1 so we can write

$$\begin{aligned}f(x)&=-1(x-3)+6\\&=-x+3+6\\&=-x+9\end{aligned}.$$

We can now write

$$f(x)=\begin{cases}x+3 & \text{if } x<3\\ -x+9 & \text{if } x\ge 3\end{cases}.$$

CHAPTER 2 TEST

1. x-intercept:

$$\begin{aligned}5x-6(0)&=-15\\5x&=-15\\x&=-3\end{aligned}$$

$(-3,0)$

y-intercept:

$$\begin{aligned}5(0)-6y&=-15\\-6y&=-15\\y&=\frac{5}{2}\end{aligned}$$

$\left(0,\frac{5}{2}\right)$

2. x-intercept:

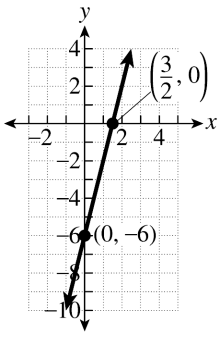
$$\begin{aligned}4x-(0)&=6\\4x&=6\\x&=\frac{3}{2}\end{aligned}$$

$\left(\frac{3}{2},0\right)$

y-intercept:

$$\begin{aligned}4(0)-y&=6\\-y&=6\\y&=-6\end{aligned}$$

$(0,-6)$



3. x-intercept:

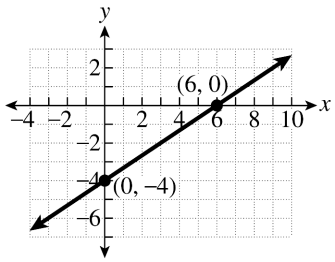
$$\begin{aligned}0&=\frac{2}{3}x-4\\4&=\frac{2}{3}x\\6&=x\end{aligned}$$

$(6,0)$

y-intercept:

$$\begin{aligned}y&=\frac{2}{3}(0)-4\\y&=-4\end{aligned}$$

$(0,-4)$



4. $m=\dfrac{9-8}{-3-2}=-\dfrac{1}{5}$

5. $m=7$, y-intercept: $(0,-8)$

6. $3x+5y=45$

$$\begin{aligned}5y&=-3x+45\\y&=-\frac{3}{5}x+9\end{aligned}$$

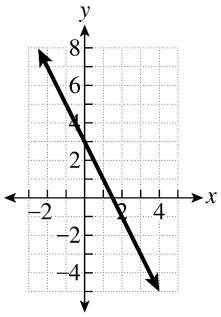
$m=-\dfrac{3}{5}$, y-intercept: $(0,9)$

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7. $m = -2$, y-intercept: $(0,3)$

From the y-intercept, count down 2 and right 1 to find the next point, $(1,1)$.



8. $m = -\frac{6}{5}$, y-intercept: $(0,5)$

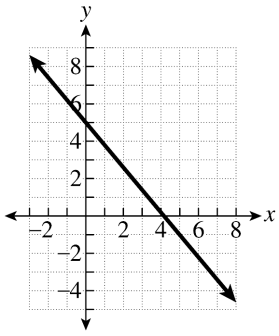
From the y-intercept, count down 6 and right 5 to find the next point, $(5,-1)$.

x-intercept: $0 = -\frac{6}{5}x + 5$

$$\frac{6}{5}x = 5$$

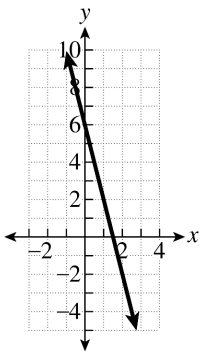
$$x = \frac{25}{6}$$

$$\left(\frac{25}{6}, 0\right)$$



9. $m = -4$, y-intercept: $(0,6)$

From the y-intercept, count down 4 and right 1 to find the next point, $(1,2)$.



10. x-intercept:

$$-4x + 5(0) = 20$$

$$-4x = 20$$

$$x = -5$$

$(-5,0)$

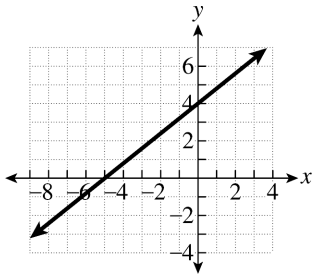
y-intercept:

$$-4(0) + 5y = 20$$

$$5y = 20$$

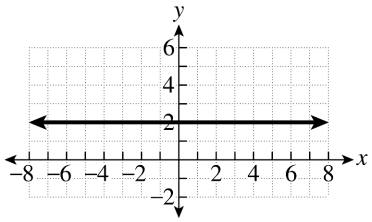
$$y = 4$$

$(0,4)$



11. This is a horizontal line.

y-intercept: $(0,2)$



12. $4y = 8x - 11$

$$y = \frac{8}{4}x - \frac{11}{4}$$

$$y = 2x - \frac{11}{4}$$

$m = 2$

$2x - y = 44$

$$-y = -2x + 44$$

$$y = 2x - 44$$

$m = 2$

The slopes are equal, so the lines are parallel.

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13. $y-9=-\frac{5}{2}(x-(-2))$

$y-9=-\frac{5}{2}(x+2)$

$y-9=-\frac{5}{2}x-5$

$y=-\frac{5}{2}x+4$

14. $m=\frac{-6-4}{-1-(-6)}=\frac{-10}{5}=-2$

$y-4=-2(x-(-6))$

$y-4=-2(x+6)$

$y-4=-2x-12$

$y=-2x-8$

15. $x-6y=-3$

x-intercept: $x-6(0)=-3$, $x-0=-3$, $x=-3$, $(-3,0)$

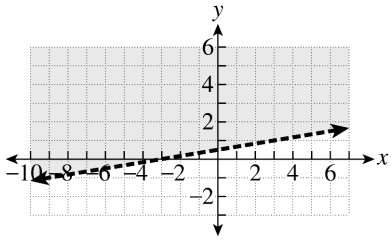
y-intercept: $0-6y=-3$, $-6y=-3$, $y=\frac{1}{2}$, $\left(0,\frac{1}{2}\right)$

Test Point: $(0,0)$

$0-6(0)<-3$

$0<-3$

False. Shade on the side of the line that does not contain the test point.

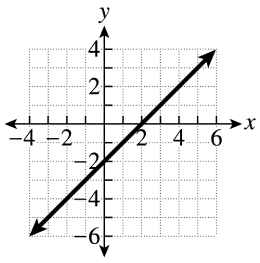


16. $f(-3)=7-2(-3)=7+6=13$

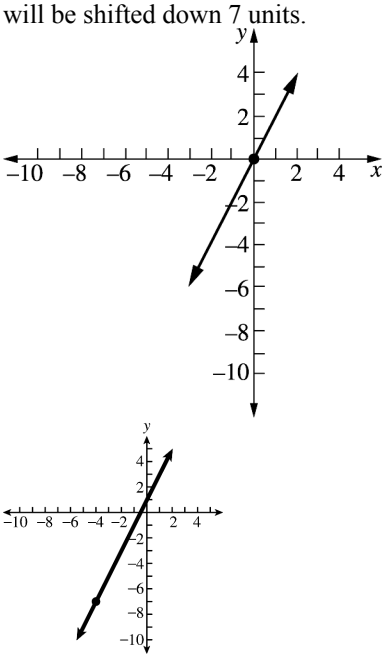
17. $f(x)=x-2$

y-intercept: $(0,-2)$, slope: 1

Starting at the y-intercept, move 1 unit up and 1 unit to the right to find a second point, $(1,-1)$.



18. The slope of the line is $m=2$. Since $x+4$ can be rewritten as $x-(-4)$ the value of h is -4 and the graph of $f(x)=2x$ will be shifted 4 units to the left. The value of k is -7, so the graph will be shifted down 7 units.



19. $x-6=0$

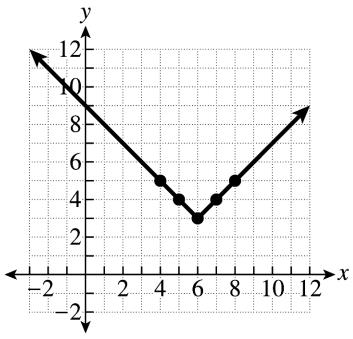
$x=6$

x	$f(x)=\lvert x-6\rvert+3$	$(x,f(x))$
4	$f(4)=\lvert 4-6\rvert+3=2+3=5$	$(4,5)$
5	$f(5)=\lvert 5-6\rvert+3=1+3=4$	$(5,4)$
6	$f(6)=\lvert 6-6\rvert+3=0+3=3$	$(6,3)$
7	$f(7)=\lvert 7-6\rvert+3=1+3=4$	$(7,4)$
8	$f(8)=\lvert 8-6\rvert+3=2+3=5$	$(8,5)$

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Domain: $(-\infty,\infty)$; range: $[3,\infty)$



20. The turning point of the graph is $(1,3)$. Since the x-coordinate is 1, the expression $x-1$ must be inside the absolute value bars. The y-coordinate of the turning point is 3 which tells us that 3 is added to the absolute value. The function is of the form $f(x)=a|x-1|+3$. To determine the value of a we need to use the coordinates of another point on the graph, such as the y-intercept $(0,4)$. This point tells us that $f(0)=4$. We will use this to find a.

$$\begin{aligned} f(0) &= 4 \\ a|0-1|+3 &= 4 \\ a+3 &= 4 \\ a &= 1 \end{aligned}$$

Substituting 1 for a, the function is $f(x)=|x-1|+3$.

