FMPC 10: Chapter 9 Review

Systems of Linear Equations

Name: _____

Date: _____ Block: _____

1. Solve each system by graphing. Change each equation into $y = mx + b$ if necessary.

a) $y = -x + 5$
$y = 3x - 3$

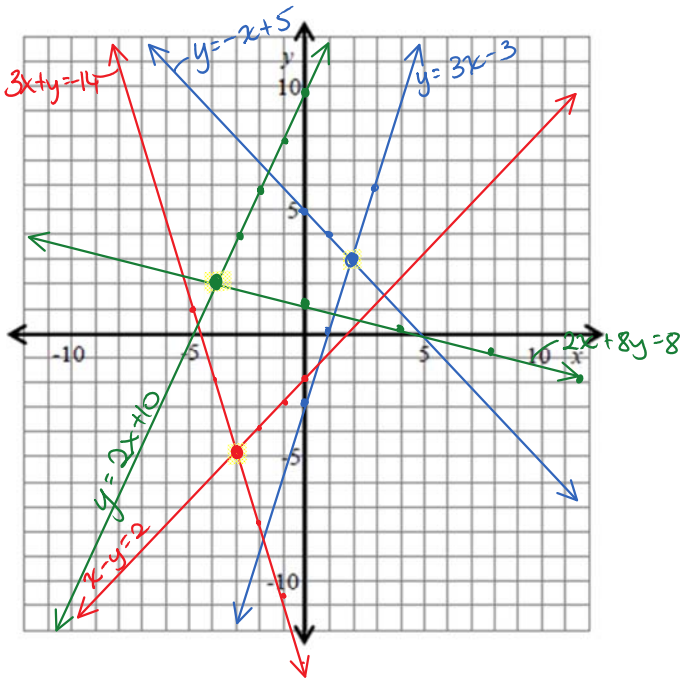
Solution:
(2,3)
or $x = 2$
$y = 3$

b) $x - y = 2$ $y = x - 2$
$3x + y = -14$
$y = -3x - 14$

Solution (-3,-5)
or $x = -3$
$y = -5$

c) $2x + 8y = 8$ $\frac{8y}{8} = \frac{-2x}{8} + \frac{8}{8}$
$y = 2x + 10$ $y = -\frac{1}{4}x + 1$

Solution:
(-4,2)
or $x = -4$
$y = 2$



2. For which of the given linear systems is $(-2,5)$ a solution? (hint: try to verify the solution for each system)

a) $3x + y = 1$
$2x + 3y = 11$

$3(-2) + 5 = 1$
$-6 + 5 = 1$ ✗
∴ not a solution

b) $5x - 3y = -5$
$3x + 2y = 4$

$5(-2) - 3(5) = -5$
$-10 - 15 = -5$ ✗
∴ not a solution

c) $-5x - 3y = -5$
$3x + 2y = 4$

$-5(-2) - 3(5) = -5$
$10 - 15 = -5$ ✓
$3(-2) + 2(5) = 4$
$-6 + 10 = 4$ ✓
∴ (-2,5) is a solution

d) $15x + 4y = -10$
$25x - 6y = -80$

$15(-2) + 4(5) = -10$
$-30 + 20 = -10$ ✓
$25(-2) - 6(5) = -80$
$-50 - 30 = -80$ ✓
∴ (-2,5) is a solution

