Answer Key

Section 3-1

1. D 2. B 3. B 4. A 5. C
6. 8 7. 12

Section 3-2

1. A 2. C 3. D 4. $\frac{5}{2}$ or 2.5
5. 12 6. $\frac{29}{2}$ or 14.5 7. $\frac{1}{4}$ or 0.25

Section 3-3

1. C 2. B 3. D 4. B 5. D

Section 3-4

1. B 2. D 3. C 4. 14 5. $\frac{3}{2}$ or 1.5
6. 3

Section 3-5

1. B 2. B 3. $\frac{4}{5}$ or 0.8 4. C
5. 1 6. $\frac{4}{3}$ or 1.33

Section 3-6

1. D 2. A 3. A 4. D 5. C
6. 3

Chapter 3 Practice Test

1. C 2. B 3. C 4. C 5. B
6. A 7. B 8. C 9. D 10. 3
11. 2 12. 6

Answers and Explanations

Section 3-1

1. D

The domain of a function is the set of all x-coordinates. Therefore, $\{-5, -2, 0, 4\}$ is the domain of the given function.

2. B

The ordered pairs $\{(-5,8), (-2,7), (2,-1), (5,8)\}$ is a correct representation of the mapping shown.

3. B

If point $(7,b)$ is in Quadrant I, b is positive.
If point $(a,-3)$ is in Quadrant III, a is negative.
Therefore, point (a,b) is in Quadrant II.

4. A

$f(x) = -2x + 7$

To find $f(\frac{1}{2}x+3)$, substitute $\frac{1}{2}x+3$ for x, in the given function.

$f(\frac{1}{2}x+3) = -2(\frac{1}{2}x+3) + 7$

$= -x - 6 + 7 = -x + 1$

5. C

$g(x) = kx^3 + 3$

$g(-1) = k(-1)^3 + 3 = 5$ $\quad g(-1) = 5$

$-k + 3 = 5$ $\quad$ Simplify.

$k = -2$ $\quad$ Solve for k.

Substitute -2 for k in the given function.

$g(x) = kx^3 + 3 = -2x^3 + 3$

$g(1) = -2(1)^3 + 3 = 1$

6. 8

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

To find $f(-3)$, first solve $x + 1 = -3$.

$x + 1 = -3 \Rightarrow x = -4$.

Substitute -4 for x in the given function.

$f(-3) = -\frac{1}{2}(-4) + 6 = 8$.

7. 12

$f(x) = x^2 - b$

$f(-2) = 7 \Rightarrow (-2)^2 - b = 7$

$\Rightarrow 4 - b = 7 \Rightarrow b = -3$

Therefore, $f(x) = x^2 + 3$.

$f(b) = f(-3) = (-3)^2 + 3 = 12$

Section 3-2

1. A

Rate of change $= \dfrac{\text{change in } y}{\text{change in } x} = \dfrac{-1-3}{0-(-3)} = \dfrac{-4}{3}$

2. C

Pick any two points from the table.
Let's pick $(-3,-1)$ and $(6,5)$.

Average rate of change $= \dfrac{\text{change in } y}{\text{change in } x}$

$= \dfrac{5-(-1)}{6-(-3)} = \dfrac{6}{9} = \dfrac{2}{3}$

3. D

slope $= \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{b-1}{1-a} = 1$

$\Rightarrow\ b-1 = 1-a \quad \Rightarrow\ a+b=2$

4. $\dfrac{5}{2}$ or 2.5

slope $= \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-8-2}{-1-3} = \dfrac{-10}{-4} = \dfrac{5}{2}$

5. 12

slope $= \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{r-3}{-5-4} = \dfrac{r-3}{-9} = -1$

$\Rightarrow\ r-3=9\ \Rightarrow\ r=12$

6. $\dfrac{29}{2}$ or 14.5

slope $= \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{a-7}{1-a} = -\dfrac{5}{9}$

$\Rightarrow\ 9(a-7) = -5(1-a)$

$\Rightarrow\ 9a-63 = -5+5a$

$\Rightarrow\ 4a = 58\ \Rightarrow\ a = \dfrac{58}{4} = \dfrac{29}{2}$

7. $\dfrac{1}{4}$ or 0.25

$-x+4y=6$

Write the equation in slope-intercept form.

