2. L will have slope $m = -2$. Using the point and the slope, we have $y - 4 = -2(x - 3)$. Solve for y to obtain slope-intercept form.

$$y - 4 = -2x + 6$$
$$y = -2x + 10$$
$$f(x) = -2x + 10$$

3. Since L is perpendicular to $y = 2x$, we know it will have slope $m = -\frac{1}{2}$. We are given that it passes through (2, 4). We use the slope and point to write the equation in point-slope form.

$$y - y_1 = m(x - x_1)$$
$$y - 4 = -\frac{1}{2}(x - 2)$$

Solve for y to obtain slope-intercept form.

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

In function notation, the equation of the line is $f(x) = -\frac{1}{2}x + 5$.

4. L will have slope $m = \frac{1}{2}$. The line passes through (–1, 2). Use the slope and point to write the equation in point-slope form.

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

Solve for y to obtain slope-intercept form.

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

5. $m = -4$ since the line is parallel to $y = -4x + 3$; $x_1 = -8$, $y_1 = -10$;
point-slope form: $y + 10 = -4(x + 8)$
slope-intercept form: $y + 10 = -4x - 32$
$y = -4x - 42$

6. $m = -5$ since the line is parallel to $y = -5x + 4$; $x_1 = -2, y_1 = -7$;
point-slope form: $y + 7 = -5(x + 2)$
slope-intercept form: $y + 7 = -5x - 10$
$y = -5x - 17$

7. $m = -5$ since the line is perpendicular to $y = \frac{1}{5}x + 6$; $x_1 = 2$, $y_1 = -3$;

point-slope form: $y + 3 = -5(x - 2)$

slope-intercept form: $y + 3 = -5x + 10$

$$y = -5x + 7$$

8. $m = -3$ since the line is perpendicular to $y = \frac{1}{3}x + 7$; $x_1 = -4, y_1 = 2$;

point-slope form: $y - 2 = -3(x + 4)$

slope-intercept form: $y - 2 = -3x - 12$

$$y = -3x - 10$$

9. $2x - 3y - 7 = 0$

$$-3y = -2x + 7$$

$$y = \frac{2}{3}x - \frac{7}{3}$$

The slope of the given line is $\frac{2}{3}$, so $m = \frac{2}{3}$ since the lines are parallel.

point-slope form: $y - 2 = \frac{2}{3}(x + 2)$

general form: $2x - 3y + 10 = 0$

10. $3x - 2y - = 0$

$$-2y = -3x + 5$$

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

The slope of the given line is $\frac{3}{2}$, so $m = \frac{3}{2}$ since the lines are parallel.

point-slope form: $y - 3 = \frac{3}{2}(x + 1)$

general form: $3x - 2y + 9 = 0$

11. $x - 2y - 3 = 0$

$$-2y = -x + 3$$

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

The slope of the given line is $\frac{1}{2}$, so $m = -2$ since the lines are perpendicular.

point-slope form: $y + 7 = -2(x - 4)$

general form: $2x + y - 1 = 0$

12. $x+7y-12=0$

$$7y=-x+12$$

$$y=\frac{-1}{7}x+\frac{12}{7}$$

The slope of the given line is $-\frac{1}{7}$, so $m=7$ since the lines are perpendicular.

point-slope form: $y+9=7(x-5)$
general form: $7x-y-44=0$

13. $\frac{15-0}{5-0}=\frac{15}{5}=3$

14. $\frac{24-0}{4-0}=\frac{24}{4}=6$

15. $\frac{5^2+2\cdot5-(3^2+2\cdot3)}{5-3}$

$=\frac{25+10-(9+6)}{2}$

$=\frac{20}{2}$

$=10$

16. $\frac{6^2-2(6)-(3^2-2\cdot3)}{6-3}$

$=\frac{36-12-(9-6)}{3}=\frac{21}{3}=7$

17. $\frac{\sqrt{9}-\sqrt{4}}{9-4}=\frac{3-2}{5}=\frac{1}{5}$

18. $\frac{\sqrt{16}-\sqrt{9}}{16-9}=\frac{4-3}{7}=\frac{1}{7}$

19. Since the line is perpendicular to $x=6$ which is a vertical line, we know the graph of f is a horizontal line with 0 slope. The graph of f passes through $(-1,5)$, so the equation of f is $f(x)=5$.

