5.3 sub notes new

Wednesday, September 16, 2020   2:14 PM

Foundations and Precalculus 10

Warm up: $(x) + 2y = 12 \longrightarrow (4) + 2y = 12$
$x = (4)$
$ -4 -4$
$$\frac{2y}{2} = \frac{8}{2}$$
$$y = 4$$

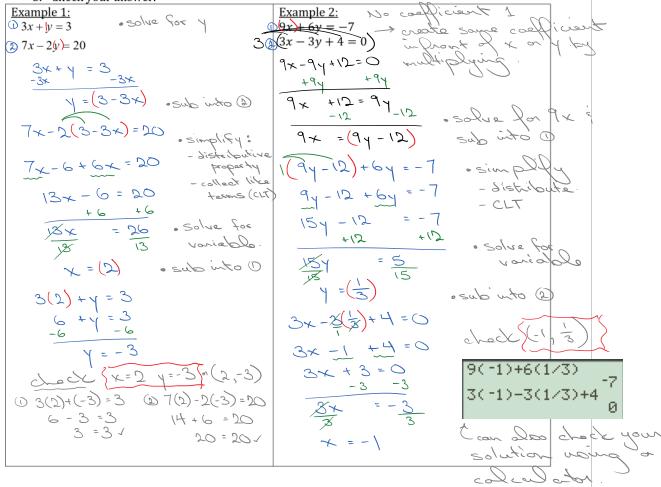## 5.3 - Solving Systems of Equations by Substitution

We can eliminate a variable by solving one equation for a variable and substituting it into the other one.

Subtitution Steps:
1. Solve for one variable from either equation (it is simplest to select the variable whose coefficient is one).
2. Substitute the result from step 1 into the other equation.
3. Solve for the remaining variable.
4. Substitute known value into either original equation and solve.
5. Check your answer.

Example 1:

① $3x + y = 3$ • solve for y

② $7x - 2y = 20$

$3x + y = 3$
$-3x -3x$

$y = (3 - 3x)$ • sub into ②

$7x - 2(3 - 3x) = 20$

• simplify:
 - distributive property
 - collect like terms (CLT)

$7x - 6 + 6x = 20$

$13x - 6 = 20$
$ +6 +6$

$$\frac{13x}{13} = \frac{26}{13}$$ • Solve for variable.

$x = (2)$ • sub into ①

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

$y = -3$

check $\{x = 2 \quad y = -3\}$ or $(2, -3)$

① $3(2) + (-3) = 3$ ② $7(2) - 2(-3) = 20$
$ 6 - 3 = 3$ $ 14 + 6 = 20$
$ 3 = 3 ✓$ $ 20 = 20 ✓$

Example 2:   No coefficient 1

① $9x + 6y = -7$ → create same coefficient in front of x or y by multiplying.

3② $(3x - 3y + 4 = 0)$

$9x - 9y + 12 = 0$
$ +9y +9y$

$9x + 12 = 9y$
$ -12 -12$

$9x = (9y - 12)$ • solve for $9x$ & sub into ①

$1(9y - 12) + 6y = -7$ • simplify
 - distribute
 - CLT

$9y - 12 + 6y = -7$

$15y - 12 = -7$
$ +12 +12$

$$\frac{15y}{15} = \frac{5}{15}$$ • Solve for variable

$y = \left(\frac{1}{3}\right)$ • sub into ②

$3x - 2\left(\frac{1}{3}\right) + 4 = 0$

$3x - 1 + 4 = 0$

$3x + 3 = 0$
$ -3 -3$

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

$x = -1$

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

```
9(-1)+6(1/3)
                -7
3(-1)-3(1/3)+4
                0
```

can also check your solution using a calculator.

Get rid of fractions by multiplying by the smallest number all the denominators divide into → LCD (least common denominator)

Get rid of fractions by multiplying by the smallest number all the denominators divide into → LCD (least common denominator)

↑ same as LCM

Example 3:   LCD of 3,2 : 6   **Recap Steps:**

① $6\left(\dfrac{2}{3}x - \dfrac{1}{2}y = 4\right) \rightarrow \left(\dfrac{6}{1}\right)\dfrac{2}{3}x - \left(\dfrac{6}{1}\right)\dfrac{1}{2}y = \left(\dfrac{6}{1}\right)4$

$$\dfrac{12}{3}x - \dfrac{6}{2}y = 24$$

$$4x - 3(y) = 24$$

② $4\left(\dfrac{1}{2}x + \dfrac{1}{4}y = \dfrac{5}{2}\right)$

$$\dfrac{4}{2}x + y = \dfrac{20}{2}$$

$$2x + y = 10$$
$$-2x \qquad\qquad -2x$$
$$\overline{\qquad\qquad y = (10-2x)}$$
   • sub into modified ①

$$4x - 3(10-2x) = 24$$ • simplify

$$4x - 30 + 6x = 24$$

$$10x - 30 = 24$$ • Solve for variable
$$+30 \qquad +30$$

$$\dfrac{10x}{10} = \dfrac{54}{10}$$

$$x = \dfrac{27}{5} \;\;\boxed{\text{or } 5.4}$$ • sub into modified ②

$$2\left(\dfrac{27}{5}\right) + y = 10$$

$$5\left(\dfrac{54}{5} + y = 10\right)$$

$$54 + 5y = 50$$
$$-54 \qquad\qquad -54$$
$$\overline{\qquad \dfrac{5y}{5} = \dfrac{-4}{5}}$$

$$y = -\dfrac{4}{5} \;\;\boxed{\text{or } -0.8}$$

check $\boxed{\left(\dfrac{27}{5}, -\dfrac{4}{5}\right)}$ in original system:

Calculator or using decimals (ok when decimal ends)

```
(2/3)(27/5)-(1/2
)(-4/5)
                4
(1/2)(27/5)+(1/4
)(-4/5)
              2.5
(5/2)
              2.5
```

HW: p425 #4,5,7b,19; challenge yourself #11, 15, 16

$\dfrac{2}{3}x - \dfrac{1}{2}y = 4$ ①

L.S. $= \dfrac{2}{3}x - \dfrac{1}{2}y$

$= \dfrac{2}{3}(5.4) - \dfrac{1}{2}(-0.8)$

$= 3.6 + 0.4$

$= 4$

$=$ R.S.

$\dfrac{1}{2}x + \dfrac{1}{4}y = \dfrac{5}{2}$ ②

L.S. $= \dfrac{1}{2}x + \dfrac{1}{4}y$

$= \dfrac{1}{2}(5.4) + \dfrac{1}{4}(-0.8)$

$= 2.7 - 0.2$

$= 2.5$

$=$ R.S.