$-x+4y=6\ \Rightarrow\ 4y=x+6\ \Rightarrow\ y=\dfrac{x}{4}+\dfrac{6}{4}$

The slope of the line is $\dfrac{1}{4}$.

Section 3-3

1. C

. Since the points $(-4,2)$ and $(4,-4)$ lie on the line, the slope of the line is $\dfrac{2-(-4)}{-4-4} = \dfrac{6}{-8} = -\dfrac{3}{4}$.

If we use the point $(4,-4)$ and the slope $m = -\dfrac{3}{4}$, the point-slope form of the line is

$y-(-4) = -\dfrac{3}{4}(x-4)$ or $y+4 = -\dfrac{3}{4}(x-4)$.

If we use the point $(-4,2)$ and the slope $m = -\dfrac{3}{4}$, the point-slope form of the line is

$y-2 = -\dfrac{3}{4}(x-(-4))$ or $y-2 = -\dfrac{3}{4}(x+4)$.

Choice C is correct.

2. B

$y-2 = -\dfrac{3}{4}(x+4)$	Point-slope form of the line.
$y-2 = -\dfrac{3}{4}x-3$	Distributive Property
$y = -\dfrac{3}{4}x-1$	Add 2 to each side and simplify.

3. D

$y = -\dfrac{3}{4}x-1$	Slope-intercept form
$4y = 4(-\dfrac{3}{4}x-1)$	Multiply each side by 4.
$4y = -3x-4$	Simplify.
$4y+3x = -3x-4+3x$	Add $3x$ to each side.
$3x+4y = -4$	Simplify.

4. B

Average rate of change

$= \dfrac{\text{change in number of smart phones}}{\text{change in years}}$

$= \dfrac{345-120}{2010-2005} = \dfrac{225}{5} = 45$

The increase in the average number of smart phones is 45 each year.

5. D

Since the line passes through point $(4,-1)$ and has slope -2, the point-slope form of the line is $y-(-1)=-2(x-4)$.

$y+1=-2(x-4)$	Point-slope form simplified.
$y+1=-2x+8$	Distributive Property
$2x+y=7$	$2x-1$ is added to each side.

Section 3-4

1. B

Lines that are parallel have the same slope. So, we need to find the equation of a line with the slope $-\frac{1}{2}$ and the point $(-2,\frac{1}{2})$.

The point-slope form of this line is

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

$y-\frac{1}{2}=-\frac{1}{2}x-1$	Simplified.
$2(y-\frac{1}{2})=2(-\frac{1}{2}x-1)$	Multiply each side by 2.
$2y-1=-x-2$	Simplify.
$x+2y=-1$	$x+1$ is added to each side.

2. D

A line parallel to the x-axis has slope 0.

$y-y_1=m(x-x_1)$	Point-slope form
$y-6=0(x-7)$	$m=0$, $x_1=7$, and $y_1=6$
$y-6=0$	Simplify.
$y=6$	

3. C

If a line is parallel to the y-axis, it is a vertical line and the equation is given in the form $x=a$, in which a is the x-coordinate of the point the line passes through. Therefore, the equation of the vertical line that passes through $(-5,1)$ is $x=-5$.

4. 14

$4x-2y=13$ can be rewritten as $y=2x-\frac{13}{2}$.

The line has slope 2. Lines that are parallel have the same slope. Therefore, $2=\frac{b-2}{5+1}$.

Solving the equation for b gives $b=14$.

5. $\frac{3}{2}$ or 1.5

Since lines ℓ and m are parallel, the two lines have the same slope. Therefore,

$\frac{0-3}{2-0}=\frac{-3-b}{-1-(-4)}$.