20. Since the line is perpendicular to $x=-4$ which is a vertical line, we know the graph of f is a horizontal line with 0 slope. The graph of f passes through $(-2,6)$, so the equation of f is $f(x)=6$.

21. First we need to find the equation of the line with $x-$intercept of 2 and $y-$intercept of -4. This line will pass through $(2,0)$ and $(0,-4)$. We use these points to find the slope.

$$m=\frac{-4-0}{0-2}=\frac{-4}{-2}=2$$

Since the graph of f is perpendicular to this line, it will have slope $m=-\frac{1}{2}$.

Use the point $(-6,4)$ and the slope $-\frac{1}{2}$ to find the equation of the line.

$$y-y_1=m(x-x_1)$$
$$y-4=-\frac{1}{2}(x-(-6))$$
$$y-4=-\frac{1}{2}(x+6)$$
$$y-4=-\frac{1}{2}x-3$$
$$y=-\frac{1}{2}x+1$$
$$f(x)=-\frac{1}{2}x+1$$

22. First we need to find the equation of the line with $x-$intercept of 3 and $y-$intercept of -9. This line will pass through $(3,0)$ and $(0,-9)$. We use these points to find the slope.

$$m=\frac{-9-0}{0-3}=\frac{-9}{-3}=3$$

Since the graph of f is perpendicular to this line, it will have slope $m=-\frac{1}{3}$.

Use the point $(-5,6)$ and the slope $-\frac{1}{3}$ to find the equation of the line.

$$y-y_1=m(x-x_1)$$
$$y-6=-\frac{1}{3}(x-(-5))$$
$$y-6=-\frac{1}{3}(x+5)$$
$$y-6=-\frac{1}{3}x-\frac{5}{3}$$
$$y=-\frac{1}{3}x+\frac{13}{3}$$
$$f(x)=-\frac{1}{3}x+\frac{13}{3}$$

23. First put the equation $3x-2y-4=0$ in slope-intercept form.

$$3x-2y-4=0$$
$$-2y=-3x+4$$
$$y=\frac{3}{2}x-2$$

The equation of f will have slope $-\frac{2}{3}$ since it is perpendicular to the line above and the same y – intercept -2.

So the equation of f is $f(x)=-\frac{2}{3}x-2$.

24. First put the equation $4x-y-6=0$ in slope-intercept form.

$$4x-y-6=0$$
$$-y=-4x+6$$
$$y=4x-6$$

The equation of f will have slope $-\frac{1}{4}$ since it is perpendicular to the line above and the same y – intercept -6.

So the equation of f is $f(x)=-\frac{1}{4}x-6$.

25. The slope indicates that the global average temperature is projected to increase by 0.01 degrees Fahrenheit each year.

26. The slope indicates that drug industry spending on marketing to doctors increased by 2 billion dollars each year.

27. The slope indicates that the percentage of U.S. adults who smoked cigarettes decreased by 0.52% each year.

28. The slope indicates that the percentage of U.S. taxpayers who were audited by the IRS decreased by 0.28% each year.

29. $f(x)=13x+222$

30. $f(x)=18.50x+135$

31. $f(x)=-2.40x+52.40$

32. $f(x)=-2.80x+46.80$

33. $\frac{f(x_2)-f(x_1)}{x_2-x_1}=\frac{f(2003)-f(1997)}{2003-1997}=\frac{25.2-32.5}{2003-1997}\approx -1.22$

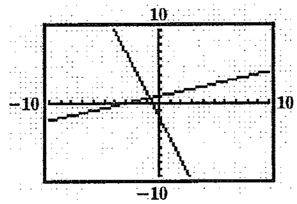
34. $\frac{f(x_2)-f(x_1)}{x_2-x_1}=\frac{f(2003)-f(1997)}{2003-1997}=\frac{13.3-10.1}{2003-1997}\approx 0.53$

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

$y = -3x - 2$

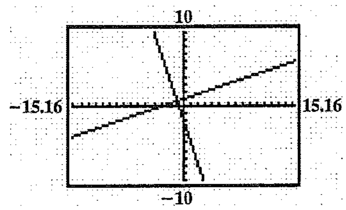
a. The lines are perpendicular because their slopes are negative reciprocals of each other. This is verified because product of their slopes is -1.

b.



