6.2 Solving Systems Using Substitution

* Solving systems by graphing is often NOT accurate if the solutions are not integers.

* Substitution Method
  - solve one of the equations for one variable & then substitute the expression for the variable into the other equation
  - use this method to solve quickly; if a variable has already been solved for

Examples:

① $y = 4x$
$3x - y = 1$

- "y" is already solved for

- Substitute $4x$ in for "y" in the other equation

$3x - 4x = 1$
$\frac{-1x}{-1} = \frac{1}{-1}$
$x = -1$

- solve for "x"

$y = 4x$
$y = 4(-1)$ $y = -4$

- Find the other variable substitute -1 in for x & solve for y ⟹

The solution is $(-1,-4)$. Since there is one solution, you know the lines are intersecting. (*) Always check your solution.

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

- Since x is already solved for in each equation, you can set them equal to each other & solve for "y"

$2y - 3 = 2y + 4$
$+3 \quad +3$
$2y = 2y + 7$
$-2y \quad -2y$
$0 = 7$

- $0 \neq 7$, therefore there is NO solution, which means parallel lines

(3) $x = 4y + 1$
$2x - 8y = 2$

- "x" is already solve for
- Substitute $4y+1$ for "x" & solve for "y"

$2(4y+1) - 8y = 2$
$8y + 2 - 8y = 2$
$2 = 2$

- Two will always equal two, therefore there are infintely many solution, which means it is the same line.

(4) $8x+4y=6$
$4x=3-y$

• Solve for "y" in the 2nd equation

$4x=3-y$
$-3 \quad -3$
$(4x-3=-y)-1$

$-4x+3=y$

Then substitute

$8x+4(-4x+3)=6$
$8x+-16x+12=6$
$-8x+12=6$
$-12 \quad -12$
$\frac{-8x=-6}{-8}$
$x=\frac{3}{4}$

$4x=3-y$
$4(\frac{3}{4})=3-y$
$3=3-y$
$-3 \quad -3$
$0=-y$
$y=0$

Solution is $(\frac{3}{4}, 0)$
Intersecting lines

* Review Problem 3, "Using Systems of Equations" on pg. 374

* (Got it #3) $22 = 4n + 2o$
$6 = n + o$

$6 = n + o$
$-o \quad -o$
$6 - o = n$

solve for 1 variable

Substitute & solve

$22 = 4(6-o) + 2o$
$22 = 24 - 4o + 2o$
$22 = 24 - 2o$
$-24 \quad -24$
$-2 = -2o$
$\overline{-2}$
$1 = o$

$6 = n + o$
$6 = n + 1$
$-1 \quad -1$
$5 = n$

Substitute & solve

5 new games
1 old game

* Word Problems < coins, Busses, Perimeter

6.2 pg. 375 #9, 10-38 even (16 problems)

9) False
Identity means same line; infinitely many solutions

10) False; just solve for a variable first (to get a coefficient of 1 or -1 first)

12) $2x+2y=38$
$y=x+3$

$2x+2(x+3)=38$
$2x+2x+6=38$
$4x+6=38$
$\frac{4x=32}{4}$
$x=8$

$y=x+3$
$y=8+3$
$y=11$

$(8,11)$

14) $y=8-x$
$7=2-y$

$(13,-5)$

$7=2-(8-x)$
$7=2-8+x$
$7=-6+x$
$x=13$

16) $3x+2y=23$
$\frac{1}{2}x-4=y$

$3x+2(\frac{1}{2}x-4)=23$
$3x+1x-8=23$
$4x-8=23$
$\frac{4x=31}{4}$

$x=7\frac{3}{4}$

$\frac{1}{2}\left(\frac{31}{4}\right)-4=y$

$\frac{31}{8}-4=y$

$\frac{31}{8}-\frac{32}{8}=y$

$y=-\frac{1}{8}$

$(7\frac{3}{4}, -\frac{1}{8})$

18) $4x = 3y - 2$
$18 = 3x + y$

$18 - 3x = y$

$4x = 3(18 - 3x) - 2$
$4x = 54 + -9x - 2$
$4x = 52 - 9x$
$13x = 52$
$x = 4$

$18 - 3(4) = y$
$18 - 12 = y$
$6 = y$

$(4, 6)$

20) $4y + 3 = 3y + x$
$2x + 4y = 18$

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

$2(y+3) + 4y = 18$
$2y + 6 + 4y = 18$
$6y + 6 = 18$
$6y = 12$
$y = 2$

$(5, 2)$

22) $4y - x = 5 + 2y$
$3x + 7y = 24$

$4y - x = 5 + 2y$
$-4y \quad -4y$
$-1(-x = 5 + -2y)$

$x = -5 + 2y$

$3(-5 + 2y) + 7y = 24$
$-15 + 6y + 7y = 24$
$-15 + 13y = 24$
$+15 \quad +15$
$13y = 39$
$y = 3$

$(1, 3)$

24) $142 = 51b + 10v$

$6 = v + b$

$6 - v = b$

$142 = 51(6 - v) + 10v$
$142 = 306 - 51v + 10v$
$142 = 306 - 41v$
$-164 = -41v$
$v = 4$

4 vans & 2 buses

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

26) $2y - x = 6$

$2(\frac{1}{2}x + 3) - x = 6$

$1x + 6 - x = 6$

$6 = 6$

Identity, same line, infitinetly many solutions

28) $x = -7y + 34$

$x + 7y = 32$

$\cancel{-7y} + 34 + \cancel{7y} = 32$

$34 \neq 32$

Parallel lines, no solution

30) $17 = 11y + 12x$

$12x + 11y = 14$

Donot have to use substitution, look @ equations

Parallel lines, no solution

32) $P = 2l + 2w$

$34 = 2l + 2w$

$l = 5 + 2w$

$34 = 2(5 + 2w) + 2w$

$34 = 10 + 4w + 2w$

$34 = 10 + 6w$

$-10 \quad -10$

$\frac{24 = 6w}{6}$

$\boxed{w = 4\text{ cm},\ l = 13}$

34) $\$3.70 = .10d + .25q$

$5 + d = q$

$3.70 = .10d + .25(5 + d)$

$3.70 = .10d + 1.25 + .25d$

$-1.25 \quad -1.25$

$\frac{2.45 = .35d}{.35}$

$d = 7$

7 dimes, 12 quarters

36) $20s + 45l = 510$
$2l = s$

$20(2l) + 45l = 510$
$40l + 45l = 510$
$85l = 510$
$l = 6$
$s = 12$

6 large & 12 small

38) a) The lines will be //.

b) A false statement is the result. (Two # are not equal.)

c) Compare the tables for both equations using the same x-values in both tables.
→ If (1) x-value has the same y-value in both tables = intersect @ that pt.
→ If the tables are exactly the same = same line
→ if you can add a constant y in one table to get the y values in the other table, the lines will not intersect