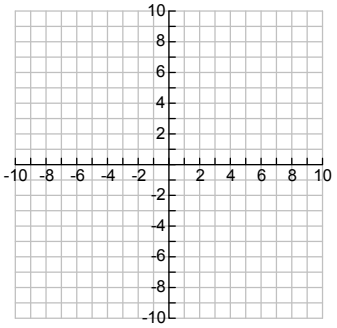
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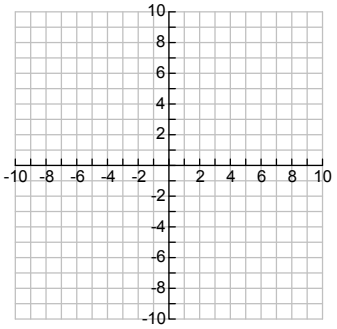
CHAPTER TEST 2A Name: _____

1. Find the x-intercept and y-intercept of $2x + 3y = 12$ **1.** _____

2. Find the x- and y-intercepts, and use them to graph $x - 2y = 8$ **2.** _____



3. Find the x- and y-intercepts, and use them to graph $3x - 4y = -9$ **3.** _____

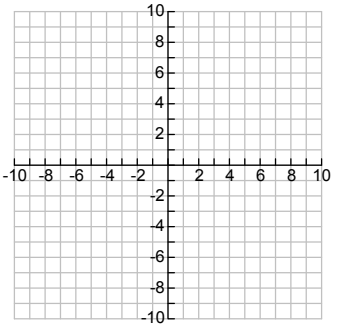


4. Find the slope of the line that passes through the points $(4, -7)$ and $(-1, 8)$. **4.** _____

5. Find the slope and y-intercept of $y = \frac{2}{3}x - 5$ **5.** _____

6. Find the slope and y-intercept of $4x + 3y = -24$ **6.** _____

7. Graph: $y = -3x + 7$ **7.**

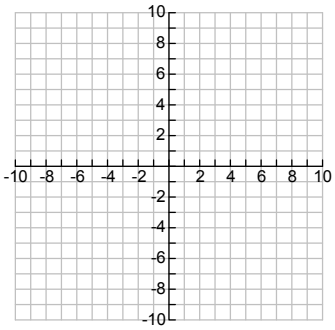


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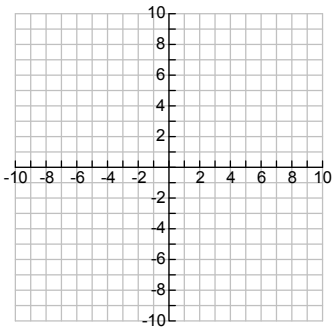
8. Graph: $y = \frac{3}{5}x - 2$

8.



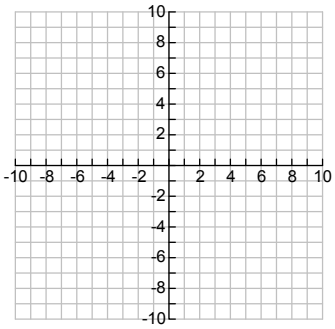
9. Graph: $y = -\frac{1}{4}x - 2$

9.



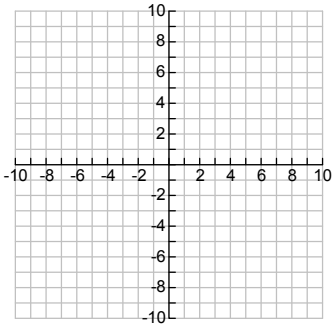
10. Graph: $5x + 3y = -15$

10.



11. Graph: $y = -2$

11.



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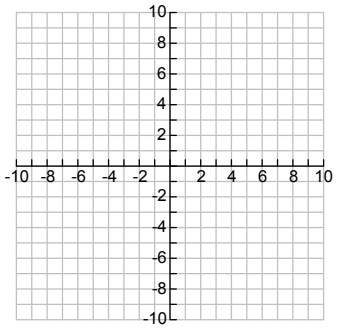
12. Are the two lines $4x + 8y = 32$ and $6x + 12y = 36$ parallel, perpendicular, or neither? **12.** _____

13. Find the slope-intercept form of the equation of a line with a slope of $-\frac{1}{2}$ that passes through the point (–4, –1). **13.** _____

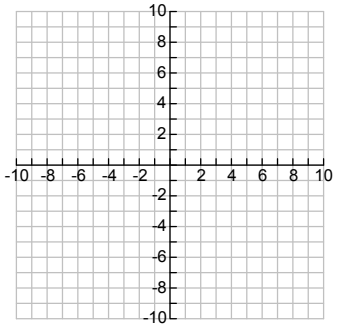
14. Find the slope-intercept form of the equation of a line that passes through the points (3, 15) and (–4, –6). **14.** _____

15. Find $f(-3)$ for the given function $f(x) = 7x + 5$. **15.** _____

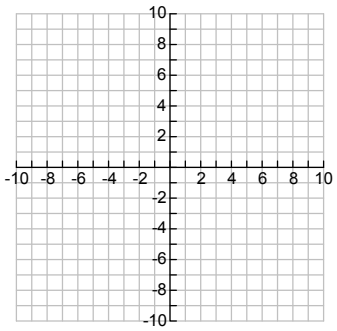
16. Graph the inequality: $y \le -2x + 7$ **16.**



17. Graph the function: $f(x) = \frac{2}{3}x + 1$ **17.**



18. Graph the function: $f(x) = 2(x - 3) + 4$ **18.**

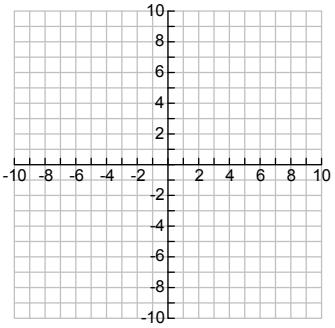


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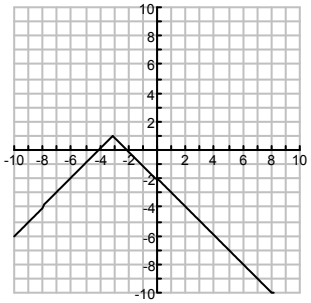
19. Graph the function: $f(x)=|x-1|+3$. State the domain and range.

19. _____



20. Determine the absolute value function $f(x)$ that has been graphed.

20. _____



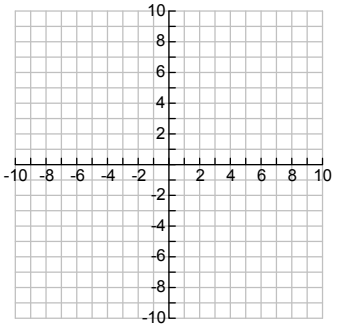
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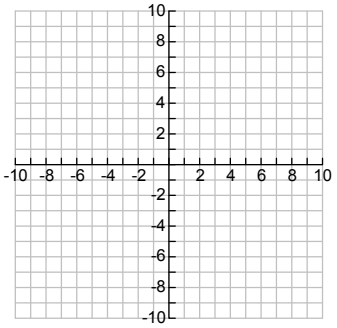
CHAPTER TEST 2B Name: _____

1. Find the x-intercept and y-intercept of $5x - 4y = 20$. **1.** _____

2. Find the x- and y-intercepts, and use them to graph $2x + 3y = -18$. **2.** _____



3. Find the x- and y-intercepts, and use them to graph $5x - 3y = 12$. **3.** _____

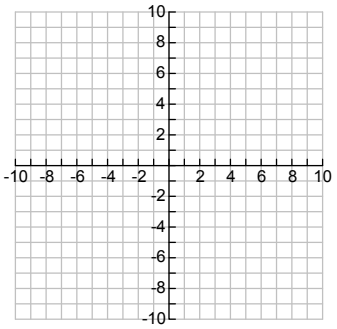


4. Find the slope of the line that passes through the points $(-8, 3)$ and $(4, -4)$. **4.** _____

5. Find the slope and y-intercept of $y = \frac{5}{8}x + 16$. **5.** _____

6. Find the slope and y-intercept of $2x - 7y = 16$. **6.** _____

7. Graph: $y = 4x - 3$ **7.**

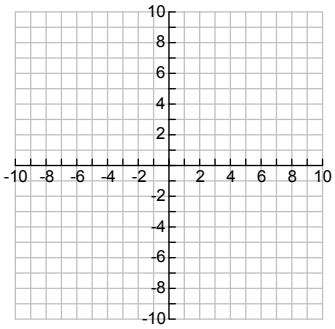


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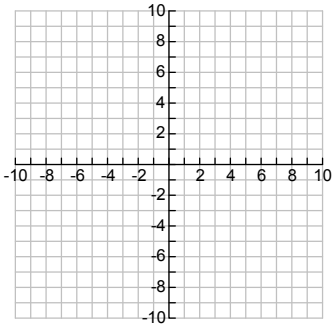
8. Graph: $y = \frac{7}{4}x + 3$

8.



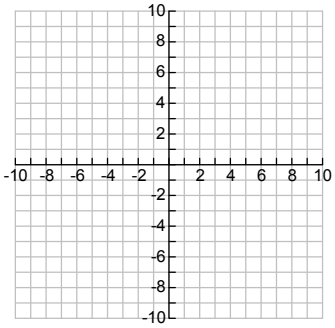
9. Graph: $y = -\frac{1}{3}x + 5$

9.



