

# Adult Learning Academy Elementary Algebra Workbook



# MODULE 1: EXPRESSIONS, EQUATIONS, AND INEQUALITIES Learning Objectives

By the time you finish this module, you should be able to:

- □ Review topic: Add, subtract, multiply, and divide fractions and integers (neg, pos)
- □ Write and simplify algebraic expressions using variables
- □ Recognize like terms; add and subtract them appropriately
- Distinguish between expressions to be simplified and equations to be solved
- □ Solve linear equations with one variable, including multi-step equations, equations requiring use of the distributive property, equations containing fractions, and equations with variables on both sides
- □ Solve linear inequalities in one variable and graph their solutions on a number line, using brackets, parentheses, the infinity symbol, set-builder notation, and interval notation appropriately. Also solve compound inequalities.

# **IMPORTANT INFORMATION FROM MODULE 1:**

Birthday song: You must have common denominators... to ADD or SUBTRACT... Birthday song: You must have like terms... to ADD or SUBTRACT...

Pos + Pos = Pos	Neg + Neg = NEG (	watch this one!)	Pos + Neg = it depends!
To subtract a number	r, ADD its OPPOSITH	Ξ	
Pos x Pos = Pos	$Neg \times Neg = Pos$	Pos x Neg = Neg	Neg x $Pos = Neg$
$Pos \div Pos = pos$	$Neg \div Neg = Pos$	$Pos \div Neg = Neg$	$Neg \div Pos = Neg$

You can SIMPLIFY expressions, but not solve them.

You can SOLVE equations (they have an = sign!). To SOLVE an equation or inequality means to find the value(s) of the variable that makes the equation or inequality true.

Golden Rule of Algebra: Whatever you do to one side of an equation or inequality, you MUST do to the other side!

To undo addition, subtract. To undo subtraction, add. To undo multiplication, divide. To undo division, multiply.

You can check the solution to any equation by plugging the value for the variable back into the original equation and see if it *satisfies* the equation.

If an equation has NO solution, it is called a CONTRADICTION. If ALL REAL NUMBERS are solutions to an equation, it is called an IDENTITY.

Use brackets [] or a closed circle for  $\geq$  or  $\leq$ . Use Parentheses ("Don't Touch Me!") or an open circle for < or >.

When you multiply or divide both sides of an inequality by a negative number, you must FLIP the inequality symbol.



## Adult Learning Academy Elementary Algebra Workbook MODULE 1 VIDEO & EXERCISE LIST



Торіс	Website	Videos	Exercises
Review Fractions, Integers	www.stlcc.edu	Blackboard Review Flashcards: Fractions	
		Blackboard Review Flashcards: Integers	
If you need more review of frac	tions and integers, see the revi	iew videos and exercises.	
Variables and Expressions	www.khanacademy.org	The Beauty of Algebra	
		Why All the Letters in Algebra?	Evaluating Expressions in 1 Var.
		What is a variable?	Combining Like Terms
		Why aren't we using the mult sign?	Comb. Like Terms w/Distribution
		Variables, Expressions, and equations	Writing Expressions
		Example: Evaluating an expression	
		Combining Like Terms	
		Comb. Like Terms & Distributive Prop	
		Combining Like Terms 1	
		Combining Like Terms 2	
		Equation Special Cases	
Solving 1-step equations	www.khanacademy.org	Why do the same thing to both sides?	One-step Equation Intuition
		Simple equations	One-step Equations
		Representing a relationship w/ equation	One-step equations w/ multipli.
		One-step equation intuition	Equations w/ Var. on both sides
		1-step eq. intuition exercise intro	Worksheets: Solving Equations
		Solving one-step equations	
		Solving one-step equations 2	
		One-step Equations	
		Add/Sub the same thing from both sides	
		Intuition why we divide both sides	

Торіс	Website	Videos	Exercises	
Solving 2-step equations	www.khanacademy.org	Why we do the same 2-step equations	Two-step equations	
		Why we do the same Multip-step	Multi-step equations w/ distrib.	
		Two-step equations	Worksheets: Solving Equations	
		Variables on both sides		
		Ex. 1 Variables on both sides		
		Ex. 2 Variables on both sides		
		Solving Equations w/ Distributive Prop		
		Ex. 1 Distributive Property to Simplify		
		Ex. 3 Distributive Property to Simplify		
Two-Step	http://www.youtube.com/w	atch?v=KBpNLjiv8pk		
Combining like terms	http://www.youtube.com/w	atch?v=fXD4DjSyoyo		
Variable on each side	http://www.youtube.com/w	atch?v=gQdH5PKWrPQ		
Distributive Property	http://www.youtube.com/w	http://www.youtube.com/watch?v=XfaWLVLfeJM		
Solving Inequalities	www.khanacademy.org	Inequalities on a Number Line	Inequalities on a Number Line	
		Inequalities Using Addition and Subtr.	One-Step Inequalities	
		Inequalities Using Mult and Division	Multi-Step Linear Inequalities	
		One-Step Inequalities		
		One-Step Inequalities 2		
		Solving Inequalities		
		Multi-Step Inequalities		
		Multi-Step Inequalities 2		
		Multi-Step Inequalities 3		
		Writing and Using Inequalities 3		
		Compound Inequalities 3		
	www.stlcc.edu	Inequalities Powerpoint on Blackboard		
Module 1 Review	www.stlcc.edu	Powerpoint on Blackboard		
Compass Review	http://www.hostos.cuny.edu	n/oaa/compass/algebra_prac5.htm		

