3.1 Solving Equations Review

Read the section titled "Parameters and Unknowns" and answer the following.

What are the three terms in the reading that describe the "knowns" of an equation?

Usually, how are letters of the alphabet used to represent the "knowns" and "unknowns"?

Class Notes – State the unknown in each equation and its coefficient.

LP#1 $2x+8=22$ Unkown = X Coefficient = 2	$16=5z+10$ Unkown = z Coefficient =	$5+y=21$ Unkown = y Coefficient = 1
LP#2 $5=3(7-y)$ Unkown = y Coefficient = -1	$15=5(w-10)$ Unkown = w Coefficient = 1	$\frac{1}{2}(x+20)=14$ Unkown = x Coefficient = 1
LP#3 $5x=25$ Unkown = X Coefficient = 5	$-6y=33$ Unkown = y Coefficient = -6	What is another term we can use to describe the unknown in an equation? Variable

Expressions versus Equations

Review – Draw a circle around all equations. Cross-out expressions.

$3x+1=11$ 　　　 $5x+3$ 　　　 $10+y$ 　　　 $15+w=2w-15$

$x+2+3x$ 　　 $2(y+4)=18$ 　　 $5x$ 　　 $\frac{1}{2}x+10=14$

$2x+10+3x=15$ 　 $20x+10$ 　 $x=11$ 　 $4w+3w+10$

Class Notes – State the expression that is on the left side of each equation. If possible, simplify it by combining any like terms.

LP#1 $3x + 1 = 11$ $3x + 1$	$15 + w = 2w - 15$ $15 + w$	$2y + 4 + 5y = 18$ $2y + 4 + 5y$ $7y + 4$
LP#2 $\frac{1}{2}x + 10 = 14$ $\frac{1}{2}x + 10$	$10y - 6y = 16$ $10y - 6y$ $4y$	$2x + 10 + 3x = 15$ $2x + 10 + 3x$ $5x + 10$

Class Notes – State the expression that is on the right side of each equation. If possible, simplify it by combining any like terms.

LP#3 $2x + 8 = 22$ 22	$15 = 5w - 10 - 40$ $5w - 10 - 40$ $5w - 50$	$5 + y = 21 - 3y$ $21 - 3y$
LP#4 $16 + z = 5z - 3z + 10$ $5z - 3z + 10$ $2z + 10$	$5x = 25$ 25	$30 = 18 + x - 10$ $18 + x - 10$ $8 + x$

The Different Types of Equations

In this unit we will be solving linear equations. Before we begin solving, we need to know how to identify a linear equation. Most linear equations are first-degree equations. First-degree equations contain a variable in which the highest exponent is one.
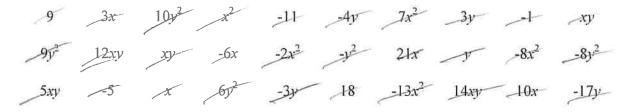
Class Notes – State the degree of each equation. Identify the equation as linear or nonlinear.

LP#1 $x + 3 = 10$ 1st linear	$3w - 15 = 2w + 3$ 1st linear	$y^2 - 36 = 0$ 2nd non-linear	$3z + z = 28$ 1st linear
LP#2 $x^2 = 25$ 2nd non-linear	$10z + 2 = 12z - 1$ 1st linear	$100 = 4w^2$ 2nd non-linear	$x^3 = 342$ 3rd non-linear
LP#3 $w = 13$ 1st linear	$y^4 = 16$ 4th non-linear	$x + 25 = 40 - 3x$ 1st linear	$x^2 - x = 12$ 2nd non-linear

Like Terms

Activity - Logically sort the following numbers into 6 different groups. Each group may contain only 5 numbers. First, use a piece of scrap paper then fill in the notes with the rest of the class.