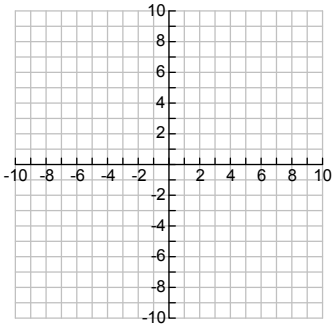
10. Graph: $2x - 6y = 18$

10.



11. Graph: $x = -5$

11.



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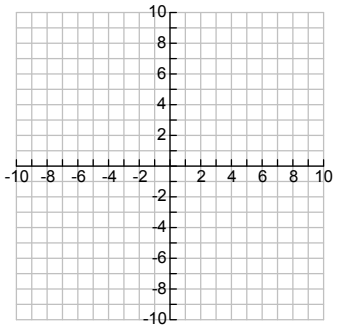
12. Are the two lines $7x - 5y = 22$ and $10x + 14y = -35$ parallel, perpendicular, or neither? **12.** _____

13. Find the slope-intercept form of the equation of a line with a slope of $\frac{5}{2}$ that passes through the point (7, 2). **13.** _____

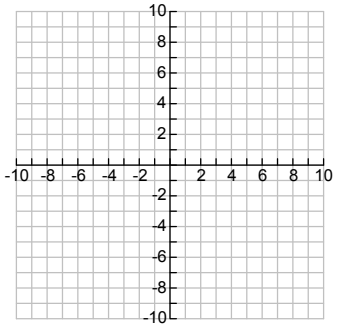
14. Find the slope-intercept form of the equation of a line that passes through the points (–1, 7) and (5, 5). **14.** _____

15. Find $f(6)$ for the given function $f(x) = -4x + 18$. **15.** _____

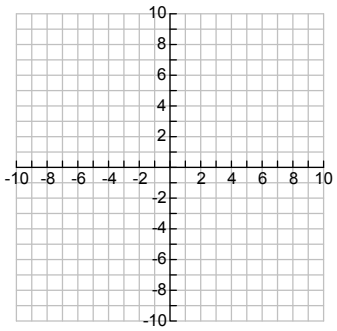
16. Graph the inequality: $y > 3x - 5$ **16.**



17. Graph the function: $f(x) = \frac{7}{3}x - 2$ **17.**



18. Graph the function: $f(x) = -3(x + 1) + 2$ **18.**

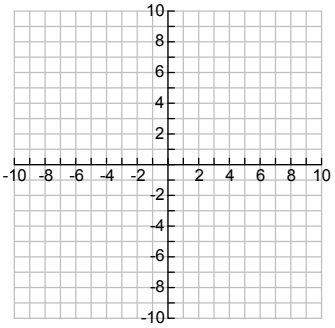


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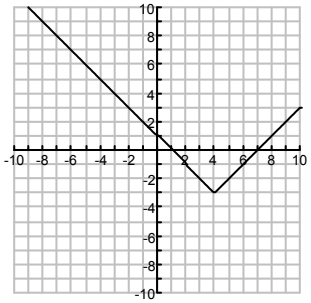
19. Graph the function: $f(x) = -|x+2|+5$. State the domain and range.

19. _____



20. Determine the absolute value function $f(x)$ that has been graphed.

20. _____



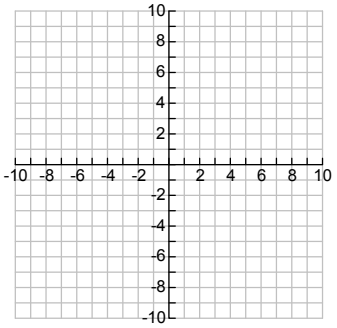
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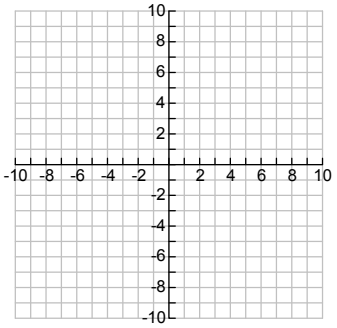
CHAPTER TEST 2C Name: _____

1. Is the ordered pair (–2, 5) a solution of $4y - 7x = -43$? **1.** _____

2. Find the x- and y-intercepts, and use them to graph $3x - 4y = 24$. **2.** _____



3. Find the x- and y-intercepts, and use them to graph $2x + 7y = -14$. **3.** _____

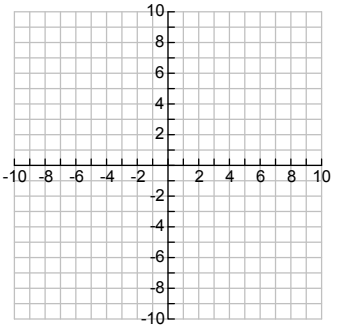


4. Find the slope of the line that passes through the points (9, 2) and (–6, 7). **4.** _____

5. Find the slope and y-intercept of $y = -\frac{3}{7}x - 5$. **5.** _____

6. Find the slope and y-intercept of $5x + 3y = -21$. **6.** _____

7. Graph: $y = -\frac{1}{3}x + 2$ **7.**

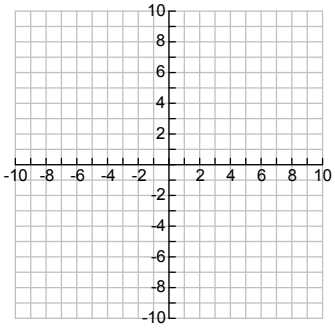


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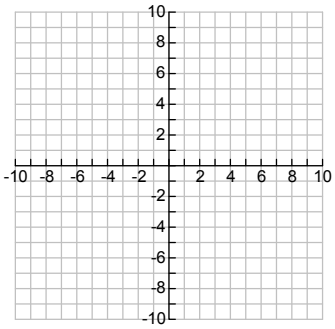
8. Graph: $y = -2x - 4$

8.



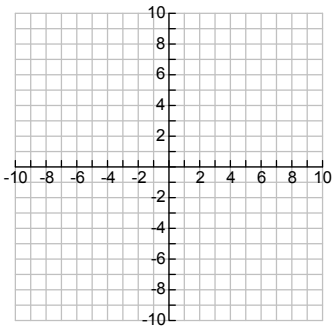
9. Graph: $y = \frac{5}{2}x - 1$

9.



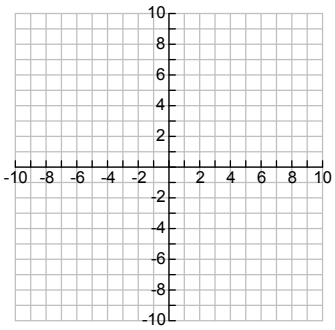
10. Graph: $8x + 2y = -12$

10.



11. Graph: $y = 7$

11.



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12. Are the two lines $6x + 9y = 18$ and $15x + 10y = 40$ parallel, perpendicular, or neither?

12. _____

13. Find the slope-intercept form of the equation of a line with a slope of $-\frac{3}{7}$ that passes through the point (14, –3).

13. _____

14. Find the slope-intercept form of the equation of a line that passes through the points (–4, –8) and (2, 0).

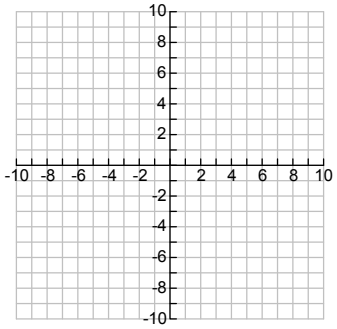
14. _____

15. Find $f(-7)$ for the given function $f(x) = -5x + 13$.

15. _____

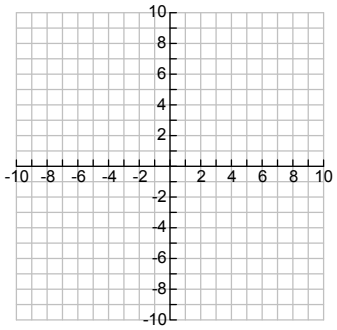
16. Graph the inequality: $2x - 3y \geq -12$

16.



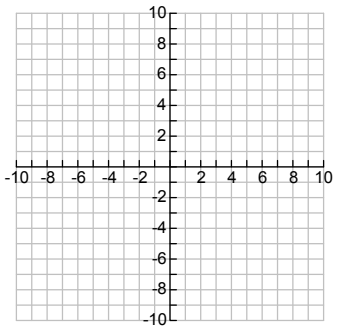
17. Graph the function: $f(x) = \frac{2}{5}x + 3$

17.



18. Graph the function: $f(x) = -\frac{2}{3}(x - 4) - 6$

18.

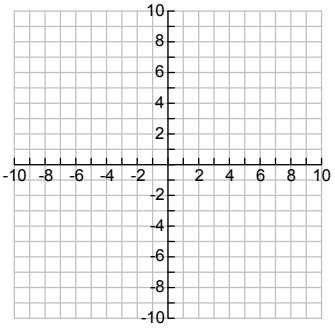


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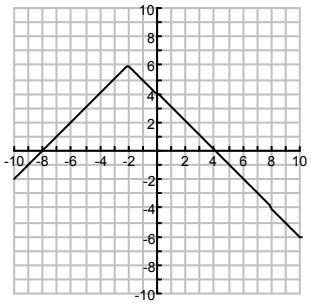
19. Graph the function: $f(x)=|x-4|-5$. State the domain and range.