$\frac{-3}{2}=\frac{-3-b}{3}$	Simplified.
$-9=-6-2b$	Cross Multiplication
$-3=-2b$	Add 6 to each side.
$\frac{3}{2}=b$	Divide each side by -2.

6. 3

The slope of line t is $\frac{1-(-3)}{2-(-4)}$, or $\frac{2}{3}$. So, the slope of the line perpendicular to line t is the negative reciprocal of $\frac{2}{3}$, or $-\frac{3}{2}$. Therefore,

$-\frac{3}{2}=\frac{-2-4}{a+1} \Rightarrow -3(a+1)=2(-6)$

$\Rightarrow -3a-3=-12$

$\Rightarrow -3a=-9 \Rightarrow a=3$

Section 3-5

1. B

$y=2x+4$	First equation
$x-y=-1$	Second equation

Substituting $2x+4$ for y in the second equation gives $x-(2x+4)=-1$.

$x-(2x+4)=-1 \Rightarrow x-2x-4=-1$

$\Rightarrow -x-4=-1 \Rightarrow -x=3$ or $x=-3$

Substituting -3 for x in the first equation gives $y=2(-3)+4=-2$. Therefore, the solution (x,y) to the given system of equations is $(-3,-2)$.

2. B

$\frac{1}{2}x+y=1$	First equation
$\underline{-2x-y=5}$	Second equation
$-\frac{3}{2}x \quad =6$	Add the equations.
$-\frac{2}{3}(-\frac{3}{2}x)=-\frac{2}{3}(6)$	Multiply each side by $-\frac{2}{3}$

$x = -4$	Simplify.
$\frac{1}{2}(-4) + y = 1$	Substitute -4 for x in the first equation.
$-2 + y = 1$	Simplify.
$y = 3$	Add 2 to each side.

Therefore, $x + y = -4 + 3 = -1$

3. $\frac{4}{5}$

If a system of two linear equations has no solution, then the lines represented by the equations in the coordinate plane are parallel. So, the slopes of the line are equal.

$2x - ky = 14$	1st equation
$y = \frac{2}{k}x - \frac{14}{k}$	1st equation in slope-intercept form
$5x - 2y = 5$	2nd equation
$y = \frac{5}{2}x - \frac{5}{2}$	2nd equation in slope-intercept form

The system of equations will have no solution if $\frac{2}{k} = \frac{5}{2}$. Solving for k yields $k = \frac{4}{5}$.

If $k = \frac{4}{5}$, the y- intercept of the first equation is $-\frac{35}{2}$, and the y- intercept of the second equation is $-\frac{5}{2}$. Therefore, the lines are parallel, but not identical.

4. C

In order for a system of two linear equations to have infinitely many solutions, the two equations must be equivalent. The two equations in the answer choice A have different slopes. The two equations in the answer choice B have different y- intercepts. For answer choice C, multiply by 6 on each side of the first equation.

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

The result is identical to the second equation. Therefore, the two equations are equivalent. The two equations in answer choice D have different slopes,

5. 1

Change the two equations into slope-intercept form.

$ax - y = 0 \Rightarrow y = ax$

$x - by = 1 \Rightarrow y = \frac{1}{b}x - \frac{1}{b}$

If $a = \frac{1}{b}$, the system of equations will have no solution. Therefore, $a \cdot b = 1$

6. $\frac{4}{3}$

In order for a system of two linear equations to have infinitely many solutions, the two equations must be equivalent. The equation $2x - \frac{1}{2}y = 15$ can be rewritten as $y = 4x - 30$ and the equation $ax - \frac{1}{3}y = 10$ can be rewritten as $y = 3ax - 30$.

If two equations are equivalent, then $4x = 3ax$ or $a = \frac{4}{3}$.

Section 3-6

1. D

By definition, the absolute value of any expression is a nonnegative number. Therefore, $|1-x| + 6 > 0$, $|1-x| + 4 > 0$, and $|1-x| + 2 > 0$. Only $|1-x| - 2$ could be a negative number.

$|1-x| - 2 = -1 \Rightarrow |1-x| = 1 \Rightarrow x = 2$ or $x = 0$.

