Math in Living C O L O R !!

1.04 Literal Equations

Intermediate Algebra: One Step at a Time, Page 48-50: #9,10,12,22,27,29,Extras

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See Section 1.04 with explanations, examples, and exercises, coming soon!

P.48. #9. Solve for x: $a(x+b)=c(x+d)$.

Solution: First, remove parentheses by the distributive property.

$$ax+ab=cx+cd$$

Next, get all the x terms on the left side by subtracting cx from each side. At the same time, subtract ab to each side to get all the non-x terms on the right side of the equation

$$\begin{array}{rcl} ax+\cancel{ab} & = & \cancel{cx}+cd \\ -cx-\cancel{ab} & & -\cancel{cx}-ab \\ \hline ax-cx & = & cd-ab \end{array}$$

Now, factor the common factor of x:

$$x(a-c) = cd-ab$$

Finally, since the x has been multiplied by $(a-c)$, you must divide both sides of the equation by $(a-c)$.

$$\frac{x\bullet\cancel{(a-c)}}{\cancel{(a-c)}} = \frac{cd-ab}{(a-c)}$$

$$x=\frac{cd-ab}{a-c}$$

NOTE: Don't be tempted to divide out the a or the c! These are "terms"! Never divide out TERMS--only FACTORS!!

P.48. #10. Solve for x: $a(x-b)=c(d-x)$.

Solution: First, remove parentheses by the distributive property.

$$ax - ab = cd - cx$$

Next, get all the x terms on the left side by adding cx from each side. At the same time, add ab to each side to get all the non-x terms on the right side of the equation

$$\begin{array}{r} ax - ab = cd - cx \\ +cx + ab \quad + ab + cx \\ \hline ax + cx \;\; = cd + ab \end{array}$$

Now, factor the common factor of x:

$$x(a+c) \;=\; cd \;+\; ab$$

Finally, since the x has been multiplied by $(a+c)$, you must divide both sides of the equation by $(a+c)$.

$$\frac{x \bullet (a+c)}{(a+c)} = \frac{ab+cd}{(a+c)}$$

$$x = \frac{ab+cd}{a+c}$$

NOTE: Don't be tempted to divide out the a or the c! These are "terms"! Never divide out TERMS--only FACTORS!!

P.49. #12. Solve for x: $Y - a = m(x - b)$.

Solution: First, remove parentheses by the distributive property.

$$Y - a = mx - mb$$

Next, notice that there is only one x term, which is on the right side of the equation. Therefore, you must get the non- x terms all on the left side by adding mb from each side.

$$\begin{array}{rcl} Y - a & = & mx - mb \\ + mb & & \cancel{+mb} \\ \hline Y - a + mb & = & mx \end{array}$$

Finally, in order to solve for x,

$$Y - a + mb = mx$$

you must divide both sides of the equation by m.

$$\frac{Y - a + mb}{m} = \frac{\cancel{m}x}{\cancel{m}}$$

$$x = \frac{Y - a + mb}{m}$$

NOTE: Don't be tempted to divide out the m! The m in the numerator is a "term"! Never divide out TERMS--only FACTORS!!

P. 50. #22. $C = 2\pi r$, solve for r.

Solution: Since you are solving for r, and the r has been multiplied by 2π, you must "undo" the multiplication, by dividing both sides by 2π:

$$\frac{C}{2\pi} = \frac{2\pi r}{2\pi}$$

$$\frac{C}{2\pi} = \frac{\cancel{2\pi}r}{\cancel{2\pi}}$$

$$r = \frac{C}{2\pi}$$

P. 50. #27. $A = \frac{1}{2}bh$, solve for h.

Solution: Since there is a denominator of 2, multiply both sides by 2 to clear the fraction!

$$2 \bullet A = \cancel{2} \bullet \frac{1}{\cancel{2}} bh$$

$$2A = bh$$

Next, remember that you are solving for h, and the h has been multiplied by b. In order to "undo" the multiplication, you must divide both sides by b:

$$\frac{2A}{b} = \frac{\cancel{b}h}{\cancel{b}}$$

$$h = \frac{2A}{b}$$

p. 50. #29. $V = \frac{1}{3}\pi r^2 h$, solve for h.

Solution: Since there is a denominator of 3, multiply both sides by 3 to clear the fraction!

$$3 \bullet V = 3 \bullet \frac{1}{3}\pi r^2 h$$

$$3V = \pi r^2 h$$

Next, remember that you are solving for h, and the h has been multiplied by π and r^2. In order to "undo" the multiplication, you must divide both sides by π and r^2:

$$\frac{3V}{\pi r^2} = \frac{\cancel{\pi}\,\cancel{r^2}\,h}{\cancel{\pi}\,\cancel{r^2}}$$

$$\frac{3V}{\pi r^2} = h$$

$$h = \frac{3V}{\pi r^2}$$

Extra Problem (from Chris).

Solve for x: $a(x-b)=cx+ab$.

Solution: First, remove parentheses by the distributive property.

$$ax-ab=cx+ab$$

Next, get all the x terms on the left side by subtracting cx from each side. At the same time, add $+ab$ to each side to get all the non-x terms on the right side of the equation

$$\begin{array}{rcl} ax-ab & = & cx+ab \\ -cx+ab & & -cx+ab \\ \hline ax-cx & = & 2ab \end{array}$$

Now, factor the common factor of x:

$$x(a-c) = 2ab$$

Finally, since the x has been multiplied by $(a-c)$, you must divide both sides of the equation by $(a-c)$.

$$\frac{x \bullet \cancel{(a-c)}}{\cancel{(a-c)}} = \frac{2ab}{(a-c)}$$

$$x = \frac{2ab}{a-c}$$

Extra Problem

Solve for x: $1-3xy=7(5xz+y)$.

Solution: First, remove parentheses by the distributive property.

$$1-3xy=35xz+7y$$

Next, get all the x terms on the right side by adding $3xy$ from each side. At the same time, subtract $7y$ from each side to get all the non-x terms on the left side of the equation

$$\begin{array}{rcl} 1 \quad \cancel{-3xy} & = & 35xz \; \cancel{+7y} \\ -7y \quad \cancel{+3xy} & & +3xy \; \cancel{-7y} \\ \hline 1-7y & = & 35xz+3xy \end{array}$$

Now, factor the common factor of x:

$$1-7y = 35xz+3xy$$
$$1-7y = x(35z+3y)$$

Finally, since the x has been multiplied by $(35z+3y)$, you must divide both sides of the equation by $(35z+3y)$.

$$\frac{1-7y}{(35z+3y)} = \frac{x\,\cancel{(35z+3y)}}{\cancel{(35z+3y)}}$$

$$x=\frac{1-7y}{35z+3y}$$

NOTE: Don't be tempted to divide out the y! These are "terms"! Never divide out TERMS--only FACTORS!!