19. _____



20. Determine the absolute value function $f(x)$ that has been graphed.

20. _____



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CHAPTER TEST 2D Name: _____

1. For which equation is the point (3, 4) a solution? **1.** _____

a) $y = -3x + 5$ **b)** $y = \frac{4}{3}$

c) $3y - 4x = 0$ **d)** $y = -\frac{4}{3}x$

2. Find the x-intercept: $4y - 3x = 12$. **2.** _____

a) $(3, 0)$ **b)** $(0, 3)$

c) $(0, -4)$ **d)** $(-4, 0)$

3. Find the y-intercept: $5x + 2y = -20$. **3.** _____

a) $(-4, 0)$ **b)** $(-10, 0)$

c) $(0, -10)$ **d)** $(0, -4)$

4. Find the slope of the line that passes through the points (–6, 2) and (4, 7). **4.** _____

a) $-\frac{5}{2}$ **b)** $-\frac{1}{2}$

c) 2 **d)** $\frac{1}{2}$

5. Find the slope and y-intercept of $4y = -8x - 20$. **5.** _____

a) slope: –2, y-intercept: (0, –5) **b)** slope: –8, y-intercept: (0, –5)

c) slope: –8, y-intercept: (0, –20) **d)** slope: –2, y-intercept: (–5, 0)

6. Find the slope and y-intercept of $6x - 3y = 18$. **6.** _____

a) slope: –2, y-intercept: (0, –6) **b)** slope: $\frac{1}{2}$, y-intercept: (0, 3)

c) slope: 2, y-intercept: (0, –6) **d)** slope: 2, y-intercept: (3, 0)

7. Find the slope-intercept equation for the line with slope $-\frac{1}{3}$ and that passes through the point (6, –5). **7.** _____

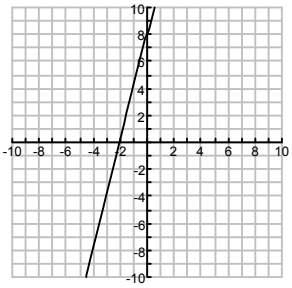
a) $y = -\frac{1}{3}x + 7$ **b)** $y = -\frac{1}{3}x - 3$

c) $y = -\frac{1}{3}x - 11$ **d)** $y = -\frac{1}{3}x + \frac{13}{3}$

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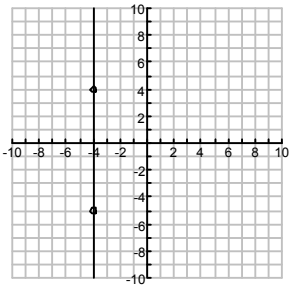
8. Find the equation of the line graphed: **8.** _____



a) $y = 4x + 8$ **b)** $y = -4x + 8$

c) $y = -\frac{1}{4}x + 8$ **d)** $y = -4x$

9. Find the equation of the line graphed: **9.** _____

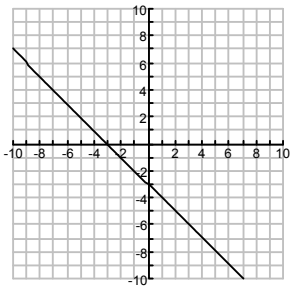


a) $x = 4$ **b)** $y = 4$

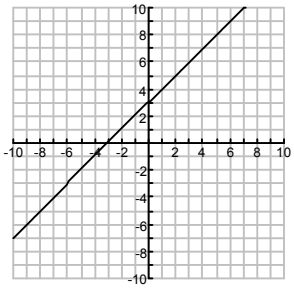
c) $y = -4$ **d)** $x = -4$

10. Graph: $y = -x + 3$ **10.** _____

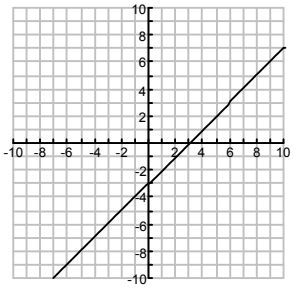
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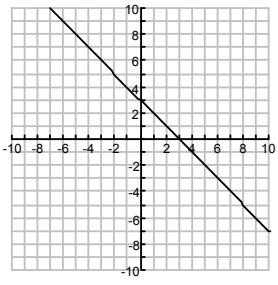
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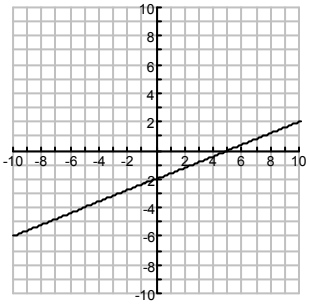


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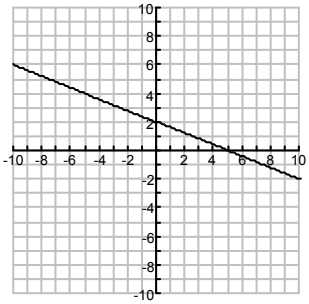
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11. Graph: $5y = 2x - 10$ **11.** _____

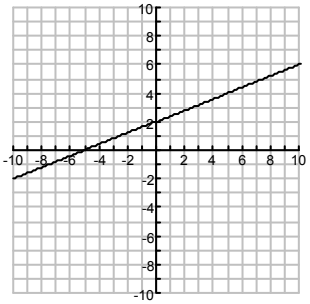
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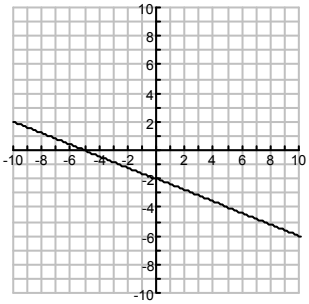
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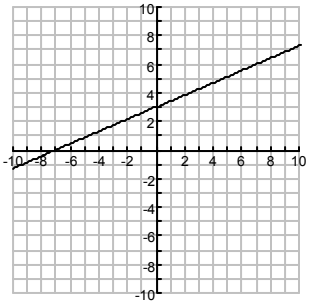


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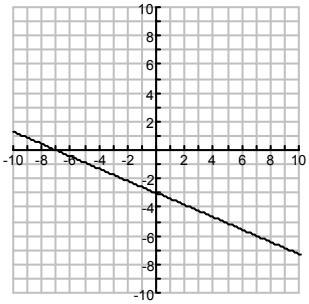


12. Graph: $3x + 7y = -21$ **12.** _____

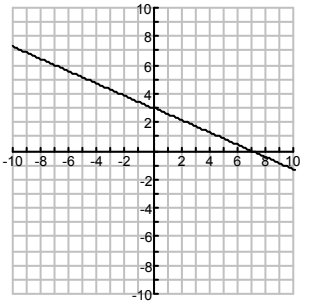
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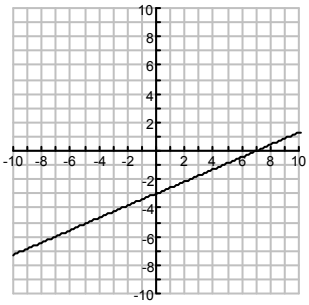
b)



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13. Which of the following lines is perpendicular to the line $4x + 6y = 18$? **13.** _____

a) $9x - 6y = 15$ **b)** $6x + 4y = 22$

c) $10x + 15y = -20$ **d)** $-12x - 8y = 6$

14. Find the slope intercept form of the equation of a line that passes through the points (–2, 7) and (3, –3). **14.** _____

a) $y = 2x + 3$ **b)** $y = -\frac{1}{2}x + 6$

c) $y = -2x + 3$ **d)** $y = -2x + 12$

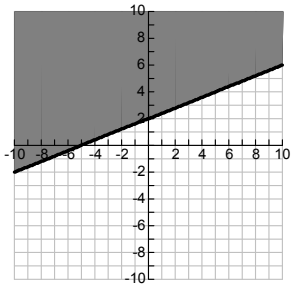
15. Find $f(-9)$ for the function $f(x) = 17 - 4x$. **15.** _____

a) –19 **b)** 53

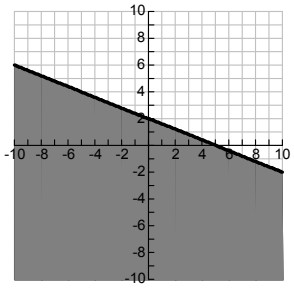
c) 30 **d)** 4

16. Graph: $2x - 5y \geq 10$ **16.** _____

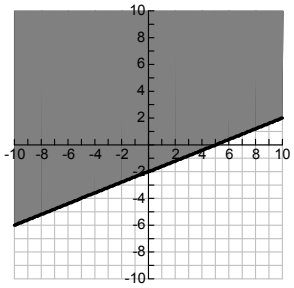
a)



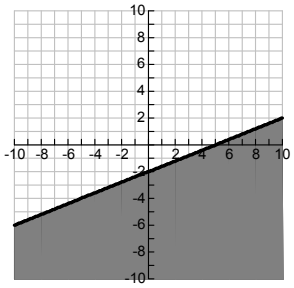
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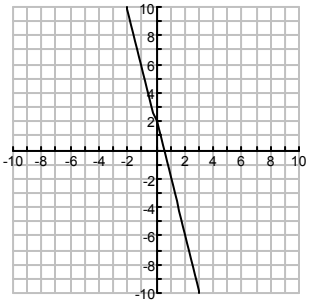


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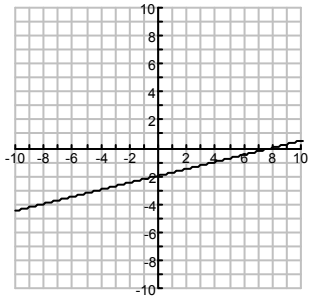
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17. Graph the function: $f(x) = -\frac{1}{4}x - 2$ **17.** _____

