Part A: Parallel Lines

Practice 1

1.
Sample: First, determine if the lines have equal slope. If the slopes are equal, then determine if the lines have different y-intercepts.If the y-intercepts are different,
the lines are parallel.

2.
$m = 2; b = 1$
$m = 2; b = 4$; parallel

3.
$m = 3; b = 9$
$m = 3; b = 9$; same

4.
$m = -\frac{4}{3}; b = \frac{5}{3}$
$m = -\frac{4}{3}; b = \frac{7}{3}$; parallel

5.
$m = \frac{1}{3}; b = 1$
$m = \frac{1}{2}; b = -3$; neither

6.
$b(x) \mid\mid c(x)$
These lines have equal slope and different y-intercepts. Therefore, they are parallel.

7.

Line	Method 1: Slope-intercept form	Method 2: $m = -(\frac{A}{B}), b = \frac{C}{B}$
$2x - y = 5$	$-y = -2x + 5$ $y = 2x - 5$	$m = \frac{-2}{-1} = 2$ $b = \frac{5}{-1} = -5$
Line a: $4x - 2y = 7$	$-2y = -4x + 7$ $y = 2x - \frac{7}{2}$	$m = \frac{-4}{-2} = 2$ $b = \frac{-7}{2}$
Line b: $6x + 3y = 15$	$3y = -6x + 15$ $y = -2x + 5$	$m = \frac{-6}{3} = -2$ $b = \frac{15}{3} = 5$
Line c: $8x - 4y = 9$	$-4y = -8x + 9$ $y = 2x - \frac{9}{4}$	$m = \frac{-8}{-4} = 2$ $b = \frac{-9}{4}$

The given line is parallel to line a and line c. given line $\mid\mid a \mid\mid c$

8.

Line	Method 1: Slope-intercept
$y - 3 = \frac{2}{3}(x + 3)$	$y - 3 = \frac{2}{3}(x + 3)$ $y - 3 = \frac{2}{3}x + 2$ $y = \frac{2}{3}x + 5$
Line a: $y - 5 = \frac{2}{3}(x - 3)$	$y - 5 = \frac{2}{3}x - 2$ $y = \frac{2}{3}x + 3$
Line b: $y + 2 = \frac{2}{3}(x - 3)$	$y + 2 = \frac{2}{3}x - 2$ $y = \frac{2}{3}x - 4$
Line c: $y - 1 = \frac{2}{3}(x - 6)$	$y - 1 = \frac{2}{3}x - 4$ $y = \frac{2}{3}x - 3$

Lines a, b, and c are parallel to $y - 3 = \frac{2}{3}(x + 3)$. given line $\|\ a\ \|\ b\ \|\ c$

9.

Line	Method 1: Slope-intercept	Method 2: $m = -(\frac{A}{B})$, $b = \frac{C}{B}$ Or Substitution
$y = \frac{1}{4}x$	$y = \frac{1}{4}x$	$m = \frac{1}{4}$ $b = 0$
a. $y - 2 = 4(x + 1)$	$y - 2 = 4x + 4$ $y = 4x + 6$	$m = 4$ The slopes are different.
b. $2x - 8y = 1$	$-8y = -2x + 1$ $y = \frac{1}{4}x - \frac{1}{8}$	$m = -\frac{2}{(-8)} = \frac{1}{4}$ $b = \frac{1}{(-8)} = -\frac{1}{8}$
c. $x - 4y = 3$	$-4y = -x + 3$ $y = \frac{1}{4}x - \frac{3}{4}$	$m = \frac{-1}{-4} = \frac{1}{4}$ $b = \frac{3}{-4} = -\frac{3}{4}$

Lines b and c are parallel to $y = \frac{1}{4}x$. given line $\|\ b\ \|\ c$

10.