2. A

$|2x + 7| = 5$

$2x + 7 = 5$	or	$2x + 7 = -5$
$2x = -2$	or	$2x = -12$
$x = -1$	or	$x = -6$

3. A

$\lvert x-1\rvert - 1 = 1$	
$\lvert x-1\rvert = 2$	Add 1 to each side.
$x - 1 = 2$ or $x - 1 = -2$	The expression can be 2 or -2.
$x = 3$ or $x = -1$	Add 1 to each side.

4. D

The expression $|3x - 5|$ is the absolute value of $3x - 5$, and the absolute value can never be a negative number. Thus $|3x - 5| = -1$ has no solution

5. C

The maximum value of the function corresponds to the y- coordinate of the point on the graph, which is highest along the vertical axis. The highest point along the y- axis has coordinates $(1,4)$. Therefore, the value of x at the maximum of $f(x)$ is 1.

6. 3

$3-|3-n|=3$

$-|3-n|=0$ Subtract 3 from each side.

If $-|3-n|=0$ or $|3-n|=0$, then $3-n=0$,

Thus $n=3$.

Chapter 3 Practice Test

1. C

Use the slope formula to find the slope of the function. Since $f(x)$ is a linear function, the slope between $(-4,-4)$ and $(0,-1)$ equals the slope between $(0,-1)$ and $(6,k)$.

Therefore, $\dfrac{-1-(-4)}{0-(-4)}=\dfrac{k-(-1)}{6-0}$.

$\dfrac{3}{4}=\dfrac{k+1}{6}$ Simplify.

$4(k+1)=18$ Cross Multiplication

$4k+4=18$ Distributive Property

$4k=14$ Subtract 4 from each side.

$k=\dfrac{7}{2}$ or 3.5 Divide each side by 4.

2. B

The equation of the line with slope $\frac{1}{3}$ and point $(9,1)$ is $y-1=\frac{1}{3}(x-9)$ or $y=\frac{1}{3}x-2$.

The slope of the second line is $\dfrac{-3-4}{5-(-2)}$ or -1.

The equation of the second line is $y-4=-1(x+2)$ or $y=-x+2$. To find the point of intersection, substitute $\frac{1}{3}x-2$ for y in the second equation and solve for x.

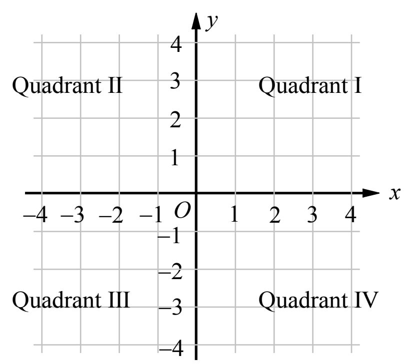
$\frac{1}{3}x-2=-x+2$

Solving for x yields $x=3$. Substituting 3 for x in the equation of the second line yields $y=-1$. Therefore, $(a,b)=(3,-1)$ and $a+b=3-1=2$.

3. C

The expressions $|x+5|$ or $|x-5|$ can never be a negative number. Thus $5+|x+5|$ or $5+|x-5|$ can not equal zero. The expression $-|x-5|$ can never be a positive number. Thus $-5-|x-5|$ can not equal zero. If $-5+|x+5|=0$, then $|x+5|=5$, when $x=0$.

4. C



If the slope of a line is positive, it is possible that the line contains no points from Quadrant II or from Quadrant IV. If the slope of a line is negative, it is possible that the line contains no points from Quadrant I or from Quadrant III. Since the line ℓ contains points from each of the Quadrants I, III, and IV, but no points from Quadrant II, the slope of line ℓ must be positive.

5. B

x	-3	-1	1	5
$f(x)$	9	5	1	-7

First, find the slope of the linear function f. We can choose any two points from the table. Let's use $(1,1)$ and $(-1,5)$ to find the slope m of f. $m=\dfrac{5-1}{-1-1}=\dfrac{4}{-2}=-2$. Thus the slope intercept form of f can be written as $f(x)=-2x+b$. From the table we know $f(1)=1$. $f(1)=-2(1)+b=1$ implies $b=3$. Thus f is defined as $f(x)=-2x+3$.

