Warm Up

Solve the follwoing systems of equations using Graphing

$3x^{-3x} + 4y = -4^{-3y}$

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

$y = -\dfrac{3}{4}x - 1$

$m = \dfrac{-3}{4}\dfrac{rise}{run}$ $y\,intercept = -1$

$x^{x} + 2y = 2^{-x}$

$\dfrac{2y}{2} = \dfrac{-1x + 2}{2}$

$y = -\dfrac{1}{2}x + 1$

$y\,int = 1$ $m = \dfrac{-1}{2}\dfrac{rise}{run}$
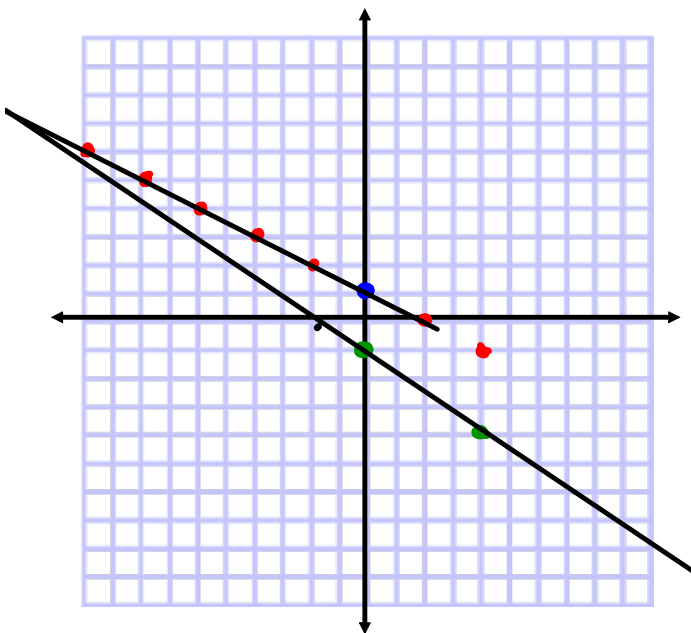
3. Determine the solution of each linear system.

a)

$-2x + y = 10$
$x + 4y = 4$

x= -4 , y= 2

b)

$x - y = -1$
$x + y = 5$
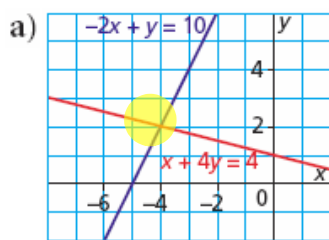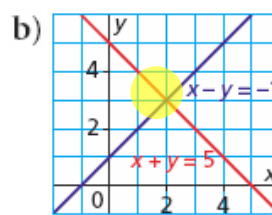
x= 2 , y= 3

> 3. a) $x = -4, y = 2$
> b) $x = 2, y = 3$
> c) $x = 1, y = -3$
> d) $x = -2, y = -1$

c)

$5x + y = 2$
$-x + y = -4$

x= 1 , y= -3

d)

$-3x + y = 5$
$x + 3y = -5$
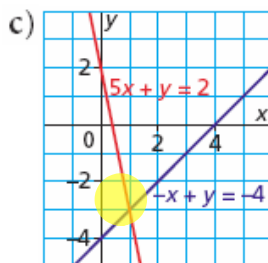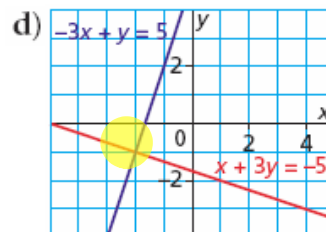
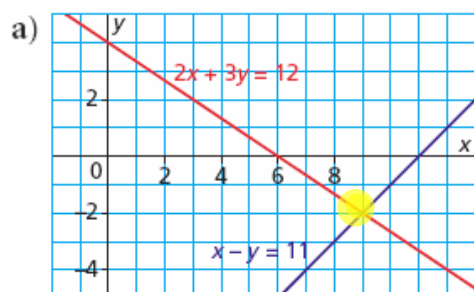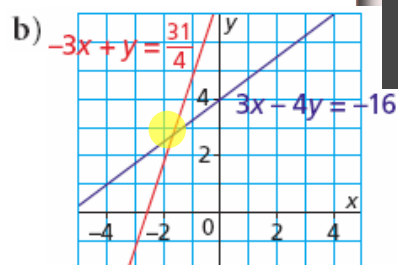**x= -2 , y= -1**