$m = 5 \mid\mid m = 5$
$(-4, 6)$
$y - 6 = 5(x + 4)$

11.
$m = -\frac{2}{5} \mid\mid m = -\frac{2}{5}$
$(1, 1)$
$y - 1 = -\frac{2}{5}(x - 1)$
$y - 1 = -\frac{2}{5}x + \frac{2}{5}$
$y = -\frac{2}{5}x + \frac{7}{5}$

12.
$m = \frac{8}{3} \mid\mid m = \frac{8}{3}$
$(1, 1)$
$y - 1 = \frac{8}{3}(x - 1)$
$y - 1 = \frac{8}{3}x - \frac{8}{3}$
$-\frac{8}{3}x + y = 1 - \frac{8}{3}$
$-3(-\frac{8}{3}x + y) = -3(1 - \frac{8}{3})$
$8x - 3y = 5$

13.
$m =$ undefined $\mid\mid m =$ undefined
$(-2, 5)$
$x = -2$

14.
Elm Street: $m = 4 \mid\mid m = 4$
$(5, -5)$
$y + 5 = 4(x - 5)$
$y + 5 = 4x - 20$
$y = 4x - 25$

15.
$y = 2, y = 6, y = 10$

Practice 2

1.
$f(x)\ ||\ g(x)$
The slopes of line $f(x)$ and $g(x)$ are parallel because the slopes are equal but their y-intercepts are different.

2.
The graph: $m = \frac{1}{3}$ and $b = -1$

Line a: $m = -\frac{A}{B} = -(\frac{3}{-1}) = 3$ (not parallel)

Line b: $m = \frac{1}{3}$ and $b = \frac{1}{3}(-9) - 1 = -4$ (parallel)

Line c: $m = \frac{1}{3}$ and $b = \frac{1}{3}(-6) + 1 = -1$ (same line)

Line d: $m = -(\frac{1}{-3}) = 1/3$ and $b = \frac{2}{-3} = -\frac{2}{3}$ (parallel)

$b\ ||\ f$ and $d\ ||\ f$ *OR* $b\ ||\ d\ ||\ f$

3.

Line	Method 1: Slope-intercept	Method 2: $m = -\frac{A}{B}$, $b = \frac{C}{B}$
Given: $6x + 7y = 3$	$7y = -6x + 3$ $y = -\frac{6}{7}x + \frac{3}{7}$	$m = -\frac{6}{7}$ $b = \frac{3}{7}$
a. $12x + 14y = 9$	$14y = -12x + 9$ $y = -\frac{6}{7}x + \frac{9}{14}$	$m = -\frac{12}{14} = -\frac{6}{7}$ $b = \frac{9}{14}$
b. $7x + 6y = 3$	$6y = -7x + 3$ $y = -\frac{7}{6}x + \frac{1}{2}$	$m = -\frac{7}{6}$ $b = \frac{3}{6} = \frac{1}{2}$
c. $6x - 7y = 4$	$-7y = -6x + 4$ $y = \frac{6}{7}x - \frac{4}{7}$	$m = \frac{-6}{-7} = \frac{6}{7}$ $b = \frac{4}{-7} = -\frac{4}{7}$

Line a is parallel to $6x + 7y = 3$.

4.
Line a is parallel to $y = 6$, because all horizontal lines are parallel.
Lines b and c are not horizontal lines.

5.

Line	Method 1: Slope-intercept	Method 2: Substitution Or $m = -\frac{A}{B}$; $b = \frac{C}{B}$
Given: $y = \frac{3}{4}x - 7$	$y = \frac{3}{4}x - 7$	
a. $y + 5 = -\frac{3}{4}(x+ 3)$	$y + 5 = -\frac{3}{4}x - \frac{9}{4}$ $y = -\frac{3}{4}x - \frac{29}{4}$	Different slopes
b. $y + 5 = \frac{3}{4}(x + 3)$	$y + 5 = \frac{3}{4}x + \frac{9}{4}$ $y = \frac{3}{4}x - \frac{11}{4}$	$m = \frac{3}{4}$ $b = -\frac{11}{4}$
c. $6x - 8y = 9$	$-8y = -6x + 9$ $y = \frac{3}{4}x - \frac{9}{8}$	$m = \frac{-6}{-8} = \frac{3}{4}$ $b = \frac{9}{-8} = \frac{-9}{8}$

Lines b and c are parallel to $y = \frac{3}{4}x - 7$.

6.

