Part A: More Applications of Linear Systems

Practice 1

1.

x: small angle, y: large angle

$$x + y = 180$$
$$x = \frac{1}{2}y - 18$$
$$x = \frac{1}{2}y - 18$$
$$\left(\frac{1}{2}y - 18\right) + y = 180$$
$$\frac{3}{2}y - 18 = 180$$
$$\frac{3}{2}y = 198$$
$$\left(\frac{2}{3}\right)\left(\frac{3}{2}y = 198\right)$$
$$y = 132$$
$$x = 48$$

The smaller angle is 48 degrees, the larger angle is 132 degrees.

2.

L: length, w: width

$$48 = 2L + 2w$$
$$w = \frac{1}{3}L$$
$$w = \frac{1}{3}L$$
$$48 = 2L + 2\left(\frac{1}{3}L\right)$$
$$48 = 2\frac{2}{3}L$$
$$48 = \frac{8}{3}L$$
$$\left(\frac{3}{8}\right)\left(48 = \frac{8}{3}L\right)$$
$$L = 18$$
$$w = \frac{1}{3}(18) = 6$$

The dimensions of the rectangle are 18 cm by 6 cm.

3.

x: side of triangle, y: side of triangle

$$x + x + y = 41$$
$$2(x + y) = 52$$

$$2x + y = 41$$
$$(-1)(2x + 2y = 52) = \underline{-2x - 2y = -52}$$
$$-y = -11$$
$$y = 11$$

$$2x + (11) = 41$$
$$2x = 30$$
$$x = 15$$

The sides of the triangle are 15 yd, 15 yd, and 11 yd.

4.
x: smaller angle, y: larger angle

$$x + y = 90$$
$$2x + 3y = 240$$

$(-2)(x + y = 90) = -2x - 2y = -180$ $x = 30$

$+ 2x + 3y = 240$

$y = 60$

The angle measures are 30 degrees and 60 degrees.

5.
L: length, w: width

$$22 = 2L + 2w$$
$$L - w = 5$$

$(22 = 2L + 2w)(\frac{1}{2}) = 11 = L + w$ $w = 3$

$+ 5 = L - w$

$2L = 16$

$L = 8$

The rectangle is 8 inches by 3 inches.

6.
$A = Lw$
$A = (8)(3)$
$A = 24$ square inches.

7.
x: second number, y: first number

$$x + y = -7$$
$$x = 5y - 13$$

$x = 5y - 13$

$x + y = -7$

$(5y - 13) + y = -7$

$6y - 13 = -7$

$6y = 6$

$y = 1$

$x + (1) = -7$

$x = -8$

The numbers are 1 and −8. (Note: any variables can be chosen but the answers are 1 and −8)

8.
t: tens, u: units

$$t + u = 16$$
$$t + 2u = 25$$

$(-1)(t + u = 16) = -t - u = -16$ $t = 7$

$+ t + 2u = 25$

$u = 9$

Joan is 79 years old.

9.
t: tens, u: units
$t - u = -3$
$t + 10u = 20t + 3 \Rightarrow -19t + 10u = 3$

$$\begin{array}{rl} & -19t + 10u = 3 \\ (10)(t - u = -3) = & \underline{+\ 10t - 10u = -30} \\ & -9t = -27 \\ & t = 3 \qquad\qquad u = 6 \end{array}$$

The number is 36.

10.
x: shirts, y: costs
income: $y = 12x$
expenses: $y = 3.25x + 180$
$12x = 3.25x + 180$
$8.75x = 180$
$x = 20.571$
Tayna's T-Shirts must sell 21 t-shirts to break even.

11.
b: biscuits, c: costs
expenses: $c = 500$
income: $c = 2.50b$
$2.50b = 500$
$b = 200$
Bob needs to sell 200 biscuits to break even.

12.
income: $c = 3b$
$500 = 3b$
$b = 166\frac{2}{3} = 167$
$200 - 167 = 33$
Bob would be able to sell 33 fewer biscuits if the price was raised to $3.