9 $3x$ $10y^2$ x^2 -11 $-4y$ $7x^2$ $3y$ -1 xy

$9y^2$ $12xy$ xy $-6x$ $-2x^2$ $-y^2$ $21x$ y $-8x^2$ $-8y^2$

$5xy$ -5 x $6y^2$ $-3y$ 18 $-13x^2$ $14xy$ $10x$ $-17y$

Group 1	Group 2	Group 3
9 -5	$3x$ x	$-4y$ $3y$
-11 -1 18	$-6x$ $21x$	y $-3y$
$\boxed{10}$	$10x$ $\boxed{29x}$	$-17y$ $\boxed{-20y}$
Group 4	**Group 5**	**Group 6**
x^2 $7x^2$	$10y^2$ $9y^2$	xy $12xy$
$-2x^2$ $-8x^2$	$-y^2$ $-8y^2$	xy $5xy$
$-13x^2$ $\boxed{-15x^2}$	$6y^2$ $\boxed{16y^2}$	$14xy$ $\boxed{33xy}$

After you have logically sorted each term into a group, add all the terms together and circle the sum.

Review

Set 1 – State whether each is an **expression** or an equation.

R#1 $21+a$ *expression*	$5(x+10)=20$ *equation*
R#2 $6x+8=20$ *equation*	$4w+3+w=18$ *equation*
R#3 $10+p=2p-20$ *equation*	$2k+12+8k$ *expression*

Set 2– State the **degree** of each equation. Identify the equation as linear or nonlinear.

R#1 $2x-6=30$ *1st* *linear*	$10=m^2-3m$ *2nd* *non-linear*
R#2 $c^4=81$ *4th* *non-linear*	$7z-1=2z+9$ *1st* *linear*
R#3 $x^3=125$ *3rd* *non-linear*	$x+8=24-x$ *1st* *linear*

Set 1 – State the expression that is on the right side of each equation. If possible, simplify it.

R#1 $30=10(w-8)$ $10(w-8)$ $10w-80$	$17+3z=7z+z-3$ $7z+z-3$ $8z-3$
R#2 $16+2w=3w-16$ $3w-16$	$11+3z=5z-z+5$ $5z-z+5$ $4z+5$
R#3 $24=3(w+2)$ $3(w+2)$ $3w+6$	$6+3z=7z-3z$ $7z-3z$ $4z$

Why do we solve equations?

Class Notes – A solution to each equation is given. Check to see if the solution is correct or incorrect.

LP#1 $x + 5 = 8$ $x = 3$ Correct	$x - 8 = 7$ $x = 18$ incorrect	$4x = 36$ $x = 8$ incorrect	$\dfrac{x}{9} = 3$ $x = 27$ correct
LP#2 $75 = 100 - x$ $x = 15$ incorrect	$19 + x = 52$ $x = 33$ Correct	$\dfrac{x}{22} = 3$ $x = 66$ Correct	$156 = 12x$ $x = 12$ incorrect

To solve equations we use properties of equality to isolate the variable to determine its value. Let A, B, C be rational numbers, then

- If $A = B$, then $A + C = B + C$ Addition Property of Equality
- If $A = B$, then $A - C = B - C$ Subtraction Property of Equality
- If $A = B$, then $A \times C = B \times C$ Multiplication Property of Equality
- If $A = B$, then $\dfrac{A}{C} = \dfrac{B}{C}$ Division Property of Equality

For additional reading go to http://en.wikipedia.org/wiki/Equations#Properties.
Read the section titled "Properties".

State which property to use here.	Solve each equation here.
Subtraction property of Equality	$x + 6 = 79$
Addition property of equality	$x - 9 = 37$
Division property of equality	$5x = 65$

Class Notes – Solve each first-degree equation and check. If you do not solve an equation, explain why.