4. For each linear system, use the graphs to determine the solution. Explain how you know whether the solution is exact or approximate.

a)

$2x + 3y = 12$

$x - y = 11$

b) $-3x + y = \dfrac{31}{4}$

$3x - 4y = -16$

x=9 , y= -2
This is exact

x= -1$\dfrac{3}{4}$, y= 2 $\dfrac{3}{4}$

This is approximate

7.2 Solving a System of Linear Equations Graphically

5. a) Solve each linear system.

i) $x + y = 7$ ⓪

$3x + 4y = 24$ ②

(1) x + y =7

y = -x + 7

m= -1

y intercept = (0,7)

x intercept = (7,0)

a)   i) $x = 4, y = 3$
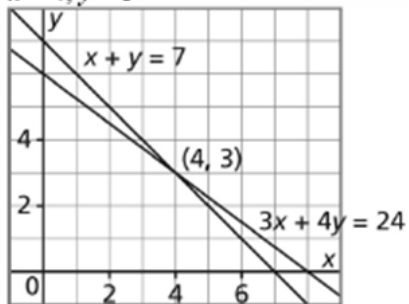
(2) 3x + 4y = 24

4y = -3x + 24

y = -3x + 6
    4

m= -3/4

y intercept = (0,6)

x intercept = (8,0)

Let's try graph by using y=mx+b

Plot y intercept

Solve each system by graphing. use

y int

$m = \frac{2}{1}$ $m = \frac{rise}{run}$

1) $y = 2x + 4$

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

2) $y = -\frac{3}{2}x - 3$ b = -3 $m = \frac{-3}{2}$

$y = \frac{1}{4}x + 4$ b = 4 $m = \frac{1}{4}$

Point of intersectiv

(-4,-4)

Intersects

(-4, 3)
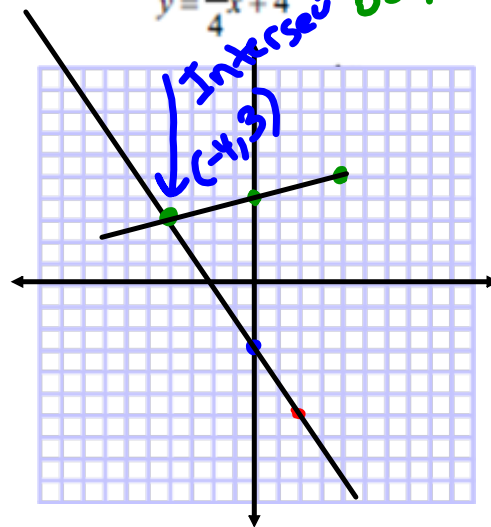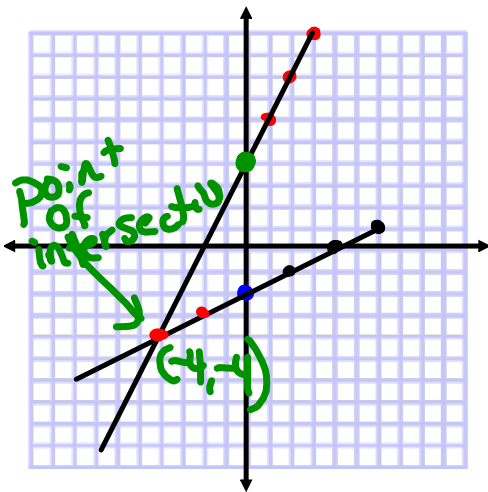
Worksheet Solutions

Solve each system by graphing.

1) $y = 2x + 4$
$y = \dfrac{1}{2}x - 2$

$(-4, -4)$

$(-4, -4)$

2) $y = -\dfrac{3}{2}x - 3$

$y = \dfrac{1}{4}x + 4$

$(-4, 3)$

$(-4, 3)$

3) $y = -2x - 3$
$y = 2x + 1$

$(-1, -1)$

$(-1, -1)$

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

$(1, 3)$

$(1, 3)$

5) $y = -\dfrac{3}{2}x - 2$
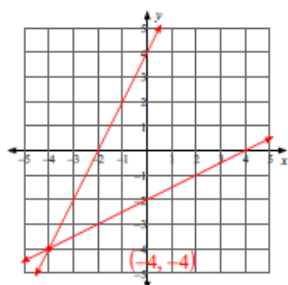
$\quad y = -\dfrac{1}{2}x + 2$