Practice 2

1.

x: equal side, y: remaining side

$x + x + y = 34$, or $2x + y = 34$

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

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

$2x + (\frac{1}{4}x - 2) = 34$

$2\frac{1}{4}x - 2 = 34$

$\frac{9}{4}x = 36$

$(\frac{4}{9})(\frac{9}{4}x = 36)$

$x = 16$ $y = 2$

The triangle has sides of 16 in, 16 in, and 2 in.

2.

x: large angle, y: small angle

$x + y = 90$

$x = 3y + 2$

$x = 3y + 2$

$(3y + 2) + y = 90$

$4y + 2 = 90$

$4y = 88$

$y = 22$ $x = 68$

The larger angle is 68 degrees.

3.

x: larger angle, y: smaller angle

$x + y = 180$

$\frac{1}{4}x - y = -55$

$x + y = 180$

$+ \frac{1}{4}x - y = -55$

$\frac{5}{4}x = 125$

$(\frac{4}{5})(\frac{5}{4}x = 125)$

$x = 100$ $y = 80$

The difference between the two angles is 20.

4.
L: length, w: width
$L = 5w$
$72 = 2L + 2w$
$L = 5w$
$72 = 2(5w) + 2w$
$72 = 10w + 2w$
$72 = 12w$
$w = 6$ $L = 30$
The rectangle is 30 ft by 6 ft.

5.
L: length, w: width
$L = w + 6$
$72 = 2L + 2w$
$L = w + 6$
$(72 = 2L + 2w)(\frac{1}{2}) = 36 = L + w$
$36 = (w + 6) + w$
$36 = 2w + 6$
$30 = 2w$
$w = 15$ $L = 21$
The dimensions of the rectangle are 21 feet by 15 feet.

6.
Q4.
$A = Lw$
$A = (30)(6)$
$A = 180$
$315 - 180 = 135$

Q5.
$A = Lw$
$A = (21)(15)$
$A = 315$

7.
t: tens, u: units
$t + u = 11$
$t + 10u = 10t + u + 27 \Rightarrow -9t + 9u = 27$

$t + u = 11$
$(-9t + 9u = 27)(\frac{1}{9}) = \underline{-t + u = 3}$
$2u = 14$
$u = 7$ $t = 4$
The number is 47.

8.
x, y: numbers
$x - y = 25$
$x + y = 61$
$x - y = 25$
$+ \; x + y = 61$
$2x = 86$
$x = 43$ $y = 18$
The numbers Gerald is thinking of are 43 and 18.

9.
x: nights, y: costs
income: $y = 1{,}200$
expenses: $y = 125x + 500$
$1{,}200 = 125x + 500$
$700 = 125x$
$x = 5.6$
The family can stay for 5 nights.
$y = 125(5) + 500$
$y = 1{,}125$
$1{,}200 - 1{,}125 = 75$
There will be \$75 remaining after 5 nights.

10.
expenses: $y = 80x + 650$
$1{,}200 = 80x + 650$
$550 = 80x$
$x = 6.875$
The family can stay for 6 nights instead of 5 nights.

11.
t: tens, u: units
$t + u = 10$
$t + 10u = 10t + u + 18$
$-9t + 9u = 18$
$(\frac{1}{9})(-9t + 9u = 18) = -t + u = 2$
$+ \; t + u = 10$
$2u = 12$
$u = 6$
$t = 4$
The correct tax is 46 cents.

12.
x: offices, y: costs
income: $y = 40x$
expenses: $y = 2x + 225$
$40x = 2x + 225$
$38x = 225$
$x = 5.921$
Cami's Cleaners will need to clean 6 offices to break even.

Part B: Applications of Linear Inequalities

Practice 1

1. Khaled could spend no more than $100 a month on gas. If gas costs $2.75 per gallon, how many gallons of gas can Khaled purchase?

g: gas; no more than: $\leq$

$2.75g \leq 100$

$g \leq 36.36$

Khaled can purchase a maximum of 36.36 gallons of gas.

2.

n: no recess

$n < 32$ or $n > 93$

Students can have outdoor recess when the temperature is greater than or equal to 32℉ but less than or equal to 93℉.