LP#3 $y + 8 = 20$ $y = 12$	$x - 6 = 10$ $x = 16$	$x^2 + 1 = 26$ DNS first degree
LP#4 $m - 10 = -2$ $m = 8$	$h^4 + h = 6$ fourth degree DNS	$y + 96 = 56$ $y = -40$

LP#5 $3t = 24$ $t = 8$	$4x^3 = 32$ DNS 3rd degree	$-36 = 4b$ $b = -9$
LP#6 $200 = 2x^2$ DNS 2nd degree	$-42 = -7x$ $x = 6$	$-2d = 84$ $d = -42$

Class Notes – Solve each equation for x. State the equality property that is used.

LP#7 $x - m = p$ addition property of equality	$w = x + y$ Subtraction property of equality	$h + x = k$ Subtraction property of equality
LP#8 $6x = r$ division property of equality	$c = -11x$ division property of equality	$15p = 3x$ division property of equality

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 $15x = 60$	$x - 15 = 49$	$k^3 + 1 = 28$
$x = 4$	$x = 64$	DNS third degree
R#2 $10 - w = 87$	$m^2 = m + 6$	$\dfrac{x}{14} = 9$
$w = 77$	DNS Second degree	$x = 126$
R#3 $4p^2 = 100$	$8k = 96$	$76 + x = 32$
DNS Second degree	$k = 12$	$x = -44$

Lesson 3.3 - Solving First-Degree Equations Involving One Step – Part II

In the previous lesson we used three of the four properties of equality to solve equations. In this lesson we will use the fourth. Before we begin let's revisit how fractions can be used to represent division.

The equations below are written using a division symbol.
Rewrite each equation using a fraction.

LP#1 $h \div 4 = 6$ $\dfrac{h}{4} = 6$	$b \div 3 = 25$ $\dfrac{b}{3} = 25$	$-13 = d \div 7$ $-13 = \dfrac{D}{7}$
LP#2 $-9 = g \div 4$ $-9 = \dfrac{g}{4}$	$31 = a \div 2$ $31 = \dfrac{a}{2}$	$x \div 11 = 7$ $\dfrac{x}{11} = 7$

State which property to use here. $w \div 7 = 12$ multiplacation of property of equality	Solve the equation here. $w = 84$

Class Notes – Solve each first-degree equation and check. If you do not solve an equation, explain why.

LP#3 $h \div 3 = 14$ $h = 42$	$n^2 \div 4 = 9$ DNS	$8 = x \div 7$ $x = 56$
LP#4 $\dfrac{y}{5} = 9$ $y = 45$	$\dfrac{x}{6} = 30$ $x = 180$	$\dfrac{w^2}{11} = 5$ 2nd degree

LP#5	$\dfrac{n}{-6} = -12$	$\dfrac{k}{-7} = 121$
$10 = \dfrac{g}{-4}$		
$g = -40$	$n = 72$	$k = -847$

Class Notes – Solve each equation for x.

LP#6	$\dfrac{x}{y} = z$	$x \div h = g$
$n = x \div m$		
$mn = x$	$x = zy$	$x = gh$
LP#7	$\dfrac{x}{de} = c$	$5r = \dfrac{x}{jk}$
$\dfrac{x}{b} = 4a$		
$x = 4ab$	$x = cde$	$x = 5rjk$

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 $x \div 5 = 10$	$\dfrac{y^2}{8} = 2$	$\dfrac{w}{3} = 12$
$x = 50$	DNS 2nd degree	$w = 36$
R#2 $p^2 \div 12 = 5$	$x \div 2 = 27$	$\dfrac{k}{13} = 5$
DNS 2nd degree	$x = 54$	$k = 65$
R#3 $\dfrac{h}{8} = 17$	$x^2 \div 5 = 5$	$\dfrac{w}{20} = 16$
$h = 136$	DNS 2nd degree	$w = 320$

Lesson 3.4 - Solving First-Degree Equations Involving Multiple Steps – Part 1

When the left side and right side of an equation are completely simplified, then the equation is ready to be solved. Using two operations is necessary to solve a multi-step equation. To solve the equation, we must make use of the order of operations (PEMDAS). However, when solving the equation we complete any addition/subtraction, first, then multiplication/division.