Line	Method 1: Slope-intercept	Method 2: $m = -\frac{A}{B}$; $b = \frac{C}{B}$
Given: $y + 1 = -\frac{5}{3}(x + 3)$	$y + 1 = -\frac{5}{3}x - 5$ $y = -\frac{5}{3}x - 6$	
a. $5x - 3y = 9$	$-3y = -5x + 9$ $y = \frac{5}{3}x - 3$ Different slopes	$m = \frac{-5}{-3} = \frac{5}{3}$ $b = \frac{9}{-3} = -3$
b. $y = -\frac{5}{3}x - 5$	$y = -\frac{5}{3}x - 5$ parallel	$m = -\frac{5}{3}$ $b = -5$
c. $y + 1 = -\frac{5}{3}(x + 3)$	$y + 1 = -\frac{5}{3}x - 5$ $y = -\frac{5}{3}x - 6$ Same line	$m = -\frac{5}{3}$ $b = -6$

Line b is parallel to line $y + 1 = -\frac{5}{3}(x + 3)$.

7.

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

$(5, 0)$

$y - 0 = \frac{2}{3}(x - 5)$

8.

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

$(8, 3)$

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

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

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

9.

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

$(-12, 12)$

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

$y - 12 = \frac{4}{3}x + 16$

$-\frac{4}{3}x + y = 28$

$-3(\frac{-4}{3}x + y = 28)$

$4x - 3y = -84$

10.

$x = -3$

11.

Row 1: $y = 3x - 4$

Second Row: $m = 3$; $(0, 1)$. $(0,1)$ is a y-intercept.

$y = 3x + 1$

Third Row: $m = 3$; $(3, -2)$

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

$y + 2 = 3x - 9$

$y = 3x - 11$

12.

Old Line: $y = -\frac{1}{2}x - 5$

New Line: $m = -\frac{1}{2}$ and $b = -5 + 3 = -2$

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

Part B: Perpendicular Lines

Practice 1

1. C

2. E

3. B

4. A

5. D

6.
$m_{b(x)} = \frac{2}{3}$, $m_{f(x)} = -\frac{3}{2}$, and $m_{j(x)} = -\frac{3}{2}$

Since $(\frac{2}{3})(-\frac{3}{2}) = -1$, then $b(x) \perp f(x)$ *and* $b(x) \perp j(x)$.

Since m is equal in $f(x)$ and $j(x)$ and the intercepts are different these lines are ||.

7.
$m_{r(x)} = 2$, $m_{m(x)} = 1$, and $m_{a(x)} = -\frac{1}{2}$

Since $(2)(-\frac{1}{2}) = -1$, then $r(x) \perp a(x)$. There are no || lines on this graph.

8.
Line a: $m_a = -\frac{3}{4}$

Line b: $m_b = \frac{4}{3}$

Line c: $m_c = -\frac{5}{4}$

Line d. $m_d = \frac{4}{5}$

Since $(-\frac{3}{4})(\frac{4}{3}) = -1$, then $a \perp b$.

Since $(-\frac{5}{4})(\frac{4}{5}) = -1$, then $c \perp d$.

9.
Line a: $m_a = -\frac{4}{3}$

Line b: $m_b = -\frac{8}{5}$

Line c: $m_c = \frac{3}{4}$

Line d: $m_d = \frac{5}{8}$

Since $(-\frac{4}{3})(\frac{3}{4}) = -1$, then $a \perp c$.

Since $(-\frac{8}{5})(\frac{5}{8}) = -1$, then $b \perp d$.

10.
Line a: $m_a = -4$
Line b: $m_b = 3$
Line c: $m_c = -\frac{1}{3}$
Line d: $m_d = \frac{1}{4}$
Since $(-4)(\frac{1}{4}) = -1$, then $a \perp d$.
Since $(3)(-\frac{1}{3}) = -1$, then $b \perp c$.

11.
Line a: $m_a = \frac{7}{8}$
Line b: $m_b = 0$ (horizontal)
Line c: $m_c = 2$
Line d: $m_d = -\frac{8}{7}$
Line e: $m_e = -\frac{1}{2}$
Line f: $m_f =$ undefined (vertical)
Since $(\frac{7}{8})(-\frac{8}{7}) = -1$, then $a \perp d$.
Since line b is horizontal and line f is vertical, then $b \perp f$.
Since $(2)(-\frac{1}{2}) = -1$, then $c \perp e$.