Or

Recess will be held outdoors when $32 \leq r \leq 93$.

3.

h: hours; $300 \leq 25x \leq 1{,}000$

$300 \leq 25x$

$12 \leq x$

$25x \leq 1{,}000$

$x \leq 40$

Giorgi can work between 12 and 40 hours each week.

4. p: pages; m: minutes

$m \geq 15$

$m \leq 45$

$p \geq 2$

$p \leq 23$

5.

c: chaperone; d: students

$d \leq 48$

$c \geq 1$

$d \geq 4$

6.

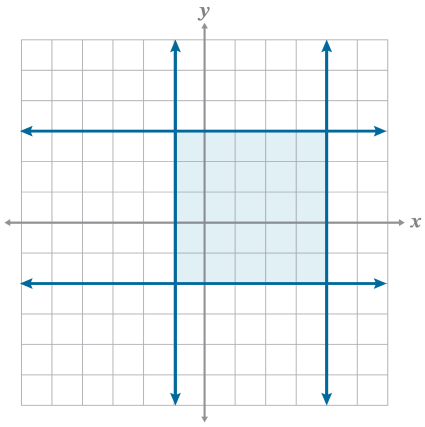
x: hours, y: money earned

$x \geq 4$

$x \leq 20$

$y = 9x$

7.



Inequalities: $y \geq -2$; $y \leq 3$; $x \geq -1$; $x \leq 4$

8.

The shaded region represents the area of the rectangle, and it represents all possible ordered pairs that will make the system of inequalities true.

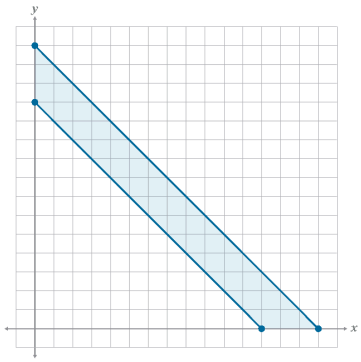
9.

p: piano, v: vocals

$p + v \geq 12$ OR $x + y \geq 12$
$p + v \leq 15$ OR $x + y \leq 15$
$p \geq 0$ OR $x \geq 0$
$v \geq 0$ OR $y \geq 0$

10.

The shaded region represents all possible combinations of practice times.

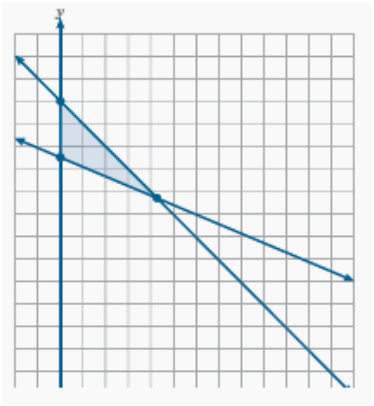


11.

x: food–service, y: tutoring

$x + y \leq 15$
$8x + 20y \geq 250$
$x \geq 0$
$y \geq 0$

12.



Hermine needs to work at least 11 hours per week tutoring.
Any ordered pair in the shaded region answers this question.

Practice 2

1. In order to maintain his current class average, Alonso needs to earn at least an 82 but no more than an 86 on the math test. If each question is worth 2 points and there are 50 questions, what is the range in scores that Alonso needs to maintain his grade?

q: question
$82 \leq 2q \leq 86$
$41 \leq q \leq 43$
Alonso needs to get 41 , 42 or 43 questions correct to maintain his current grade.

2. Santiago was using a cab service in the city. The cab service charged $2 per mile and a $1 cleaning fee. Santiago could spend no more than $20 for his ride. What is the maximum distance he can travel in the cab?

m: mile; no more than $\leq$
$2m + 1 \leq 20$
$2m \leq 19$
$m \leq 9.5$
Santiago can travel a maximum of 9.5 miles with $20.

3. Amir plans to walk more than 10,000 steps a day. He walks every morning and logs 4,700 steps. How many more steps does Amir need to walk to meet his goal?

s: steps; more than $>$
$s + 4{,}700 > 10{,}000$
$s > 5{,}300$
Amir needs to walk more than 5,300 steps to meet his goal. OR Amir needs to walk 5,301 or more steps.