Class Notes – Solve each first-degree equation and check. If you do not solve an equation, explain why.

Set 1 $3x + 2 = 8$	$5x - 6 = 9$	$4m = 10 = 26$
$x = 2$	$x = 3$	$M = 4$
Set 2 $5 + \dfrac{d}{2} = 37$	$\dfrac{p}{3} + 9 = -8$	$\dfrac{w^2}{11} + 10 = 15$
$d = 64$	$p = 51$	DNS 2nd degree

Set 3 $13 = 19 + 2n$ $n = -3$	$6x^2 + 10 = 226$ DNS 2nd degree	$\dfrac{k}{-4} + 10 = -40$ $K = 200$
Set 4 $3k - 11 = 10$ $K = 7$	$\dfrac{n}{7} - 6 = 7$ $n = 91$	$39 = 4d + 7$ $d = 8$

Lesson 3.4

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 $2x - 7 = 17$	$\dfrac{m}{5} + 15 = 19$	$5x + 7 = -38$
$x = 12$	$m = 20$	$x = -9$
R#2 $6x - 4 = 20$	$4x - 3 = 13$	$\dfrac{d}{12} - 1 = 2$
$x = 4$	$x = 4$	$d = 36$
R#3 $4x + 1 = 49$	$\dfrac{k}{7} - 3 = 4$	$3x - 9 = 12$
$x = 12$	$k = 49$	$x = 7$

Lesson 3.4

Lesson 3.5 - Solving First-Degree Equations
Involving Multiple Steps – Part 2

This lesson contains equations in which the distributive property is used first.

Reviewing the Distributive Property
State whether the following statements are true or false. If false, correct the statement.

LP#1 $3(x + 4) = 3x + 12$ true	$6(y + 7) = 6y + 7$ false	$4(n + 2) = 4n + 8$ true
LP#2 $-3(x + 5) = -3x + 15$ false	$-6(w – 9) = -6w + 54$ true	$-5(m + 9) = -5m – 9$ false
LP#3 $(y – 3)(-4) = -4y + 12$ true	$(a – 7)(6) = y – 42$ false	$(a + b)(5) = 5a + 5b$ true
LP#4 $-5(y+1) = -5 – 5$ true	$3(x + 4) = 3x + 12$ true	$-2(y + 5) = -2y – 10$ true

Complete the rule below.

Let a, b, and c represent real numbers,
$$a(b+c) = ab + ac$$

Class Notes – Solve each first-degree equation and check. If you do not solve an equation, explain why.

LP#5 $2(x+3)=-16$	$28=4(m+5)$	$120=15(w-2)$
$x=-11$	$m=-2$	$w=10$
LP#6 $8(y-1)=64$	$-4(p-9)=-48$	$14(4-d)=-168$
$y=9$	$p=21$	$d=16$
LP#7 $6=-3(x-1)$	$2(p-20)=8$	$4=4(b-2)$
$x=-1$	$p=24$	$b=3$

Lesson 3.5

118

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 $5(6x - 7) = -35$	$4(1 - 5x) = -56$	$-4(1 - 6x) = 164$
$x = 0$	$x = 3$	$x = 7$
R#2 $5(x - 1) = 20$	$6(10 + x) = 132$	$-6(7x + 10) = -144$
$x = 5$	$x = 12$	$x = 2$
R#3 $-2(6x + 9) = -150$	$3(3 + 6x) = 225$	$-6(1 + 4x) = 90$
$x = 11$	$x = 12$	$x = 4$

Lesson 3.6
More Practice Solving Linear Equation

Class Notes – Solve each first-degree equation and check. If you do not solve an equation, explain why.