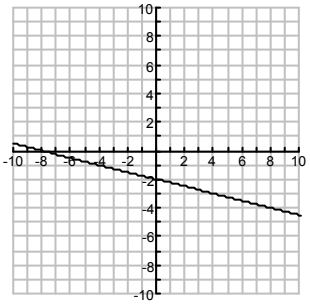
a)



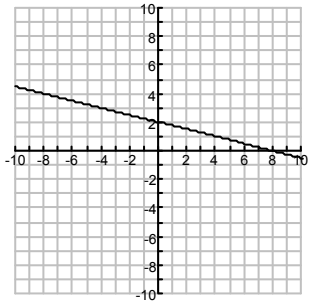
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c)

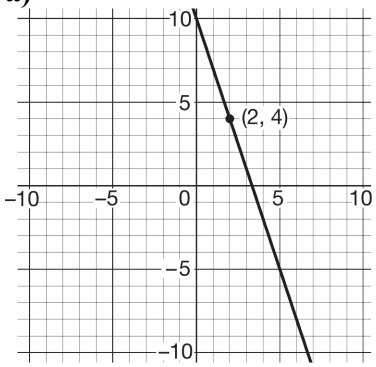


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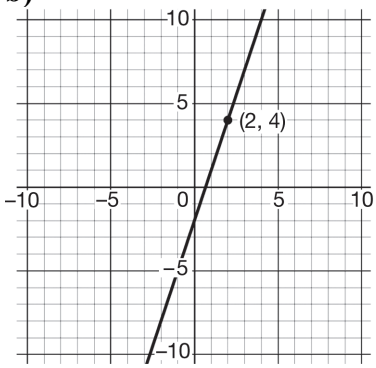


18. Graph the function: $f(x) = 3(x-2) - 4$ **18.** _____

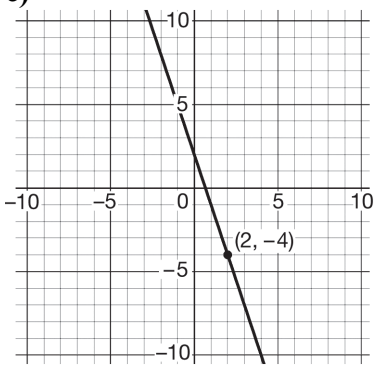
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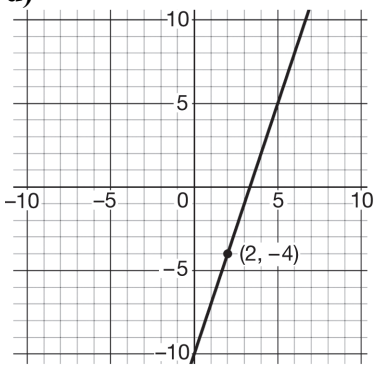
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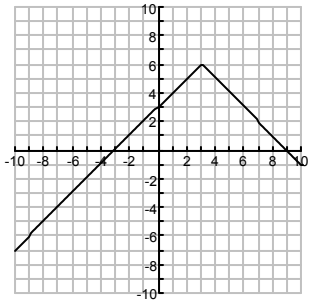


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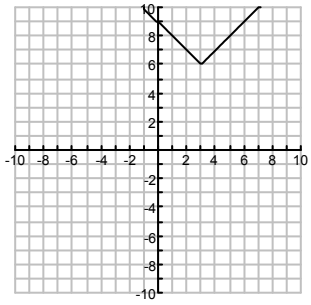
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19. Graph: $f(x) = -|x-3|+6$ **19.** _____

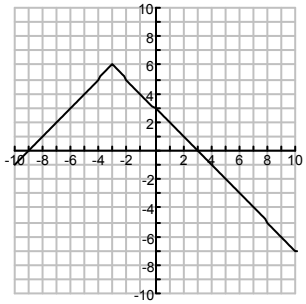
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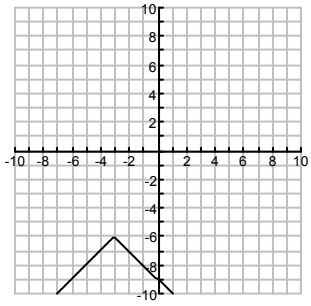
b)



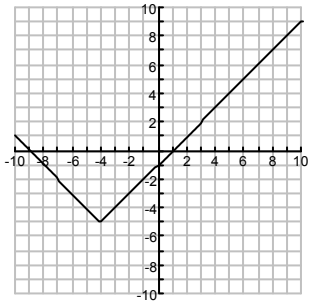
c)



d)



20. Find the absolute value function for the graph: **20.** _____



a) $f(x) = -|x+4|-5$

b) $f(x) = |x+4|-5$

c) $f(x) = |x-4|-5$

d) $f(x) = |x+4|+5$

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CHAPTER TEST 2E Name: _____

1. For which equation is the point (–5, 2) a solution? **1.** _____

a) $3x + 4y = 7$ **b)** $y = -\frac{2}{5}$

c) $2x - 4y = 2$ **d)** $3x + 4y = -7$

2. Find the x-intercept: $7x + 3y = -42$. **2.** _____

a) $(-6, 0)$ **b)** $(0, -14)$

c) $(0, -6)$ **d)** $(-14, 0)$

3. Find the y-intercept: $6x - 5y = 30$. **3.** _____

a) $(5, 0)$ **b)** $(0, -6)$

c) $(0, 6)$ **d)** $(0, -5)$

4. Find the slope of the line that passes through the points (–2, –5) and (4, –1). **4.** _____

a) $-\frac{2}{3}$ **b)** $\frac{2}{3}$

c) $\frac{1}{9}$ **d)** $\frac{3}{2}$

5. Find the slope and y-intercept of $12x + 3y = -24$. **5.** _____

a) slope: –4, y-intercept: (0, –24) **b)** slope: –12, y-intercept: (0, –8)

c) slope: –4, y-intercept: (0, –8) **d)** slope: 4, y-intercept: (–2, 0)

6. Find the slope and y-intercept of $4x = -2y + 16$. **6.** _____

a) slope: –2, y-intercept: (0, 8) **b)** slope: $-\frac{1}{2}$, y-intercept: (0, 4)

c) slope: 2, y-intercept: (0, 8) **d)** slope: 2, y-intercept: (8, 0)

7. Find the slope-intercept equation for the line with slope $-\frac{3}{4}$ and that passes through the point (8, –3). **7.** _____

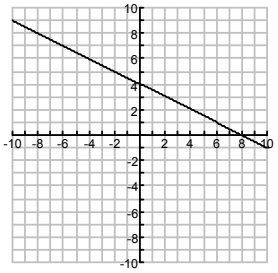
a) $y = -\frac{3}{4}x + 9$ **b)** $y = -\frac{3}{4}x - 9$

c) $y = -\frac{3}{4}x - 11$ **d)** $y = -\frac{3}{4}x + 3$

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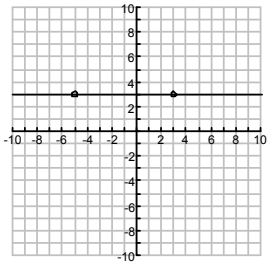
8. Find the equation of the line graphed: **8.** _____



a) $y = -\frac{1}{2}x + 4$ **b)** $y = -2x + 4$

c) $y = -\frac{1}{2}x - 4$ **d)** $y = -2x + 8$

9. Find the equation of the line graphed: **9.** _____

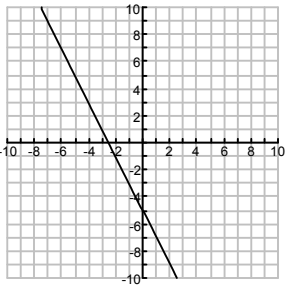


a) $x = 3$ **b)** $y = 3$

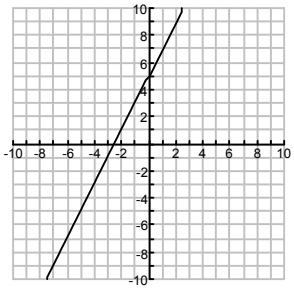
c) $y = -5$ **d)** $x = -5$

10. Graph: $y = 2x - 5$ **10.** _____

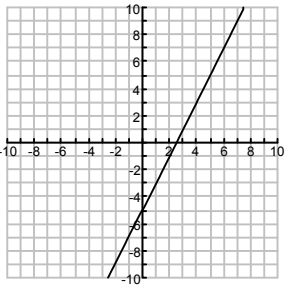
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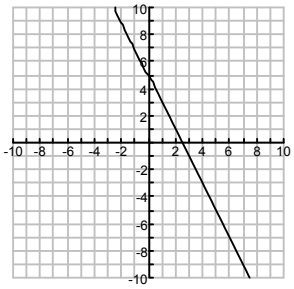
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c)



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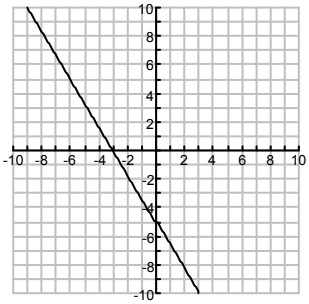


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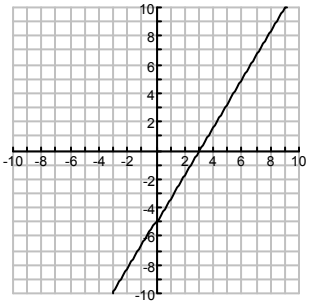
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11. Graph: $5x = -3y - 15$ **11.** _____

