Solving Linear Systems by Substitution

Given $y = 2x + 3$, what does it mean if:

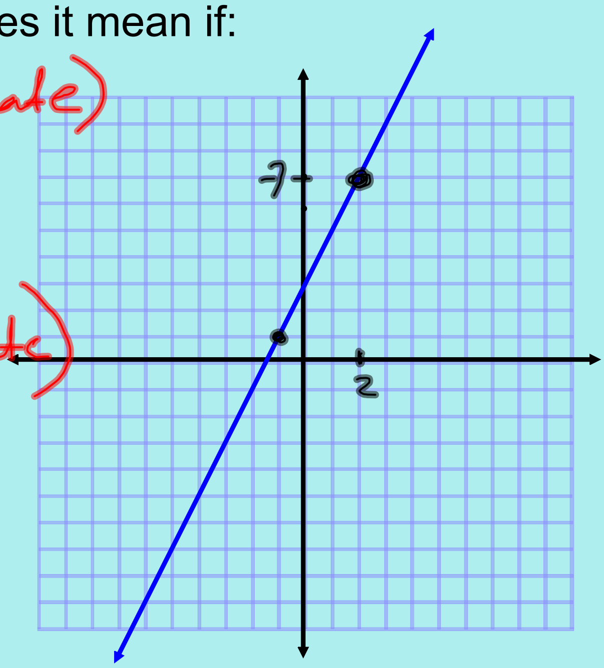
(a) $x = -1$ (b) $y = 7$ (c) $y = x - 1$

solve graphically

Given $y = 2x + 3$, what does it mean if:

(a) $x = -1$ (x-coordinate)

$$y = 2(-1) + 3$$
$$= -2 + 3$$
$$y = 1$$ (y-coordinate)



(b) $y = 7$

$$7 = 2x + 3$$
$$-3 \qquad -3$$
$$\frac{4}{2} = \frac{2x}{2}$$
$$x = 2$$

solve graphically

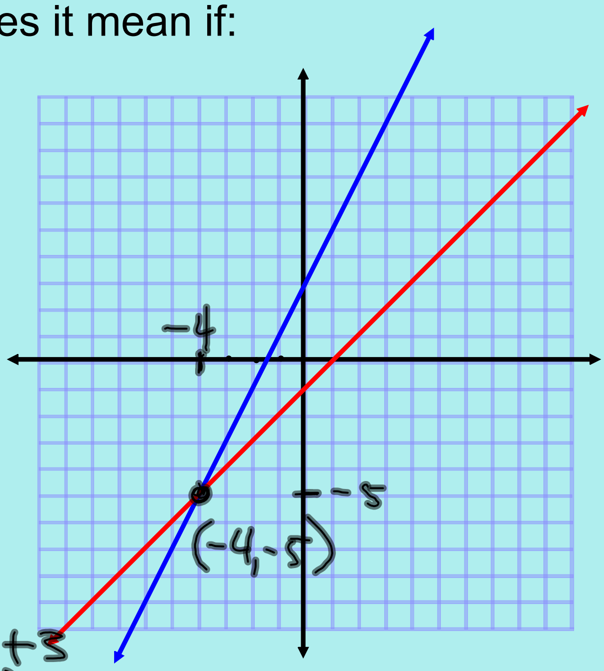
Given y = 2x + 3, what does it mean if:

(c) y = x - 1

$$x - 1 = 2x + 3$$
$$-2x + 1 \quad -2x + 1$$
$$-x = 4$$
$$\underline{x = -4}$$

$y = x - 1$ OR
$\;\;= -4 - 1$
$y = -5$

$y = 2x + 3$
$\;\;= 2(-4) + 3$
$y = -5$



solve graphically

Solving Linear Systems by Substitution

Substitution is an algebraic method where we replace one value with an equivalent amount.

For example,

1 dollar = 4 quarters and 1 quarter = 5 nickels
1 dollar = 4 (5 nickels)
1 dollar = 20 nickels

Since a quarter is equivalent to 5 nickels, we can replace each quarter with 5 nickels and the equations are still valid (true).

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Ex.1. Solve y = 3x - 2 and y = x + 2.

Since $y = y$

$$3x - 2 = x + 2$$
$$-x + 2 \quad -x + 2$$

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

$$x = 2 \rightarrow \text{x-coordinate of solution}$$

for y, sub $x = 2$ into either original equation

$$y = (2) + 2$$
$$y = 4.$$

$\therefore$ Solution is $(2, 4)$ or $x = 2$, $y = 4$

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Ex.1. Solve y = 3x - 2 and y = x + 2.
The solution is (2, 4), or x = 2 and y = 4.

To perform a <u>formal check</u> of the solution, sub these values into each equation and compare sides.

y = 3x - 2	y = x + 2
$LS = y$ $RS = 3x - 2$	$LS = 4$
$LS = 4$ $= 3(2) - 2$	$RS = 2 + 2$
$= 4$	$= 4$
$LS = RS$ ✓	$LS = RS$ ✓

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Ex.2. Solve 2y = x + 5 and x - 4y = 0.

need to write one equation as

$y = \ldots$ or $x = \ldots$

(2): $x - 4y = 0$

$+4y \quad +4y$

$x = 4y$ (3)

Sub (3) into (1)

$2y = 4y + 5$

$-4y \quad -4y$

$-2y = 5$

$y = -\frac{5}{2}$

Sub $x = -\frac{5}{2}$ into (3)

$x = \cancel{4}^{2}\left(-\frac{5}{\cancel{2}_{1}}\right)$

$x = -10$

$\therefore$ solution is $\left(-10, -\frac{5}{2}\right)$

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<u>Solving Linear Systems by Substitution</u>

Graphically, the <u>solution</u> to a system of linear equations is the point where the lines <u>intersect</u>.

Algebraically, we can:

1. isolate one variable in an equation.
2. substitute the isolated variable into the other equation.
3. solve for the single variable.
4. sub the answer from step 3 into the isolated equation from step 1 to find the other variable.

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Assigned Work:

p. 92 # (1, 2, 4), 7, 8odd, 12odd

only if confused by lesson

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Attachments

Basic 2D Grid.agg