

# **Algebra III**

## **Lesson 6**

**Fractional Equations · Radical Equations ·  
Systems of Three Linear Equations ·**

# Fractional Equations

Make note of any unacceptable values to the variable.  
--If a value would make any of the denominators equal to zero.

Remove fractions by multiplying by LCD

## Example 6.1

Solve:  $\frac{4}{7} + \frac{2}{x+2} = \frac{5}{3}$   $x \neq -2$

$$\left(\frac{4}{7} + \frac{2}{x+2} = \frac{5}{3}\right)(3)(7)(x+2)$$

$$(4)(3)(x+2) + (2)(7)(3) = (5)(7)(x+2)$$

$$12x+24+63 = 35x+70$$

$$12x+87 = 35x+70$$

$$17 = 23x$$

$$x = \frac{17}{23}$$

## Example 6.2

Solve: a)  $\left\{ \begin{array}{l} \frac{3}{7}x + \frac{2}{5}y = 11 \\ 0.03x - 0.2y = -0.37 \end{array} \right.$

a)  $\left( \frac{3}{7}x + \frac{2}{5}y = 11 \right) 35$

b)  $(0.03x - 0.2y = -0.37) 100$

a)  $15x + 14y = 385$

b)  $(3x - 20y = -37)(-5)$       Take (b) times -5 to cancel x

a)  $15x + 14y = 385$

$-15x + 100y = 185$

$114y = 570$

$y = 5$

Use this in (a) or (b) to find x

I choose (b)

$3x - 20(5) = -37$

$3x = 63$

$x = 21$

**(21, 5)**

# Radical Equations

- Get radical all by itself on one side of equation then raise both sides to the power needed to remove the radical.
- If more than one radical, pick one, get rid of it, and then do the next one.

## Example 6.3

Solve:  $\sqrt[3]{x-5} - 2 = 2$

$$\sqrt[3]{x-5} = 4$$

Cube both sides

$$x-5 = 64$$

$$x=69$$

## Example 6.4

Solve:  $\sqrt{S-48} + \sqrt{S} = 8$

I will remove  $\sqrt{S-48}$  first. It's uglier.

$$\sqrt{S-48} = 8 - \sqrt{S}$$

Cross check answers...

$$S - 48 = 64 - 16\sqrt{S} + S$$

$$16\sqrt{S} = 112$$

$$\sqrt{S} = \frac{112}{16}$$

$$\sqrt{S} = 7$$

$$S = 49$$

$$\sqrt{49-48} + \sqrt{49} = 8$$

$$1 + 7 = 8$$

$$8 = 8$$

# Systems of Three Linear Equations

## Example 6.5

Solve:

$$\begin{cases} \text{a)} & 2x+2y-z = 14 \\ \text{b)} & 3x+3y+z = 16 \\ \text{c)} & x-2y = 0 \end{cases}$$

From (c) get  $x=2y$ , sub this into (a) & (b)

$$\begin{array}{l} \text{a)} \quad 4y+2y-z = 14 \\ \text{b)} \quad 6y+3y+z = 16 \end{array} \quad \begin{array}{c} \xrightarrow{\hspace{1cm}} \\ \xrightarrow{\hspace{1cm}} \end{array} \quad \begin{array}{r} 6y-z = 14 \\ 9y+z = 16 \\ \hline 15y = 30 \\ y = 2 \end{array}$$

Use this to find  $x$  from (c)  $x = 4$

Put these into (a) or (b) to get  $z$   $8+4-z = 14$

$$-z = 2$$

$$z = -2$$

$$(4, 2, -2)$$

## Example 6.6

Solve: a)  $x+2y+z = 4$   
b)  $2x-y-z = 0$   
c)  $2x-2y+z = 1$

Add (a) & (b) to get rid of z

$$\begin{array}{r} x+2y+z = 4 \\ 2x-y-z = 0 \\ \hline \text{d) } 3x+y = 4 \end{array}$$

Need a second equation with only x's & y's, so add (b) & (c)

$$\begin{array}{r} 2x-y-z = 0 \\ 2x-2y+z = 1 \\ \hline \text{e) } 4x-3y = 1 \end{array}$$

Rewriting (d) & (e)      d)  $3x+y = 4$

   e)  $4x-3y= 1$

Multiply (d) by 3 to get rid of y

$$9x+3y = 12$$

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

$$13x = 13$$

$$x = 1$$

Put  $x=1$  into (d) to find y

$$3+y = 4$$

$$y = 1$$

Put  $x=1$  &  $y=1$  into (c) to get z

$$2-2+z = 1$$

$$Z = 1$$

**(1, 1, 1)**

# Practice

a) Solve:  $\sqrt{S-27} + \sqrt{S} = 9$

Rearrange

$$\sqrt{S-27} = 9 - \sqrt{S}$$

Square

$$S - 27 = 81 - 18\sqrt{S} + S$$

$$18\sqrt{S} = 108$$

$$\sqrt{S} = 6$$

$$S = 36$$

Cross check

$$\sqrt{36-27} + \sqrt{36} = 9$$

$$3 + 6 = 9$$

$$9 = 9$$

b) Solve: 
$$\begin{cases} 2x+3y = -1 \\ x-2z = -3 \\ 2y-z = -4 \end{cases}$$

Note: No two equations have the same variables, so have to build one

From  $2y-z = -4$  find  $z$  for substitution

$$-z = -4-2y$$

$$z = 4+2y$$

Use this in  $x-2z = -3$  to get an equation in  $x$  &  $y$

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

$$x-8-4y = -3$$

$$x-4y = 5$$

Top times 4, bottom time 3

$$8x+12y = -4$$

$$3x-12y = 15$$

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$$11x = 11$$

$$x=1$$

Put  $x=1$  into  $2x+3y = -1$  to find  $y$

$$2+3y = -1$$

$$3y = -3$$

$$y = -1$$

Put these into  $z=4+2y$

$$z = 4-2$$

$$z = 2$$

**(1, -1, 2)**