St. Louis
Community
College

# Adult Learning Academy Elementary Algebra Workbook



# 1.1 PRE-ALGEBRA REVIEW: DO YOU REMEMBER FRACTIONS?

1. Write a fraction that is equal to $\frac{1}{2}$ :	10. $\frac{4}{5} \cdot \frac{15}{9}$
2. Write a fraction that is equal to 1:	
3. Write a fraction that is greater than 1:	11. $\frac{4}{5} \div \frac{8}{15}$
4. Write a fraction that is less than $\frac{1}{5}$ :	12. $3\frac{7}{9} - 1\frac{1}{6}$
5. Write a fraction that is equal to 0:	
6. What is half of $\frac{2}{3}$ ?	13. $5\frac{1}{2} \cdot 2\frac{4}{5}$
7. Write a fraction that is UNDEFINED:	
Simplify:	14. $\left(\frac{3}{4}\right)^2$
8. $\frac{4}{10} + \frac{3}{10}$	
	15. $\frac{15}{3} + \frac{9}{16} \left(1\frac{1}{3}\right)^2$
9. $\frac{3}{10} + \frac{2}{15}$	



#### Adult Learning Academy Elementary Algebra Workbook 1.2 PRE-ALGEBRA REVIEW: FRACTIONS VIDEO & EXERCISE LIST



Торіс	Website	Videos	Exercises
Understanding Fractions	www.khanacademy.org	Numerator, Denominator of a Fraction	Recognizing Fractions 0.5
		Identifying Fraction Parts	Recognizing Fractions
			Fractions on the Number line 1
			Fraction Word Problems 1
Equivalent Fractions	www.khanacademy.org	Equivalent Fractions	Simplifying Fractions
		Equivalent Fractions Example	Comparing Fractions 1
		Comparing Fractions	Equivalent Fractions
		Fractions in Lowest Terms	Equivalent Fractions 2
		Finding Common Denominators	Comparing Fractions 2
		Ordering Fractions	
		Comparing Fractions 2	
Add, Subtract Fractions	www.khanacademy.org	Adding Fractions w/ Like Denominators	Adding Frac. w/ Common Denom
		Subtracting Fractions	Subtract Frac. w/Common Denom
		Adding and Subtracting Fractions	Adding Fractions
		Adding Fractions w/ unlike denom	Subtracting Fractions
		Adding Fractions Ex. 1	Adding and Subtracting Fractions
Multiplying Fractions	www.khanacademy.org	Multiplying Fractions	Multiplying Fractions 0.5
		Multiplying Fractions Word Problem	Multip. Fractions Word Problems
Dividing Fractions	www.khanacademy.org	Dividing Fractions	Dividing Fractions 0.5
		Dividing Fractions Example	Dividing Fractions Word Problems
		Dividing Fractions Word Problems	

Торіс	Website	Videos	Exercises
Mixed Numbers and	www.khanacademy.org	Proper and Improper Fractions	Fractions on the Number Line 2
Improper Fractions		Comparing Imp Frac & Mixed Numbers	Comparing Imp Frac & Mixed No.
		Mixed Numbers and Improper Frac.	Converting Mixed Numbers & I.F.
		Changing a Mixed Number to Imp Frac	
		Changing an Imp Fract to a Mixed No.	
		Ordering Imp. Fractions & Mixed No.	
Mixed Number Add & Sub	www.khanacademy.org	Adding Mixed Numbers	Add/Subt Mixed Numbers 0.5
		Adding Mixed Nos. w/ Unlike Denom	Add/Subt Mixed Numbers 1
		Adding Mixed Nos. Word Problem	
		Subtracting Mixed Numbers	
		Subtracting Mixed Numbers 2	
		Subtracting Mixed Numbers Word Prob	
Mixed Number Mult & Div		Multiplying Fractions and Mixed Nos.	Multiplying Mixed Numbers 1
		Multiplying Mixed Numbers	
		Dividing Mixed Numbers	
		Dividing Mixed Numbers and Fractions	



This product is 100% funded by the MoSTEMWINS \$19.7 million grant from the U.S. Department of Labor Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.



Unless otherwise noted this MoSTEMWINs material by <u>St. Louis Community College</u> is licensed under a <u>Creative Commons Attribution 4.0 International License</u>.