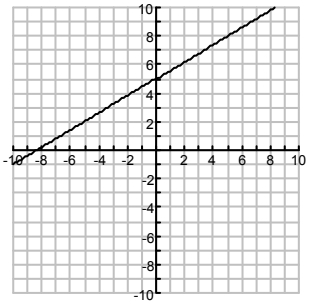
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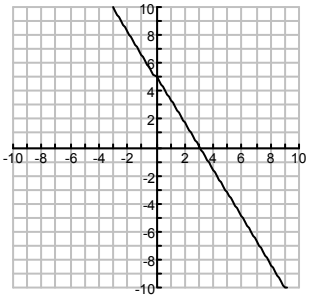
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c)

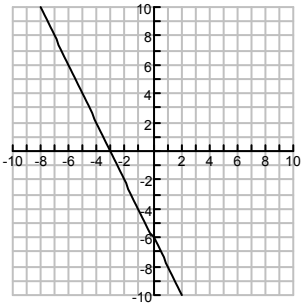


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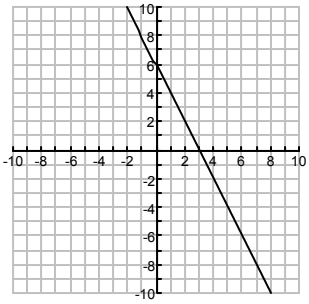


12. Graph: $4x - 2y = 12$ **12.** _____

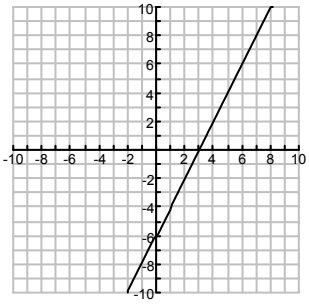
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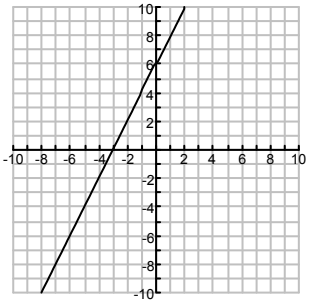
b)



c)



d)



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13. Which of the following lines is parallel to the line $10x - 8y = 40$? **13.** _____

a) $4x + 5y = 20$ **b)** $-15x + 12y = 24$
c) $5x + 4y = 15$ **d)** $16y + 20x = 56$

14. Find the slope intercept form of the equation of a line that passes through the points (–5, 2) and (9, 4). **14.** _____

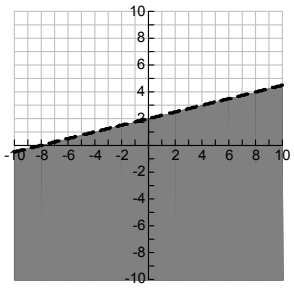
a) $y = -7x + 67$ **b)** $y = 7x - 59$
c) $y = -\frac{1}{7}x + \frac{37}{7}$ **d)** $y = \frac{1}{7}x + \frac{19}{7}$

15. Find $f(7)$ for the function $f(x) = 5x - 62$. **15.** _____

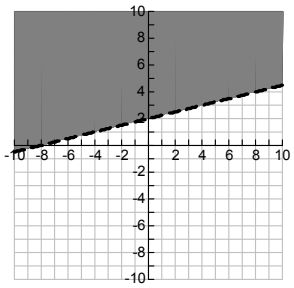
a) 97 **b)** –27
c) –50 **d)** –20

16. Graph: $4y - x < 8$ **16.** _____

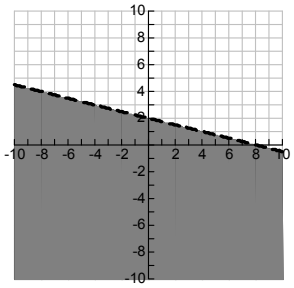
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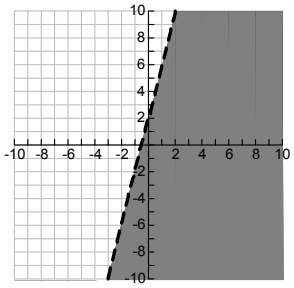
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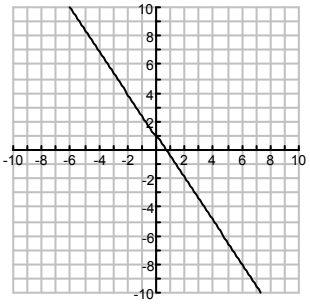


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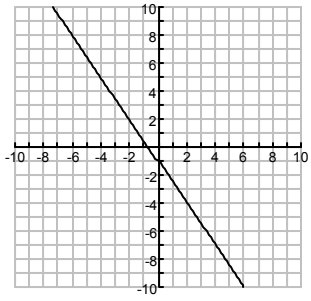
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17. Graph the function: $f(x)=\frac{3}{2}x+1$ **17.** _____

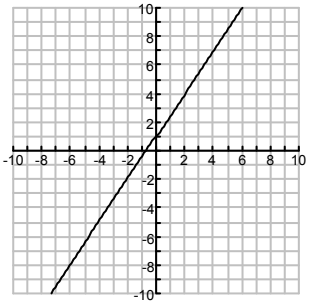
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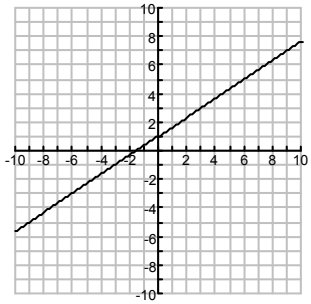
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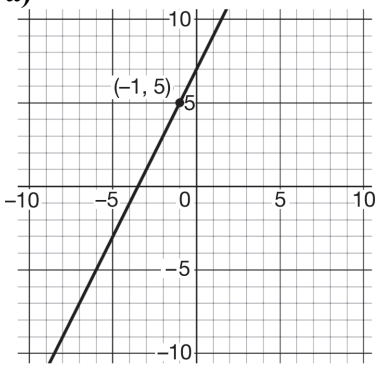


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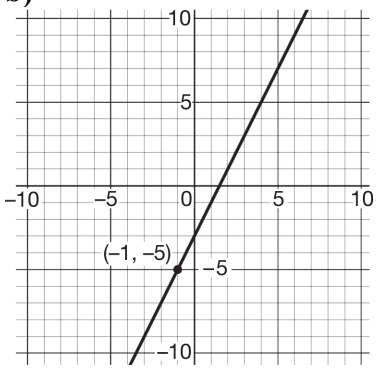


18. Graph the function: $f(x)=2(x+1)+5$ **18.** _____

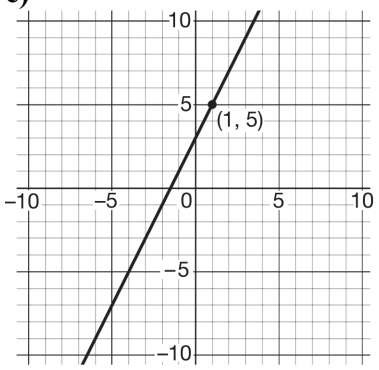
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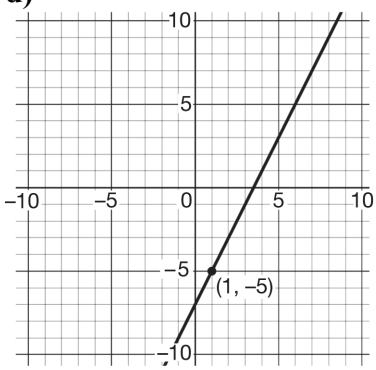
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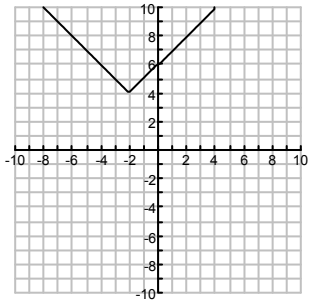


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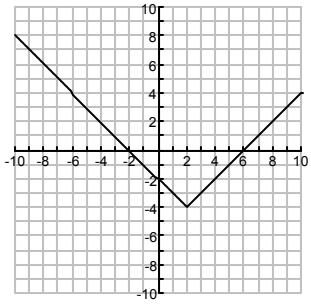
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19. Graph: $f(x)=|x+2|-4$ **19.** _____

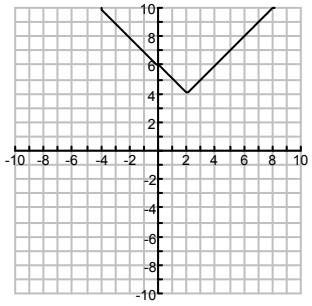
a)



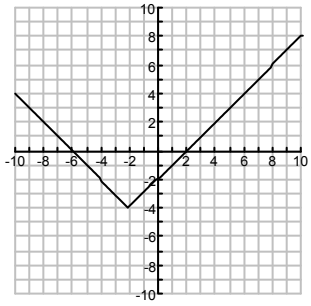
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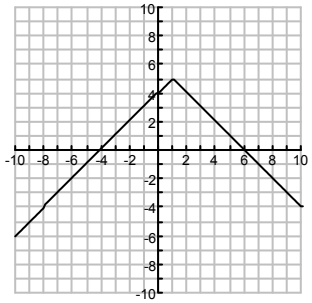
c)



d)



20. Find the absolute value function for the graph: **20.** _____



a) $f(x)=|x-1|+5$

b) $f(x)=-|x+1|+5$

c) $f(x)=-|x-1|+5$

d) $f(x)=-|x+1|-5$

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Section 2.1 – The Rectangular Coordinate System; Equations in Two Variables

1. DETERMINE WHETHER AN ORDERED PAIR IS A SOLUTION OF AN EQUATION IN TWO VARIABLES.
2. PLOT ORDERED PAIRS ON A RECTANGULAR COORDINATE PLANE.
3. COMPLETE ORDERED PAIRS FOR A LINEAR EQUATION IN TWO VARIABLES.