$(-4, 4)$

6) $y = \dfrac{5}{4}x - 3$

$\quad y = 2$

$(4, 2)$

7) $y = -\dfrac{2}{3}x - 2$

$\quad y = -\dfrac{8}{3}x + 4$

$(3, -4)$
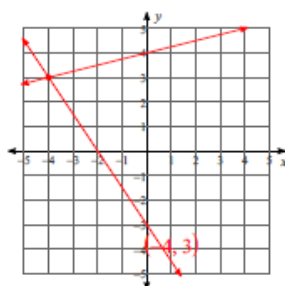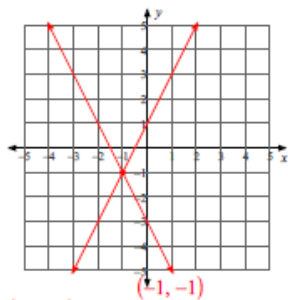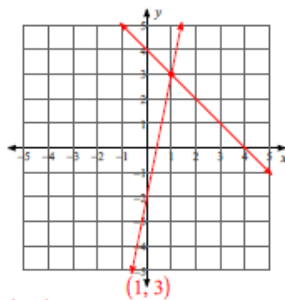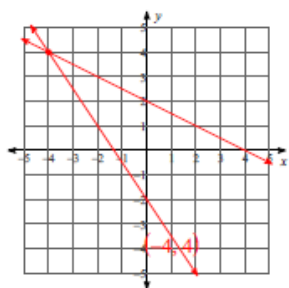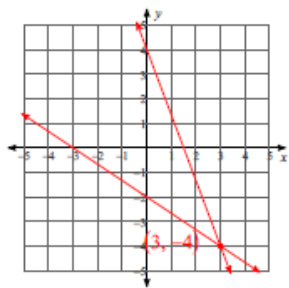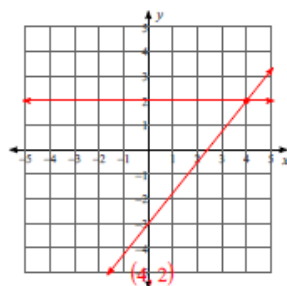
8) $y = \dfrac{1}{2}x + 3$

$\quad y = 4x - 4$
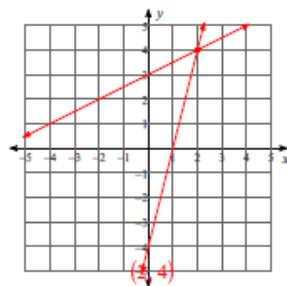
$(2, 4)$

9) $0 = 1 - \dfrac{1}{12}x - \dfrac{1}{3}y$ y= -1/4x +3

$-4y - 4 + 3x = 0$ y= 3/4x -1

(4, 2)

(4, 2)

10) $0 = 3y - x + 6$ y= 1/3x - 2

$0 = -3y - x + 12$ y= -1/3x + 4

(9, 1)

(9, 1)
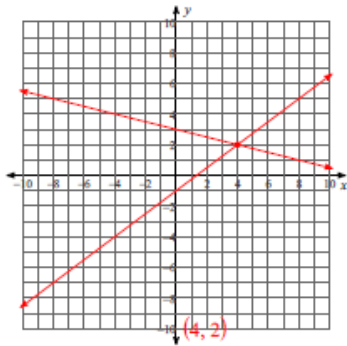
11) $-y = 4x + 1$ y= -4x-1

$0 = -2y - 16 - x$ y= -1/2x - 8

(2, −9)

(2, −9)
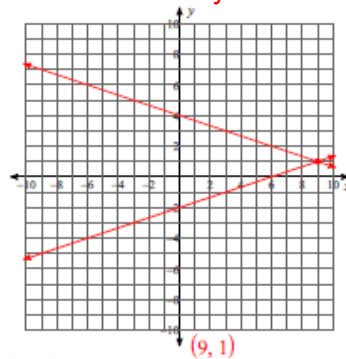
12) $-4y = -7x - 20$ y= 7/4x + 5