St. Louis
Community
College



#### 1.3 PRE-ALGEBRA REVIEW: DO YOU REMEMBER INTEGERS?

SIN 1.	1PLIFY: -5 + -3	10. 10÷(-2)
2.	-5 + 3	1110÷(-2)
3.	3 – 5	123(5 – 4)
4.	-3 - 5	135 <sup>2</sup>
5.	-3 - (-5)	14. (-5) <sup>2</sup>
6.	-5 - (-3)	15. $7 - 6(2 - 3)^3$
7.	-5 - 3	16. $14 \div 7(-5+4)^2$
8.	-5(-2)	17 -6
9.	-5(2)	1712



#### Adult Learning Academy Elementary Algebra Workbook 1.4 PRE-ALGEBRA REVIEW: INTEGERS VIDEO & EXERCISE LIST



Торіс	Website	Videos	Exercises
Negative Number Basics	www.khanacademy.org	Negative Numbers Introduction	Number Line 2
		Ordering Negative Numbers	Ordering Negative Numbers
			Number Line 3
Adding Integers	www.khanacademy.org	Example: Adding Negative Numbers	Adding Negative Numbers
		Ex: Adding integers w/ diff. signs	
Subtracting Integers	www.khanacademy.org	Why subtracting neg is adding positive	Adding and Subtracting Neg Num.
	www.stlcc.edu	Subtracting Integers PPT on Blackboard	
		Adding/Sub Negative Numbers	
Multiplying/Dividing Neg #	www.khanacademy.org	Multiplying Pos and Neg Numbers	Mult/Div Negative Numbers
		Why Neg x Neg is positive	Negative Number Word Probs
		Dividing Pos and Neg Numbers	
		Example: Mult #'s w/ diff signs	
		Mult and Div Negative numbers	
	·		
Absolute Value	www.khanacademy.org	Absolute Value and Number Lines	Finding Absolute Values
		Absolute Value 1	Comparing Absolute Values
		Absolute Value of Integers	
		Comparing Absolute Values	
Exponente	www.libonooodomy.org	Level 1 Exponents	Desitive and Zero Exponents
Exponents	www.khanacademy.org		Positive and Zero Exponents
		Understanding Exponents 2	
Scientific Notation	www.khanacademv.org	Scientific Notation	Scientific Notation
	<i></i>	Scientific Notation 1	
Square Roots	www.khanacademy.org	Understanding Square Roots	Square Roots



#### Adult Learning Academy Elementary Algebra Workbook 1.5 PRACTICE WITH FRACTIONS AND INTEGERS



Simplify the expression in each box and color any that match the same color.

#### There should be three of each answer!

$\frac{4}{5} + \frac{3}{10}$	-1 – 1	$\frac{3}{6} - \frac{4}{8}$	6 ÷ 0	$\frac{2}{1}$
(-5)(4)	$\frac{3}{6} + \frac{5}{10}$	Half of ½	-3 <sup>2</sup>	Double 10.
-32 + 32	$(-10)^2$	$\frac{47}{0}$	$\frac{33}{30}$	Half of $\frac{5}{3}$
10 - (-2)	$\frac{-10}{2}$	$\frac{-50}{-25}$	-15 – 5	7 + (-6)
-2-7	$\frac{7}{14} \div 2$	$\frac{1}{2} + \frac{1}{3}$	$\frac{0}{47}$	$\frac{45}{54}$
15 – (-5)	$5\frac{1}{2} \div 5$	$3\frac{1}{2} \cdot 1\frac{1}{2}$	-4 - 1	-5 + 3
$\frac{15}{37} \cdot \frac{37}{15}$	-6 ÷ 3	10 <sup>2</sup>	-11 + 2	3-5
$5\frac{1}{4}$	9 ÷ (3 – 3)	(-3)(-4)	$\frac{3}{2} \div \frac{2}{7}$	0 - 5
$\frac{5}{2} \cdot \frac{24}{5}$	(-4)(-5)	$50 \div \frac{1}{2}$	$-12 \cdot \frac{5}{3}$	.25

	St. Louis Community College	Adult Learning Academy Elementary Algebra Workbook 1.6 SIMPLIFYING EXPRESSIONS	MoST R
1.	5x + 3x	10. $5(x-2)$	
2.	5x - 3x	11. $3(x + 1)$	
3.	3x – 5x	12. $5(x-1) + 3(x+2)$	
4.	x + x	13. $3x + 5 - (2x + 1)$	
5.	X – X	14. $3x + 5 - (2x - 1)$	
6.	x • x	15. $3x + 5(2x - 1)$	
7.	$\mathbf{x} \div \mathbf{x}$	16. $3x - 5(2x - 1)$	
8.	x + y	17. 7 – 3(2x – 1)	
9.	3x + 3y + 5x - y	18. $7 - 3(2x + 1)$	