12.
$m = 3 \perp m = -\frac{1}{3}$
$(-6, 3)$
$y - 3 = -\frac{1}{3}(x - (-6))$
$y - 3 = -\frac{1}{3}(x + 6)$
$y - 3 = -\frac{1}{3}x - 2$
$y = -\frac{1}{3}x + 1$

13.
$m = \frac{1}{2} \perp m = -2$
$(-1, -4)$
$y - (-4) = -2(x - (-1))$
$y + 4 = -2(x + 1)$

14.

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

$(2, -2)$

$$y - (-2) = \frac{3}{4}(x - 2)$$
$$y + 2 = \frac{3}{4}x - \frac{3}{2}$$
$$-\frac{3}{4}x + y = -\frac{3}{2} - 2$$
$$-4(-\frac{3}{4}x + y) = -4(-\frac{3}{2} - 2)$$
$$3x - 4y = 6 + 8$$
$$3x - 4y = 14$$

15.

$x = -10$

16.

The graph: $m = \frac{1}{3}$

Line a: $m_a = -(\frac{3}{-1}) = 3$

Line b: $m_b = -\frac{1}{3}$

Line c: $m_c = -(\frac{3}{1}) = -3$

Line d: $m_d = -3$

Line e: $m_e = -(\frac{1}{-3}) = \frac{1}{3}$

Since $(\frac{1}{3})(-3) = -1$, then $c \perp f$ and $d \perp f$.

17.

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

$(15, -5)$

$$y + 5 = -\frac{1}{5}(x - 15)$$
$$y + 5 = -\frac{1}{5}x + 3$$
$$y = -\frac{1}{5}x - 2$$

Practice 2

1. D

2. B

3. A

4. E

5. C

6.
$m_{b(x)} = -\frac{2}{6} = -\frac{1}{3}$; $m_{f(x)} = 3$; $m_{j(x)} = 3$
Since $(-\frac{1}{3})(3) = -1$, then $b(x) \perp f(x)$ *and* $b(x) \perp j(x)$.

7.
$m_{a(x)} = -\frac{1}{2}$; $m_{m(x)} = \frac{3}{0}$ (undefined) vertical; $m_{r(x)} = \frac{0}{6} = 0$ horizontal
Since $r(x)$ is horizontal and $m(x)$ is vertical, then $r(x) \perp m(x)$.

8.
Line a: $m_a = -10$
Line b: $m_b = 1$
Line c: $m_c = \frac{1}{10}$
Line d: $m_d = -1$
Since $(-10)(\frac{1}{10}) = -1$, then $a \perp c$.
Since $(1)(-1) = -1$, then $b \perp d$.

9.
Line a: $m_a = -\frac{2}{7}$
Line b: $m_b = \frac{7}{2}$
Line c: $m_c = -1$
Line d: $m_d = 1$
Since $(-\frac{2}{7})(\frac{7}{2}) = -1$, then $a \perp b$.
Since $(-1)(1) = -1$, then $c \perp d$.

10.

Line a: $m_a = -\frac{2}{3}$

Line b: $m_b = 4$

Line c: $m_c = -\frac{1}{4}$

Line d: $m_d = \frac{3}{2}$

Since $(-\frac{2}{3})(\frac{3}{2}) = -1$, then $a \perp d$.

Since $(4)(-\frac{1}{4}) = -1$, then $b \perp c$.

11.

Line a: m_a = undefined (vertical)

Line b: $m_b = -\frac{3}{5}$

Line c: $m_c = 0$ (horizontal)

Line d: $m_d = -\frac{3}{5}$

Line e: $m_e = \frac{2}{7}$

Line f: $m_f = -\frac{7}{2}$

Since vertical and horizontal lines are perpendicular, then $a \perp c$.

Since $(-\frac{3}{5})(\frac{5}{3}) = -1$, then there is no line perpendicular to b or d.

Since $(\frac{2}{7})(-\frac{7}{2}) = -1$, then $e \perp f$.