$-y - 9 = 0$ y= -9

(−8, −9)
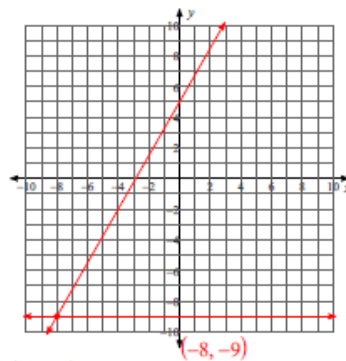
(−8, −9)

13) $2x - 7y = -42$ y= 2/7 x - 6
    $2x - 7y = 56$ y= 2/7 x + 6

No solution

No solution

14) $2x - 3y = 3$ y= 2/3 x - 1
    $x + 9y = -72$ y=-1/9 x - 8

$(-9, -7)$

$(-9, -7)$
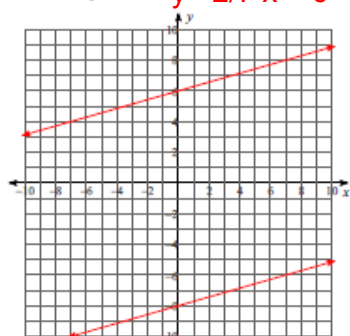
15) $13x + 9y = -63$ y= -13/9 x - 7
    $2x + 9y = 36$ y= -2/9 x + 4

$(-9, 6)$

$(-9, 6)$
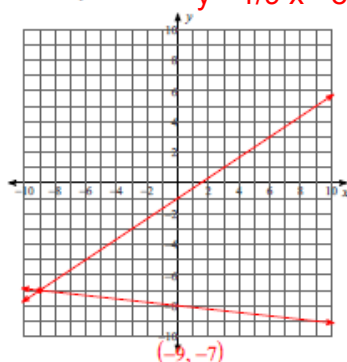
16) $x + y = -5$ y= - x - 5
    $13x + 3y = 15$ y= -13/3 x - 5

$(3, -8)$
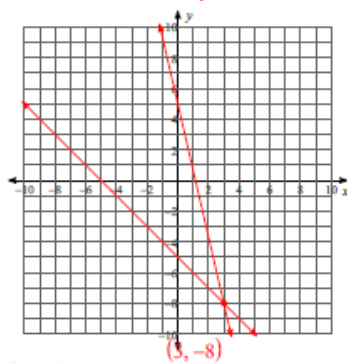
$(3, -8)$

Warm Up
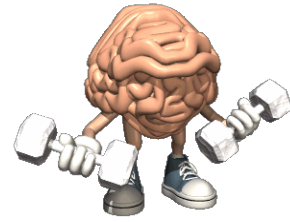
Solve the follwoing systems of equations using substitution

① $3x + 4y = -4$

② $\boxed{x} + 2y = 2$ ⟹ ③ $x = -2y + 2$

↳

sub into ①

① $3x + 4y = -4$

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

$-6y + 6 + 4y = -4$

$-2y + 6 = -4$

$-2y + \cancel{6}^{-6} = -4^{-6}$

$\dfrac{-2y}{-2} = \dfrac{-10}{-2}$

$\boxed{y = 5}$

↓ Sub into ③

$x = -2y + 2$

$= -2(5) + 2$

$= -10 + 2$

$\boxed{x = -8}$

Point of intersection

$(-8, 5)$

Method 2: Substitution

I like this one better

7.4   Using a Substitution Strategy to Solve a System of Linear Equations

Solving Systems of Equations
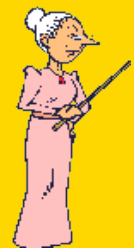
There are a number of different ways in which to solve systems of equations. The second method we are going to look at is called *substitution.*

When we refer to solving a system of equations, we want to **solve for a numerical value** for one variable.

Rules for Substitution as a method for solving a system of equations.

● **There must be the same number of equations as variables.**

- If there are two variables, there must be two equations; three variables, three equations, etc.