S	St. Louis Community College	Adult Learning Aca Elementary Algebra W 1.7 SOLVING 1-STEP EQ	demy orkbook UATIONS
1.	x + 3 = 15	9.	-5 = x + 4
2.	x-4 = 20	10.	5x = 7
3.	6y = 48	11.	<sup>1</sup> ∕₂ x = 12
4.	$\frac{a}{3} = 12$	12.	<sup>3</sup> ⁄ <sub>4</sub> x = 18
5.	w + 100 = -300	13.	7x = 7
6.	x - 12 = -20	14.	$\mathbf{X} - \frac{1}{2} = \frac{3}{2}$
7.	-6y = 48	15.	-x = -7
8.	$\frac{a}{3} = -9$	16.	5x = 0

STEN

	St. Louis Community College	Adult Learning Academy Elementary Algebra Workbook 1.8 SOLVING 2-STEP EQUATIONS	
1.	2x + 1 = 7	7. $7 = 5 + 2x$	
2.	3x - 1 = 11	8. $10 - 3x = 13$	
3.	-2x + 1 = 9	9. $\frac{x+4}{3} = 10$	
4.	-5x - 1 = 9	10. $\frac{x-7}{5} = 2$	
5.	5 + 3x = 17	11. $-4a + 2 = 2$	
6.	7 - 3x = 13	$12.  \frac{w}{3} - 10 = 0$	

ſ	St. Louis Community College	Adult Learning Academy Elementary Algebra Workbook 1.9 SOLVING MULTI-STEP EQUATIONS
1.	x + 3x = 12	$7. \qquad 3x = x + 4$
2.	5x - 3x + 2 = 12	$8. \qquad 4x = 2x + 10$
3.	3x - 5x + 2 = 12	9.  -5x + 3 = -4x
4.	5(x-2) = 20	10. $x - 5 = 2x$
5.	3(x + 1) = 15	11. $2(x + 1) = x - 3$

6. -2(x+4) = 16 12. -2(x+1) = 3x - 7

OSTEN



# Adult Learning Academy Elementary Algebra Workbook 1.10 EXPRESSIONS & EQUATIONS



	EXPRESSION (SIMPLIFY if possible)	<b>EQUATION</b> (SOLVE)
1.	x + x + x	9. $x + x + x = 12$
2.	3(x - 4)	10. $3(x-4) = 5$
3.	5x - x	11. $5x - x = -20$
4.	2 – x	12. $2 - x = -6$
5.	x - 5 - 3	13. $x - 5 - 3 = 80$
6.	7 - 2(x + 1)	14. $7 - 2(x + 1) = -1$
7.	7 - 2(x - 1)	15. $7 - 2(x - 1) = -1$
8.	4x – ½ x	16. $4x - \frac{1}{2}x = 7$





#### x + 4 = x

When we subtract x from both sides of this equation, we get 4 = 0. The variables have disappeared, and we are left with a FALSE statement. There is NO solution—we have a **CONTRADICTION**!

3x - 5 = 3x + 1

When we subtract 3x from both sides of this equation, we get -5 = 1 (or some other false statement with no variables in it). This is also a CONTRADICTION and has no solution!

4x + 5 = 4x + 5

If we subtract 4x from both sides of this equation, we get 5 = 5. The variables have disappeared, but this time the statement we have left is TRUE! This is called an **IDENTITY**, and ALL real numbers are solutions.

3(x-6) = 3x - 18

If you try solving this equation, you lose all your variables, and the remaining statement is true. This is also an identity. It doesn't matter what value we put in for x, the statement is always true!

NOTE: These special equations (contradictions and identities) only come up once in a while. Most equations are what we call "**Conditional**" they have a solution, but not every number in the world is a solution.

#### What type of equation is it--Identity? Contradiction? Conditional?

1. $3x + 5 = 5$	
2. $3x + 5 = 3x + 5$	
3. $3x + 5 = 3x + 7$	
4. $3(x+2) = 3x + 6$	
5. $3(x+2) = 3x + 5$	
6. $3(x+2) = 2x + 5$	
7. x = x	
8. $x = x - 1$	
9. $4x + 1 = x - 2$	
10. $x + x = 2x$	
11. $x + x = 3x$	
12. $x + x = 6$	
13. $x + x = x + 1$	
14. $x + 1 = x + 2$	
15. $x + 1 = 6$	



b. Set-builder  $\{X \mid$ 

}

c. Interval notation:

- b. Set-builder  $\{X \mid \}$
- c. Interval notation:





12. **x** + 4 > 12





#### Adult Learning Academy Elementary Algebra Workbook 1.13 COLOR MATCHING INEQUALITIES



Find three ways (one from each column) to express the same inequality. Color the matches the same color.

	x > 3	(-∞, 3)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	x < -3	[3, ∞)
	x <u>&gt;</u> 3	(-∞, 3]
	-3 < x <u>&lt;</u> 3	$(3,\infty)$
	x <u>&lt;</u> -3	(-3, 3)
	-3 < x < 3	[-3, 3)
	x <u>&lt;</u> 3	(-3, 3]
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-3 <u>&lt;</u> x < 3	(-∞, -3)
	x <u>&gt;</u> −3	[-3, ∞)
-5 -42 -1 0 1 2 3 4 5	x < 3	(-∞,-3]