I like to begin this section by writing down a linear equation in two variables, then ask students for multiple ordered pairs that are solutions. (After a student gives me the first pair of values, I define what an ordered pair is.) This provides me with a set of ordered pairs that we can graph. I also give values of x and ask students for the value of y that makes an ordered pair solution before I tell them how to do it. (Letting students find their own way is often the best approach.)

STEM Opportunity: After making it through the first example, consider giving students a set of STEM-related paired data to graph. (Example 4 relates cricket chirps to temperature.) You can then ask students to share their observations, such as the number of chirps seems to increase as the temperature increases.

4. GRAPH LINEAR EQUATIONS IN TWO VARIABLES.
Your students will notice that the points appear to be on a straight line. After you discuss the solutions of a linear equation in two variables, you can walk through a new example. I tell my students that there are other ways to graph lines (using intercepts or slope) that are more efficient, and that this strategy is just meant as an introduction.

5. FIND THE x-AND y-INTERCEPTS OF A LINE FROM ITS EQUATION.
After a brief introduction to the concept of intercepts, I like to ask my students if they can draw a line that only has one intercept. Often they will quickly come up with vertical or horizontal lines, but I push them for an example that is not vertical or horizontal. I am looking for a line that passes through the origin.

6. GRAPH LINEAR EQUATIONS USING THEIR INTERCEPTS.
After a couple examples of graphing using intercepts, I go back to show how efficient it is to graph by intercepts when the equation is of the form $Ax + By = C$. To find the x-intercept, the equation $Ax = C$ can be solved by simple division. The same is true for the y-intercept by solving $By = C$. Often many students come in with a preference for graphing by slope, and I want them to know that graphing by intercepts can be quicker and easier in the right situation.

Be sure to cover the case where the line passes through the origin. Some students struggle with the concept of finding a second point on the line, and they can always graph this type of line by using slope in the next section.

7. GRAPH HORIZONTAL AND VERTICAL LINES.
I tell my students to think of equations that have only one variable as "special lines." Some students struggle with determining whether the line should be vertical or horizontal. When working with an equation like $x = 6$, I have them first plot a point where they know x is 6, which is at $(6, 0)$ on the x-axis. Graphing the vertical line seems natural at that point. The same strategy works well for horizontal lines.

8. INTERPRET THE GRAPH OF AN APPLIED LINEAR EQUATION.
The key idea is that the y-intercept is often some sort of initial value of y, and the x-intercept is often some sort of break-even point.

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Section 2.2 – Slope of a Line

1. UNDERSTAND THE SLOPE OF A LINE.
2. FIND THE SLOPE OF A LINE PASSING THROUGH TWO POINTS USING THE SLOPE FORMULA.

Getting students to understand that slope measures "rise over run" or the "change in y over the change in x" will help students should they have a hard time recalling the slope formula. I like to include an example that leads to a slope of 0 and an undefined slope, which leads nicely into the discussion of horizontal and vertical lines. Be sure to discourage students from using the ambiguous phrase "no slope."

STEM Opportunity: Discussing rate of change with a STEM example will open the door to discussing the rate of change of a function (as well as the average rate of change) in upcoming sections.

3. FIND THE SLOPES OF HORIZONTAL AND VERTICAL LINES.

This is a good opportunity for students to develop a list of everything they know about horizontal lines and everything they know about vertical lines, including their equations and slopes. I encourage my students to memorize the slope of one type of line (like the slope of a horizontal line is 0), because if they know one type, they can essentially get the slope of the other type for free.

4. FIND THE SLOPE AND Y-INTERCEPT OF A LINE FROM ITS EQUATION.

This gives you a great chance to refer back to solving linear equations, showing students that many of the concepts in this course are related and will appear in future sections.

5. GRAPH A LINE USING ITS SLOPE AND Y-INTERCEPT.

Students typically do well with this type of graphing, but I want to make one more pitch that graphing equations whose form is $Ax + By = C$ is often more efficiently handled by graphing using intercepts rather than using slope.

Some students will mistakenly start by plotting the y-intercept on the x-axis and then using the slope. Consider graphing one this way and then asking students to find the mistake.

6. DETERMINE WHETHER TWO LINES ARE PARALLEL, PERPENDICULAR, OR NEITHER.

After explaining the concept, I like to go through several examples in a quick format, asking students to put up 1 finger if they think the lines are parallel, two fingers if they are perpendicular, and three fingers if they are neither. It can be a lot of fun. I like to use two lines like $y = 3$ and $y = -\frac{1}{3}x$. Students often will say perpendicular, not realizing that 3 is not the slope of the first (horizontal) line. It's a good learning moment.

7. INTERPRET THE SLOPE AND Y-INTERCEPT IN REAL-WORLD APPLICATIONS.

The y-intercept is again often an initial value. When it comes to slope, the interpretation of slope is very important in many STEM fields.

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Section 2.3 – Equations of Lines

1. FIND THE EQUATION OF A LINE USING THE POINT-SLOPE FORM.
Begin by making sure that students know the goal of finding the equation of a line is to find the values of m (slope) and b (y-intercept). Once those two values are known, the equation is $y = mx + b$. Finding slope varies from problem to problem – sometimes you are given the slope, other times you must find it by using the slope formula or from another line in the problem.

Although all of the examples in the book are worked out using the point-slope form, you may choose to have your students use the slope-intercept form instead. I flip my classroom, and my students watch videos about using the point-slope form before coming to class. In class I work through each problem using both forms, and leave it to my students to decide which form of the equation they wish to use.

General Note: I typically spend two days (50 minutes each) in this section. On the first day we work through problems where the slope and a point on the line are given or two points on the line (but not the slope) are given. On the second day we work on the problems involving parallel or perpendicular lines, followed by a collaborative assignment containing a mixture of all the types.

2. FIND THE EQUATION OF A LINE GIVEN TWO POINTS ON THE LINE.
When you give students just the two points, ask them "How are we going to find the slope?" Give them time to figure out that they will need to use the slope formula. For the first example I find the equation twice – once using the slope and the first point and once using the slope and the second point. Once students see that either point can be used, recommend that they use the point they feel will be easier to work with.

3. FIND A LINEAR EQUATION TO DESCRIBE REAL DATA.
These problems are similar to the previous problems, except that students will need to find the ordered pairs. They must be able to determine which quantity will be represented by x and which will be represented by y, and that can be found through the context of the problem.

STEM Opportunity: Use paired data from a STEM-related field and have students find the linear equation to describe the data. While it is important to use variables that are approximately linear in their relation, there is an opportunity to use data from a quadratic/exponential relation and use it to foreshadow the upcoming nonlinear equations.

4. FIND THE EQUATION OF A PARALLEL OR PERPENDICULAR LINE.
Again, begin by determining the slope before finding the equation of the line.

MODELING LINEAR FUNCTIONS
At the end of this section there is a mini-section on using least squares regression to find the line of best fit. Although this can be assigned to students to work on at home, I like to take a day of class to have students work through this in groups. Begin by using a previous example to find the line of best fit when there are two points, then move on to the examples/exercises that have several ordered pairs.

I use Desmos for this material. Students with a smartphone can download their free app, while students working on a laptop can visit their website: desmos.com. Working in groups can help those students who won't have access to the technology in class.

There are three more modeling sections in the book, using quadratic functions, square-root functions, exponential functions.

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Section 2.4 – Linear Inequalities

1. DETERMINE WHETHER AN ORDERED PAIR IS A SOLUTION OF A LINEAR INEQUALITY IN TWO VARIABLES.
This is not the first time this idea has appeared. (Checking solutions to linear equations in one or two variables, as well as checking solutions to a linear inequality in one variable.) Substitute the values for x and y and determine whether the resulting inequality is true (solution) or false (not a solution).

2. GRAPH A LINEAR INEQUALITY IN TWO VARIABLES.
Some of the key ideas to discuss:

- Should the line be solid or dashed?
- Should the line be graphed using its x- and y-intercepts, or using its slope and y-intercepts?
- Which half-plane should be shaded?

In my experience, deciding which half-plane to shade can be tough for some students. At the beginning I like to have students try a test point from each half-plane, and label each half-plane as "true" or "false." Then they shade the half-plane they labeled as "true." Eventually we move on to only using one test point, and we use the origin whenever it is not on the line. I suggest that my students use the point $(1,0)$ or some other point on the positive x-axis as the test point if the line passes through the origin.

Another suggestion I would make is to start by having some graphs prepared ahead of time, allowing you to focus on only determining which half-plane to shade.

3. GRAPH A LINEAR INEQUALITY INVOLVING A HORIZONTAL OR VERTICAL LINE.
The same idea is at work here, and these problems give your students a chance to review graphing horizontal and vertical lines. Rather than using a test point, students can easily determine which half-plane through logic and reasoning.

4. GRAPH LINEAR INEQUALITIES ASSOCIATED WITH APPLIED PROBLEMS.
The challenge here is to come up with the inequality that describes the situation in the problem.