● **One of the equations can easily be substituted into the other equation to solve for one variable.**

You try with Substitution

Solve the follwoing systems of equations using substitution

$$y - 3x = 5 \qquad y = 3x + 5$$
$$y + x = 3$$

① $y - 3x = 5$

② $y = 3x + 5$

③ $y + x = 3$

$(3x + 5) + x = 3$

$4x + 5 = 3$

$4x + 5 - 5 = 3 - 5$

$\dfrac{4x}{4} = \dfrac{-2}{4}$

$x = -0.5$

③ $y = 3x + 5$

$y = 3(-0.5) + 5$

$y = -1.5 + 5$

$y = 3.5$

Solve the follwoing systems of equations using substitution

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

Hint: Get rid of fraction by multiplying by LCM

$\frac{1}{3}x - \frac{1}{3}y = \frac{-1}{3}$ ($\times 3$, $\times 3$, $\times 3$) $\Rightarrow$ ② $x - y = -1$ $\downarrow$ ③ Sub into ②

$(x) - y = -1$

$-2y + 5 - y = -1$

$-3y + 5 {}^{-5} = -1 {}^{-5}$

$\dfrac{-3y}{-3} = \dfrac{-6}{-3}$

$\boxed{y = 2}$

$\downarrow$ Sub into 3

Point of intersection

$(1, 2)$

③ $x = -2y + 5$

$-2(2) + 5$

$-4 + 5$

$\boxed{x = 1}$

ii) $x - y = -1$
$3x + 2y = 12$

(2)   **3x + 2y = 12**

(1)   **x - y = -1**

     y = x + 1

     m= 1

     y intercept = (0,1)

     x intercept = (-1,0)

         2y = -3x + 12

         y = $\frac{-3x}{2}$ + 6

         m= -3/2

         y intercept = (0,6)

         x intercept = (4,0)

ii) $x = 2, y = 3$
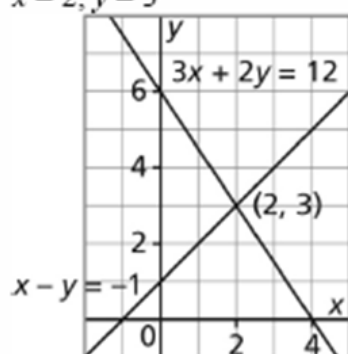
iii) $5x + 4y = 10$
$5x + 6y = 0$

(1) 5x + 4y = 10

4y = -5x + 10

y = -5x + 5
   4   2

m= -5/2

y intercept = (0,2.5)

x intercept = (2,0)

(2) 5x + 6y = 0

6y = -5x

y = -5x
     6

m= -5/6

y intercept = (0,0)

x intercept = (0,0)

iii) $x = 6, y = -5$

iv) $x + 2y = -1$
     $2x + y = -5$

(2)   2x + y = -5

(1)
x + 2y = -1

2y = -x - 1

y = -1x - 1
  2   2

(2)   2x + y = -5

y = -2x - 5

m= -2
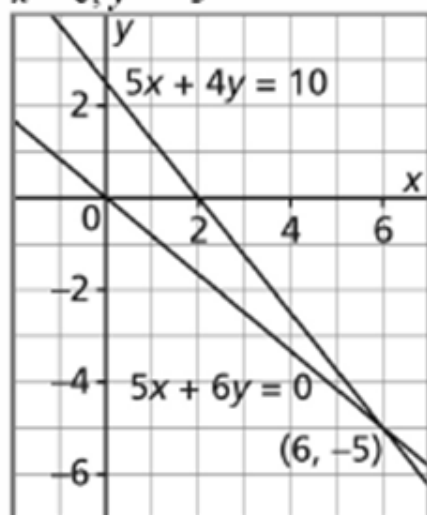
y intercept = (0,-5)

x intercept = (-2.5,0)

m= -1/2

y intercept = (0,-1/2)

x intercept = (-1,0)

iv) $x = -3, y = 1$

(-3, 1)

y

x

-4

-2 $x + 2y = -1$

$2x + y = -5$

-6
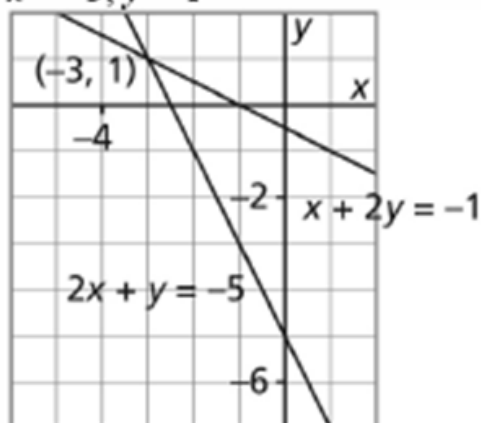
b) Choose one linear system from part a. Explain the meaning of the
   point of intersection of the graphs of a system of linear equations.

   The coordinates of the point of intersection represent the solution of the linear system.