LP#1 $8x - 2x = 30$ $x = 5$	$8y - 4y = -10$ $x = -5$	$x + 6 = 31 - 4x$ $x = 5$
LP#2 $5y - 10 = -3y + 6$ $y = 2$	$5 + 3m^2 - m = 1$ DNS Second degree	$13 = w - 2w + 6$ $w = -7$
LP#3 $29 = 4n^2 - 7 - n^2 + 6$ DNS Second degree	$-4 + a = 5 - 2a + 3$ $a = 4$	$10 - 4x + x - 6 = -23$ $x = 9$

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 $4x + 10 + 2x = 70$	$-3 = -7x + 5x - 5$	$5 + 3x + 5x = -11$
$x = 10$	$x = -1$	$x = 2$
R#2 $7x - 2 - 5x = 6$	$3x + 5 - 4x = -1$	$x + 1 + 3x = -39$
$x = 4$	$x = 6$	$x = 10$
R#3 $6x + 7 - 2x = -33$	$1 + 4x + 6x = 101$	$2x - 7 + 6x = 73$
$x = -10$	$x = 10$	$x = -20$

Lesson 3.7 - Using Algebraic Expressions to Represent a Situation

Class Notes – Write an expression to represent each situation.

LP#1 14 less than a number	11 more than a number	A number increased by 15
$x - 14$	$y + 11$	$e + 15$
LP#2 A number minus 9	20 plus a number	A number divided by 30
$b - 9$	$c + 20$	$w \div 30$
LP#3 - COMPARE The product of -9 and a number $-9n$ The quotient of 12 and a number $\dfrac{12}{n}$	**COMPARE** Double a number $2n$ Triple a number $3n$	**COMPARE** 7 subtracted from a number $n - 7$ A number subtracted from 6 $6 - n$

LP#4		
6 times a number subtracted from 30 $30 - 6n$	The product of 8 and a number added to 50 $8n + 50$	10 times a number added to the 3 times the number $10n + 3n$
LP#5 13 subtracted from 5 times a number $5n - 13$	9 fewer than 8 times a number $8n - 9$	The sum of triple a number and the number $3n + n$

LP #6 - Write an expression to for the amount of money in your pocket using variables to represent the number of each coin.

An unknown amount of quarters $0.25q$	An unknown amount of nickels $0.5n$	An unknown amount of pennies $.1p$
An unknown amount of quarters and dimes $0.25q + 0.10d$	An unknown amount of nickels and pennies $0.5n + .1p$	An unknown amount of pennies and half-dollars $.1p + .50hd$

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 -5 added to a number $n + (-5)$	18 minus a number $18 - n$	Twice a number added to 6 $2n + 6$
R#2 3 fewer than a number $n - 3$ 8 divided by a number $n \div 8$	The product of 5 and the sum of a number and 12 $5(n + 12)$	The product of -7 and a number $-7n$
R#3 20 times a number plus 10 $20n + 10$	16 fewer than the product of a number and 7 $n = 16 + 7$	8 divided by a number $\dfrac{n}{8}$

Lesson 3.8 - Using Algebraic Expressions to Represent an Equation

Class Notes – Translate each sentence into an equation and solve.

LP#1 If 3 times a number is added to 4, the result is 19. Find the number. $n = 5$	If 7 is subtracted from 6 times a number, the result is -25. Find the number. $n = -3$
LP#2 If four times a number is decreased by 2, the result is 26. Find the number. $g = 7$	The sum of 8 and 5 times a number is 53. Find the number. $g = 5$

LP#3	Heather had put some money aside in a an
Some people got on an empty bus at its first stop. At the second stop, 3 people got on. At the third stop 5 more people got on. At the fourth stop, 10 people got off, but 4 people were still on the bus. How many people got on at the first stop?	envelope for household expenses. Yesterday she took out $20 for groceries. Today a friend paid back a loan and Heather put the $34 in the envelope. Now she had $43 in the envelope. How much was in the envelope at the start?
$g = 6$	$g = -29$
LP#4	Michael had completed 5 less than three times as many lab experiments as David. If Michael has completed 13 experiments, how many experiments has David completed?
Three friends each put in the same amount of money to buy a gift. After they spent $2 for a card and $31 for the gift, they had $6 left. How much money had each friend put in originally?	
$g = \$39$	$D = 6$