3. Solve each system using the substitution method.

a) $x+y=9 \rightarrow y=9-x$
$2x+y=11$

$2x+(9-x)=11$
$x+9=11$
$x=2$

$y=9-2$
$y=7$

b) $x-y=7 \rightarrow x=7+y$
$2x+y=-10$

$2(7+y)+y=-10$
$14+2y+y=-10$
$14+3y=-10$
$3y=-24$
$y=-8$

$x=7+(-8)$
$x=-1$

c) $3x-4y=-15$
$5x+y=-2 \rightarrow y=-5x-2$

$3x-4(-5x-2)=-15$
$3x+20x+8=-15$
$23x=-23$
$x=-1$

$y=-5(-1)-2$
$y=5-2$
$y=3$

d) $x+5y=-11 \rightarrow x=-5y-11$
$4x-3y=25$

$4(-5y-11)-3y=25$
$-20y-44-3y=25$
$-23y-44=25$
$-23y=69$
$y=-3$

$x=-5(-3)-11$
$x=15-11$
$x=4$

4. Solve each linear system by elimination method.

a) $5(3x+4y=29)$
$4(2x-5y=-19)$

$15x+20y=145$
$+(8x-20y=-76)$
$23x=69$
$x=3$

$3(3)+4y=29$
$9+4y=29$
$4y=20$
$y=5$

b) $3x+5y=12$
$-(7x+5y=8)$
$-4x=4$
$x=-1$

$3(-1)+5y=12$
$-3+5y=12$
$5y=15$
$y=3$

c) $2(5x+2y=5)$ → $10x+4y=10$
$3x-4y=-23$ → $+(3x-4y=-23)$
$13x=-13$
$x=-1$

$5(-1)+2y=5$
$-5+2y=5$
$2y=10$
$y=5$

d) $3(3x-y=5)$ → $9x-3y=15$
$2x+3y=10$ → $+(2x+3y=10)$
$11x=25$
$x=\frac{25}{11}$

$\frac{3}{1}\left(\frac{25}{11}\right)-y=5$
$\frac{75}{11}-y=5$
$-y=\frac{55}{11}-\frac{75}{11}$
$-y=-\frac{20}{11}$
$y=\frac{20}{11}$

5. a) Four pens cost 70 cents more than five pencils. Together, one pen and one pencil cost $1.30. Find the cost of each pen and each pencil.

Let x = cost of a pen
y = cost of a pencil

$x+y=1.30 \rightarrow y=1.30-x$
$4x=5y+0.70$
$4x=5(1.30-x)+0.70$
$4x=6.50-5x+0.70$
$+5x \quad +5x$
$\frac{9x}{9}=\frac{7.20}{9}$
$x=0.80$

$y=1.30-0.80$
$y=0.50$

The pens each cost $0.80 and the pencils each cost $0.50

b) The length of a rectangle is five less than three times its width. If the perimeter is 38 inches, find the rectangle's dimensions.

Let x = length
y = width

$x=3y-5$
$2x+2y=38$
$2(3y-5)+2y=38$
$6y-10+2y=38$
$+10 \quad +10$
$8y=48$
$y=6$

$x=3(6)-5$
$x=18-5$
$x=13$

The length is 13 inches, and the width is 6 inches.

c) Zachary invested part of his $12,500 into World Oil, which paid 8% interest. He invested the other part into Sask Power, which paid 3%. If he made $850 total, how much was invested into each fund?

let x = amount in World Oil
y = amount in Sask Power

$x + y = 12{,}500 \rightarrow y = 12{,}500 - x$

$0.08x + 0.03y = 850$

$0.08x + 0.03(12{,}500 - x) = 850$

$0.08x + 375 - 0.03x = 850$
$-375 \quad\quad -375$

$0.05x = 475$

$x = 9500$

$y = 12500 - 9500$

$y = 3000$

Zachary invested $9500 into World Oil, and $3000 into Sask Power.