Adult Learning Academy Elementary Algebra Workbook 1.12 CAREER APPLICATIONS: STEM



- 1. A laptop computer weighs 3 pounds.
  - a. How much would 2 computers weigh?
  - b. How much would 10 computers weigh? \_\_\_\_\_
  - c. How much would x computers weigh? \_\_\_\_\_
- 2. An experimental plant has X leaves. Write an expression for the number of leaves on these plants:
  - a. A plant with two more leaves than the experimental plant: \_\_\_\_\_
  - b. A plant with 4 fewer leaves than the experimental plant:
  - c. A plant with twice as many leaves as the experimental plant: \_\_\_\_\_
  - d. A plant with 3 more than 5 times as many leaves as the experimental plant:
  - e. A plant with 1 less than twice as many leaves as the experimental plant: \_\_\_\_\_
  - f. A plant with the same number of leaves as the experimental plant:
- 3. One solution contains X milliliters of saline. A second solution contains Y milliliters of saline. Write an expression for each situation:
  - a. If we add 20 ml of saline to the first solution, how much saline will it contain?
  - b. The total saline used in both solutions:
  - c. If X > Y, how much more saline is in the first solution than the second?
  - d. The mean amount of saline in the two solutions:
  - e. If we double the amount of saline in each solution, what will be the total amount of saline?
  - f. If we pour the first solution equally into four smaller beakers, how much saline will be in each?

- 4. Using the variable R to represent the number of millions of red blood cells (RBC) per cubic milliliter of blood. Write an EQUATION for each description (use an = sign!). Then solve.
  - a. If Charles' red blood cell count increased by 1.3, his red blood cell count would be at the maximum normal of 6. What is his current RBC?
  - b. A change in medication lowered Rhonda's RBC by 2.1, so it is now 3.9. What was Rhonda's starting RBC?
  - c. James' RBC started a medical trial at 7.2 and ended at 4.9. How much did his RBC drop during the course of the study?
  - d. If my RBC doubled, it would be 7. What is it currently?
  - e. Half of Robert's RBC would be 2.6. What is his current RBC?
  - f. The total RBC for two brothers is 12. The older brother's RBC is 1.5 higher than the younger brother's RBC. What is the red blood cell count for each brother?
  - g. The total RBC for two sisters is 9. The sick sister's RBC is double that of the healthy sister. What is the red blood cell count for each sister?
  - h. The total RBC for two siblings is 12. The brother's RBC is one less than the twice that of his sister. What is the red blood cell count for each sibling?

- 5. Write an equation for each situation. Then solve.
  - a. An updated program requires 40 gigabytes of memory more than its predecessor. The original program required 100 gigabytes. How much does its updated version require?
  - b. The perimeter of the rectangular lab is 88 feet. The length is 4 feet more than the width. What are the dimensions of the lab?
  - c. The perimeter of the rectangular computer storage room is 150 feet. The length is twice the width. What are the dimensions of the storage room?
  - d. Insurance will pay half the replacement cost due to flooded equipment, after the lab pays the \$500 deductible. The replacement costs \$15,000. How much will insurance pay?

6. Write an expression for the perimeter and the area of each.

a. X inches X inches	b. X feet X + 3 feet	c. X miles 2X miles
Perimeter:	Perimeter:	Perimeter:
Area:	Area:	Area:

- 7. Expressing Inequalities: Let X equal the volume of liquid to be used in an experiment. Write an inequality to describe each situation.
  - a. To avoid overloading the equipment, the volume must be at most 10 liters.
  - b. To ensure accurate measurement, the volume must be at least 3 liters.
  - c. To conduct the experiment, the volume of liquid must be between 3 and 10 liters, inclusive.
  - d. If a liter of liquid is lost to condensation, the remaining volume must be at least 3 liters.



# **Adult Learning Academy Elementary Algebra Workbook MODULE 1 ANSWER KEY**



<b>1.1 Do You Remember Fractions?</b>		
1. $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}, \frac{50}{100}, etc$		
$2. \ \frac{1}{1}, \frac{2}{2}, \frac{37}{37}, \frac{456}{456}, etc$		
3. $\frac{9}{8}, \frac{10}{8}, \frac{5}{2}, numerator > denominator$		
$4. \ \frac{1}{6}, \frac{1}{10}, \frac{1}{50}, etc$		
5. $\frac{0}{2}, \frac{0}{6}, \frac{0}{329}, etc$		
<b>6.</b> of means multiply: $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$		
7. $\frac{1}{0}, \frac{7}{0}, \frac{387}{0}, etc$		
8. $\frac{7}{10}$		
$9.  \frac{9}{30} + \frac{4}{30} = \frac{13}{30}$		
<b>10.</b> $\frac{60}{45} = \frac{4}{3} = 1 \frac{1}{3}$		
<b>11.</b> $\frac{4}{5} \times \frac{15}{8} = \frac{60}{40} = \frac{3}{2} = 1\frac{1}{2}$		
<b>12.</b> $\frac{34}{9} - \frac{7}{6} = \frac{68}{18} - \frac{21}{18} = \frac{47}{18} = 2 \frac{11}{18}$		
<b>13.</b> $\frac{11}{2} \cdot \frac{14}{5} = \frac{154}{10} = $ <b>15</b> $\frac{2}{5}$		
<b>14.</b> $\frac{3}{4} \cdot \frac{3}{4} = \frac{9}{16}$		
<b>15.</b> $5 + \frac{9}{16} \left(\frac{4}{3}\right)^2 = 5 + \frac{9}{16} \left(\frac{16}{9}\right) = 5 + 1 = 6$		