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Questions: 4, 5, 8, 9

4a) ① $y = 9 - x$

② $2x + 3y = 11$

- - - - - - - - -

$2x + 3y = 11$

$2x + 3(9-x) = 11$

$2x + 27 - 3x = 11$

$-x + 27 = 11$

$-x = 11 - 27$

$-x = -16$

$\boxed{x = 16}$

$y = 9 - x$

$y = 9 - 16$

$\boxed{y = -7}$

b) $x = y - 1$

$3x - y = 11$

- - - - - -

$3(y-1) - y = 11$

$3y - 3 - y = 11$

$2y - 3 = 11$

$2y = 11 + 3$

$2y = 14$

$\boxed{y = 7}$

$x = y - 1$

$x = 7 - 1$

$\boxed{x = 6}$

c) $x = 7 + y$

$\quad 2x + y = -10$

$2(7+y) + y = -10$

$14 + 2y + y = -10$

$\quad 14 + 3y = -10$

$\quad\quad 3y = -10 - 14$

$\quad\quad 3y = -24$

$\quad\quad \boxed{y = -8}$

$x = 7 + y$

$x = 7 + (-8)$

$\boxed{x = -1}$

d) $3x + y = 7$

$\quad y = x + 3$

$3x + (x+3) = 7$

$\quad 4x + 3 = 7$

$\quad\quad 4x = 7 - 3$

$\quad\quad 4x = 4$

$\quad\quad \boxed{x = 1}$

$y = x + 3$

$y = 1 + 3$

$\boxed{y = 4}$

5) ① $2x + 3y = 11$

② $4x - y = -13$

② $4x - y = -13$

$-y = -4x - 13$

$\boxed{y = 4x + 13}$

Subsitute into equation 1

$2x + 3y = 11$

$2x + 3(4x + 13) = 11$

$2x + 12x + 39 = 11$

$14x + 39 = 11$

$14x = 11 - 39$

$14x = -28$

$\boxed{x = -2}$

Subsitute back into to see what y=

$y = 4x + 13$

$y = 4(-2) + 13$

$y = -8 + 13$

$\boxed{y = 5}$

$x = -2 \quad , \quad y = 5$

b) ① $4x + y = -5$

② $2x + 3y = 5$

① $4x + y = -5$

$\boxed{y = -4x - 5}$

Sub into equations 2

$2x + 3y = 5$

$2x + 3(-4x - 5) = 5$

$2x - 12x + 15 = 5$

$-10x + 15 = 5$

$-10x = 5 - 15$

$-10x = -10$

$\boxed{x = 1}$

Sub into equation
to solve for y

$y = -4x - 5$

$y = -4(1) - 5$

$y = -4 - 5$

$\boxed{y = -9}$

$x = 1 \qquad y = -9$

c) ① $x + 2y = 13$

② $2x - 3y = -9$

① $x + 2y = 13$

$\boxed{x = -2y + 13}$

Sub into equation 2

$2x - 3y = -9$

$2(-2y + 13) - 3y = -9$

$-4y + 26 - 3y = -9$

$-7y + 26 = -9$

$-7y = -9 - 26$

$-7y = -35$

$\boxed{y = 5}$

Sub into equation to solve for x

$x = -2y + 13$

$x = -2(5) + 13$

$x = -10 + 13$

$\boxed{x = -3}$

$x = -3$, $y = 5$

d) ① $3x + y = 7$

② $5x + 2y = 13$

① $3x + y = 7$

$\boxed{y = -3x + 7}$

Sub into equation 2

$5x + 2y = 13$

$5x + 2(-3x + 7) = 13$

$5x - 6x + 14 = 13$

$-x + 14 = 13$

$-x = 13 - 14$

$-x = -1$

$\boxed{x = 1}$

Sub into equation to solve for y

$y = -3x + 7$

$y = -3(1) + 7$

$y = -3 + 7$

$\boxed{y = -4}$

$x = 1$, $y = -4$

8a) $\dfrac{x}{3} - \dfrac{y}{2} = 2$ $\dfrac{5x}{6} + \dfrac{3y}{4} = 1$

$6\left[\dfrac{x}{3} - \dfrac{y}{2} = 2\right]$ $12\left[\dfrac{5x}{6} + \dfrac{3y}{4} = 1\right]$