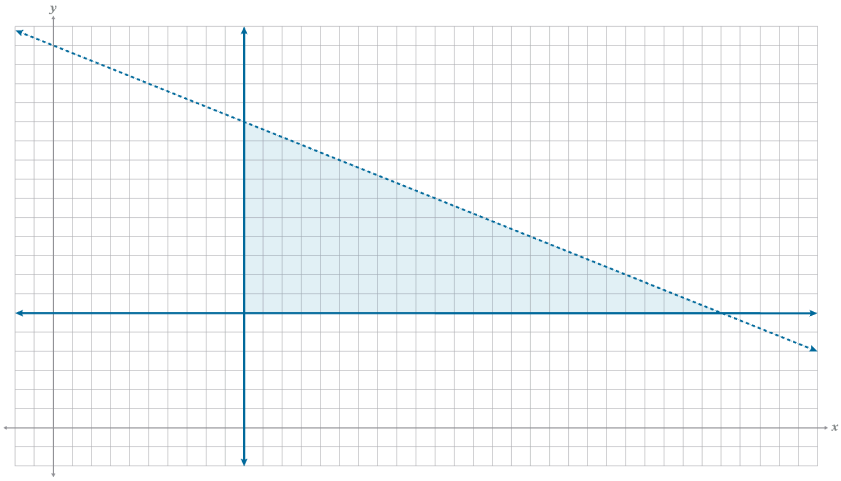
4.
L: length, w: width
$w > 1.5$
$w \leq 3$
$L > 0$
$L \leq 10.5$

5.
e: experiment redo
$e < 2$
$e > 5$
$e \geq 0$

6.
g: gas
$g \leq 24$
$g > \frac{1}{4}(24)$
$3g \leq \$150$

7.
x: chicken, y: fish
$x \geq 10$
$y \geq 6$
$8x + 20y < 400$

8.



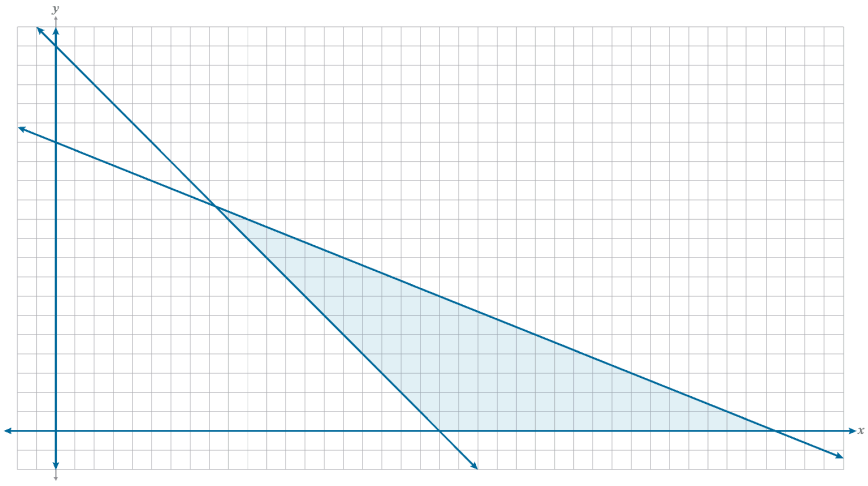
Note: Your student's answer will be 10 ≤ chicken ≤ 22, using y = 11 fish as the guide. Therefore, their chosen values for chicken orders should be between 10 and 22 or equal to 10 and 22.

9.
c: car, t: truck
$180c + 450t \leq 300{,}000$
$c + t \geq 700$; $c \geq 0$; $t \geq 0$

10.
x: pepperoni, y: veggie
$15x + 12y > 5{,}000$
$6x + 7y < 840$

11.
x: scarves, y: sweaters
$x + y \geq 20$
$4x + 10y \leq 150$
$x \geq 0$
$y \geq 0$

12.
Julianna will still be able to reach her goal because she has the time to make at least 16 scarves with the hours she has remaining.