#### **1.3 Do you Remember Integers?**

1	-8	
2	-2	
3	-2	
4	-8	
5.	2	
6	-2	
7	8	
<b>8.</b> 1	.0	
9	-10	
10.	-5	
11.	5	
12.	-3	
13.	-25	
14.	25	
15.	$7 - 6(-1)^3 = 7 - 6(-1)$	= 7 + 6 = 13
16.	$14 \div 7(-1)^2 = 14$	$\div$ 7(1) = <b>2</b>
17.	$\frac{1}{2}$	
	4	

## **1.5 Practice with Fractions & Integers**

$\frac{\frac{4}{5} + \frac{3}{10}}{= 1\frac{1}{10}}$	-1 - 1 = -2	$\frac{3}{6} - \frac{4}{8} = 0$	6 ÷ 0 undefined	$= \frac{\frac{2}{1}}{2}$
(-5)(4) = - <b>20</b>	$\frac{3}{6} + \frac{5}{10} = 1$	Half of ½ = 1/4	-3 <sup>2</sup> = - 9	Double 10. = 20
-32 + 32 = <b>0</b>	$(-10)^2$ = 100	47 0 undefined	$ \frac{33}{30} 1\frac{1}{10} $	$Half of \frac{5}{3} = \frac{5}{6}$
10 – (-2) <b>= 12</b>	$\frac{-10}{2}$ = -5	$\frac{-50}{-25} = 2$	-15 – 5 <b>= -20</b>	7 + (-6) = <b>1</b>
-2 - 7 = - 9	$\frac{7}{14} \div 2$ $= 1/4$	$\frac{\frac{1}{2} + \frac{1}{3}}{= \frac{5}{6}}$	$\frac{0}{47} = 0$	$\frac{45}{54} = \frac{5}{6}$
15 – (-5) <b>= 20</b>	$5\frac{1}{2} \div 5$ $1\frac{1}{10}$	$3\frac{1}{2} \cdot 1\frac{1}{2}$ $= 5\frac{1}{4}$	-4 - 1 = -5	-5 + 3 = - <b>2</b>
$\frac{15}{37}\cdot\frac{37}{15}$	-6 ÷ 3 = - <b>2</b>	$10^2$ = 100	-11 + 2 = - 9	3 – 5   = <b>2</b>
$5\frac{1}{4}$	9 ÷ (3 – 3) <b>undefined</b>	(- <u>3)(</u> -4) = <b>12</b>	$\frac{\frac{3}{2} \div \frac{2}{7}}{=5\frac{1}{4}}$	0 – 5 = - <b>5</b>
$\frac{5}{2} \cdot \frac{24}{5} = 12$	(- <u>4)(</u> -5) = <b>20</b>	$50 \div \frac{1}{2}$ = 100	$-12 \cdot \frac{5}{3} = -20$	.25 = 1/4

#### **1.6 Simplifying Expressions**

1. 8x
2. 2x
32x
4. 2x
5. 0
<b>6. x</b> <sup>2</sup>
7. 1
8. x + y (not like terms)
9. $8x + 2y$
10. $5x - 10$
<b>11.</b> $5x - 5 + 3x + 6 = 8x + 1$
<b>12.</b> $3x + 5 - 2x - 1 = x + 4$
<b>13.</b> $3x + 5 - 2x + 1 = x + 6$
<b>14.</b> $3x + 10x - 5 = 13x - 5$
<b>15.</b> $3x - 10x + 5 = -7x + 5$
<b>16.</b> $7 - 6x + 3 = 10 - 6x$
<b>17.</b> $7 - 6x - 3 = 4 - 6x$

