Solving Systems by Substitution

Sometimes, the Regents exam will tell you that you have to solve a system of equations **algebraically** or without the use of a graph. An **algebraic method** for solving systems of equations is the **substitution method**.

Examples:

1. $y = x - 4$
   $y = 4x + 8$

2. $y = 4x$
   $2y + 6 = 2x$

3. $x = 2y$
   $7x + y = 15$

4. $x = 4y - 4$

$-3x + 5y = -2$

Let's Try a Word Problem

5. A farmer grown only pumpkins and corn on her 420-acre farm. This year she wants to plant 250 more acres of corn than pumpkins. How many acres of each crop does the farmer need to plant?

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Examples:

1. $y = x - 4$
   $y = 4x + 8$

$x - 4 = 4x + 8$
$-x \quad\quad -x$
$-4 = 3x + 8$
$\quad\quad -8 \quad -8$
$-12 = 3x$
$\frac{-12}{3} = \frac{3x}{3}$
$-4 = x$

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

2. $y = 4x$
   $2y + 6 = 2x$

$2(4x) + 6 = 2x$
$8x + 6 = 2x$
$-8x \quad\quad -8x$
$6 = -6x$
$\frac{6}{-6} = \frac{-6x}{-6}$
$-1 = x$

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

3. $x = 2y$
   $7x + y = 15$

$7(2y) + y = 15$
$14y + 1y = 15$
$\frac{15y}{15} = \frac{15}{15}$
$y = 1$

$(2, 1)$
$7x + y = 15$
$7x + 1 = 15$
$\quad -1 \quad -1$
$\frac{7x}{7} = \frac{14}{7}$
$x = 2$

4. $x = 4y - 4$

$-3x + 5y = -2$

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

$-12y + 12 + 5y = -2$

$-7y + 12 = -2$

$-12 \quad -12$

$\frac{-7y}{-7} = \frac{-14}{-7}$

$y = 2$

$x = 4y - 4$

$x = 4(2) - 4$

$x = 4$

$(4, 2)$

Let's Try a Word Problem

5. A farmer grown only pumpkins and corn on her 420-acre farm. This year she wants to plant 250 more acres of corn than pumpkins. How many acres of each crop does the farmer need to plant?

$C + P = 420$

$C = 250 + P$

Let p = pumpkin acres

Let c = corn acres

$c = 250 + p$

$c = 250 + 85$

$250 + P + P = 420$

$250 + 2p = 420$

$-250 \quad -250$

$\frac{2p}{2} = \frac{170}{2}$

$p = 85$

85 acres of pumken

335 acres of corn