12.

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

$(-1, 3)$

$$y - 3 = -\frac{6}{5}(x - (-1))$$

$$y - 3 = -\frac{6}{5}(x + 1)$$

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

$$y = -\frac{6}{5}x + \frac{9}{5}$$

13.

$m = 4 \perp m = -\frac{1}{4}$

$(8, -2)$

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

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

14.

$m = -\frac{1}{3} \perp m = 3$

$(-6, 7)$

$y - 7 = 3(x - (-6))$

$y - 7 = 3(x + 6)$

$y - 7 = 3x + 18$

$-3x + y = 25$

$3x - y = -25$

15.

This line is vertical. Any line perpendicular to this line will be horizontal.

$y = 9$

16.

The student found the reciprocal slope but did not change the sign.

Correction:

$y - 2 = \frac{1}{5}(x - (-3))$

$y - 2 = \frac{1}{5}(x + 3)$

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

$y = \frac{1}{5}x + \frac{13}{5}$

17.

$m = \frac{7}{10} \perp \text{m} = -\frac{10}{7}$

$(-4, -6)$

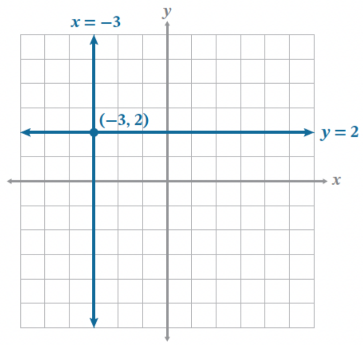
$y - (-6) = -\frac{10}{7}(x - (-4))$

$y + 6 = -\frac{10}{7}(x + 4)$

Targeted Review

Problem	1	2	3	4	5	6	7	8	9	10	11	12	13
Lesson Origin	11	11	9	9	10	11	11	7	8	7	11	11	11

1.

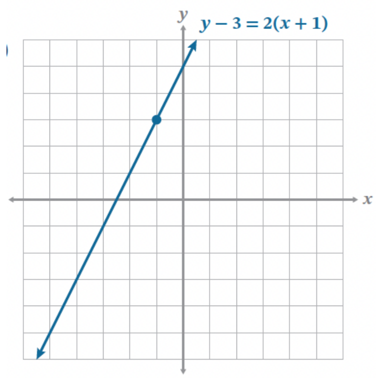


2.
$y = 2$

3.
$x = -3$

4.
$y - 3 = 2(x + 1)$

5.



6.
(cups of lemonade, money earned)

Given: $m = 0.75$, (47, 15.25)
Point-slope is the most efficient equation since the directions do not specify.

$$y - 15.25 = 0.75(x - 47)$$
$$y - 15.25 = 0.75x - 35.25$$
$$y = 0.75x - 20$$

The y-intercept is −20. This means that Joseph had to borrow $20 to start his business (or that he owes $20 to someone).

7.

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

8.

$$7a + 3(0) = 18$$
$$7a = 18$$
$$a = \frac{18}{7}$$

$\left(\frac{18}{7}, 0\right)$

$$7(0) + 3b = 18$$
$$3b = 18$$
$$b = 6$$

(0, 6)

9.
Line a: $f(0) = 0$ line c
Line b: $f(-3) = 0$ line a and b
Line c: $f(0) = 4$ line a
Line d: $f(3) = 4$ line b

10.
The graph of $g(x)$ is translated up two units from the graph of $f(x)$.

11.
Domain: {−3, 0, 1, 2}
Range: {−9, 0, 3, 6}
This is a function because the domain values do not repeat.

12. C

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

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

C. $2x - 3y = -5$

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

Distractor Rationale:

A and D are not in standard form. B has the incorrect y-intercept.

Using the points $(-1, 1)$ and $(2, 3)$:

$$m = \frac{(3-1)}{(2-(-1))} = \frac{2}{3}$$

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

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

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

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

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

13. D

A. $x = -8$

B. $x = 14$

C. $y = -8$

D. $y = 14$

Distractor Rationale:

A and B represent equations of vertical lines.

C uses the x-coordinate rather than the y-coordinate for the equation.