**1.7 One-Step Equations 1.** x + 3 - 3 = 15 - 3x = 12**2.** x - 4 + 4 = 20 + 4x = 24**3.** 6y/6 = 48/6 y = 8 4.  $(\frac{a}{3})$ 3 = (12)3 a = 36 **5.** w + 100 - 100 = -300 - 100w = -400 6. x - 12 + 12 = -20 + 12x = -8**7.** -6y/-6 = 48/-6 **y** = -8 **8.**  $(\frac{a}{3})$ **3** = (-9)**3** a = -27 9. -5 - 4 = x + 4 - 4-9 = x or x = -910. 5x/5 = 7/5x = 7/5**11.**  $(\frac{1}{2} x)2/1 = (12)2/1$ **x** = 24 12.  $(\frac{3}{4} x)4/3 = (18)4/3$ **x** = 72/3 = **24 13.** 7x/7 = 7/7 **x = 1 14.**  $x - \frac{1}{2} + \frac{1}{2} = \frac{3}{2} + \frac{1}{2}$  $x = \frac{4}{2} = 2$ **15.** -x/-1 = -7/-1 **x** = **7 16.** 5x/5 = 0/5 **x** = **0** 

# **1.8 Two-Step Equations**

1. 2x + 1 - 1 = 7 - 1 2x = 6 2x/2 = 6/2 x = 32. 3x - 1 + 1 = 11 + 1 3x = 12 3x/3 = 12/3 x = 43. -2x + 1 - 1 = 9 - 1 -2x = 8 -2x/-2 = 8/-2x = -4

**<u>1.8 Two-Step Equations (cont.)</u> 4.** -5x - 1 + 1 = 9 + 1-5x = 10-5x/-5 = 10/-5 $\mathbf{x} = -2$ **5.** 5 + 3x - 5 = 17 - 53x = 123x/3 = 12/3**x** = **4** 6. 7 - 3x - 7 = 13 - 7-3x = 6-3x/-3 = 6/-3**x** = -2 7. 7 - 5 = 5 + 2x - 52 = 2x2/2 = 2x/21 = x or x = 18. 10 - 3x - 10 = 13 - 10-3x = 3-3x/-3 = 3/-3x = -1 9.  $(\frac{x+4}{3})$ 3 = (10)3 x + 4 - 4 = 30 - 4x = 2610.  $(\frac{x-7}{5})$  5 = (2) 5 x - 7 + 7 = 10 + 7**x** = 17 **11.** -4a + 2 - 2 = 2 - 2-4a = 0-4a/-4 = 0/-4**a** = **0**  $12.\frac{w}{3} - 10 + 10 = 0 + 10$  $\left(\frac{w}{2}\right)\mathbf{3} = (10)\mathbf{3}$ w = 30

#### **1.9 Multi-Step Equations**

1. 
$$x + 3x = 12$$
  
 $4x = 12$   
 $4x/4 = 12/4$   
 $x = 3$   
2.  $5x - 3x + 2 = 12$   
 $2x + 2 = 12$   
 $2x + 2 - 2 = 12 - 2$   
 $2x = 10$   
 $2x/2 = 10/2$   
 $x = 5$ 

**1.9 Multi-Step Equations 3.** 3x - 5x + 2 = 12-2x + 2 = 12-2x + 2 - 2 = 12 - 2-2x = 10-2x/-2 = 10/-2x = -5 4. 5(x-2) = 205x - 10 = 205x - 10 + 10 = 20 + 105x = 305x/5 = 30/5**x** = 6 5. 3(x + 1) = 153x + 3 = 153x + 3 - 3 = 15 - 33x = 123x/3 = 12/3 $\mathbf{x} = \mathbf{4}$ **6.** -2(x + 4) = 16-2x - 8 = 16-2x - 8 + 8 = 16 + 8-2x = 24-2x/-2 = 24/-2x = -12 7. 3x - x = x + 4 - x2x = 42x/2 = 4/2 $\mathbf{x} = \mathbf{2}$ 8. 4x - 2x = 2x + 10 - 2x2x = 102x/2 = 10/2 $\mathbf{x} = \mathbf{5}$ 9. -5x + 3 + 5x = -4x + 5x3 = 1x or x = 3**10.** x - 5 - x = 2x - x-5 = x or x = -5**11.** 2(x + 1) = x - 32x + 2 = x - 32x + 2 - 2 = x - 3 - 22x = x - 5 $2\mathbf{x} - \mathbf{x} = \mathbf{x} - \mathbf{5} - \mathbf{x}$ x = - 5 12. -2(x + 1) = 3x - 7-2x - 2 = 3x - 7-2x - 2 + 7 = 3x - 7 + 7-2x + 5 = 3x-2x + 5 + 2x = 3x + 2x5 = 5x5/5 = 5x/51 = x or x = 1

**1.10 Expressions and Equations** 1. 3x 2. 3x - 12 3. 4x 4. 2 - x (not like terms) 5. x - 8 6. 7 - 2x - 2= 5 - 2x7.7 - 2x + 2= 9 - 2x8. 3<sup>1</sup>/<sub>2</sub>x or 3.5x 9. 3x = 12x = 12/3 = 4**10.** 3x - 12 = 53x = 17x = 17/3 = 5 2/3 or 5.666 11. 4x = -20x = -20/4 = -512. -x = -8-x/-1 = -8/-1 so x = 8**13.** x - 8 = 80 so x = 8814. 7 - 2x - 2 = -15 - 2x = -1-2x = -6**x** = -6/-2 = **3** 15. 7 - 2x + 2 = -19 - 2x = -1-2x = -10x = -10/-2 = 516. 3.5x = 7x = 7/3.5 = 2**1.11 Special Equations** 1. x = 0 conditional 2. identity 3. contradiction 4. identity 5. contradiction **6.**  $\mathbf{x} = -1$  conditional 7. identity 8. contradiction 9. x = -1 conditional 10. identity 11. x = 0 conditional 12. x = 3 conditional 13. x = 1 conditional 14. contradiction