6. A

$f(x) = -6x + 1$

$f(\frac{1}{2}x - 1) = -6(\frac{1}{2}x - 1) + 1$ Substitute $\frac{1}{2}x - 1$ for x.

$= -3x + 6 + 1$ Distributive Property

$= -3x + 7$ Simplify.

7. B

Since the points $(0, 3000)$ and $(4, 2400)$ lie on the line, the slope of the line is $\frac{2400 - 3000}{4 - 0} = -150$.

The H-intercept of the line is 3,000. Therefore the relationship between H and m can be represented by $H = -150m + 3000$, the slope-intercept form of the line.

8. C

$H = -150m + 3000$ Equation of the line

$1350 = -150m + 3000$ Substitute 1350 for H.

Solving for m yields $m = 11$.

9. D

The point-slope form of the line that passes through the point $(1, -2)$ and has a slope of $\frac{1}{3}$ is $y + 2 = \frac{1}{3}(x - 1)$. The slope-intercept form of the line is $y = \frac{1}{3}x - \frac{7}{3}$. We can replace $f(x)$ for y to get the function form. Thus, $f(x) = \frac{1}{3}x - \frac{7}{3}$.

Now check each answer choices.

A) $(3, -2)$ $f(3) = \frac{1}{3}(3) - \frac{7}{3} = -\frac{4}{3} \neq -2$

B) $(2, -\frac{4}{3})$ $f(2) = \frac{1}{3}(2) - \frac{7}{3} = -\frac{5}{3} \neq -\frac{4}{3}$

C) $(0, -2)$ $f(0) = \frac{1}{3}(0) - \frac{7}{3} = -\frac{7}{3} \neq -2$

D) $(-1, -\frac{8}{3})$ $f(-1) = \frac{1}{3}(-1) - \frac{7}{3} = -\frac{8}{3}$

Choice D is correct.

10. 3

$f(x) = ax + 2$

If $f(-1) = 4$, then $f(-1) = a(-1) + 2 = 4$.

Solving for a yields $a = -2$.

Thus $f(x) = -2x + 2$ and

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

11. 2

Use the slope formula.

$\text{Slope} = \frac{k - (-4)}{6 - 2} = \frac{3}{2}$.

$\frac{k + 4}{4} = \frac{3}{2}$ Simplify.

$2(k + 4) = 3 \cdot 4$ Cross Product

$2k + 8 = 12$ Distributive Property

Solving for k yields $k = 2$.

12. 6

$\frac{1}{3}x - \frac{3}{4}y = -11 \overset{\text{Multiply by 3}}{\Rightarrow} x - \frac{9}{4}y = -33$

$\frac{1}{2}x + \frac{1}{6}y = -1 \overset{\text{Multiply by } -2}{\Rightarrow} -x - \frac{1}{3}y = 2$

Add the equations and we get $-\frac{9}{4}y - \frac{1}{3}y = -31$.

$12(-\frac{9}{4}y - \frac{1}{3}y) = 12(-31)$ Multiply each side by 12.

$-27y - 4y = -372$ Distributive Property

$-31y = -372$ Simplify.

$\frac{-31y}{-31} = \frac{-372}{-31}$ Divide each side by -31.

$y = 12$ Simplify.

$\frac{1}{3}x - \frac{3}{4}y = -11$ First equation

$\frac{1}{3}x - \frac{3}{4}(12) = -11$ $y = 12$

$\frac{1}{3}x - 9 = -11$ Simplify.

$\frac{1}{3}x - 9 + 9 = -11 + 9$ Add 9 to each side.

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

$3(\frac{1}{3}x) = 3(-2)$ Multiply each side by -2.

$x = -6$ Simplify.

Therefore, $x + y = -6 + 12 = 6$.