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 If a number is added to twice the number, the result is -15. What is the number? $x = 7.5$	If a number is subtracted from three times the number, the result is -8. What is the number? $g = -2$
R#2 If the product of some number and 5 is increased by 12, the result is seven times the number. Find the number. $g = 6$	Ricardo gained 15 pounds over the winter. He went on a diet and lost 28 pounds. Then he regained 5 pounds and weighed 177 pounds. How much did he weigh originally? $g = 185$
R#3 Mr. Chee deposited $80 into his checking account. Then, after writing a $23 check for gas and a $90 check for his child's day care, the balance in his account was $67. How much was in his account before he made the deposit? $g = -34$	There were 18 cookies in Magan's cookie jar. While she was busy in another room, her children ate some of the cookies. Magan bought three dozen cookies and added them to the jar. At that point she had 49 cookies in the jar. How many cookies did her children eat? $g = 5$

Lesson 3.9 - Solving More Equations

Class Notes – Solve each first-degree equation and check. If you do not solve an equation, explain why.

LP#1 $2(10y + 4) - 4 = 2y + 22$	$9(2y^2 - 1) + 3 = 7y + 93$	$5(8r + 1) - 2 = 5r + 353$
$y = 1$	DNS 2nd degree	$r = 10$
LP#2 $4(9g + 3) + 1 = 7g + 42$	$5(7v - 4) + 1 = 9v + 59$	$2(4b + 3) + 3 = 7b + 17$
$g = 1$	$v = 3$	$b = 8$
LP#3 $10(2s - 3) - 2 = 8s^2 + 64$	$8(3c - 2) - 3 = 6c + 107$	$8(2y + 3) - 2 = 6y + 32$
DNS 2nd degree	$c = 7$	$y = 1$

Review – Solve each first-degree equation and check. If you do not solve an equation, explain.

R#1 $5(2y - 3) + 1 = 6y - 6$ $Y = 2$	$5(8y + 2) - 3 = 9y + 317$ $y = 10$	$7(10k^2 - 2) - 2 = 7k + 425$ DNS 2nd degree
R#2 $10(6n - 2) + 3 = 8n + 87$ $n = 2$	$9(10g - 4) + 4 = 4g^2 + 226$ DNS 2nd degree	$10(5a + 4) - 2 = 8a + 332$ $a = 7$
R#3 $2(9d + 3) + 2 = 6d + 80$ $D = 6$	$5(4a - 2) + 1 = 10a + 31$ $a = 4$	$8(6b + 4) + 1 = 9b + 111$ $B = 2$

Lesson 3.10 - Solutions of a Linear Equation

Class Notes – Solve each first-degree equation. State whether it has one solution, infinite solutions, or no solution.

LP#1
$6x-15=5(x-3)$
 	
one
  solution
	$5x-15=5(x-3)$
	
	infinite
	  solutions
		$5x-15=5(x-4)$
		
		no
		  solutions

LP#2 $2(x-6)=2x-12$ in finite solution	$2(x-6)=3x-6$ no solutions	$2(x-6)=2x-18$ no solutions
LP#3 $2x+3(x+1)=5x+4$ no solutions	$2x+3(x+1)=10x+4$ one solution	$2x+3(x+1)=5x+3$ infinite solutions

Review – Solve each first-degree equation. State whether it has one solution, infinite solutions, or no solution.

R#1 $x+3=-(2x+2)$	$9p-4p+6=7p-2p$	$6(3w+5)=2(10w+10)$
one solution	no solution	one Solution
R#2 $6(4x-1)=12(2x+3)$	$2(x+6)=2x+12$	$-3(5z+24)+2=2(3-2z)-4$
no solution	infinite solutions	one solution
R#3 $0.30(30)+0.15x=0.20(30+x)$	$6(2x+8)=4(3x-6)$	$-(6k-5)-(-5k+8)=-3$
One Solution	no solution	One Solution