15. x = 5 conditional

#### **1.12 Solving Inequalities**



## **<u>1.12 Solving Inequalities (cont.)</u>**



#### **<u>1.13 Color Matching Inequalities</u>**

↔ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	x > 3	(-∞, 3)
	x < -3	<b>[3, ∞</b> )
	x <u>&gt;</u> 3	(-∞, 3]
	-3 < x <u>&lt;</u> 3	(3, ∞)
< <u>,</u> ,,),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	x <u>&lt;</u> -3	(-3, 3)
	-3 < x < 3	[-3, 3)
	x <u>&lt;</u> 3	(-3, 3]
$\left(\begin{array}{c} 1 \\ -1 \\ -3 \\ -3 \\ -4 \\ -3 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1$	-3 <u>&lt;</u> x < 3	(-∞, -3)
	x <u>&gt;</u> -3	[-3, ∞)
	x < 3	<b>(</b> -∞,-3]

**1.14 Career Pathway Applications – STEM (cont.) 1a.**  $3 \cdot 2 = 6$  pounds **1b.** 3 • 10 = **30 pounds 1c.**  $3 \cdot x = 3x$  pounds 2a. x + 22b. x - 42c. 2x 2d. 5x + 32e. 2x - 12f. 2x - 13a. x + 20 or 20 + x3b. x + y3c. x - y3d.  $\frac{1}{2}(x+y)$  or  $\frac{x+y}{2}$ 3e. 2x + 2y or 2(x + y)3f. x/4 or <sup>1</sup>/<sub>4</sub> x or .25x 4a.  $\mathbf{R} + \mathbf{1.3} = \mathbf{6}$ R + 1.3 - 1.3 = 6 - 1.3 **R** = **4.**7 4b. R - 2.1 = 3.9R - 2.1 + 2.1 = 3.9 + 2.1 $\mathbf{R} = \mathbf{5}$ 4c. 7.2 - R = 4.97.2 - R - 4.9 + R = 4.9 - 4.9 + RR = 2.34d. 2R = 72R/2 = 7/2 $R = 3\frac{1}{2} \text{ or } 3.5$ 4e. .5R = 2.6.5R/.5 = 2.6/.5R = 5.24f. *let* R = the younger brother's RBC = 5.25 So R + 1.5 = older brother's RBC = 6.75 R + R + 1.5 = 122R + 1.5 - 1.5 = 12 - 1.52R/2 = 10.5/2R = 5.24g. let R = the healthy sister's RBC = 3 So 2R = the sick sister's RBC = 6 R + 2R = 93R/3 = 9/3 $\mathbf{R} = \mathbf{3}$ 

**1.14 Career Pathway Applications – STEM (cont.) 4h.** *let* R =the sister's RBC = **4** 1/3 or **4.333** So 2R - 1 = the brother's RBC = 7 2/3 or 7.667 R + 2R - 1 = 123R - 1 + 1 = 12 + 13R/3 = 13/3 **R = 4 1/3 or 4.333** 2R/2 = 10.5/2R = 5.25**5a.** *let* x = the updated program = 5.25 x = 100 + 40 = 140 gigabytes **5b.** *Perimeter* = *sum of all sides (rectangle has 4* sides) *let* width = W and let length = W + 4W + W + W + 4 + W + 4 = 884W + 8 - 8 = 88 - 84W/4 = 80/4 W = 20 width = 20ft. length = 24ft. **5b.** *let* width = W and let length = 2WW + W + 2W + 2W = 1506W/6 = 150/6 W = 25 width = 25ft. length = 50ft. **5b.** *let* x = the amount insurance will pay x = 1/2(15,000 - 500) $\mathbf{x} = 1/2(14,500) =$ **\$7,250** *Perimeter* = sum of all sides; Area = Length x Width  $A = x^2$  inches 6a. P = 4x inches **6b.** P = 4x + 6 feet  $A = x^2 + 3$  sq. feet 6c. P = 6x miles  $A = 2x^2$  miles 7a. x < 10 7b. x > 37c. 3 < x < 107d.  $3 \le x - 1 \le 10$  or  $4 \le x \le 11$ 



This product is 100% funded by the MoSTEMWINS \$19.7 million grant from the U.S. Department of Labor Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.



Unless otherwise noted this MoSTEMWINs material by <u>St. Louis Community College</u> is licensed under a <u>Creative</u> <u>Commons Attribution 4.0 International License</u>.