Solving by Elimination

- When neither equation is arranged in the form $y =$ or $x =$, a third method of solving is needed: elimination.

- This method eliminates one of the variables by either adding or subtracting the two equations together.

- Identify the coefficient that is the same in both equations, then examine its sign. The rule is SAME SIGN SUBTRACT!

Ex/ Solve.

a) $2x + 4y = 9$
$2x + 3y = 4$

Same terms and same signs so subtract

$1y = 5$
$y = 5$

Pick one of original

$2x + 3y = 4$

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

$2x + 15 = 4$

numbers on one side, letters on the other

$2x = 4 - 15$
$\frac{2x}{2} = \frac{-11}{2}$
$x = -5.5$

POI $(-5.5, 5)$

b) $3x + 2y = 5$
$x - 2y = -1$

same terms but opposite signs so Add

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

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

POI $(1, 1)$

c) $-3x + 2y = 5$
$3x - 6y = -1$

Add

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

$3x - 6y = -1$
$3x - 6(-1) = -1$
$3x + 6 = -1$
$3x = -1 - 6$
$\frac{3x}{3} = \frac{-7}{3}$
$x = -\frac{7}{3}$

doesn't divide nicely so just leave

POI $\left(-\frac{7}{3}, -1\right)$

If no coefficients are equal, multiply the whole equation by a constant **(make an equivalent equation)**

d) $2x + 5y = 4$
$-x + 3y = 9$ ← multiply whole thing by 2

$2x + 5y = 4$
$-2x + 6y = 18$

Add

$11y = 22$
$y = 2$

$2x + 5y = 4$
$2x + 5(2) = 4$
$2x + 10 = 4$
$2x = 4 - 10$
$\frac{2x}{2} = \frac{-6}{2}$
$x = -3$

POI $(-3, 2)$

e) $3x + 2y = 1$

$2x + 4y = -2$ ← multiply by 2

$6x + 4y = 2$

same sign subtract

$-4x = -4$

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

$x = 1$

$2x + 4y = -2$

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

$2 + 4y = -2$

$4y = -2 - 2$

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

$y = -1$

POI $(1, -1)$

Ex/ Four chocolate bars and three ice-cream cones cost $5.30. Two chocolate bars and one ice-cream cost $2.20. Find the cost of a chocolate bar and the cost of an ice-cream cone.

$4b + 3c = 5.30$

$2b + c = 2.20$ ← multiply by 3

$4b + 3c = 5.30$

$6b + 3c = 6.60$

subtract

$-2b = -1.30$

$\frac{-2b}{-2} = \frac{-1.30}{-2}$

$b = 0.65$

$2b + c = 2.20$

$2(0.65) + c = 2.20$

$1.3 + c = 2.20$

$c = 2.20 - 1.30$

$c = 0.9$

∴ Bars cost $0.65 and cones $0.90

Practice: Handout - Solving by Elimination