$\dfrac{6x}{3} - \dfrac{6y}{2} = 12$ $\dfrac{60x}{6} + \dfrac{36y}{4} = 12$

$\boxed{2x - 3y = 12}$

$\boxed{10x + 9y = 12}$

New equations to work with

① $2x - 3y = 12$
② $10x + 9y = 12$

① $2x - 3y = 12$

$2x = 3y + 12$

$\boxed{x = \dfrac{3}{2}y + 6}$

Sub into equation 2

$10x + 9y = 12$

$10\left(\dfrac{3}{2}y + 6\right) + 9y = 12$

$\dfrac{30}{2}y + 60 + 9y = 12$

$15y + 60 + 9y = 12$

$24y = 12 - 60$

$24y = -48$

$\boxed{y = -2}$

Now sub $y = -2$ into

$x = \dfrac{3}{2}y + 6$

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

$x = \dfrac{-6}{2} + 6$

$x = -3 + 6$

$\boxed{x = 3}$

9) $2x + 2y = -4$ $-12x + 4y = -24$

$2(x + y = -2)$ $4(-3x + y = -6)$

① $x + y = -2$
② $-3x + y = -6$

① $x + y = -2$

$\boxed{x = -y - 2}$

sub into ②

$-3x + y = -6$

$-3(-y-2) + y = -6$

$3y + 6 + y = -6$

$4y + 6 = -6$

$4y = -12$

$\boxed{y = -3}$

Sub $y = -3$ into

$x = -y - 2$

$x = -(-3) - 2$

$x = 3 - 2$

$\boxed{x = 1}$

10) ① $r + n = 186$

   ② $n - r = 94$

① $r + n = 186$

$$\boxed{r = 186 - n}$$

② $n - r = 94$

$n - (186 - n) = 94$

$n - 186 + n = 94$

$2n - 186 = 94$

$2n = 94 + 186$

$2n = 280$

$$\boxed{n = 140}$$

③ $r = 186 - n$

$r = 186 - (140)$

$$\boxed{r = 46}$$

11) ① $2l + 2w = 540$

 ② $l - w = 90$

② $l - w = 90$

$\boxed{l = 90 + w}$

① $2l + 2w = 540$

$2(90 + w) + 2w = 540$

$180 + 2w + 2w = 540$

$180 + 4w = 540$

$4w = 540 - 180$

$4w = 360$

$\boxed{w = 90}$

$l = 90 + w$

$l = 90 + 90$

$\boxed{l = 180}$

14) ① $P + a = 85$

② $0.6p + 0.4a = 38$

① $P + a = 85$

$$\boxed{P = -a + 85}$$

② $0.6p + 0.4a = 38$

$0.6(-a + 85) + 0.4a = 38$

$-0.6a + 51 + 0.4a = 38$

$-0.2a + 51 = 38$

$-0.2a = 38 - 51$

$-0.2a = -13$

$a = \dfrac{-13}{-0.2}$

$$\boxed{a = 65}$$

③ solve for p

$P = -a + 85$

$P = -65 + 85$

$$\boxed{P = 20}$$

19) ① $\frac{1}{2} x + \frac{2}{3} y = 1$ ② $\frac{1}{4} x - \frac{1}{3} y = \frac{5}{2}$

$6 \left(\frac{1}{2} x + \frac{2}{3} y = 1 \right)$ $12 \left(\frac{1}{4} x - \frac{1}{3} y = \frac{5}{2} \right)$

$\frac{6}{2} x + \frac{12}{3} y = 6$ $\frac{12x}{4} - \frac{12}{3} y = \frac{60}{2}$

① $\boxed{3x + 4y = 6}$ ② $\boxed{3x - 4y = 30}$

These are now the new equations.

$3x = -4y + 6$

$\boxed{x = \frac{-4}{3} y + 2}$

Now Sub into new equation #2

$3x - 4y = 30$

$3 \left(\frac{-4}{3} y + 2 \right) - 4y = 30$

$\frac{-12}{3} y + 6 - 4y = 30$

$-4y + 6 - 4y = 30$

$-8y + 6 = 30$

$-8y = 30 - 6$

$-8y = 24$

$\boxed{y = -3}$

Now sub $y = -3$ into

$x = \frac{-4}{3} y + 2$

$x = \frac{-4}{3} (-3) + 2$

$x = \frac{12}{3} + 2$

$x = 4 + 2$

$\boxed{x = 6}$