Targeted Review

Problem	1	2	3	4	5	6	7	8	9	10	11	12
Lesson Origin	17	17	17	17	15	11	11	7	17	16	15	7

1.
n = nickel, p = penny
$0.05n + 0.01p = 0.97$
$n + p = 25$

2.
h: hotdog, d: drink
$8h + 3d = 44.50$
$5h + 7d = 45.75$

3.
Sample: Not all systems of equations will intersect on a grid line. If a system is graphed and the intersection or solution does not contain integer values, it is difficult to accurately determine the solution without solving algebraically.

4.

$$\begin{aligned} & -2x + 7y = 0 \\ (2)(x - y = 5) = & \underline{+\ 2x - 2y = 10} \\ & 5y = 10 \\ & y = 2 \end{aligned}$$

Write the second equation in standard form.

$$\begin{aligned} x - (2) &= 5 \\ x &= 7 \end{aligned}$$

$(7, 2)$

5.

Sample: The solution to a system of equations is where the lines would intersect on the coordinate plane. Another way of saying this is the ordered pair that makes both equations true.

6.

$(-6, \frac{2}{5})$

(x, y)

$x = -6$

$y = \frac{2}{5}$

7.

$(x, 0)$

$$\begin{aligned} 5x - 8y &= 22 \\ 5x - 8(0) &= 22 \\ 5x &= 22 \\ x &= \frac{22}{5} = 4\frac{2}{5} \end{aligned}$$

$(\frac{22}{5}, 0)$

8.

x	y
-6	8
-3	8
0	14
3	14

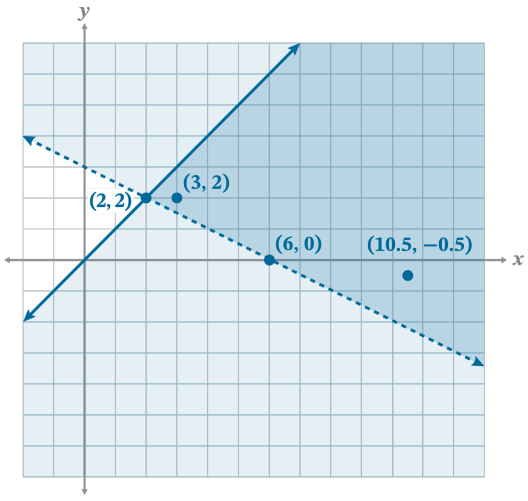
Domain: $\{-6, -3, 0, 3\}$

Range: $\{8, 14\}$

9. B
A. 7
B. 2
C. −2
D. −7
Distractor Rationale:
A occurs when (4, 1) is used rather than (1, 4) and $2x - y$ is evaluated rather than $y - 2x$.
C occurs when $2x - y$ is evaluated rather than $y - 2x$.
D occurs when (4, 1) is used rather than (1, 4).

10. A
A. −2
B. −1.5
C. −0.5
D. 1
Distractor Rationale:
B is the x-value of the solution (−1.5, −2).
C and D are the y-intercepts of the given equations.

11.
☐ (6, 0)
☑ (3, 2)
☐ (2, 2)
☑ (10.5, −0.5)
Distractor Rationale:
The first and third points are on a dashed line, and do not make both inequalities true.



12.

☐ $f(1) = 7$

☑ $f(2) = -\frac{20}{3}$

☑ $f(6) = -10$

☑ $f(-3) = -\frac{5}{2}$

Distractor Rationale:

Your student would select the first answer if they forgot to multiply the sum by $-\frac{5}{6}$.

$f(x) = -\frac{5}{6}(x + 6)$

$f(1) = -\frac{5}{6}(1 + 6) = -\frac{5}{6}(7) = -\frac{35}{6}$

$f(2) = -\frac{5}{6}(2 + 6) = -\frac{5}{6}(8) = -\frac{20}{3}$

$f(6) = -\frac{5}{6}(6 + 6) = -\frac{5}{6}(12) = -10$

$f(-3) = -\frac{5}{6}(-3 + 6) = -\frac{5}{6}(3) = -\frac{5}{2}$