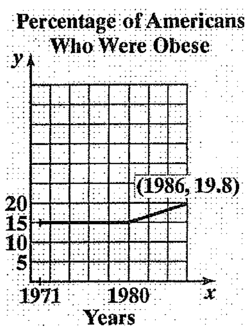
The lines do not appear to be perpendicular.

c.

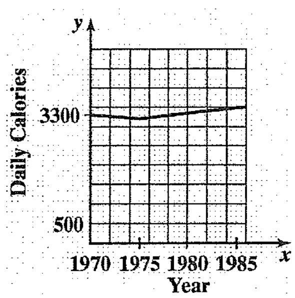


The lines appear to be perpendicular. The calculator screen is rectangular and does not have the same width and height. This causes the scale of the x–axis to differ from the scale on the y–axis despite using the same scale in the window settings. In part (b), this causes the lines not to appear perpendicular when indeed they are. The zoom square feature compensates for this and in part (c), the lines appear to be perpendicular.

42.



43.



44. Write $Ax + By + C = 0$ in slope-intercept form.

$$Ax + By + C = 0$$
$$By = -Ax - C$$
$$\frac{By}{B} = \frac{-Ax}{B} - \frac{C}{B}$$
$$y = -\frac{A}{B}x - \frac{C}{B}$$

The slope of the given line is $-\frac{A}{B}$.

The slope of any line perpendicular to $Ax + By + C = 0$ is $\frac{B}{A}$.

45. The slope of the line containing $(1,-3)$ and $(-2,4)$ has slope

$$m = \frac{4-(-3)}{-2-1} = \frac{4+3}{-3} = \frac{7}{-3} = -\frac{7}{3}.$$

Solve $Ax + y - 2 = 0$ for y to obtain slope-intercept form.

$$Ax + y - 2 = 0$$
$$y = -Ax + 2$$

So the slope of this line is $-A$.

This line is perpendicular to the line above so its slope is $\frac{3}{7}$. Therefore, $-A = \frac{3}{7}$ so $A = -\frac{3}{7}$.

Mid-Chapter 2 Check Point

1. The relation is not a function.
The domain is $\{1,2\}$.
The range is $\{-6,4,6\}$.

2. The relation is a function.
The domain is $\{0,2,3\}$.
The range is $\{1,4\}$.

3. The relation is a function.
The domain is $\{x \mid -2 \le x < 2\}$.
The range is $\{y \mid 0 \le y \le 3\}$.

4. The relation is not a function.
The domain is $\{x \mid -3 < x \le 4\}$.
The range is $\{y \mid -1 \le y \le 2\}$.

5. The relation is not a function.
The domain is $\{-2,-1,0,1,2\}$.
The range is $\{-2,-1,1,3\}$.

6. The relation is a function.
The domain is $\{x \mid x \le 1\}$.
The range is $\{y \mid y \ge -1\}$.

7. $x^2 + y = 5$

$$y = -x^2 + 5$$

For each value of x, there is one and only one value for y, so the equation defines y as a function of x.

8. $x + y^2 = 5$

$$y^2 = 5 - x$$
$$y = \pm\sqrt{5-x}$$

Since there are values of x that give more than one value for y (for example, if $x = 4$, then $y = \pm\sqrt{5-4} = \pm 1$), the equation does not define y as a function of x.

9. Each value of x corresponds to exactly one value of y.

10. Domain: $(-\infty, \infty)$

11. Range: $(-\infty, 4]$