$t = \frac{d}{v}$

d) A cyclist leaves home at 9:00 a.m. to ride to his friend's house 8 km away. He cycles at 12 km/h until he has a flat tire. He then walks his bike the rest of the way at 2 km/h. He arrives at his friend's house at 10:30 a.m. How far did he have to push his bicycle?

let x = distance cycled
y = distance pushed

9:00 – 10:30 → 1½ hr or 1.5 hours

Distance: $x + y = 8 \rightarrow x = 8 - y$

Time: $\frac{x}{12} + \frac{y}{2} = 1.5 \quad \cdot 12$

$x + 6y = 18$

$x + 6y = 18$
$8 - y + 6y = 18$
$8 + 5y = 18$
$5y = 10$
$y = 2$

He pushed his bike 2km.

e) Kirk ran 100 m along a moving conveyor in 25 seconds, when moving against the conveyor. When running with the conveyor, it takes him 5 seconds to run the same distance. Calculate Kirk's average speed and the conveyor's average speed.

let x = Kirk's average speed
y = Conveyor's average speed

Speeds

Against conveyor: Speed $= \frac{100m}{25s} = 4m/s$

$x - y = 4$

With conveyor: Speed $= \frac{100m}{5s} = 20m/s$

$x + y = 20$

$x - y = 4$
$+ (x + y = 20)$
$2x = 24$

$x = 12$

$12 + y = 20$

$y = 8$

Kirk's average speed is 12m/s, and the conveyor's average speed is 8m/s.

f) The sum of two numbers is 7. Three times one of the numbers is 15 more than the other number. Find the numbers.

let x = 1st #
y = 2nd #

$x + y = 7$
$3x = y + 15$

$\begin{cases} x + y = 7 \\ +(3x - y = 15) \end{cases}$

$4x = 22$
$\frac{4x}{4} = \frac{22}{4}$
$x = \frac{11}{2}$

$\frac{11}{2} + y = 7$
$\frac{11}{2} + y = \frac{14}{2}$
$y = \frac{3}{2}$

The two numbers are $\frac{11}{2}$ and $\frac{3}{2}$.

g) Two numbers differ by 5. Four times the smaller number is 5 less than three times the larger. Find the numbers.

let x = larger #
y = smaller #

$x - y = 5 \rightarrow x = 5 + y$
$4y = 3x - 5$
$4y = 3(5 + y) - 5$
$4y = 15 + 3y - 5$
$-3y \quad -3y$
$y = 10$

$x = 5 + 10$
$x = 15$

The two numbers are 15 and 10

h) Shana has $1.95 in nickels and dimes. There are three more nickels than dimes. How many of each does she have?

let x = # of nickels
y = # of dimes

$0.05x + 0.10y = 1.95$
$x - y = 3 \rightarrow x = 3 + y$
$0.05(3 + y) + 0.10y = 1.95$
$0.15 + 0.05y + 0.10y = 1.95$
$-0.15 \qquad\qquad -0.15$
$0.15y = 1.8$
$y = 12$

$x - 12 = 3$
$x = 15$

There are 15 nickels and 12 dimes

i) Taylor has $4.80 in nickels and quarters. She has six more nickels than quarters. How many of each does she have?

Let x = # of nickels
y = # of quarters

$0.05x + 0.25y = 4.80$
$x - y = 6 \rightarrow x = 6 + y$

$0.05(6+y) + 0.25y = 4.80$
$0.3 + 0.05y + 0.25y = 4.80$
$-0.3 \quad\quad\quad\quad\quad\quad -0.3$
$0.3y = 4.5$
$y = 15$

$x = 6 + 15$
$x = 21$

There are 21 nickels and 15 quarters.

Answer Key:

1. a) (2, 3) b) (–3, –5) c) (–4, 2)
2. a) no b) no c) yes d) yes
3. a) (2, 7) b) (–1, –8) c) (–1, 3) d) (4, –3)
4. a) (3, 5) b) (–1, 3) c) (–1, 5) d) $\left(\frac{25}{11}, \frac{20}{22}\right)$
5. a) pens cost $0.80, pencils cost $0.50
   b) length = 13 in, width = 6 in
   c) $9500 in World Oil, $3000 in Sask Power
   d) 2 km
   e) Kirk's speed = 12 m/s, conveyor's speed = 8 m/s
   f) $\frac{11}{2}$ and $\frac{3}{2}$
   g) 15 and 10
   h) 15 nickels, 12 dimes
   i) 21 nickels, 15 quarters