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Section 2.5 – Linear Functions

1. DEFINE FUNCTION, DOMAIN, AND RANGE.
2. EVALUATE FUNCTIONS.

Students need to be comfortable with the definition of a function (each input associated with only one output) as well as function notation. I like to point out that evaluating a function is similar to evaluating an algebraic expression, except that the notation is different.

3. GRAPH LINEAR FUNCTIONS.

Graphing a linear function is similar to graphing an equation in slope-intercept form.

STEM Opportunity: Heading toward College Algebra – Rate of Change for a Function
This is the first of several appearances of the difference quotient. The rate of change of a linear function $f(x) = mx + b$ is always equal to the slope m. The algebra is quite accessible for linear functions, and it gives you a chance to relate the rate of change of other functions to the slope of a line.

4. GRAPH LINEAR FUNCTIONS THAT ARE IN TRANSFORMATION FORM.

The transformation form of a linear function is $f(x) = m(x-h)+k$. Covering this form will help when it comes to graphing more advanced functions by horizontal and vertical transformations. For example, it will make graphing absolute values by shifting more accessible in the next section. After working through a couple of examples I like to point out another strategy for graphing linear functions in this form – start by plotting the point (h,k) and then graph a line of slope m through that point.

5. INTERPRET THE GRAPH OF A LINEAR FUNCTION.

If a point (x,y) is on the graph of a function $f(x)$, that implies that $f(x) = y$.

6. DETERMINE THE DOMAIN AND RANGE OF A FUNCTION AND ITS GRAPH.

It is important for students to be able to read the domain and range from a graph, rather than trying to memorize them. Try drawing some graphs that have restricted domains and ranges to help students to understand.

7. FIND A LINEAR FUNCTION THAT MEETS GIVEN CONDITIONS.

Finding linear functions is similar to finding linear equations, as covered in Section 2.3. The examples in the book are worked out using function notation, although some of your students will prefer using the point-slope form.

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Section 2.6 – Absolute Value Functions

1. GRAPH ABSOLUTE VALUE FUNCTIONS BY PLOTTING POINTS.
Begin by creating a table of ordered pairs for the basic absolute value function and then plotting those points. (All graphs in the textbook use 5 points, but you could definitely cut that down to 3.) Ask your students for their observations about the graph rather than pointing them out to them. This is the first function they are dealing with that has a restricted range. I prefer to focus on reading the range from the graph rather than trying to memorize the form. Finding the value of x where the graph goes from decreasing to increasing (or vice versa) is the most important skill. You do have an opportunity to discuss the importance of turning points in higher level mathematics.

As you work through the examples, be sure to include at least one that opens downward. I like to leave all of the examples on the board, so when we turn to graphing by shifting I can use the graphs as visual aids.

2. GRAPH ABSOLUTE VALUE FUNCTIONS BY SHIFTING.
If you covered the transformation form of a linear function in Section 2.5, the concept of shifting the graph of an absolute value function should be accessible to your students. I prefer to focus on the turning point (h,k), asking my students if they notice a relation between the turning points in the previous examples and the functions themselves. They usually can pick off the pattern fairly quickly, and then I put up a new example and ask them where the turning point would be.

My focus is on first plotting the turning point, and creating the graph from there.

STEM Opportunity: Heading toward College Algebra – Piecewise Functions
As we head toward college algebra and calculus, the concept of expressing an absolute value function as a piecewise function is very useful. The concept is accessible for intermediate algebra students. In addition to expressing an absolute value function as a piecewise function, consider giving your students a piecewise function and asking them to express it as an absolute value function. (See exercises 33-36.) I also like to have my students graph a piecewise function. (See exercises 37-40.)

3. FIND THE INTERCEPTS OF AN ABSOLUTE VALUE FUNCTION.
The process for finding the intercepts of an absolute value function is similar to the process for finding the intercepts of a linear function. After pointing this out, you can tell your students that this process will be used throughout the semester. The only difference is that the technique for solving the equation that gives the x-intercept(s) changes depending on the type of function.

4. DETERMINE AN ABSOLUTE VALUE FUNCTION FROM ITS GRAPH.
If you want to know if students truly understand a concept, see if they can reverse the process. Here, if you give them a graph of an absolute value function, they should be able to give you the function itself. It's a great opportunity to focus in on h and k, graphs that open downward, etc.

Consider having your student create a graph and asking a partner to find the function.

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Chapter 2 Test

I included a problem asking students to graph a linear function in transformation form in the test bank for the Chapter 2 test. Even if you did not cover this form, I'd encourage you to leave it on the test as students could simplify the function and then graph it using the slope and y-intercept.

There are several concepts that I did not include in the test, but they could definitely be added to the test or assessed in some other manner. These problems include:

- Plotting STEM-based real data
- Finding the rate of change using STEM-based ordered pairs
- Finding the equation of a line given two real STEM-based ordered pairs
- Finding the rate of change of a linear function using the difference quotient
- Rewriting an absolute value function as a piecewise function
- Graphing a piecewise function

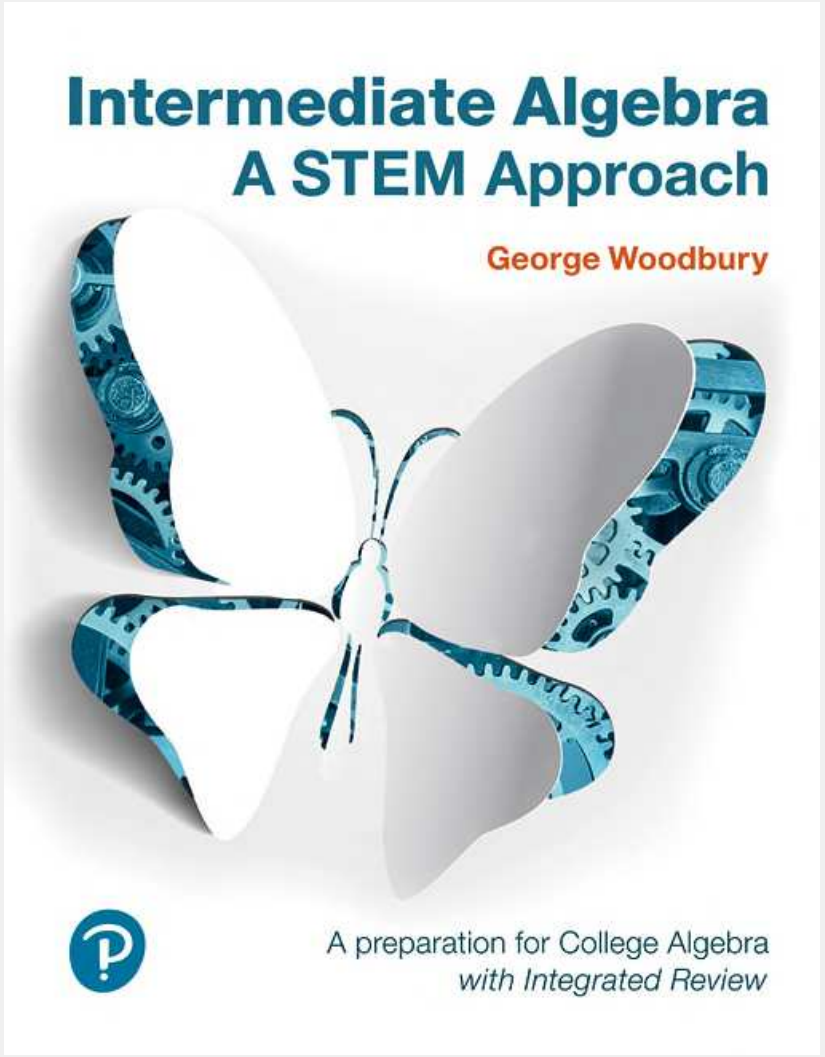
Both the chapter test at the end of the chapter and the tests in the test bank contain 20 questions, and I have found these to fit very well in a 50-minute testing period. However, I see no problem with cutting down the number of questions to alleviate any of the pressure that comes from a perception that there will not be enough time.

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Chapter R
Review of Real Numbers

Section R.2
Exponents and Order of Operations



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Objectives

1 Simplify exponents.

2 Use the order of operations to simplify arithmetic expressions.

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Base, Exponent

For the expression 3^5, the number being multiplied (3) is called the base. The exponent (5) tells how many times the base is used as a factor.

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Example 1

Simplify 4^3.

$$4^3 = 4 \cdot 4 \cdot 4$$
$$= 64$$

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Example 2

Simplify $(-5)^2$.

$$(-5)^2 = -5 \cdot -5$$
$$= 25$$

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Order of Operations (1 of 2)

1. Remove grouping symbols. Begin by simplifying all expressions within parentheses, brackets, and absolute value bars. Also perform any operations in the numerator or denominator of a fraction. This is done by following Steps 2–4, presented next.
2. Perform any operations involving exponents. After all grouping symbols have been removed from the expression, simplify any exponential expressions.

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Order of Operations (1 of 2)

3. Multiply and divide. These two operations have equal priority. Perform multiplications or divisions in the order they appear from left to right.
4. Add and subtract. At this point, the only remaining operations should be additions and subtractions. Again, these operations are of equal priority, and we perform them in the order they appear from left to right. We also can use the strategy for totaling integers from Section R.1.

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Example 6

Simplify: $8 \div (3 \cdot 5 - 19) - 7^2$

$$8 \div (3 \cdot 5 - 19) - 7^2 = 8 \div (-4) - 7^2$$

$$= 8 \div (-4) - 49$$

$$= -2 - 49$$

$$= -51$$

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